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A Market Study and Updated Roadmap to Support Local Industries in the Development of EE and Clean Technologies for Motor Systems

October 2022

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Abbreviations

BO	Business Opportunity
BOM	Business Opportunity Mapping
CAPEX	Capital Expenditures
COGS	Cost of Goods Sold
EBIT	Earnings Before Interest and Taxes
EBT	Earnings Before Taxes
EE	Energy Efficiency
EEHC	Egyptian Electricity Holding Company
ENCPC	Egyptian National Cleaner Production Center
EOS	Egyptian Organization For Standardization & Quality
EV	Electric Vehicle
GOEIC	General Organization For Export & Import Control
HDPE	High Density Polyethylene
HVAC	Heating, Ventilation and Air Conditioning
HP	Horsepower
ICA	Industrial Control Authority
IDA	Industrial Development Authority
IE	International Efficiency
IFC	International Finance Corporation
IMC	Industrial Modernization Centre
IMEP	Industrial Motor Efficiency Program
IRR	Internal Rate of Return
LV	Low Voltage
MEPS	Minimum Energy Performance Standard
MoF	Ministry of Finance
MoTI	Ministry of Trade and Industry
MV	Medium Voltage
NGOES	Non-Grain Oriented Electric Steel
NI	Net Income

NPV	Net Present Value
OEM	Original Equipment Manufacturers
OPEX	Operating Expenditures
PBP	Payback Period
PP	Polypropylene
SG&A	Selling, General & Administrative
SME	Small and medium-sized enterprises
STEP	Smart Technology and Energy Efficient Production Program
UNIDO	United Nations Industrial Development Organization
VAT	Value Added Tax
WACC	Weighted Average Cost of Capital

Acknowledgment

This document comes as part of the “Egyptian Programme for Promoting Industrial Motor Efficiency” by UNIDO focusing on improving the efficiency of Electric Motor Driven Systems (EMDS) and accelerating the market penetration of energy efficient motors in the industrial sector.

This document presents an update to the local manufacturing market of EE motors in Egypt, focusing on the business opportunities (BO) of local manufacturing and the feasibility of top potential BOs. It also updates the roadmap and value chain analysis of the local manufacturing of EE motors, considering the recent market dynamics, particularly reflecting the Covid-19 impact and the launch of the decree 463/2020.

This document and all relevant activities are developed by a consortium of consultants: *Chemonics Egypt Consultants and Waide Strategic Efficiency*, UNIDO’s consultants for the assignment of “Recommendation and development of operational policy tools, action plans and guidelines to promote the deployment of energy efficient motor driven systems in Egypt”.

The roadmap update is based on the consultant’s experience, literature review, desk research and conducted interviews with key value chain stakeholders. The updated roadmap and proposed polices were presented in a workshop and discussed with relevant stakeholders for validation.

Moreover, we would like to thank all the participated stakeholders in both interviews and workshops for their valuable input, market data and reflections, as well as discussions.

Executive Summary

Energy efficiency is one of the priorities of the green energy transition. It is increasingly seen as a way to achieve a sustainable energy supply and reduce greenhouse gas emissions while boosting the economy and competitiveness of countries. This report addresses the subject of energy efficient industrial motors usage and manufacturing in Egypt through a systematic approach that takes into consideration market specialties and statistics, technicality, business chances, feasibility of manufacturing, road mapping, and policies promotion.

This report comes under the assignment of developing roadmap and policies to support local manufacturing of EE and clean technologies for motor systems, under the Egyptian Program for Promoting Industrial Motor Efficiency by UNIDO.

The report consists of four sections as shown in Figure 1:

Figure 1: Report Layout

The first section updates the market study developed by the IFC in the STEP programme in 2018 to show the limited change in the value chain of locally manufactured motors. It also states the marginal expansion of manufacturers activities in the motors market without a change in the list of key players. It also reflects on the effects of COVID-19 in terms of imports shrinkage and encouraging local manufacturing. Additionally, this part shows how decree 463/2020 motivated key players in Egypt to invest more in the production of IE3 motors. Moreover, it was concluded that the estimated annual market size is expected to reach about 251 M USD, with a potential of local manufacturing market up to 122 M USD for the motors or ratings less than 75 kW.

In the second section, Business Opportunity Mapping (BOM) methodology is applied to the market of local manufacturing of EE motors in Egypt. After developing a long list of business opportunities for all the value chain, a short list is presented after excluding the business opportunities of producing raw material which usually require huge investments. The short list is the result of business opportunities weighting with the utilization of heat map and fact sheets for business opportunities. Top four business opportunities (manufacturing of motor cooling fans, machining of shafts/couplings, manufacturing of varnish coated Aluminum wires as well as manufacturing of varnish coated Copper wires) implicates that the top successful opportunities are for machining and production of small components of the motor.

The third section provides a feasibility study for the selected business opportunities in terms of demand and supply, manufacturing technology, infrastructure, technical parameters, and financial forecast as well as projects feasibility. Considering the outputs of the feasibility model, such as Net Present Value (NPV), and Internal Rate of Return (IRR) and Payback Period (PBP) of the selected business opportunities, a conclusion about manufacturing of annealed copper and aluminum wires being the most profitable, with highest revenues and IRR, is reached.

Finally, the fourth section updates the IFC's roadmap by validating the market barriers and prioritizing the previously proposed interventions through market research and interviews with the key market players. Also, the status of these interventions is discussed and updated, based on the market dynamics. Recommended interventions at the conclusion can be categorized according to (duration, responsibility holder, and leading entity). These recommendations include:

- Review custom tariff
- Support of investments in local manufacturing
- Establishing testing labs and labs strategy
- Market data and intelligence
- Stop exclusion of Egyptian products in public tenders
- Good monitoring and control of market

Furthermore, new interventions are proposed considering the post-COVID and launch of decree 463/2020. With the same categorization, a set of interventions is presented as the following:

- Emphasize on local networking and platform to connect value chain
- High level engagement of key manufacturers
- Emphasize on local motor procurement and maintenance in Electric Vehicle (EVs)
- Joint procurement of motors
- Creation of local manufacturing hub and component platform.

The proposed timeline of the updated roadmap is presented in Figure 2.

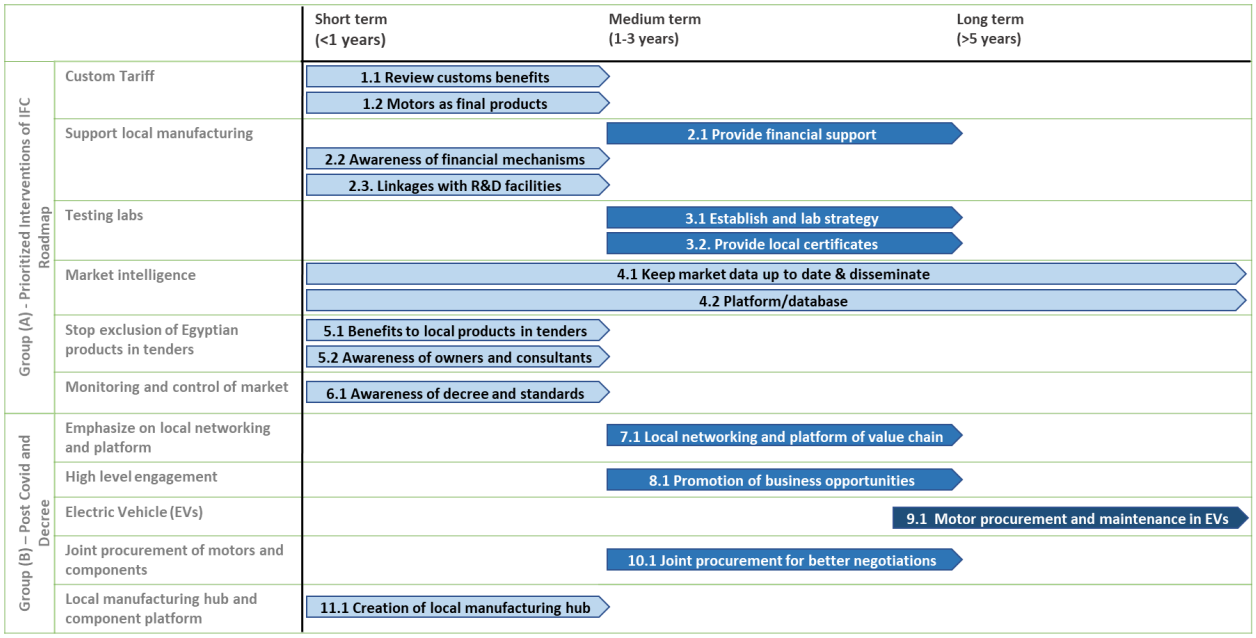

Figure 2: Timeline of updated roadmap

Introduction

This report is developed as part of activity 4: “Develop a market study to support local industries in the development of EE and clean technologies for motor systems”, under the assignment of developing roadmap and policies to support local manufacturing of EE and clean technologies for motor systems, under the Egyptian Program for Promoting Industrial Motor Efficiency by UNIDO. The objectives of this activity are: Develop a market study including the investment opportunities for local manufacturing and feeder industries of EE industrial motor systems; Recommend concrete policies to promote local manufacturers for motors systems; Support relevant public-sector entity in the dissemination and implementation of the action plan; and Create opportunities for matchmaking and business-to-business networking within the value chain of EE industrial motor systems.

This report presents the methodology and outcomes of the work done to achieve these objectives. This report builds upon the value chain analysis and strategies identified by the IFC to promote the local manufacturing of EE industrial equipment and motors, under the Smart Technology and Energy Efficient Production Program (STEP) in 2018.

In section 1, an update to the value chain analysis and market assessment is presented. It focusses on the updates related to market dynamics following the Covid-19 and release of the decree 463/2020 of MEPS. Interviews and surveys were conducted with the key stakeholders of the value chain to update the market assessment (a list of interviewed stakeholders is presented in Annex 2, and the template of interview is presented in Annex 3). In addition, updated market size is presented through updating imports/exports data and sales data from key suppliers.

In section, the business opportunity mapping (BOM) approach is used to map the available business opportunities within the value chain of local manufacturing of motors. The BOs were shortlisted to the most promising 10 opportunities and then evaluated to present the top four feasible BOs. The feasibility of these four opportunities were studied and presented in section 3. The analysis focuses on certain key technical and financial aspects. The study targets new investors entering the local manufacturing market of electric motors, or existing players planning to expand their activities within the value chain, by estimating the key financial indicators (NPV, IRR, payback period and profitability index), to support in decision-making process based on a cost benefit analysis.

In section 4, an update to the roadmap to support local manufacturing of EE motors developed by IFC STEP program is presented. The followed approach in this update was the deep understand of the developed roadmap and interventions, reliance on the existing network with the value chain stakeholders, as well as strong engagement of the key stakeholders through the individual interviews and workshops to understand their reflections on the market dynamics and the policy interventions. The previous interventions developed by IFC’s roadmap were prioritized according to updated market dynamics. Also, new policy interventions are introduced to consider the post Covid and decree market status.

I. Section 1: Market Assessment of Local Manufacturing of Electric Motors

1. Overview

This section presents the market assessment of electric motors manufacturing in Egypt. A quick overview of the value chain of electric motors manufacturing and the market current status are highlighted. Also, updated market size of motors in Egypt is presented, as well as the updated potential market size of local manufacturing of motors and motors' components. The market sizing and segmentation will help in guiding the business plans of both existing and potential local manufacturers. In addition, it can help banks and financial institutions better understand the market and potential opportunities. It would also help in developing the roadmap of local manufacturing in Egypt.

This assessment builds on the market assessment and value chain analysis provided by the study of the IFC to promote the local manufacturing value chain of energy efficient (EE) industrial equipment and motors, which were developed under the Smart Technology and Energy Efficient Production Program (STEP) of IFC in 2018. This assessment shall update the value chain and market assessment based on the recent market dynamics, particularly to reflect the Covid-19 impact and the launch of the decree 463/2020.

2. Value chain of local manufacturing of electric motors

2.1. Overview of the motors value chain

Figure 3 shows an overview of the structure of the value chain of electric motor manufacture, showing the raw materials, key components of the electric motor and the motor manufacture itself. The figure also extends the value chain to include the integration of motors into end-products, such as white goods, pumps, industrial fans, compressors, and HVAC. Motors can be manufactured and sold as standalone motors or integrated into the final product by the Original Equipment Manufacturers (OEM). Some OEMs are manufacturing motors themselves, while most others prefer to source it from a motor manufacturer.

The value chain analysis focuses mainly on the AC induction motor and its components. AC induction motor is the dominant type in the annual market of standalone motors in Egypt, see Figure 4.

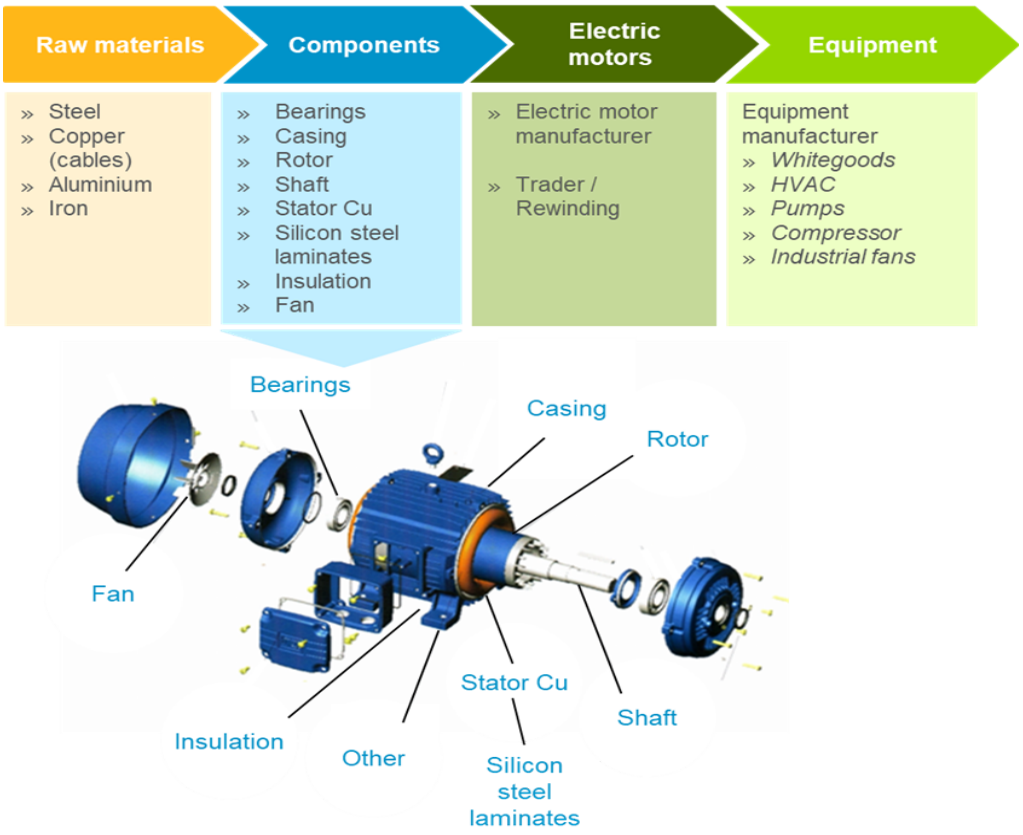

Figure 3: Electric motor value chain Key components and material of motor manufacturing (STEP, IFC)

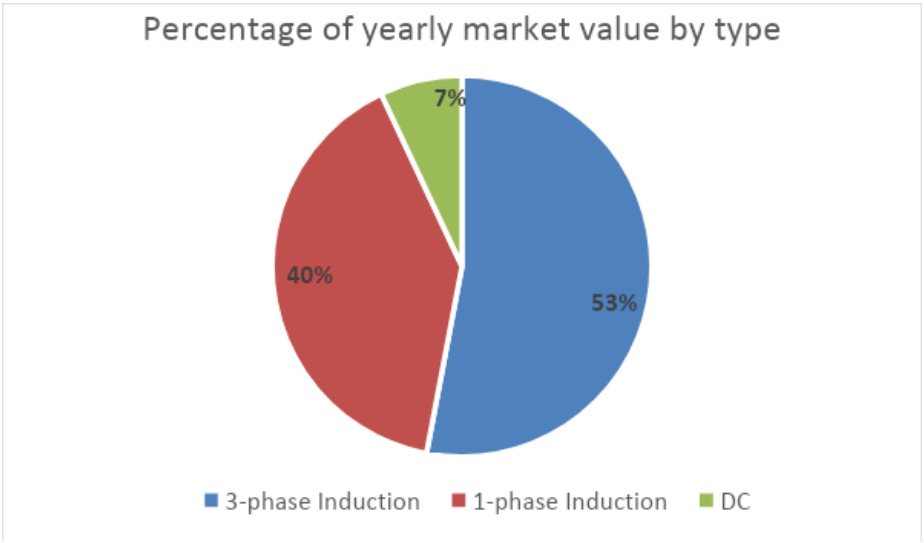

Figure 4: Standalone motor annual market value by motor type

Figure 5 presents the key market players and manufacturers of the motors value chain, as mapped by the STEP project of IFC. It shows the key manufacturers of each component and raw material used in motor

manufacturing, as well as key suppliers/traders of motors and end-market manufacturers who integrate motors into their products.

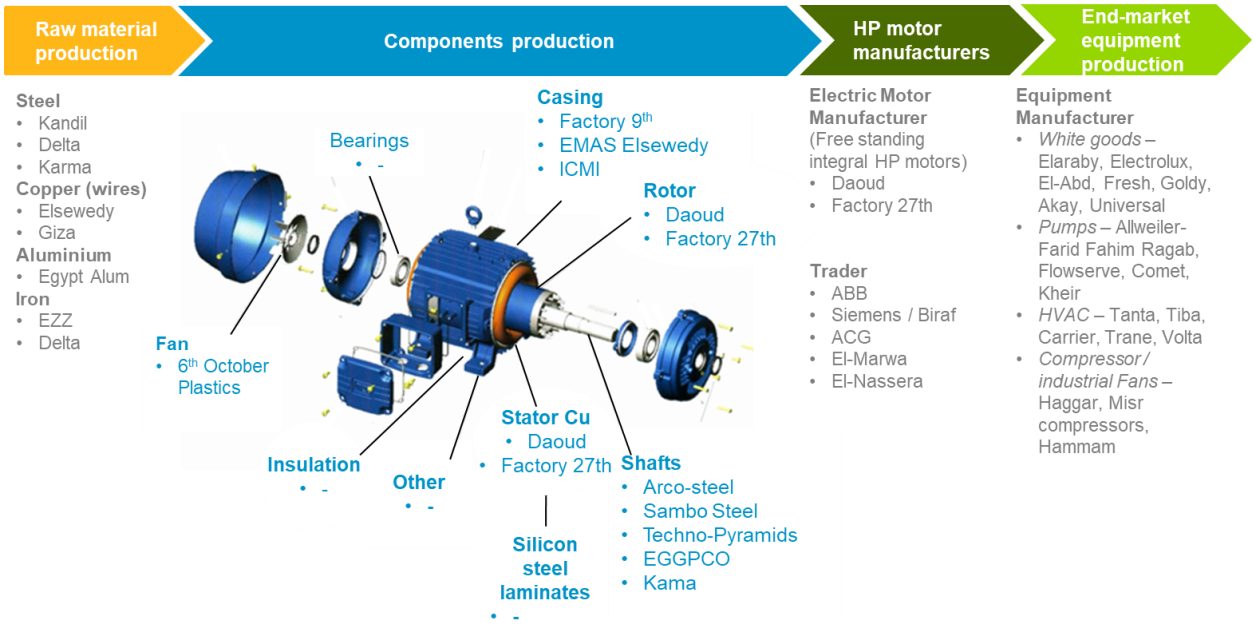

Figure 5: Mapped key manufacturers of the motors value chain (STEP, IFC)

2.2. Updates of value chain of electric motors

Limited changes in the locally manufactured motors value chain. The motors market and value chain have not changed a lot since the last study and report in 2018/2019. The demand is large for the large motors for the infrastructure and national projects, which are mostly imported (large integral LV and MV motors). However, for locally manufactured motors, which are basically focused in fractional HP motors for whitegoods, the changes in the market are limited. In addition, Covid-19 pandemic affected the market and manufacturers' sales and new investments significantly, especially in the year 2020.

No mapped new players in the manufacturing value chain. Generally, the same market players and manufacturers exist with no new key players entering the market. The existing players are playing the same role in the value chain and manufacturing the same components (either increasing their market share or developing the same product/component with different specifications or quality), or in some few cases they have invested to manufacture one or more additional components to support their basic manufactured product.

New investments in motor manufacturing were mainly in fractional motors as predicted by the roadmap in the absence of a decree. They are not focusing on the EE motors. New investments are mainly focusing on the fractional motors being locally manufactured for whitegoods applications. The main exception is the investment being done by one of the key integral motors manufacturers in upgrading their designs to IE4 motors, as will be illustrated in the following subsection.

The updates of the value chain can be summarized as the following:

- ***EE integral HP motors*** – Daoud for Motors (one of the key motors manufacturers in Egypt) is moving to manufacturing new designs of IE4 efficiency class to meet the market minimum energy performance standards (MEPS) as per the decree 463/2020 of the Ministry of Trade and Industry (MoTI). They decided to invest in the new designs of IE4 motors (not in IE3), through a German design company, to lead by a step forward and to be ready for any updates of the decree in the future with higher efficiency grades, as well as being able to export to Europe and other countries having MEPS of IE4. They also plan to invest in the procurement of new moulds for the manufacturing of rotors suitable for the IE4 motors.
- **Carbon steel laminations –** A new cooperation started between a steel factory (Kandil Steel) and a fractional HP motors manufacturer (Fresh), by supplying them the carbon steel sheets for the manufacturing of motors used in their whitegoods application. The steel company has not invested in a new production line of equipment, however they invested in the R&D, to upgrade the process and operation methodology using the same facilities to produce steel sheets with magnetic properties that meets the client's requirements.
- **Coupling and Gearbox –** Arab Commercial Group (ACG), a one of the key integral HP standalone motors suppliers in addition to pumps and compressors, has started manufacturing gears and coupling elements used in coupling imported motors with driven equipment (basically pumps). They have started with a small factory for manufacturing gears and coupling elements, and planning for expanding their activities into motor manufacturing.
- **Fractional motors manufacturing –** Al-Araby, a key whitegoods manufacturer, has established a new factory for manufacturing of fractional HP motors required for integration with their production of whitegoods. They have already started the production of the new factory. The plan is to cover all their demand, and in few years, they will increase the production capacity of motors to supply other whitegoods manufacturers in the market.

Minor changes of the local manufacturing volume versus imports. There are no major changes in the volume of local manufacturing volume vs imports along the value chain, since the study of the IFC in 2018/2019. The new updates mentioned previously within last two years (new investments and interlinkages within the value chain) caused minor increase of the volumes of the local share vs imports. of carbon steel as well as fractional motors of whitegoods. It focuses on manufacturing of fractional motors for whitegoods as well as the contribution of a steel manufacturer in increasing the volume of locally manufactured carbon steel laminates (which is different from silicon steel laminates used in integral HP motors).

For other components and material the situation is unchanged versus imported volumes, especially that no change in the manufacturing of motor itself, and hence no increase or investment in the feeding industries.

Increased potential for local manufacturing due to Covid-19 and increased shipment cost in 2020. Prices of imports and inputs of motor components increased significantly in 2020 (sometimes doubled or tripled) because of the global shortage issue happened due to Covid-19 and increased international shipment costs. Also, the reduced international exports of China affected the global prices of products. All of these are key motives and large potential to increase the volume share of the local manufacture in the few coming years.

Promising opportunity for whitegoods exports. Whitegoods exports of Egypt has been increasing in good steps and last year they achieved the highest value of exports within the last 10 years. This raises the opportunity of a new market for local manufacturers in addition to the local market, and hence increases demand for local feeding industries.

3. Market sizing of local manufacturing

The motor market sizing relies on two approaches; bottom up and top down. The top-down approach starts by tracking motor imports which represents 95% of the motor market size of standalone motors[1]. The bottom-up approach relies on analysis of the number of motors installed in each industrial subsector based on electricity consumption per subsector as well as typical motor usage in various subsector[2].

The standalone motor market (from both imports and local manufacturing) of yearly market value between 200 and 243 Million USD showing a stable growth level of industrial activities and motor replacement process. Figure 6 shows 3-years rolling average of motors market size. The period from 2008 to 2013 has seen steady growth while the period from 2014 to 2016 has seen decrease mainly due to the exchange rate increase and subsequent floatation of the Egyptian currency which has seen the EGP devaluating to third of its value against the USD. The market started recovering from 2017 to 2019. In 2020, and mainly due to the COVID-19, there was a slowdown reaching the lowest value since 2008 at a low of 176.5 Million USD. It is expected that 2021 will reach pre-COVID-19 values.

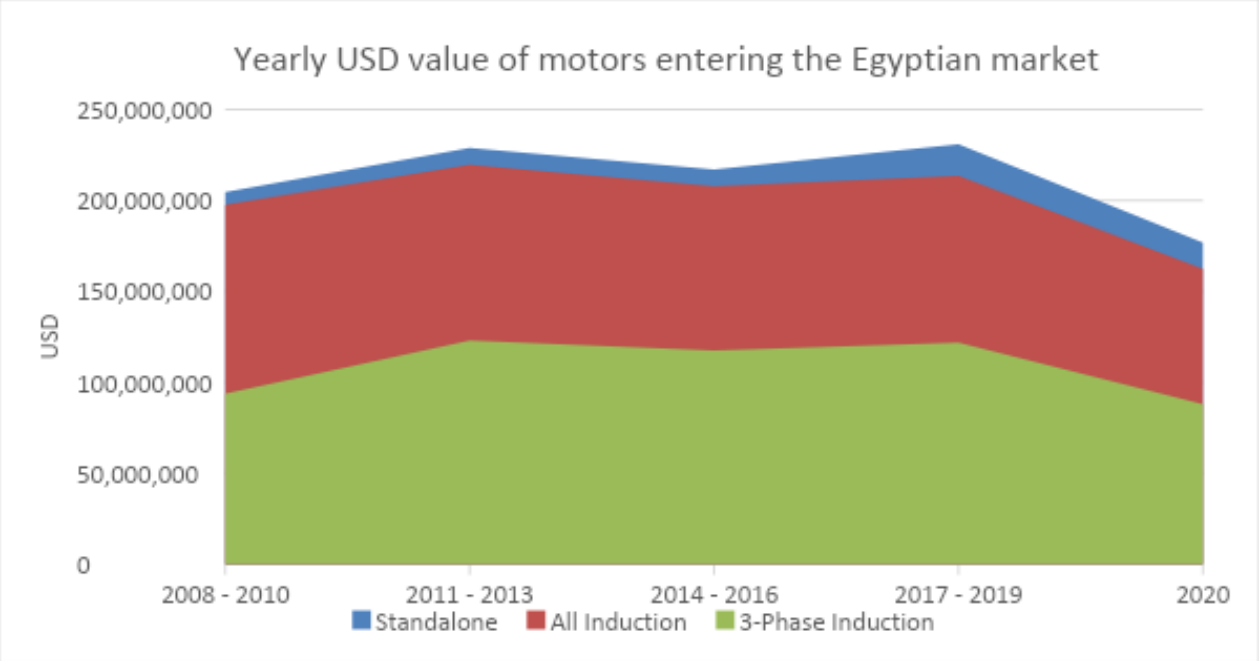

Figure 6: Standalone motors yearly market using 3-years rolling average

[1] *Market Analysis of the Motor Market in Egypt for Energy Efficient Motors Standards and Labeling Program, Task 1a Final Report, E3 international in association with Lawrence Berkley National Laboratory and Cairo University*

[2] *Electricity consumption data are from EETC, EgyptERA and CAPMAS – Motor usage in various subsectors is based on Bertoldi, Paolo, Anibal T. de Almeida, and Hugh Falkner, eds. Energy Efficiency Improvements in Electronic Motors and Drives. Springer Science & Business Media, 2012.*

Estimated annual market size is expected to reach about 251 M USD. This includes all the motor types (both integral and fractional HP motors) and also with an expected increase of 10% to the investment of integral motors to be higher efficiency to IE3 after applying the MEPS of the decree. Table 1 illustrates the detailed estimates of each different categories of standalone motors. The current contribution of local manufacturing is estimated to be about 5% of the total annual market[3], with expected increase in the local contribution in the upcoming years as illustrated in previous sections.

Table 1: Estimated market size of standalone motors in Egypt

Type	Value (M USD)
Integral MV	108
Integral LV	65
Total Integral	**173**
Fractional HP	78
Total Integral + Fractional	**251**

Potential local manufacturing market is estimated to be 122 M USD, as the local manufacturing of Egypt has the capacity to target motors < 75 kW[4]. Table 2 presents the value of the estimated share of total market size for each component of the value chain. This presents the potential market size of each component in case the whole value chain is locally manufactured for the estimated market size. Moreover, Figure 7 shows the percentage share of each component of the estimated local market size.

Table 2: Estimated share of each component

Component	Market Value (M USD)
Steel sheets **(NGOES)**	50.0
Cu for stator windings	26.8
Casings Al (or Fe)	18.3
Bearings	11.0
Miscellaneous other	6.1
Shafts	3.7
Rotor materials	3.7
Insulation	1.2
Fans	1.2
Total	122

[3] *The 5% estimate is based on STEP IFC project workshop presentations*
[4] *Based on IFC STEP project, local manufacturing capacity targets LV motors below 75 kW. Based on the percentage contribution of integral HP motors below 75 kW as well as fractional HP motors (as illustrated in Annex 1), the total estimated local manufacturing market size is 122 M USD.*

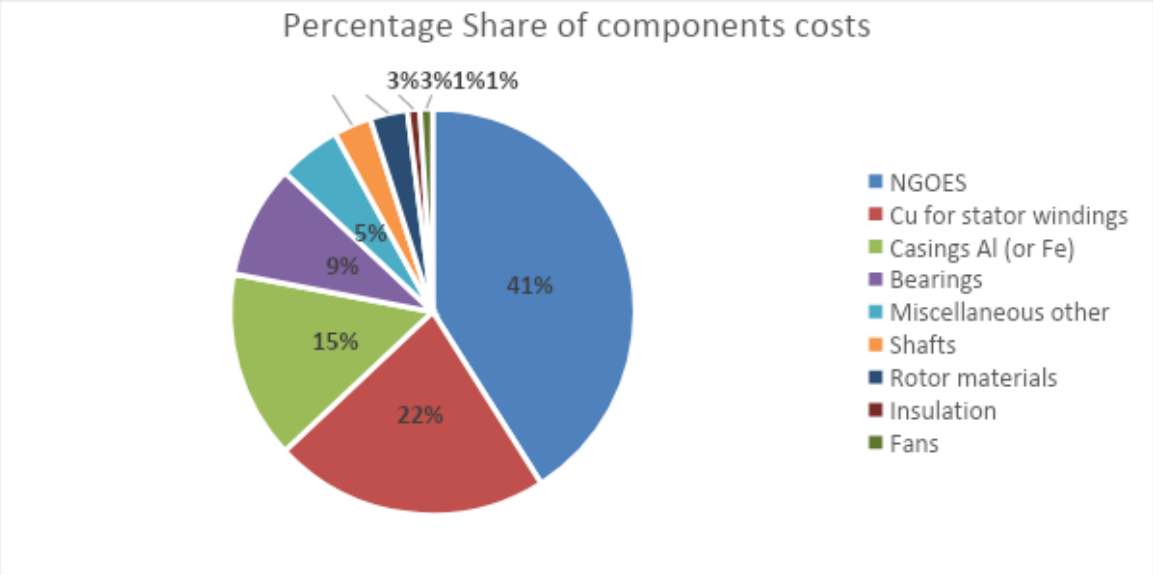

Figure 7: Percentage share of components cost of the local manufacturing market size

4. Conclusion

This section presents updates for the value chain and market size of local manufacturing of electrical motors in Egypt. It builds on the market study developed by the IFC in the STEP programme in 2018. The assessment considered the updates in the market based on the recent market dynamics, particularly to reflect the Covid-19 impact and the launch of the decree 463/2020.

The key updates to the value chain and market can be summarized as:

- ***Limited changes in the locally manufactured motors value chain –*** Although there is an increased demand of motors (especially for applications of infrastructure and large-scale projects), local manufacturing market and its value chain had limited changes.
- ***Same key players –*** as no new players entered the market. Only some manufacturers expanded their activity or increased their manufacturing capacities.
- ***Few new investments and interlinkages were developed since 2018 –*** including:
    - Daoud for motors: upgrade to manufacture IE4 motors
    - Kandil-Fresh cooperation: to supply the carbon steel required by Fresh for fractional motors of home appliances
    - ACG: expanding to manufacturing gearboxes and coupling elements between motors and pumps
    - Al-Araby: establishing new factory of fractional HP motors manufacturing

Effect of Covid-19 on the value chain and market assessment – Covid-19 caused slow-down to the market progress, in terms of reduced sales (clear in 2020 sales) and new investment after the developed roadmap by IFC. On the other hand, it increased the potential of local manufacturing to overcome the global shortage and increased shipment cost and lead time, especially from China.

Effect of decree 463/2020 – Suppliers and manufacturers invested in moving towards motors with efficiency grade of IE3 (or higher). In addition, this added to the value of the market size at least about 10% to account for the increased cost of the IE3 motors over lower efficiency ones.

Estimated annual market size is expected to reach about 251 M USD - including all the motor types (both integral and fractional HP motors).

Potential local manufacturing market is estimated to be 122 M USD, as the local manufacturing of Egypt has the capacity to target motors < 75 kW.

II. Section 2: Business Opportunity Mapping of Local Manufacturing of EE Motors

1. Overview

This section presents the Business Opportunity Mapping (BOM) of local manufacturing of motors in Egypt. The Business Opportunity Mapping (BOM) is a methodology developed by Chemonics Egypt for UNIDO in 2014, which offers a systematic approach to map and prioritize business opportunities (BOs).[5] The section follows a series of steps to help identify the most promising Bos in the electric motor manufacturing value chain.

The main objective of the BOM is to identify Bos that meet a pre-set criterion with a high success probability for electric motors manufacturers. Also, the BOM tool contributes to knowledge by providing key general information for each BO, as well as information around market data and possible challenges. Bos are defined as any process, technology or service which connects available resources (supply) with needs (demand). It also serves to fill identified gaps within the value chain. The main beneficiaries from the BOM are investors in which it could guide them to allocate the available resources in the best possible way. Also, it could allow investors to point out the parts of the electric motor manufacturing value chain which are most suited for integration into the local market.

The Business Opportunity Mapping (BOM) consists of the following four main steps:

1. Development of the business opportunities long list
2. Development of the business opportunities short list
3. Development of fact sheets for the business opportunities short list
4. Assessment and ranking of the business opportunities short list according to a set of diverse indicators

The following sub-sections will discuss each of these steps in details.

[5] "Waste Management Entrepreneurship Support in Southern Upper Egypt for Sustainable Development", Chemonics Egypt Consultants & Cleantech Arabia, implemented by UNIDO in "Enhancing Youth Employability and Local Economic Development in Upper Egypt Project" funded by the government of Japan, 2014.

2. Business Opportunity Mapping Methodology

2.1. Development of the business opportunities long list

A long list of 18 business opportunities in the electric motor manufacturing value chain was mapped through the internal desk research done by the consultants consortium of the project, Chemonics Egypt and Waide Strategic. Then the internal research was validated and consolidated by eight (8) interviews done with the key stakeholders across the value chain. List of the interviewed stockholders can be found in Annex 2. Identification of BOs was done by searching for a technology which can connect supply and demand, or a business service which can serve the needs of existing businesses. Each gap or a need in the value chain also offers a business opportunity. Figure 8 represents the electric motor value chain structure with the various raw materials and components of motor.

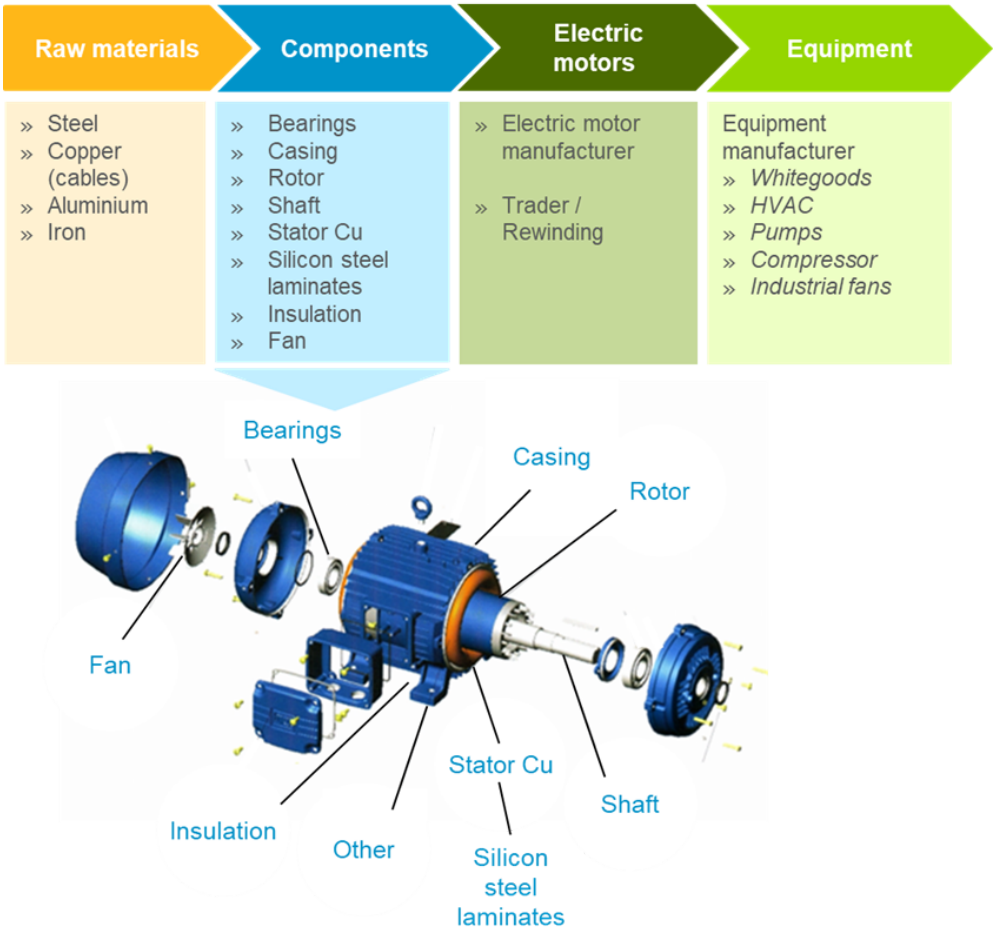

Figure 8: Electric motor value chain key components and material of motor manufacturing (STEP, IFC) [6]

The long list covers all the main and intermediate steps required to manufacture an electric motor. This includes the production of different raw materials (iron, copper, silicon steel, etc.), production of major components of electric motors (motor casings, end-shields, silicon steel laminates, varnish wire, stator and rotor, etc.), production of minor components of electric motors (cooling fans, shafts) and production

[6] *IFC, "Development of local clean manufacturing of electric motors in Egypt", 2018, unpublished report.*

of secondary components of electric motors (different types of couplings). Table 3 represents the BOs long list.

Table 3: Business opportunities long list

No.	BO Title	Input (Supply)	Technology	Final Product (Demand)
1	Production of motor cooling fans	Plastic (HDPE, PP) pellets	Plastic injection molding	Motor cooling fans
2	Casting of motor frames (Cast iron)	Cast iron, Pig iron	Sand casting, machining	Cast iron frames of electric motors
3	Casting of motor frames (Aluminum)	Aluminum billets	Die casting, machining	Aluminum frames of electric motors
4	Machining of shafts (Coupling)	Carbon steel rods, Stainless steel rods	Machining	Steel and stainless-steel shafts and couplings
5	Producing copper	Copper ore	Melting, reduction, and electrolysis (electro purification)	Copper cathodes for cable manufacturing
6	Producing grain-oriented silicon steel	Ferrosilicon	Furnace, rolling and annealing	GOSS sheets
7	Producing non-grain-oriented silicon steel	Ferrosilicon	Furnace, rolling and annealing	NGOSS sheets
8	Producing low carbon steel	Raw iron, Scrap iron	Furnace, rolling and annealing	Low carbon steel bars
9	Producing stainless steel	Scrap stainless steel, scrap iron, iron core	Melting, forming heat treatment and machining	Stainless steel bars
10	Producing cast iron	Iron ore, pig iron (molten or solid)	Foundry	Cast iron billets
11	Producing aluminum	Bauxite	Grinding, calcination, and smelting	Aluminum billets
12	Insulating material	Several types of chemical compounds and basically resins	Heating chemical mixture	Insulating varnish
13	Rolling silicon steel to different thicknesses	Silicon steel sheets	Cold or Hot rolling and heat treatment	Silicon steel sheets of varying thicknesses

No.	BO Title	Input (Supply)	Technology	Final Product (Demand)
14	Manufacturing varnish coated copper wires	Electrical-grade copper, insulating varnish	Wire drawing, coating	Varnish coated, copper wire
15	Manufacturing varnish coated aluminum wires	Electrical-grade aluminum, insulating varnish	Wire drawing, coating	Varnish coated, aluminum wire
16	Stacking rotor laminations and die-casting of rotor cage	Silicon steel laminates, insulating varnish	Copper, aluminum stamping	Rotor and stator blocks
17	Stamping the motor's fan cover	Low carbon steel sheets	Sheet metal stamping and punching	Motor fan cover
18	Stamping of motor laminations	Silicon steel sheets	Punching	Stator and rotor laminations

Analysis of the BOs long-list reveals that most of BOs identified are for production of major components accounting for 48% as presented in Figure 9, while production of raw material account for 42%, production of minor and secondary components account for 5% each.

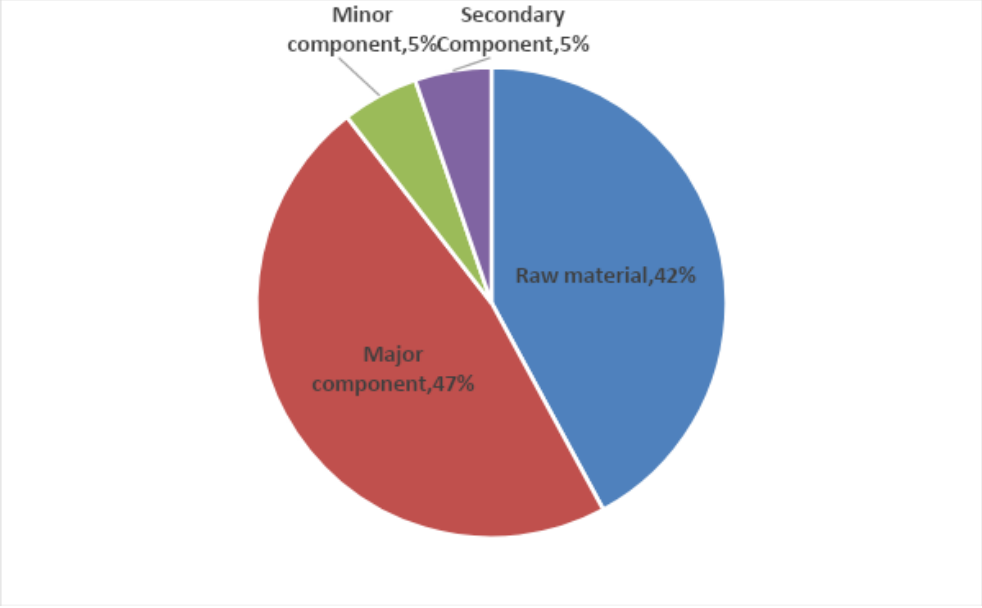

Figure 9: Classification of business opportunities long list in the electric motors value chain

2.2. Development of the business opportunities short list

Having identified the BOs long list, this section will develop a short list of BOs. The short list presents the BOs with the most success potential in the electric motor manufacturing value chain.

According to the consultant experience and interviewed stakeholders (8 interviews), all of the business opportunities related to extraction and production of raw material were excluded. This is due to these industries are usually large-scale industries which require high capital investments and serve other markets that are larger than that of electric motors. Thus, confining the assessment of these opportunities to the scope of electric motors only is counterproductive. The list of the remaining business opportunities is then referred to the short list. Table 4 represents the 10 BOs short list.

Table 4: Business opportunities short list

No.	BO Title	Input (Supply)	Technology	Final Product (Demand)
1	Production of motor cooling fans	Plastic (HDPE, PP) pellets	Plastic injection molding	Motor cooling fans
2	Casting of motor frames (Cast iron)	Cast iron, Pig iron	Sand casting, machining	Cast iron frames of electric motors
3	Casting of motor frames (Aluminum)	Aluminum billets	Die casting, machining	Aluminum frames of electric motors
4	Machining of shafts (coupling)	Carbon steel rods, Stainless steel rods	Machining	Steel and stainless-steel shafts
5	Rolling silicon steel to different thicknesses	Silicon steel sheets	Cold or Hot rolling and heat treatment	Silicon steel sheets of varying thicknesses
6	Manufacturing varnish coated copper wires	Electrical-grade copper, insulating varnish	Wire drawing, coating	Varnish coated, copper wire
7	Manufacturing varnish coated aluminum wires	Electrical-grade aluminum, insulating varnish	Wire drawing, coating	Varnish coated, aluminum wire
8	Stacking rotor laminations and die-casting of rotor cage	Silicon steel laminates, insulating varnish	Copper, aluminum stamping	Rotor and stator blocks
9	Stamping the motor' fan cover	Low carbon steel sheets	Sheet metal stamping and punching	Motor fan cover
10	Stamping of motor laminations	Silicon steel sheets	Punching	Stator and rotor laminations

2.3. Development of fact sheets for the business opportunities short list

Having identified the BOs short list, factsheets are developed for each to present key data and information. Table 5 presents an example of a BO factsheet. Each factsheet provides the necessary information related to each opportunity and the base for developing the electric motors manufacturing

value chain. The BO fact sheet also covers key market, process, forward and backward business linkage across the value chain, financial features, as well as the key challenges and advantages. All the fact sheets for the shortlisted BOs are listed in the upcoming subsections.

Table 5: Sample of a business opportunity fact sheet

Business Opportunity Fact Sheet - Stamping of motor laminations	
Market Information	
Final product	Stator and rotor laminations
Required inputs	Silicon steel sheets
Market gap	Wide range of lamination designs, lack of local manufacturers of motors and hence low demand
Competing products	Ready-made stator and rotor blocks
Process description	
Key processes	Punching
Tools & technology	Progressive cavity die
Special human resources	Machine operators and engineers
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers
Backward linkage	Silicon steel sheet manufacturers
Financial Features	
Revenue stream	Selling of stator, rotor stacks
CAPEX range	1 - 10 M EGP
OPEX main elements	Raw material: GOSS, NGOSS
Considerations	
Key challenge	Low available demand due to shortage in motors manufacturers /low demand
Advantages	Very low local competition / low competition

In the fact sheets, the following points are considered:

- ***CAPEX range*** – it defines the estimated CAPEX range required to capture this BO and contribute to the value chain. This is a preliminary evaluation, and the range considers the variation of production line capacity, origin, specs and quality, as well as range of covered produced components. In addition, the range considers both cases of **new investment case** by new players in this sector (large investment for new facility) vs **upgrading case** (or added capacity) by existing players where they already have the base of the process (low investment). However, in case of BOs of heavy industries (such as silicon steel sheets), the CAPEX of existing players upgrading or adding production lines is only considered, due to the huge cost of new facility of a new market player.

- ***Key challenges*** – for some BOs, the challenges are divided into short-term and long-term challenges. Short-term challenges represent the existing challenges according to the current market status and demand. Long-term challenges represent those which are expected in case of unlocked market and increased demand.

2.3.1. Production of motor cooling fans

Business Opportunity Fact Sheet - Production of motor cooling fans	
Market Information	
Final product	Plastic fans
Required inputs	Plastic pellets (HDPE, PP)
Market gap	Lack of locally manufactured fans, "small volume" required as this is typically a component with very low failure rates
Competing products	Imported products
Process description	
Key processes	Plastic injection molding
Tools & technology	Injection molding machines
Special human resources	Plastic injection molding technicians
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers, Motor Traders, Motor rewinders
Backward linkage	Manufacturers of plastic pellets
Financial Features	
Revenue stream	Selling of injection-molded products
CAPEX range	1 - 5 M EGP
OPEX main elements	Raw material: plastic pellets
Considerations	
Key challenge	- Short-term: Small market size, Low failure rate of component - Long term: High competition in the market, Low price of competing products
Advantages	- Simple technology and process - Diversity of potential end markets. The factory can serve several other end markets (such as plastic pipes and accessories)

2.3.2. *Casting of motor frames (Cast iron)*

Business Opportunity Fact Sheet - Casting of motor frames (Cast iron)	
Market Information	
Final product	Cast iron frames of electric motors
Required inputs	Cast iron, Pig iron
Market gap	Lack of manufacturers as a cast iron frame is not a standalone product
Competing products	Imported products, aluminum frames
Process description	
Key processes	Sand casting, machining
Tools & technology	Cast iron furnace, sand processing facility for mold making, machining centers
Special human resources	Metallurgy engineers, furnace operators and machinists
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Electric motor manufacturers
Backward linkage	Iron mills, scrap traders
Financial Features	
Revenue stream	Selling cast iron parts, machining services
CAPEX range	Upgrading case: 10 – 30 M EGP New investment case: 80 – 100 M EGP
OPEX main elements	Raw material: Cast iron, Furnace fuel
Considerations	
Key challenge	- High CAPEX - Market competition - Proximity to suppliers
Advantages	- The industry requires minimal knowledge transfer - Diversity of potential end markets of iron casting with adding only new moulds as per client's requirements

2.3.3. *Casting of motor frames (Aluminum)*

Business Opportunity Fact Sheet - Casting of motor frames (Aluminum)	
Market Information	
Final product	Aluminum frames of electric motors
Required inputs	Aluminum billets
Market gap	Lack of manufacturers as an aluminum frame is not a standalone product
Competing products	Imported products, cast iron frames
Process description	
Key processes	Die casting, machining
Tools & technology	Furnace, Die casting machine and dies, machining center
Special human resources	Metallurgy engineers, furnace operators and machinists
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Electric motor manufacturers
Backward linkage	Aluminum foundries
Financial Features	
Revenue stream	Selling aluminum die cast products
CAPEX range	Upgrading case: 10 – 30 M EGP New investment case: 80 – 100 M EGP
OPEX main elements	Raw material cost: Aluminum billets and additives, Furnace fuel
Considerations	
Key challenge	- Aluminum die cast motors are relatively new to the market, thus not as common as cast iron motors - Difficulty of diversifying end-products due to the high cost of tooling (dies)
Advantages	- The industry requires minimal knowledge transfer

2.3.4. Machining of shafts/coupling

Business Opportunity Fact Sheet - Machining of shafts/couplings	
Market Information	
Final product	Steel and stainless-steel shafts
Required inputs	Carbon steel rods, Stainless steel rods
Market gap	Small volume is required, steel shafts are not frequently demanded, some technologies are missing for local manufacturers to produce with competitive cost
Competing products	Imported products
Process description	
Key processes	Machining
Tools & technology	Machining centers, Lathes, milling machines, Grinding machines
Special human resources	Machinists and engineers
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers, End market
Backward linkage	Steel mills, Traders
Financial Features	
Revenue stream	Selling of steel shafts
CAPEX range	Upgrading case: 1-3 M EGP New investment case: 15 - 20 M EGP
OPEX main elements	Raw material and tooling
Considerations	
Key challenge	- High competition (with potential local manufacturers in case of increased demand or imported shafts from China which have low cost due to the mass production and used technology)
Advantages	- A mature industry with several potential manufacturers - Diversity of potential end markets

2.3.5. Rolling silicon steel to different thicknesses

Business Opportunity Fact Sheet - Rolling silicon steel to different thicknesses	
Market Information	
Final product	Silicon steel sheets of varying thicknesses
Required inputs	Silicon steel sheets
Market gap	Absence of local manufacturers of silicon steel sheets
Competing products	Imported sheets
Process description	
Key processes	Cold or Hot rolling and heat treatment
Tools & technology	Rolling mills, Heat treatment ovens
Special human resources	Metallurgy engineers, oven and production line operators
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motors manufacturers, Transformer manufacturers
Backward linkage	Silicon steel producers
Financial Features	
Revenue stream	Selling of silicon steel sheets of varying thicknesses
CAPEX range	220 - 290 M EGP
OPEX main elements	Raw material, energy
Considerations	
Key challenge	- Determine market size and production capacity for each type of silicon steel
Advantages	- Absence of local competition

2.3.6. *Manufacturing varnish coated copper wires*

Business Opportunity Fact Sheet - Manufacturing varnish coated copper wires	
Market Information	
Final product	Varnish coated, copper wire
Required inputs	Electrical-grade copper, insulating varnish
Market gap	Already locally produced
Competing products	Aluminum varnish coated wires
Process description	
Key processes	Wire drawing, coating
Tools & technology	Wire drawing machines
Special human resources	Machine operators and engineers
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers, Motor rewinders, Transformer manufacturers
Backward linkage	Producers of Electrical Grade Copper, Producers of insulating varnish
Financial Features	
Revenue stream	Sales of wires
CAPEX range	Upgrading case: 2-5 M EGP New investment case: 40 - 50 M EGP
OPEX main elements	Raw material (Electrical-grade copper, insulating varnish)
Considerations	
Key challenge	Sometimes a special varnish is required for high-class of motor insulation (which may be not available locally and should be imported)
Advantages	- Possible extension to manufacturing of aluminum varnish wire - It can serve other equipment such as transformers windings

2.3.7. *Manufacturing varnish coated aluminum wires*

Business Opportunity Fact Sheet - Manufacturing varnish coated aluminum wires	
Market Information	
Final product	Varnish coated, aluminum wire
Required inputs	Electrical-grade aluminum, insulating varnish
Market gap	Low demand at current status
Competing products	Copper varnish coated wires
Process description	
Key processes	Wire drawing, coating
Tools & technology	Wire drawing machines
Special human resources	Machine operators and engineers
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers, Motor rewinders
Backward linkage	Producers of Electrical Grade Aluminum, Producers of insulating varnish
Financial Features	
Revenue stream	Sales of wires
CAPEX range	Upgrading case: 2-5 M EGP New investment case: 40 - 50 M EGP
OPEX main elements	Raw material
Considerations	
Key challenge	- Not a common technology as copper wires, which limits the end market
Advantages	- Possible extension to manufacturing of copper varnish wire

2.3.8. Stacking rotor laminations and die-casting of rotor cage

Business Opportunity Fact Sheet - Stacking rotor laminations and die-casting of rotor cage	
Market Information	
Final product	Rotor and stator blocks
Required inputs	Silicon steel laminates, insulating varnish
Market gap	Lack of high-volume production capacity
Competing products	Imported products
Process description	
Key processes	Copper, aluminum stamping
Tools & technology	Press, die casting machine, copper or aluminum melting furnace
Special human resources	Machine operators and engineers
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers
Backward linkage	Producers of copper, aluminum, Producers of silicon steel laminates
Financial Features	
Revenue stream	Sales of stator blocks and rotor squirrel cages
CAPEX range	Upgrading case: 2-10 M EGP New investment case: 40 - 50 M EGP
OPEX main elements	Raw material and tooling
Considerations	
Key challenge	- High CAPEX associated with die casting process - Limited availability of end products (i.e., low diversity of clients)
Advantages	Simple technology and process

2.3.9. *Stamping the motor fan cover*

Business Opportunity Fact Sheet - Stamping the motor fan cover	
Market Information	
Final product	Motor fan cover
Required inputs	Low carbon steel sheets
Market gap	Lack of high-volume demand for the market current status
Competing products	Imported products
Process description	
Key processes	Sheet metal stamping and punching
Tools & technology	Punching, cutting, and stamping machines
Special human resources	Machine operators and engineers
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers, motor traders, motor rewinders
Backward linkage	Producers/Traders of mild steel sheets
Financial Features	
Revenue stream	Sales of motor fan covers
CAPEX range	Upgrading case: 2-5 M EGP New investment case: 40 - 50 M EGP
OPEX main elements	Raw material and tooling
Considerations	
Key challenge	- Short-term: High CAPEX associated with stamping machines and tooling, relatively low market demand within the value chain of motors - Long-term: High competition in case of increased demand
Advantages	- Ability to diversify product range

2.3.10. Stamping of motor laminations

Business Opportunity Fact Sheet - Stamping of motor laminations	
Market Information	
Final product	Stator and rotor laminations
Required inputs	Silicon steel sheets
Market gap	Wide range of lamination designs, lack of local manufacturers of motors and hence low demand
Competing products	Ready-made stator and rotor blocks
Process description	
Key processes	Punching
Tools & technology	Progressive cavity die
Special human resources	Machine operators and engineers
Business Linkages (Suppliers and Clients)	
Forward linkages (Clients)	Motor manufacturers
Backward linkage	Silicon steel sheet manufacturers
Financial Features	
Revenue stream	Selling of stator, rotor stacks
CAPEX range	1 - 10 M EGP
OPEX main elements	Raw material: GOSS, NGOSS
Considerations	
Key challenge	Low demand
Advantages	Low competition

2.4. Assessment and ranking of the business opportunities short list according to a set of diverse indicators

Building on the short list identified in the previous sections, this section presents the qualitative assessment through a set of diverse indicators reflecting success level of each BO. After assessing the BOs short list, a heat map is developed. The heat map is a tool that allows a rapid decision making on the top BOs ranked through a color-coded score.

The BOs short list are qualitatively assessed against a set of six indicators, namely, low initial investment, availability of local knowhow, availability of skilled labor, availability of supplier (access to industrial inputs), ease of managing technology, market diversity as shown in Table 6.

Table 6: Scoring criteria and the weight of each criterion

Criteria	High Score= (3)	Medium Score= (2)	Low Score= (1)
Availability of skilled labor	All main skills are available	Some skills are missing (but not critical ones)	Critical skills are missing
Availability of supplier (access to industrial inputs)	All main suppliers are available	Some suppliers are missing (but not critical ones)	Critical suppliers are missing
Gap in local manufacturing capacity	Capable of expanding production to satisfy demand	Capable to expand production to partially satisfy demand	Low (or no) capability to expand production
Market diversity	Motors is one market of many	Motor is the key market	Motors is the only market
Presence of local capacity to innovate	Local manufacturer can independently innovate and update the technology/process	Local manufacturer can innovate and update the technology/process with some foreign support	Local manufacturer cannot innovate and needs foreign know how
Low initial investment	< 50 Million EGP	50 - 200 Million EGP	> 200 Million EGP

The key experts within the consortium consultancy team have qualitatively scored each criterion for comparison and ensured the consensus. The scoring criteria ranges from the following:

- Highest favourable = 3
- Moderate = 2
- Least favourable = 1

Scoring is cross validated through internal research by the consortium and with the interviewed stakeholders.

This scoring is reflecting how positive the business opportunity ranked against the criterion. A color-coded heat map was generated to represent each criterion score. Green indicated a score of “3”, yellow indicated a score of “2”, and red indicated a score of “1”, see Figure 10. The final score was calculated as average of key experts’ scores for the evaluation criteria.

#	Business opportunity	Availability of skilled labor	Availability of supplier	Gap in local manufacturing capacity	Market diversity	Presence of local capacity to innovate	Low initial investment	Total score
1	Rolling silicon steel to different thicknesses	3	3	3	2	3	1	2.50
2	Production of motor cooling fans	3	2	3	3	1	3	2.50
3	Manufacturing varnish coated aluminum wires	2	3	3	2	1	3	2.33
4	Machining of shafts (coupling)	3	3	1	3	1	3	2.33
5	Manufacturing varnish coated copper wires	2	3	2	2	1	3	2.17
6	Stamping the motor fan cover	3	2	2	1	1	3	2.00
7	Casting of motor frames (Cast iron)	2	2	2	2	1	2	1.83
8	Stamping of motor laminations	1	2	3	1	1	3	1.83
9	Casting of motor frames (Aluminum)	1	1	3	2	1	2	1.67
10	Stacking rotor laminations and die-casting of rotor cage	1	1	3	1	1	3	1.67

Figure 10: Heat map of the business opportunities short list

3. Conclusion

Business Opportunity Mapping (BOM) methodology is applied to the market of local manufacturing of EE motors in Egypt, to map the investment opportunities with the highest success levels probabilities.

A long list of 18 BOs was developed, covering all the key possible opportunities in the value chain of the motors manufacturing. The next step was to develop a short list of 10 business opportunities after excluding the industries of extraction and production of raw material, due to the required massive investments.

The ranking of the BOs, as per Table 10, gives the following top five opportunities which have total score above 2 out of 3 as the following:

- Rolling silicon steel to different thicknesses
- Production of motor cooling fans
- Manufacturing varnish coated Aluminium wires
- Machining of shafts/couplings
- Manufacturing varnish coated Copper wires

Basically, the top successful opportunities are for machining and production of small components of the motor (shafts and fans), which provide quick win investments, low required capital cost, easy to implement and available know how and technology along with market diversity.

It is also important to highlight that having motors manufacturers (i.e., manufacturers of the motor itself as a final product) is the most important step to open market and demand for other feeding industries and components. Otherwise, components manufacturers will not invest as long as there is no demand.

The business opportunity of manufacturing silicon steel sheets (rolling silicon steel to different thicknesses) has a key drawback of the huge required initial investments and infrastructure (more than 200 M EGP for the new production lines, assuming that the manufacturer expands the activities while having existing infrastructure of the facility). Limited exiting entities in the local market can expand to such activity. Hence, this BO will be excluded in future exploration when studying the feasibility analysis of top BOs in next section.

In next section, the next top four business opportunities shall be considered and addressed in the feasibility analysis, namely:

- Production of motor cooling fans
- Manufacturing varnish coated Aluminium wires
- Machining of shafts/couplings
- Manufacturing varnish coated Copper wires

III. Section 3: Feasibility Analysis of Local Manufacturing Opportunities of Electric Motors Components

1. Overview

This report presents the feasibility analysis of four selected business opportunities (BO) of local manufacturing in the value chain of electric motors in Egypt. The objective is to ascertain the viability of these opportunities, focusing on certain key technical and financial aspects. It aims at identifying market opportunities and status, defining the successful outcomes, as well as assessing the range of costs and financial projections. The study targets new investors entering the local manufacturing market of electric motors, or existing players planning to expand their activities within the value chain. It should support in decision-making process based on a cost benefit analysis, prior to the commitment of a formal business plan.

The report discusses some key items regarding each opportunity, including:

- Market analysis (demand and supply)
- Manufacturing process and technology
- Business opportunity considerations (infrastructure and technical parameters)
- Financial forecast and determination of financial feasibility

1.1. Selected business opportunities for feasibility analysis

The report builds upon the business opportunity mapping (BOM) report. The top four selected BOs as scored according to the BOM section are studied in more details for their technical and financial feasibilities. The considered BOs for feasibility study are:

- Production of motor cooling fans
- Machining of shafts/coupling
- Manufacturing varnish coated Aluminium wires
- Manufacturing varnish coated Copper wires

They are mainly manufacturing of components of the motor, as marked in red in the value chain, see Figure 11.

In next section, the key assumptions used to develop the financial feasibilities are presented, as well as the financial feasibilities of each business opportunity.

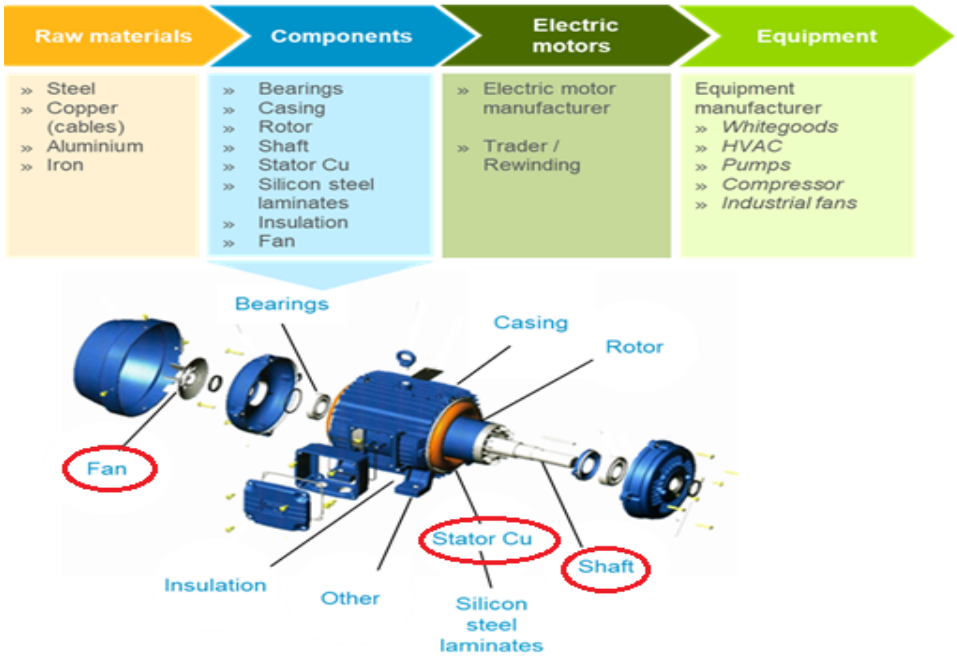

Figure 11: Selected manufacturing BOs for feasibility analysis as part of the value chain

2. Technical and financial feasibility analysis

2.1. Introduction and key assumption

In this section, the key assumption used in developing the financial analysis are introduced, their definitions, as well as the financial indicators used to assess the feasibility.

Table 7 presents general macroeconomic assumptions that were used to develop the four business opportunities feasibilities[7].

Table 7: General macroeconomic assumption for feasibility of manufacturing motor components

Macroeconomic Assumptions	%	Definition	Comments
Discount rate	11.75 %	It is the interest rate used to determine the present value of future cash flows	As per Central Bank of Egypt (CBE)[8]
Equity	100%		Fully funded through direct investment.
Income tax rate	22.5%	Income tax rate.	For annual income > 200,000 EGP[9]
Exchange rate (EGP/USD)	18.7		Updated on June 2022[10]
Value added tax (VAT)	14%		

Table 8 illustrates the definition of the financial indicators that are used to evaluate the feasibility studies to facilitate comparison.

Table 8:Feasibility economic indicators definition[11]

Factor		Definition
Net Present Value	NPV	The difference between the present value of cash inflows and the present value of cash outflows over a period of time. A positive net present value indicates that the projected earnings generated by a project or investment exceeds the anticipated costs. It is assumed that an investment with a

[7] *Effect of inflation rate and Weighted Average Cost of Capital (WACC) are not considered in this study. Therefore, average costs per year during the lifetime of each investment are considered for all years in the cash flow analysis.*
[8] https://www.cbe.org.eg/en/EconomicResearch/Statistics/Pages/DiscountRates.aspx
[9] *Egyptian Tax Authority, "Low No. 97 of 2018, Income Tax Law," 2018. [Online]. Available:* http://www.incometax.gov.eg/pdf/law-97-2018.pdf
[10] https://www.cbe.org.eg/en/EconomicResearch/Statistics/Pages/ExchangeRatesListing.aspx
[11] https://www.investopedia.com/

		positive NPV will be profitable, and an investment with a negative NPV will result in a net loss.
Internal Rate of Return	IRR	It is the discount rate that makes the net present value (NPV) of all cash flows (both positive and negative) equal to zero in a discounted cash flow analysis. (If it is higher than bank interest rate, investment is feasible, but according to the sector).
Payback Period	PBP	It is the amount of time it takes to recover the cost of an investment (i.e., an investment's cash flows to equal its initial cost). In other words, it's the amount of time it takes for an investment to pay for itself.

2.2. Feasibility analysis

The following subsections present the feasibility analysis of the selected top four BOs. The analysis covers the following key aspects:

- Market analysis (demand and supply)
- Technology description
- Market environment (advantages and risks)
- Technical parameters and assumptions
- Financial projections and cash flow

For equal comparison of business opportunities, it is assumed in the financial models that all of them are a new business, so that the cost of new land and facility construction are considered as part of the CAPEX.

This financial feasibility model was established using different technical and market assumptions based on the type of motor. Based on which, the income statement and balance sheet were built using fixed units (number / quantity) yet increasing values (unit sales / costs) using projected inflation rates throughout the projected period (10 years). Additionally, the balance sheet construction required the estimation of days in hand for the working capital to be projected.

Based on the projected income statement and balance sheet, the cash flow statement was calculated. Accordingly, the discounted cash flow statement was predicted including the terminal value. Using the discount rate appropriate for each sector, the cash flows were discounted and the different investment decision criteria such as NPV, IRR, and payback period were calculated.

2.2.1. Feasibility analysis of local manufacturing of cooling fans of motors

The following table, Table 9, presents the feasibility analysis of local manufacturing of plastic cooling fans for motors.

Table 9: Feasibility analysis of local manufacturing of plastic cooling fans

BO Study 1	**Local Manufacturing of Plastic Cooling Fans**		
Market Analysis			
Output (DEMAND)	**Name**	**Application**	**Target Market**
Final Product	Plastic cooling fans for motors	Used for cooling of motors. Fans are mounted on motor shaft to support in air circulation for motor cooling.	Local manufacturers of motors, as well as rewinding and maintenance facilities of motors (to replace damaged fans)
Required Inputs (SUPPLY)	**Name**	**Key Suppliers**	
Raw Material	Polypropylene (PP) and High-Density Poly Ethylene (HDPE) plastic pellets	Local manufacturing available, several suppliers	
Technology Description			
Technology	**Description**		
Process or Technology Used	Plastic injection molding, machining, die-shop		
Market Environment			
Market Environment (Advantages & Risks)	**Description**		

Competitive Advantage (compared to Imported items)	Low cost of raw material, labour and overheads Short lead time Easy customized sizes and shapes according to client's demand
Barriers to Entry	Maintaining the quality level of the product Low demand at the short term, due to low capacity of local manufacturing of end product (motors)
Key Stakeholders	Local manufacturers of motors Motor rewinding and maintenance facilities Manufacturers or service centres of any device needs a cooling fan (such as inverters, PCs, etc.)
Risks	Quality control and safety aspects related to plastic injection machines (such as plastic fume, high temperature, dust, noise, etc.)

Technical Parameters and Assumptions				
Technical Parameters	**Quantity**	**Unit**	**Comments**	
Land Area Required	1000	m^2	Assuming new factory is constructed, with average 8,000 EGP/m2	
Production Capacity	115	tons/month	Working 2 shifts, 26 days/month, with assumed utilization factor of the machinery of 80%. The assumed basic machinery: 2 plastic injection machine and 4 moulds.	
Required Raw Material Input	128	tons/month	Assuming 10% production loss + 7.5% scrap	
Establishment Period	6	Months		
Project Life	10	Years		
Capital Expenditures	**Quantity**	**Unit**	**Lifetime**	**Comments**
Total CAPEX of building, constructing, equipment and furnishing	20,405,000	EGP	10 years	Including land cost, construction, licensing, and administration cost Assuming 2 injection machines and 4 moulds (for several sizes)
Operating Expenditures	**Quantity**	**Unit**	**Comments**	

Cost of Goods Sold (COGS)			COGS is the carrying value of goods sold during a particular period. It includes all of the direct costs involved in manufacturing products
Cost of Raw Material, Energy, Utilities, Direct Labour and Maintenance	2,871,224	EGP/month	
Other Selling, General & Administrative (SG&A)			
Utilities (unrelated to production)	25,000	EGP/month	
Logistics and supplies	25,000	EGP/month	
Marketing and sales	50,000	EGP/month	
Indirect labour	40,000	EGP/month	

Financial Projections and Cash Flow							
		Number of Years					
Income statement	Units	0	1	2	3	…	10
Sales	EGP	-	24,780,252	54,597,802	60,330,571	..	110,286,645
COGS	EGP	-	(20,969,372)	(46,201,370)	(51,052,513)	..	(93,325,992)
Depreciation	EGP	-	(1,440,500)	(1,440,500)	(1,440,500)	..	(1,440,500)
Gross profit	**EGP**	**-**	**2,370,381**	**6,955,933**	**7,837,558**	**..**	**15,520,153**
Pre-operating expenses	EGP	(123,901)				..	
SG&A	EGP	-	(1,672,707)	(3,685,441)	(4,072,412)	..	(7,444,528)

Other revenues	EGP	-	1,540,610	3,394,394	3,750,805	..	6,856,618
EBIT	**EGP**	**(123,901)**	**2,238,284**	**6,664,886**	**7,515,951**	**..**	**14,932,243**
Interest expense	EGP	-	-	-	-	..	-
EBT	**EGP**	**(123,901)**	**2,238,284**	**6,664,886**	**7,515,951**	**..**	**14,932,243**
Loss carry forward	EGP	(123,901)	(123,901)	-	-	..	-
Tax expense	EGP	-	475,736	1,471,721	1,691,089	..	3,359,755
NI (Net Income)	**EGP**	**(123,901)**	**1,762,548**	**5,193,164**	**5,824,862**	**..**	**11,572,488**

Financial Indicators	
Summary of investment decision criteria:	
Initial investment	20,405,000 EGP
NPV	17,836,995
IRR	10.6%
Simple payback period	4.6 yrs.
Discounted payback period	7.6 yrs.
Profitability index	1.7

Remark:

Plastic fans represent small portion (value) of the value chain of motors, and not expected to be a standalone business. It can be considered as a business expansion activity of an existing plastic injection manufacturer. Therefore, if the cost of new land and construction are excluded from the CAPEX and only new machinery and moulds are included, the financial indicators shall be:

Summary of investment decision criteria:	
Initial investment	9,405,000 EGP
NPV	32,276,796
IRR	29.7%

Simple payback period	3.1 yrs.
Discounted payback period	3.9 yrs.
Profitability index	3.5

2.2.2. *Feasibility analysis of local manufacturing of motor shafts/couplings*

The following table, Table 10, presents the feasibility analysis of local manufacturing of motor shafts.

Table 10: Feasibility analysis of local manufacturing of motor shafts

BO Study 2	**Local Manufacturing of Motor Shafts/coupling**		
Market Analysis			
Output (DEMAND)	**Name**	**Application**	**Target Market**
Final Product	Steel shafts for motors	Manufacturing of cylindrical shafts of motors. They are used to convert mechanical energy from the rotor to the end-use application or equipment	Local manufacturers of motors, as well as rewinding and maintenance facilities of motors (to replace damaged shafts)
Required Inputs (SUPPLY)	**Name**	**Key Suppliers**	
Raw Material	Mild steel and Stainless steel bars	Local manufacturing available, several suppliers	
Technology Description			
Technology	**Description**		
Process or Technology Used	CNC machine, shaping, cutting and subtractive process, boring, drilling, internal and external threading, hardening, welding, coating		
Market Environment			
Market Environment (Advantages & Risks)	**Description**		
Competitive Advantage (compared to Imported items)	Low cost of raw material, labour and overheads Short lead time Easy customized sizes and shapes according to client's demand		

Barriers to Entry	Maintaining the quality level of the product Low demand at the short term, due to low capacity of local manufacturing of end product (motors)
Key Stakeholders	Local manufacturers of motors Motor rewinding and maintenance facilities Manufacturers or OEMs of other equipment having driving shafts (such as whitegoods, automotives, generators, etc.)
Risks	Quality control and safety aspects Competition with imported alternatives having mass production and low cost

Technical Parameters and Assumptions				
Technical Parameters	**Quantity**	**Unit**	**Comments**	
Land Area Required	1000	m^2	Assuming new factory is constructed, with average 8,000 EGP/m2	
Production Capacity	71	tons/month	Working 2 shifts, 26 days/month, with assumed utilization factor of the machinery of 80%. The assumed basic machinery: 3 Band saws, 6 machining centres, and 2 grinding machines.	
Required Raw Material Input	80	tons/month	Assuming 10% production loss + 7.5% scrap	
Establishment Period	6	Months		
Project Life	10	Years		
Capital Expenditures	**Quantity**	**Unit**	**Lifetime**	**Comments**
Total CAPEX of building, constructing, equipment and furnishing	21,054,000	EGP	10 years	Including land cost, construction, licensing, and administration cost, in addition to the cost of machineries (3 Band saws, 6 machining centres, and 2 grinding machines).
Operating Expenditures	**Quantity**	**Unit**	**Comments**	
Cost of Goods Sold (COGS)			COGS is the carrying value of goods sold during a particular period. It includes all of the direct costs involved in manufacturing products	

Cost of Raw Material, Energy, Utilities, Direct Labour and Maintenance	759,433	EGP/month	
Other Selling, General & Administrative (SG&A)			
Utilities (unrelated to production)	25,000	EGP/month	
Logistics and supplies	25,000	EGP/month	
Marketing and sales	50,000	EGP/month	
Indirect labour	40,000	EGP/month	

Financial Projections and Cash Flow							
		Number of Years					
Income statement	Units	0	1	2	3	...	10
Sales	EGP	-	9,365,449	20,634,693	22,801,336	..	41,681,734
COGS	EGP	-	(5,375,487)	(11,843,696)	(13,087,284)	..	(23,924,067)
Depreciation	EGP	-	(1,305,400)	(1,305,400)	(1,305,400)	..	(1,305,400)
Gross profit	**EGP**	**-**	**2,684,561**	**7,485,597**	**8,408,652**	**..**	**16,452,267**
Pre-operating expenses	EGP	(46,827)				..	
SG&A	EGP	-	(1,258,603)	(2,773,053)	(3,064,224)	..	(5,601,521)
Other revenues	EGP	-	209,927	462,528	511,094	..	934,299

EBIT	**EGP**	**(46,827)**	**1,635,886**	**5,175,072**	**5,855,522**	**..**	**11,785,045**
Interest expense	EGP	-	-	-	-	..	-
EBT	**EGP**	**(46,827)**	**1,635,886**	**5,175,072**	**5,855,522**	**..**	**11,785,045**
Loss carry forward	EGP	(46,827)	(46,827)	-	-	..	-
Tax expense	EGP	-	357,538	1,153,855	1,317,492	..	2,651,635
NI (Net Income)	**EGP**	**(46,827)**	**1,278,348**	**4,021,217**	**4,538,029**	**..**	**9,133,410**

Financial Indicators	
Summary of investment decision criteria:	
Initial investment	21,054,000 EGP
NPV	10,261,089
IRR	6.8%
Simple payback period	5.3 yrs.
Discounted payback period	9.6 yrs.
Profitability index	1.5

Remark:

Motor shafts represent small portion (value) of the value chain of motors, and not expected to be a standalone business. It can be considered as a business expansion activity of an existing manufacturer providing CNC and shaping services. Therefore, the if the cost of new land and construction are excluded from the CAPEX and only new machineries are included, the financial indicators shall be:

Summary of investment decision criteria:	
Initial investment	10,604,000 EGP
NPV	19,568,638
IRR	21.0%
Simple payback period	3.7 yrs.

Discounted payback period	5.0 yrs.
Profitability index	2.7

2.2.3. *Feasibility analysis of local manufacturing of Aluminum varnished wires*

The following table, Table 11, presents the feasibility analysis of local manufacturing of plastic Aluminum varnished wires.

Table 11: Feasibility analysis of local manufacturing of Aluminum varnished wires

BO Study 3	**Local Manufacturing of Aluminium varnished wires**		
Market Analysis			
Output (DEMAND)	**Name**	**Application**	**Target Market**
Final Product	Aluminium varnished wires	Manufacturing of Aluminium varnished wires, used for the windings of the motors	Local manufacturers of motors, as well as rewinding and maintenance facilities of motors
Required Inputs (SUPPLY)	**Name**	**Key Suppliers**	
Raw Material	Aluminium rods/wires of different gauges, Enamel varnish, Packing materials	Local manufacturing available, several suppliers	
Technology Description			
Technology	**Description**		
Process or Technology Used	Cable Drawing Process, Annealing, Enameling, Tinning Process (Hot dipping or Electroplating), Winding and packaging		
Market Environment			
Market Environment (Advantages & Risks)	**Description**		
Competitive Advantage (compared to Imported items)	Low cost of labour and overheads Short lead time Easy customized sizes and shapes according to client's demand		

Barriers to Entry	Maintaining the quality level of the product Competition with existing manufacturers
Key Stakeholders	Local manufacturers of motors and generators Motor rewinding and maintenance facilities Local manufacturers of small inductors
Risks	Quality control and safety aspects

Technical Parameters and Assumptions				
Technical Parameters	**Quantity**	**Unit**	**Comments**	
Land Area Required	1000	m^2	Assuming new factory is constructed, with average 8,000 EGP/m2	
Production Capacity	526	tons/month	Working 2 shifts, 26 days/month, with assumed utilization factor of the machinery of 80%. The assumed basic machinery: 2 Rod breakdown machines, 2 inline annealers, and 16 enamelling machines.	
Required Raw Material Input	585	tons/month	Assuming 10% production loss + 7.5% scrap	
Establishment Period	6	Months		
Project Life	10	Years		
Capital Expenditures	**Quantity**	**Unit**	**Lifetime**	**Comments**
Total CAPEX of building, constructing, equipment and furnishing	191,931,250	EGP	10 years	Including land cost, construction, licensing, and administration cost, in addition to the cost of machineries (2 Rod breakdown machines, 2 inline annealers, and 16 enamelling machines)
Operating Expenditures	**Quantity**	**Unit**	**Comments**	
Cost of Goods Sold (COGS)			COGS is the carrying value of goods sold during a particular period. It includes all of the direct costs involved in manufacturing products	

Cost of Raw Material, Energy, Utilities, Direct Labour and Maintenance	65,018,155	EGP/month	Raw material includes cost of 10mm Aluminium wire-rod coils, insulating varnish and packaging material
Other Selling, General & Administrative (SG&A)			
Utilities (unrelated to production)	35,000	EGP/month	
Logistics and supplies	50,000	EGP/month	
Marketing and sales	500,000	EGP/month	
Indirect labour	48,000	EGP/month	

Financial Projections and Cash Flow							
		Number of Years					
Income statement	Units	0	1	2	3	...	10
Sales	EGP	-	540,969,471	1,191,906,506	1,317,056,690	..	2,407,631,153
COGS	EGP	-	(443,927,910)	(978,096,902)	(1,080,797,077)	..	(1,975,739,339)
Depreciation	EGP	-	(18,393,125)	(18,393,125)	(18,393,125)	..	(18,393,125)
Gross profit	**EGP**	**-**	**78,648,436**	**195,416,479**	**217,866,487**	**..**	**413,498,689**
Pre-operating expenses	EGP	(2,704,847)				..	
SG&A	EGP	-	(7,691,089)	(16,945,613)	(18,724,902)	..	(34,229,853)
EBIT	**EGP**	**(2,704,847)**	**70,957,347**	**178,470,866**	**199,141,586**	**..**	**379,268,836**
Interest expense	EGP	-	-	-	-	..	-

EBT	**EGP**	**(2,704,847)**	**70,957,347**	**178,470,866**	**199,141,586**	**..**	**379,268,836**
Loss carry forward	EGP	(2,704,847)	(2,704,847)	-	-	..	-
Tax expense	EGP	-	15,356,812	39,547,354	44,806,857	..	85,335,488
NI (Net Income)	**EGP**	**(2,704,847)**	**55,600,535**	**138,923,512**	**154,334,729**	**..**	**293,933,348**

Financial Indicators	
Summary of investment decision criteria:	
Initial investment	191,931,250 EGP
NPV	767,107,455
IRR	32.6%
Simple payback period	3.0 yrs.
Discounted payback period	3.7 yrs.
Profitability index	3.9

For the case of business expansion activity of an existing manufacturer, the cost of new land and construction are excluded from the CAPEX and only new machineries are included. Therefore, the financial indicators shall be:

Summary of investment decision criteria:	
Initial investment	179,631,250 EGP
NPV	778,496,259
IRR	34.3%
Simple payback period	3.0 yrs.
Discounted payback period	3.6 yrs.
Profitability index	4.1

2.2.4. *Feasibility analysis of local manufacturing of Copper varnished wires*

The following table, Table 12, presents the feasibility analysis of local manufacturing of plastic Copper varnished wires.

Table 12: Feasibility analysis of local manufacturing of Copper varnished wires

BO Study 4	**Local Manufacturing of Copper varnished wires**		
Market Analysis			
Output (DEMAND)	**Name**	**Application**	**Target Market**
Final Product	Copper varnished wires	Manufacturing of Copper varnished wires, used for the windings of the motors	Local manufacturers of motors, as well as rewinding and maintenance facilities of motors Local manufacturers of transformers and inductors
Required Inputs (SUPPLY)	**Name**	**Key Suppliers**	
Raw Material	Copper rods/wires of different gauges, Enamel varnish, Packing materials	Local manufacturing available, several suppliers	
Technology Description			
Technology	**Description**		
Process or Technology Used	Cable Drawing Process, Annealing, Enameling, Tinning Process (Hot dipping or Electroplating), Winding and packaging		
Market Environment			
Market Environment (Advantages & Risks)	**Description**		
Competitive Advantage (compared to Imported items)	Low cost of labour and overheads Short lead time Easy customized sizes and shapes according to client's demand		

Barriers to Entry	Maintaining the quality level of the product
Key Stakeholders	Local manufacturers of motors and generators Motor rewinding and maintenance facilities Local manufacturers of transformers and inductors
Risks	Quality control and safety aspects

Technical Parameters and Assumptions				
Technical Parameters	**Quantity**	**Unit**	**Comments**	
Land Area Required	1000	m^2	Assuming new factory is constructed, with average 8,000 EGP/m2	
Production Capacity	1740	tons/month	Working 2 shifts, 26 days/month, with assumed utilization factor of the machinery of 80%. The assumed basic machinery: 2 Rod breakdown machines, 2 inline annealers, and 16 enamelling machines.	
Required Raw Material Input	1930	tons/month	Assuming 10% production loss + 7.5% scrap	
Establishment Period	6	Months		
Project Life	10	Years		
Capital Expenditures	**Quantity**	**Unit**	**Lifetime**	**Comments**
Total CAPEX of building, constructing, equipment and furnishing	191,931,250	EGP	10 years	Including land cost, construction, licensing, and administration cost, in addition to the cost of machineries (2 Rod breakdown machines, 2 inline annealers, and 16 enamelling machines)
Operating Expenditures	**Quantity**	**Unit**	**Comments**	
Cost of Goods Sold (COGS)			COGS is the carrying value of goods sold during a particular period. It includes all of the direct costs involved in manufacturing products	

Cost of Raw Material, Energy, Utilities, Direct Labour and Maintenance	207,692,472	EGP/month	Raw material includes cost of 8 mm Copper wire-rod coils, insulating varnish and packaging material
Other Selling, General & Administrative (SG&A)			
Utilities (unrelated to production)	35,000	EGP/month	
Logistics and supplies	50,000	EGP/month	
Marketing and sales	500,000	EGP/month	
Indirect labour	48,000	EGP/month	

Financial Projections and Cash Flow							
		Number of Years					
Income statement	Units	0	1	2	3	...	10
Sales	EGP	-	1,724,247,479	3,798,997,723	4,197,892,484	..	7,673,911,686
COGS	EGP	-	(1,429,894,309)	(3,150,455,659)	(3,481,253,503)	..	(6,363,867,593)
Depreciation	EGP	-	(18,393,125)	(18,393,125)	(18,393,125)	..	(18,393,125)
Gross profit	**EGP**	**-**	**275,960,044**	**630,148,939**	**698,245,856**	**..**	**1,291,650,968**
Pre-operating expenses	EGP	(8,621,237)				..	
SG&A	EGP	-	(7,691,089)	(16,945,613)	(18,724,902)	..	(34,229,853)
EBIT	**EGP**	**(8,621,237)**	**268,268,955**	**613,203,327**	**679,520,954**	**..**	**1,257,421,115**
Interest expense	EGP	-	-	-	-	..	-

EBT	**EGP**	**(8,621,237)**	**268,268,955**	**613,203,327**	**679,520,954**	**..**	**1,257,421,115**
Loss carry forward	EGP	(8,621,237)	(8,621,237)	-	-	..	-
Tax expense	EGP	-	58,420,736	136,030,970	152,892,215	..	282,919,751
NI (Net Income)	**EGP**	**(8,621,237)**	**209,848,219**	**477,172,357**	**526,628,740**	**..**	**974,501,364**

Financial Indicators	
Summary of investment decision criteria:	
Initial investment	191,931,250 EGP
NPV	2,842,222,394
IRR	65.3%
Simple payback period	2.3 yrs.
Discounted payback period	2.5 yrs.
Profitability index	7.5

For the case of business expansion activity of an existing manufacturer, the cost of new land and construction are excluded from the CAPEX and only new machineries are included. Therefore, the financial indicators shall be:

Summary of investment decision criteria:	
Initial investment	179,631,250 EGP
NPV	2,853,611,198
IRR	67.2%
Simple payback period	2.3 yrs.
Discounted payback period	2.5 yrs.
Profitability index	7.8

3. Conclusion

This section presents the preliminary feasibility analysis of the top four business opportunities (BO) as concluded from the BOM report. They are:

- Production of motor cooling fans
- Machining of shafts
- Manufacturing varnish coated Aluminium wires
- Manufacturing varnish coated Copper wires

The analysis gives estimates of the key financial indicators to support the decision makers prior to the commitment of a formal business plan. Key assumptions as well as financial and technical parameters are presented.

They key financial indicators of the four BOs are as in Table 13. In addition, Figure 12 shows a graphical representation comparison between the key financial indicators of the four business opportunities.

Table 13: Summary of the financial indicators of feasibility analysis

	BO of Copper Varnished Wires	BO of Aluminum Varnished Wires	BO of Machining of Shafts	BO of Copper Varnished Wires
Investment Cost	434,961,391	267,411,165	23,966,503	21,982,055
NPV	2,842,222,394	767,107,455	17,836,995	10,261,089
IRR	65.3%	32.6%	10.6%	6.8%
Simple PBP	2.3 yrs.	3.0 yrs.	4.6 yrs.	5.3 yrs.
Discounted PBP	2.5 yrs.	3.7 yrs.	7.6 yrs.	9.6 yrs.
Profitability index	7.5	3.9	1.7	1.5

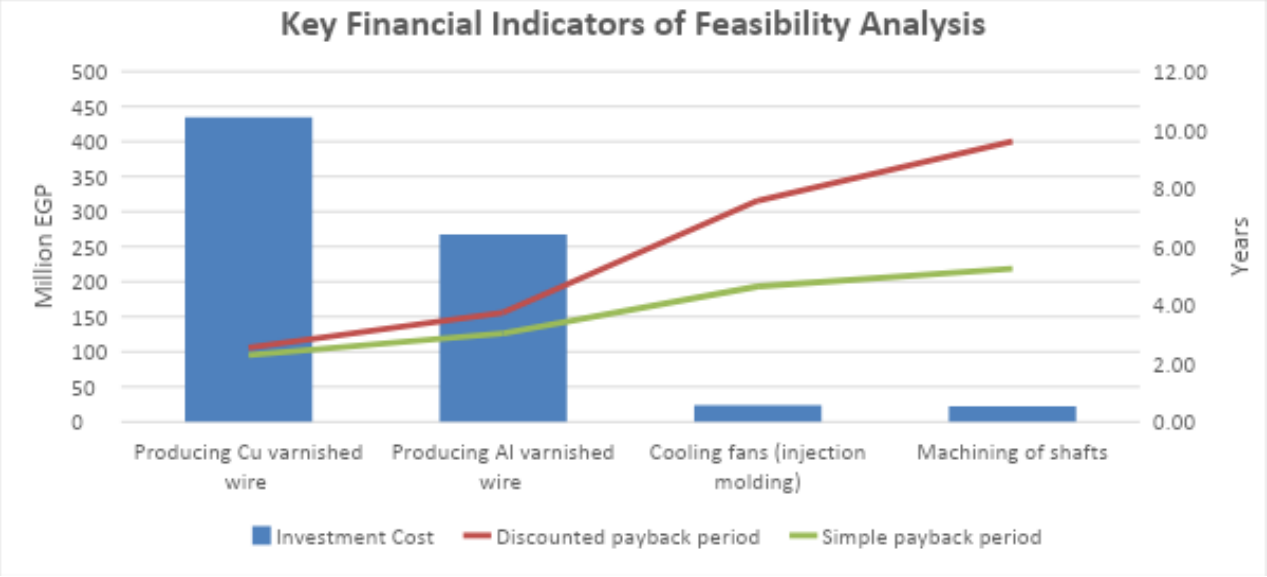

Figure 12: Representation of the key financial indicators of the four BOs

It can be concluded that the BO of manufacturing of annealed copper and aluminum wires are the most profitable, with highest revenues and IRR. On the other hand, small components, such as fans and shafts are less profitable as they present small value in the value chain (1.2% for fans and 3.7% for shafts, compared to 26.8% for annealed wires).

IV. Section 4: Roadmap and Policies to Support Local Manufacturing of EE and Clean Technologies for Motor Systems

1. Overview

1.1. Background and Objectives

This section aims at supporting the local industries in the development of EE and clean technologies for motor systems. It should build upon the strategies identified by the IFC to promote the local manufacturing value chain of EE industrial equipment and motors, which were developed by the Smart Technology and Energy Efficient Production Program (STEP) of IFC.

The updated roadmap and polices shall support local manufacturers in the production of EE motor systems through on-ground mapping of barriers to local manufacturing, development of detailed policy interventions and update the roadmap of IFC STEP. This section shall present the feedback of the key market stakeholders on the roadmap, to prioritize the interventions of the roadmap considering the market dynamics since the development of the roadmap in 2018, particularly to reflect the Covid-19 impact and the launch of the decree 463/2020, to ensure that the recommendations and interventions provided are in line with current market trends.

1.2. Background of the Roadmap of IFC STEP Program

The STEP program of the IFC was developed, focusing on 2 components:

1. ***Component 1***: Increase up-take of energy efficient electric motors by:
   - Developing minimum energy performance standards (MEPS),
   - Developing a labelling system for energy efficient motors,
   - Improving the monitoring verification & enforcement mechanism.
2. ***Component 2***: Catalyse investment in energy efficient technology manufacturing and increasing their availability and use by industries by:
   - Improving policies and regulatory frameworks to encourage investment in energy efficient technology manufacturing,
   - Developing policies that support energy efficient technology use by industries.

Within the context of Component 2, a detailed assessment was performed to analyze the electric motor value chain and the potential for local manufacturing in Egypt, as well as to develop a roadmap for stakeholders to stimulate local manufacturing of electric motors. The assessment has primarily identified key market segments where local manufacturing can compete, and where demand conditions are favorable as well as key gaps and opportunities in the value chain structure.

However, the roadmap was developed in 2018/2019 and need to be updated according to the current market status. It is important to map the market dynamics and recent events (such as the decree 463/2020 launch and Covid-19) on the roadmap and required polices to practically represent the stakeholders' vision and measures.

1.3. Work Methodology

This subsection describes the approach and methodology, as well as key considerations during implementation of this methodology and activities.

Our approach is based on three basic pillars, as described below:

- ***Deep understand of the roadmap and proposed interventions.*** Chemonics Egypt participated with the consortium worked previously in component 2 of the IFC STEP program and in developing the roadmap. Relying on this and the deep understand of the proposed interventions as well as challenges and barriers, a review of the roadmap is provided to reflect the market dynamics and its recent status.
- ***Reliance on Existing Networks***. Leveraging existing networks of market players and stakeholders to provide access to data and knowledge as well as to map the updates of the value chain and market dynamics, affecting the priorities of the roadmap.
- ***Individual interviews with key stakeholders.*** Our approach depends on individual interviews with stakeholders to obtain detailed feedback on the roadmap activities and market dynamics. This allows the room for capturing detailed data while ensuring confidentiality is protected, such as data of manufacturing plans, investment amounts, sales or marketing plans, production values, monitoring verification & enforcement mechanisms of MEPS. In addition, the interlinkages with existing/new players in the market are mapped, representing the market integration and possible business opportunity and investments.
- ***Validation of the roadmap policy interventions through a workshop –*** attended by the key stakeholders of the value chain. This aims at considering the feedback of stakeholders and achieving their endorsement and agreement on the proposed roadmap.

2. Overview the IFC Roadmap for Development of Local Manufacturing of Electric Motors

2.1. Summary of the Roadmap and Proposed Interventions

IFC STEP program developed a roadmap with defined actions to overcome the barriers of the local manufacturing market. Figure 13 presents an overview of the interventions and timeline of the roadmap, as well as the key stakeholders who should lead each intervention.

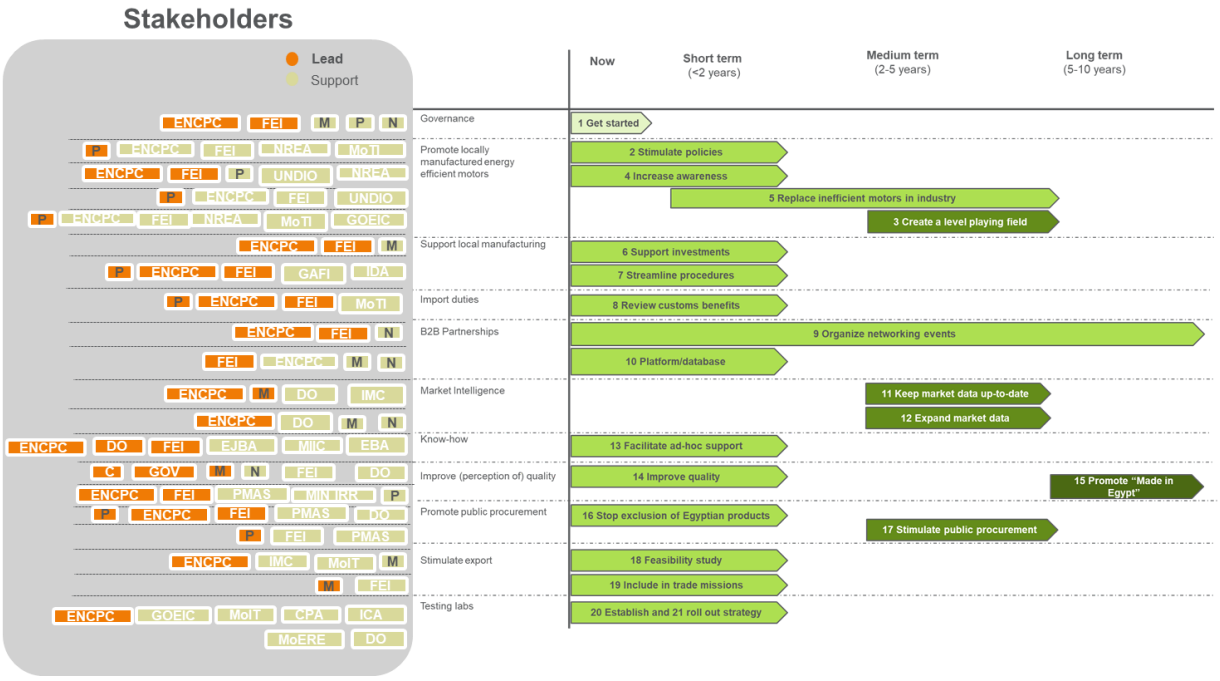

Figure 13: Overview of the roadmap of IFC STEP showing proposed timeline of recommended actions and key stakeholders

The list of interventions is grouped together based on their targeted barriers and impact. They can be summarized and defined as the following:

2.1.1. Promote locally manufactured energy efficient motors

Promoting manufacturing and using EE motors helps to reduce Egypt's electricity consumption and transfers revenues from electricity generators to motor manufacturers. The market value of the most efficient (IE4) motors is approximately double the market value of the least efficient (IE1) motors. Additionally, promotion and usage increase the competitiveness of Egypt's industry using these motors, reduces Egypt's greenhouse gas emissions, and enables more trade agreements. Interventions of this group include:

- ***Stimulate the development of policies for EE electric motors*** – through the engagement with the decision makers within the Egyptian government, to ensure that there is transparency on the regulations, and to stimulate acknowledgement of their relevance. Proposals of regulations on energy efficiency of motors (incentives) shall be prepared, and an effective dialogue among entities of the value chain is to be conducted allowing stakeholders to present their recommendations on the regulatory changes.
- ***Create a level playing field for compliant Egyptian produced products*** - by identifying deficiencies in current market surveillance and conformity assessment practice. This includes introducing a whistle blower system on non-compliance, such as cheap low quality/efficiency motors and informal trading (in some components and in white good) and imports of used products as if they were new.

- ***Raising customer awareness of energy efficient motors –*** awareness of MEPS and standards, through awareness campaigns and workshops targeting staff in the industrial, agricultural and the W&WWT sector acquiring motors. It focuses on raising consumer awareness of the benefits of using high energy efficient motors
- ***Replace inefficient motors in industry with efficient motors*** to reduce the electricity consumption of motors in industry by ensuring that new motors have a high energy efficiency and eliminating the use of low efficiency motors in the installed base. This would stimulate demand for motors with a high energy efficiency. Such an intervention shall be self-applied once the decree of MEPS is applied.

2.1.2. Support local manufacturing

The shortage of local manufacturing support requires the development of knowledge, sales and after sales infrastructure, as well as the full value chain of EE motors in Egypt. This can be achieved through:

- ***Provide support for investments increasing Egyptian production capacity of electric motor (components)*** – financial support mechanics varies and depend on the entity. They can be in form of grants, loans, equity or guarantees.
- ***Streamline procedures*** – Faster and more streamlined procedures to obtain manufacturing licenses would facilitate foreign investments or partnerships.

2.1.3. Import Duties

Streamlining import duties (the duties themselves as well as the process to reclaim customs and the method of determining local content) is crucial for many manufacturers in the value chain. This includes:

- ***Review customs benefits for (partly) locally manufactured products*** – by optimizing the import duties on electric motors, components and finished goods of electric motors to give more benefits to local manufacturers rather than complete imported components.

2.1.4. Stimulate B2B partnerships

Business partnerships can be stimulated through:

- ***Organize networking events*** – to share knowledge and market intelligence, as well as linking international brands with local manufacturers which could lead to joint ventures or partnerships.
- ***Develop a platform and create a database of manufacturers, products and specs***. This could be done in one of two ways:
    - In a database; obviously, part of this information may well be confidential (for competition rules). As a minimum, companies could include what they supply and their contact details in this database. Such a database makes it easier to find potential partners.
    - A subsection of “I am looking for”, where companies could indicate what they are currently searching for.

2.1.5. Enhance and maintain market data and intelligence

- ***Keeping the market data and potential additions up to date*** – market data and market studies shall be updated and disseminated using events and networking.
- ***Expand market data*** on the use of motors in locally produced end-products, and on the sales and distribution channels used by the various motor manufacturers.

2.1.6. Enhance the know-how

Facilitating technical support to Egyptian companies considering investing in local production of motor (components), as well as essential knowledge and know-how transfer are needed. This includes paying for support from industrial consultants. Also, companies can provide training and capacity building programs.

2.1.7. Increase the quality of locally manufactured products and the perception of this

The weak brand power and brand reputation of Egyptian motors hinders market development. This issue can be resolved by:

- ***Improve the quality of Egyptian motors (and components)*** – by optimizing production, testing, quality assurance systems, encouraging and facilitation certification of local products and good sales and after sales services.
- ***Promote "Made in Egypt"*** – through awareness campaigns by the government.

2.1.8. Promote the public procurement of Egyptian motors

It is important to ensure that no bias against locally manufactured products exists in public procurement specifications. Lack of trust in local products can be defined as one of the factors that discourage the R&D programs of entities. Therefore, this intervention aims at:

- ***Eliminating barriers against procuring Egyptian motors*** – by preventing the exclusion of Egypt from the shortlist of countries at which products of local tenders must be manufactured in.
- ***Stimulate public procurement with preferential treatment to local products*** – by strengthening the implementation of the Egyptian law (number 5, 2015) which provides a directive on preferential treatment of locally manufactured products in public tenders, to support local manufacturing.

2.1.9. Stimulate export

In principle, the size of addressable market is much greater for exports than domestically but developing sales channels is even more challenging, and usually following the development of the local market. stimulating exports depends on the following proposed interventions:

- ***Feasibility study for foreign markets (market study for export)*** - identify the best possibilities for export of electric motors (and their components) and thus provide market intelligence to potential investors.
- ***Make the export of electric motors (and their components) part of trade missions.***

2.1.10. Improve access to test labs

This can be achieved by:

- ***Establish testing lab strategy*** – In these testing labs, the quality and energy efficiency of motors (and their components) could be tested for development, certification, and verification purposes, and thus increasing the confidence in Egyptian motor.
- ***Roll out testing lab strategy*** – after establishing the labs and also publishing where other tests could be executed. Awareness raising of industrial clients is important to know they may leverage the existence of laboratories to ensure quality of local cost competitive products.

2.2. Feedback of Key Stakeholders and Local Manufacturers

This subsection presents the feedback of the interviewed stakeholders and local manufacturers regarding the barriers against expansion of local manufacturing of electric motors (components) in Egypt, as well as prioritizing the roadmap interventions and proposed policies.

2.2.1. Barriers against expansion of local manufacturing of motors

High custom tariff and its inconsistency, absence of local manufacturing support and Lack of trust in local products are the top three barriers against the expansion of local manufacturing of motors/components in Egypt. Figure 14 shows the intensity of captured barriers according to the interviewed stakeholders.

Validation of barriers and roadmap actions was conducted through interviews with 9 key value chain entities and manufacturers. The template of the interview with local manufacturers is presented in Annex 3. Also, a list of the interviewed entities is presented in Annex 2.

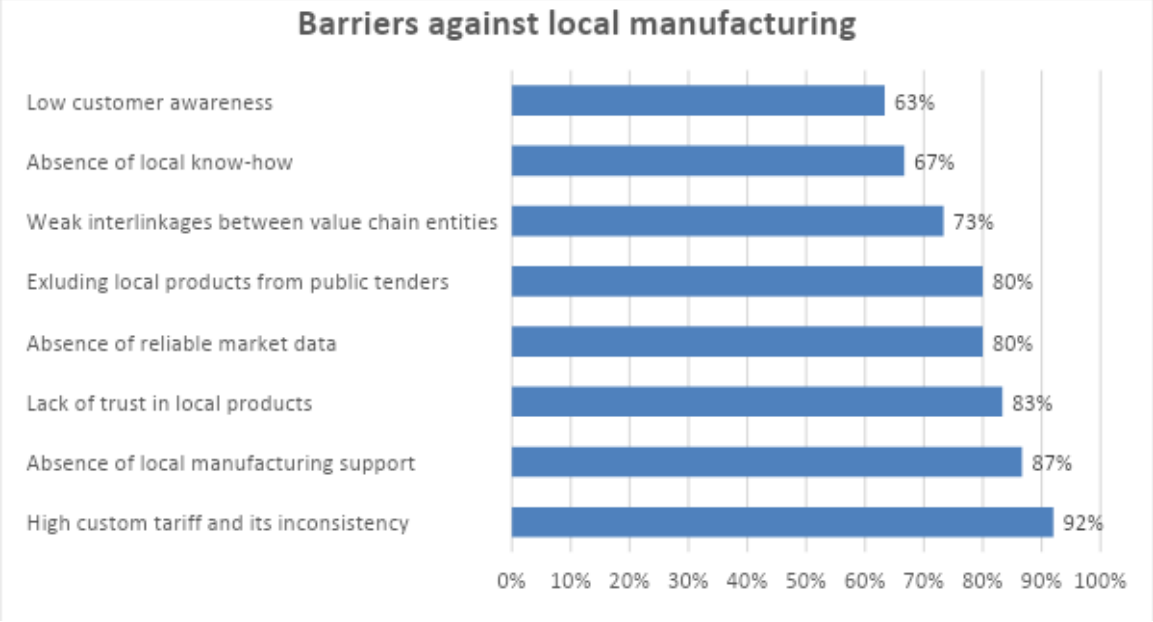

Figure 14: Barriers against local manufacturing of motors (components)

The absence of reliable market data and excluding local products from public tenders (by shortlisting the countries where products are manufactured, with excluding Egypt) are the next highest barriers following the top three barriers.

An additional mapped barrier that was mentioned by one of the interviewed entities was the difficulty to integrate with other manufacturers in the value chain, especially for components and feeding industries. This comes as result of absence of suitable raw material, lake of technology and know-how to comply with the required specs, and the uncompetitive prices compared to the imported products (especially compared to Chinese products with low unit cost due to mass production).

Another mapped barrier is the lack of clarity on regulatory frame, especially what is related to the implementation of the decree.

2.2.2. Priorities of roadmap interventions

The feedback explored the priorities of the roadmap interventions in light of the market dynamics, release of decree 463/2020 regarding labelling and MEPS, as well as the impact of Covid-19 on the market and business in general.

Reviewing customs tariff benefits for (partly) locally manufactured products, providing support for investments in production of electric motor (components), keeping market and roadmap data up to date, as well as establishing testing lab strategy are the top four interventions or the roadmap that were highlighted by the stakeholders, emphasizing their priority and the need to move forward with them at a short-term basis. Table 14 presents the group of interventions with their priorities based on level of agreement of interviewed stakeholders.

Table 14: Priorities of roadmap interventions

#	Intervention Group	Intervention	Level of Agreement (Priority)[12]
1	**Promote locally manufactured EE motors**	Create a level playing field for compliant Egyptian products	90%
		Raising customer awareness of energy efficient motors	77%
		Replace inefficient motors in industry with efficient motors	70%
2	**Support local manufacturing**	Provide support for investments increasing Egyptian production capacity of electric motor (components)	***100%***
		Streamline procedures	80%
3	**Review Import Duties**	Review customs benefits for (partly) locally manufactured products	***100%***

[12] *According to the interview template, as in Annex 3, the interviewed stakeholders were asked to give the interventions a score from 1 to 5 (where 1 is least important and 5 is the highest important). Average of scores is transferred to percentages where 5 equals 100%.*

4	**Stimulate B2B partnerships**	Organize networking events	90%
		Develop a platform and create a database of manufacturers, products and specs	83%
5	**Enhance and maintain market data and intelligence**	Keep market and roadmap data, and potential additions, up-to-date	***100%***
		Expand market data	90%
6	**Enhance the know-how**	Facilitate ad-hoc support	80%
7	**Increase the quality of locally manufactured products**	Improve the quality of Egyptian motors (and components)	93%
		Promote "Made in Egypt"	93%
8	**Promote the public procurement of Egyptian motors**	Eliminating barriers against procuring Egyptian motors	88%
		Stimulate public procurement with preferential treatment to local products	76%
9	**Stimulate export**	Feasibility study for foreign markets (market study for export)	93%
		Include motors (and components) exports in trade missions	93%
10	**Improve access to test labs**	Establish and Roll-out testing lab strategy	***97%***

Valid roadmap interventions yet slowed down timeframe. The feedback of stakeholders shows the validity of the roadmap and interventions, with minor updates on the priorities and needed timeline for implementing these interventions.

The roadmap interventions proposed short, medium, and long-term investments to stimulate the market and increase the volume of locally manufactured motors and components. Survey and updated market assessment showed that several short-term recommendations were achieved, such as interlinkages between some value chain stakeholders (for components and feeding industry level). In addition, some interventions are achieved or in progress under the support of UNIDO IMEP project and activities of IMC and ENCPC. However, the estimated timeline of other proposed interventions may be expanded, due to the slowed down investments as a result of market updates, such as Covid-19 pandemic which affected the market progress and increased prices of shipment and raw material globally. In addition, the release of the decree of the motors MEPS of IE3 efficiency shall increase the value of the investments of some components to match the targeted new level of efficiency of motors (such as high grades of silicon steel and copper wires, efficient gears and couplings, high quality stator/rotor blocks and designs). This in turn entails accurate market data and high investments in new designs and higher quality materials.

Moreover, market dynamics, global increase of prices (affecting sales and competitiveness) as well as the consequences of Covid-19 pandemic bring together to the foreground the interventions of quick wins and fast revenues to the local manufacturing. In addition, very careful steps towards long-term and large

investments are also highlighted, illustrating the need of updated and rugged market data. Besides, the release of the decree of MEPS raises the importance of establishing testing labs and rolling out the testing strategy.

Table 15 presents a summary of the status of each intervention, either achieved (in green), in progress or not yet. In addition, the next chapter presents the key recommended polices and interventions (to be continued following the IFC roadmap) as well as the new proposed interventions as post-Covid and decree.

Table 15: Implementation status of roadmap interventions

#	Intervention Group	Intervention	Status
1	**Promote locally manufactured EE motors**	***Create a level playing field for compliant Egyptian products***	Through UNIDO IMEP program, by promoting and raising awareness of the decree, developing a technical memorandum of the decree, developing decree implementation action plan and conformity plan
		Raising customer awareness of energy efficient motors	Through UNIDO IMEP program by trainings, awareness sessions and communication plan
		Replace inefficient motors in industry with efficient motors	Decree of MEPS is launched and shall be applied in April 2022. Also, the UNIDO IMEP program promotes for the feasibility of upgrading to EE motors
2	**Support local manufacturing**	Provide support for investments increasing Egyptian production capacity of electric motor (components)	Not yet
		Streamline procedures	Not yet
3	**Review Import Duties**	Review customs benefits for (partly) locally manufactured products	Not yet
4	**Stimulate B2B partnerships**	Organize networking events	In progress, through UNIDO IEMP program
		Develop a platform and create a database of manufacturers, products and specs	Not yet
5	**Enhance and maintain market data and intelligence**	***Keep market and roadmap data, and potential additions, up-to-date***	UNIDO IMEP program updates the roadmap and the market data and business opportunities, considering the new market dynamics and post covid and decree concerns
		Expand market data	In progress, through workshops, training and events of UNIDO IMEP program

6	**Enhance the know-how**	Facilitate ad-hoc support	Not yet
7	**Increase the quality of locally manufactured products**	Improve the quality of Egyptian motors (and components)	Not yet
		Promote "Made in Egypt"	Not yet
8	**Promote the public procurement of Egyptian motors**	Eliminating barriers against procuring Egyptian motors	Not yet
		Stimulate public procurement with preferential treatment to local products	Not yet
9	**Stimulate export**	Feasibility study for foreign markets (market study for export)	Not yet
		Include motors (and components) exports in trade missions	Not yet
10	**Improve access to test labs**	***Establish and Roll-out testing lab strategy***	Testing lab strategy is developed by GOEIC. A new lab in cooperation with ABB to test motors up to 75 kW is established, as well as additional smaller ratings labs are established in several ports by GOEIC. In addition, facilitating the use of labs for private sector is proposed.

3. Proposed Policy Interventions

The proposed polices to target the crucial roadmap interventions are presented in this section. It presents two groups of polices:

- Group A – prioritized interventions: presenting the key interventions from IFC roadmap that need to be continued and prioritized,
- Group B – post covid and decree interventions: they are the new interventions raised considering the new market dynamics.

For each intervention, the following are illustrated: Key actions; Duration – short term (<1 year), medium (1-3 years) or long term (>5 years); Responsible stakeholders; and expected stakeholders to lead these actions.

The updated roadmap, including actions and sub-actions along the proposed time frame, is presented in Figure 15.

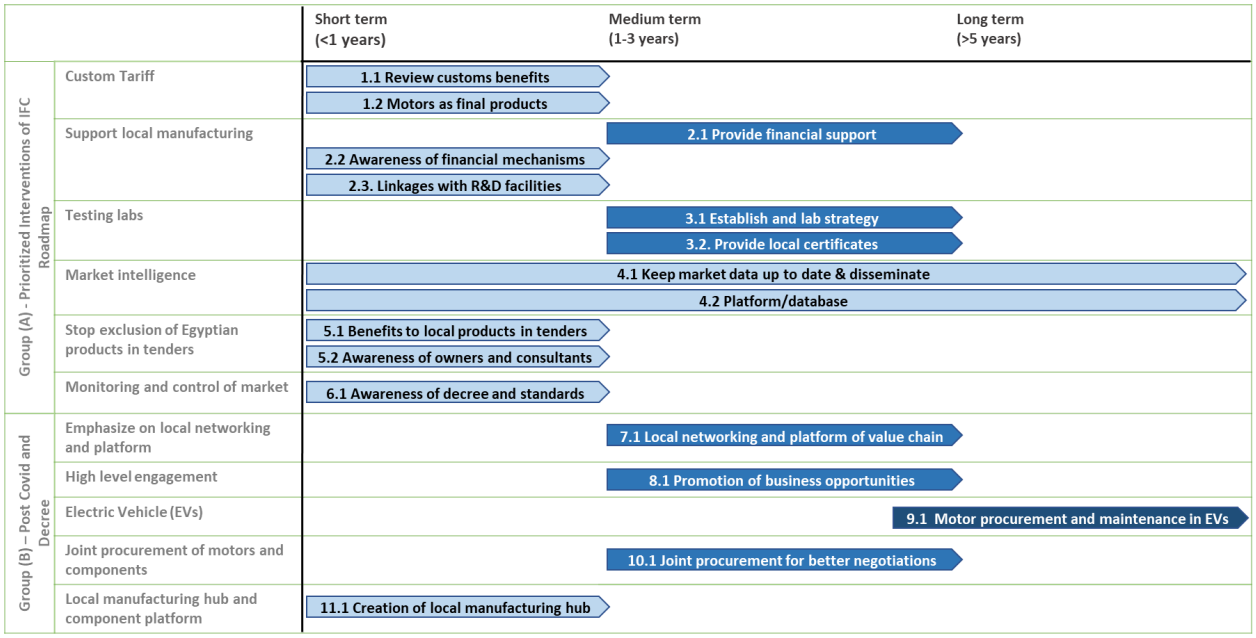

Figure 15: Updated roadmap timeline

3.1. Group A – Prioritized Interventions:

3.1.1. Review customs tariff

Customs tariffs should be reviewed to give more benefits to local manufacturers – Custom tariffs in motor components in Egypt are highly skewed and difficult to comprehend. It also varies by the percentage of local components in the investment (final product). This tariff distortion makes it difficult for investor to assess the cost of production.

#	Policy Intervention	Duration	Responsible	Lead
1.1	Update the custom tariff to be ascending tariffs	Short term	MoF, MoTI (GOEIC)	GOEIC, IMC
1.2	Consider motors manufacturing as final products in customs	Short term	MoF, MoTI (GOEIC)	GOEIC, IMC

Recommendations:

- It shall be ascending tariffs, starting from lowest tariff (or zero) at the raw material (such as steel sheets and copper for winding), then increases gradually along the value chain till applying the highest tariff rate on the imported standalone motors and final products (pumps, compressors, fans, etc.)
- Motors shall be considered as final products not as a component which will be integrated in another application (i.e. if a factory is manufacturing motors, the motor itself is as a final product even if it will be integrated in load/application in a later stage of manufacturing). This shall allow the local manufacturers of motors to benefit of reduction of tariff on imported components and raw material up to 60% instead of 30% when the motor is considered as part of production requirements.

3.1.2. *Support of investments of local manufacturing*

Manufacturing of motors (and their components) are strategic products to the country as motors contribute to almost all kind of sectors (industrial, commercial, agricultural and residential). Therefore, exceptional support to stimulate this industry is crucial. Several governmental and non-governmental supporting mechanisms can be implemented

#	Policy Intervention	Duration	Responsible	Lead
2.1	Provide financial support to local manufacturers of motors either by governmental or special programs by the financial institutions and banks	Medium term	MoF, MoTI, Banks	ENCPC, IMC, UNIDO
2.2	Raise awareness of the existing financial mechanisms and facilitations	Short term	MoF, MoTI (GOEIC)	ENCPC, IMC
2.3	Link manufacturers with research centres to provide supported R&D projects and facilities	Short term	MoTI, MoHE	IMC

Recommendations:

- ***Governmental support***: including facilitating reduced land prices to establish new factories, reduced taxes especially at establishment and beginning of business, and guarantees for long-term loans. Also clear vision of the government's directions and plans should be declared so that the investor can rely on in planning investment.
- ***Financial support***: in terms of grants and low-interest loans should be available. For example, In China, local manufacturers of strategic products have loans with only 4.3% interest rate versus 11% in Egypt[13]. There is an initiative after Covid for the industrial sector with interest rate of 8%, however it is still higher than China's rate. It was recommended that motor (and its components) manufacturers can benefit from the initiative of having loans with 5% interest rate as the SMEs, whatever the size of the loan and/or the corporate.
- More awareness on the supporting mechanisms (either governmental or non-governmental) is required. Supporting mechanisms may exist, however investors are not aware of it and they are not used. Awareness campaigns and promotional materials are required to update the market with the new opportunities and support. This can be led by the IMC and FEI in cooperation with banks.
- ***Incentives to R&D***: one of the main issues with local manufacturing is the lack of R&D, due to its high cost, long duration and sometime non-guaranteed results. Research funds and linking industry with university and research centres are essential to stimulate R&D and improve the local manufacturing process. The research must be product oriented. Coordination between Ministry of Trade and Industry (MoTI) and Ministry of Higher Education and Scientific Research (MoHE) is essential.

[13] *The World Bank Data, "Lending interest rate (%) indicator", https://data.worldbank.org/indicator/FR.INR.LEND?locations=CN*

3.1.3. Establishing testing labs and labs strategy

Testing labs (for motors and components) are crucial to ensure the quality of the whole process along the value chain and guarantee the quality of the final product through the quality control of each induvial component.

#	Policy Intervention	Duration	Responsible	Lead
3.1	Establish and improve access to testing labs through a lab strategy	Medium term	GOEIC	GOEIC
3.2	Provide local certificates that can be used as alternative of international ones in local tenders	Medium term	EOS	ENCPC

Recommendation:

- ***Establishing and accrediting testing labs***. Labs must be equipped with up to date test setups and tools. This includes also training of the testing staff to follow the standards and best practices of tests. Public sector labs are essential (such as labs of GOEIC for testing imported motors) and should cover wide range of ratings used in the Egyptian market. However private sector labs are also encouraged, especially when accredited, and wetness tests are approved by a public third-party entity (such as ENCPC), to increase the access to labs and increase the available power range in the market. Using private sector labs can be an alternative when the rating capacity of public labs (such as labs of GOEIC) are insufficient. The available labs at GOEIC have the following ratings:
  - Cairo airport lab – 7.5 kW
  - Alexandria lab – 10 kW (to be upgraded to 75 kW)
  - Port Said lab – 3.5 kW
  - Sokhna lab – 20 kW
- ***Testing labs strategy***: labs should be available for private sector, and not only for official check of GOEIC (for imported motors) or motors under verification of ICA (for locally manufactured motors). Other entities may request testing and validation of motors, for example to double-check the nameplate data of a motor, or evaluate the performance or a rewound motor. This should be available against certain and pre-defined process and fees.
- ***Provide equivalent local certificates***: should be provided to local manufacturers based on international standards, to be used locally instead of testing local motors abroad and adding extra overhead cost to the local product. Such certificate can be provided by EOS and ICA.

3.1.4. Market data and intelligence

Updated market data, roadmap and value chain are crucial to the investments of new players and expansion of existing market players.

#	Policy Intervention	Duration	Responsible	Lead

4.1	Update and disseminate market data and value chain dynamics	Short term (continuous)	ENCPC, IMC	UNIDO
4.2	Create an up-to-date platform and database for local networking of value chain entities	Short term (continuous)	ENCPC, IMC, FEI	UNIDO

Recommendations:

- ***Update local market data***: including market size, investment opportunities, feasibility studies and sales data of end market. These data should be updated and disseminated using events and networking. International donors (such as the running UNIDO IMEP program) have key role in cooperation with public entities such as IMC and ENCPC.
- ***Updated database of manufacturers with their actual services, products and capacity***: to be updated periodically (suggested with the renewal of the industrial license of each manufacturer). This will strengthen the interlinkages of various value chain entities and enable the integration. This recommendation can be led by the FEI through the chamber of engineering industries (CEI).

3.1.5. Stop exclusion of Egyptian products in public tenders

Public tenders of infrastructure projects are one of the key sales opportunities of electric motors. Stopping the exclusion of Egyptian products in public tenders will significantly increase the sales of the local manufacturers of motors and end applications (such as pumps, HVAC systems, compressors, etc) and hence increase the demand on the local manufactured components and feeding industry.

#	Policy Intervention	Duration	Responsible	Lead
5.1	Strengthen the implementation of the Egyptian law which provides benefits (credits) to local products in public tender	Short term	MoTI	IMC
5.2	Raise awareness of owners and consultants not to exclude local manufactured products	Short term	IMC, ENCPC	UNIDO

Recommendations:

a. Awareness of owners and consultants not to exclude Egyptian products, by shortlisting the country of origin of tendered products. They should consider the specifications, provided warranty and after sales services rather than the country of origin. Also, the advantages of the local products should be highlighted in terms of low cost, short lead time and availability of spare parts. Awareness sessions and campaigns can be led by IMC and ENCPC and sponsored by international donors.

3.1.6. Good monitoring and control of market

Poor monitoring and control of local market lead to unfair competition for local manufacturers with high quality and comply to standards.

One of the examples of market poor monitoring and control, is the imports of non-standard fractional HP motors (< 0.75 kW). Motors < 0.75 kW are not applied to the MEPS of IE3 efficiency levels, and only

labelling article is applied, however they should follow the IEC standards regarding the efficiency level, so that it must be labelled IE1 at least. Practically, some motors are being imported with non-standard efficiency level (IE0), which comes with low price which destroys the market of the local manufacturers with motors of IE1 level and higher price. Another example is the imported used production lines with integrated motors. These motors are disassembled from the production line and brought to the market as standalone motors with no control or monitoring on their nameplate data.

#	Policy Intervention	Duration	Responsible	Lead
6.1	Raise awareness of the decree and standards for proper implementation	Short term	GOEIC, ICA	UNIDO

Recommendations:

- Awareness of the decree and standards to prevent importing low quality (efficiency) motors which are lower in price and local manufacturing cannot compete. As per IEC standard and Egyptian standard, motors from 120 W to 750 W should be IE1 or higher, otherwise not to enter the market. This should be the role of GOEIC.

3.2. Group B – post covid and decree interventions

3.2.1. Emphasize on local networking and platform to connect value chain

Interconnection between various players in the value chain becomes critical, as imports prices are increasing and many SMEs are also losing business. One of the key issues in the value chain is that market players are still unaware of local potential and capacities. In addition, Investors are not aware of local capacities and the available business opportunities.

#	Policy Intervention	Duration	Responsible	Lead
7.1	Emphasize on local networking and platform to connect value chain	Medium term	IMC, ENCPC, Export council	IMC, UNIDO

3.2.2. High level engagement of key manufacturers

High level engagement of key manufacturers by promotion of business opportunities and investments in Egypt - Currently many players (large ones, and even outside the value chain of motors) are looking to invest in manufacturing, especially post Covid, to diversify. In addition, Many European manufacturers are looking to replace China due to the recent market dynamics of reduced Chinese exports and increased shipment prices. Other reginal industrial hubs are recently required.

Egyptian Government need to engage large scale and directly discuss with current producers to promote local capacity, skills, and opportunities on high level.

#	Policy Intervention	Duration	Responsible	Lead
8.1	High level engagement by promotion of business opportunities and investments in Egypt	Medium term	IDA, MoTI	ENCPC, IDA

3.2.3. *Emphasize on local motor procurement and maintenance in Electric Vehicle (EVs)*

Government of Egypt is moving strongly to localization of EV industry, however currently, negotiations with international producers doesn't focus on local production of motors and the focus is only on the assembly of EVs. Egyptian local market is capable of producing locally electric motors and increase the local contribution of Egypt in the EV (not only the assembly process). In addition, maintenance centers and services of motors within of EVs can be easily performed locally.

#	Policy Intervention	Duration	Responsible	Lead
9.1	Emphasize on local motor procurement and maintenance in EVs	Long term	MoTI	ENCPC, IMC

3.2.4. *Joint procurement of motors*

Joint procurement of motors can allow SMEs particularly and large producers to negotiate better prices. Currently imports of motors and certain parts for home appliance has increased in cost due to global shortage issues, increase shipment prices and reduced Chinese exports. Joint procurement can allow reducing imports and shipment prices for bulky quantities.

#	Policy Intervention	Duration	Responsible	Lead
10.1	Joint procurement of motors (and components) for better negotiations	Medium term	Private entities, IMC, MoTI	IMC, FEI

3.2.5. *Creation of local manufacturing hub and component platform*

Matching investment and manufacturing capacities is achievable. Certain manufacturers can co-invest in large motor facilities for pumps and home appliances, for example, and provide the local market with motors. Some manufacturers have excess capacity and good expansion business opportunities. These linkages can be done with the platform.

#	Policy Intervention	Duration	Responsible	Lead
11.1	Creation of local manufacturing hub and component platform	Short term	IMC, ENCPC	UNIDO

4. Conclusion and Recommendations

This section presents the roadmap to support local manufacturing of energy efficient (EE) motors. It builds on the previously developed roadmap by the IFC in 2018/2019. The assignment updates the IFC's roadmap by validating the market barriers and prioritizing the previously proposed interventions through market research and interviews with the key market players. Also, the status of these interventions is discussed, based on the market dynamics and updated. In addition, new interventions are proposed considering the post-Covid and launch of decree 463/2020.

It can be concluded that IFC's roadmap is valid and effective. Some of the short-term interventions were implemented or in progress, such as the activities done by the UNIDO IMEP program. However, some other interventions are slowed down or their priorities are changed from point of view of the market

stakeholders due to the market updates, launch of the decree, increased prices of imports and shipment, as well as global shortage issues of some materials and components.

The proposed policy interventions and actions can be divided as policies extended from the IFC's roadmap, and new post-Covid and decree interventions. The discussed interventions are:

A) Extended interventions from IFC's roadmap

1. Review custom tariff
2. Support of investments in local manufacturing
3. Establishing testing labs and labs strategy
4. Market data and intelligence
5. Stop exclusion of Egyptian products in public tenders
6. Good monitoring and control of market

B) Post Covid and decree interventions

7. Emphasize on local networking and platform to connect value chain
8. High level engagement of key manufacturers
9. Emphasize on local motor procurement and maintenance in Electric Vehicle (EVs)
10. Joint procurement of motors
11. Creation of local manufacturing hub and component platform

V. Annexes

Annex 1 – Motors Market Size and Segmentation

The installed motor base in the industrial sector is estimated to be at 1.24 million motors with a total value of 570 M USD. This estimate can be reached through two methods; bottom up and top-down analysis.

The bottom-up analysis relies on assessing the number of motors in each industrial subsector and aggregating the numbers to create all the motor installed base. The process relies on benchmarks which correlates the yearly electricity consumption in each industrial subsector distributed by each motor rating bracket[14]. Coupling this with estimates of number of operating hours can lead to number of motors in each rating bracket. This leads to aggregated number of motors in industrial sector in Egypt of 1.24 million motors. The data for energy consumption was mainly managed through Egyptian Electricity Holding Company (EEHC) official report of 2018/2019. It was considered that data from 2018/2019 is more representative than that of 2019/2020. The number of motors estimated of 1.24 million represents that in stock in 2019. The number could have increased in 2020 but no attempts were made to estimate this value. This is due to difficulties in estimation due to market disturbance associated with COVID-19.

The top-down analysis on the other hand relies on aggregating motors entering the Egyptian market as recorded in CAPMAS data which provides information on motors imported/exported by rating bracket[15]. This assessment leads to an estimated 1.15 million motors in Egypt industry. This number doesn't account for motor integrated in production machinery. The difference between the two methods is 7%. The total values were validated with sales data from key manufacturers.

Based on the above analysis, the highest number of motors being installed in Metals and Machinery sector (48%) followed by Chemicals (16%) and Food and Beverage (13%) – see Figure 16.

[14] *Percentages by subsector of energy consumption in motors can be found in "Energy Efficiency and CO2 Emissions Reduction Potential in Industrial Motor Systems in Egypt", 2015, UNIDO and Global Efficiency Intelligence.*
[15] *CAPMAS data are also till the year 2019 as well and they can be searched by motors HS code and are mainly of the family 8508 and 8509*

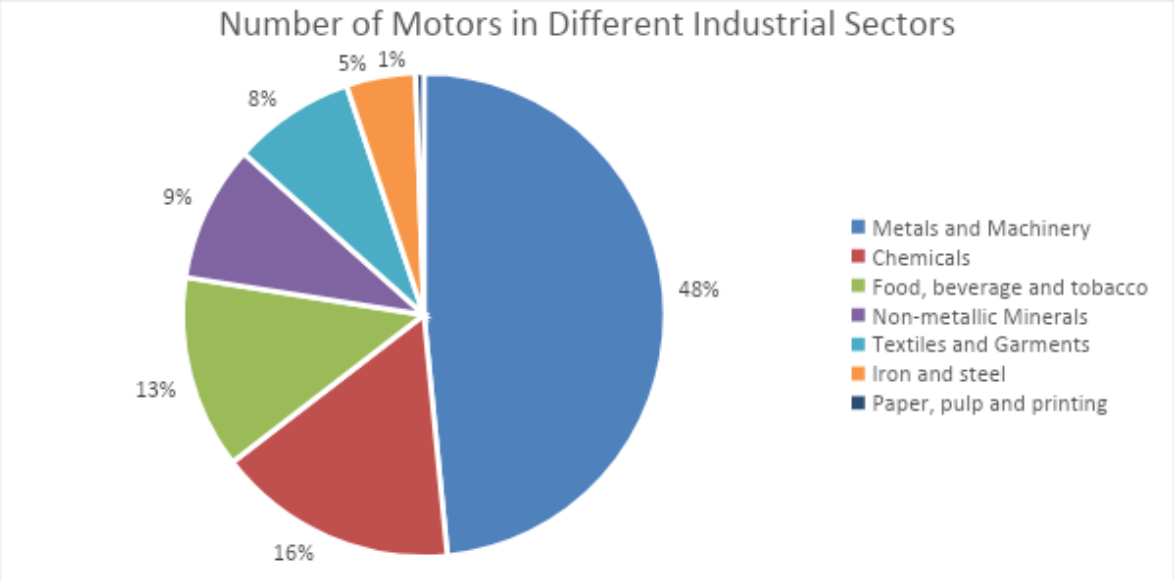

Figure 16: Percentage of motors installed base in Egyptian industry by subsector as of 2019

Another view of the distribution of motors is that of the kW range. In terms of numbers, the fractional HP motors represent 27% of the installed base. The range of 0.75 kW to 10 kW includes the highest percentage of the installed base at about 62% of the market. The range of 10 kW to 70 kW captures 10% of the installed base. The range above 70 kW only represents 1% of the installed base. Figure 17 presents the percentage of motors distribution by kW range. In addition, Figure 18 presents the distribution of motors according to size range in different industrial sectors.

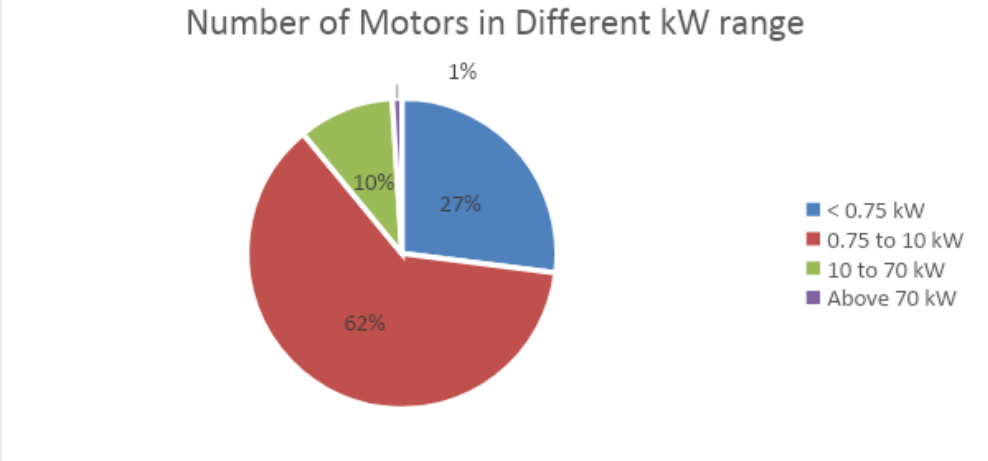

Figure 17: Percentage of motors installed base in Egyptian industry by kW range as of 2019

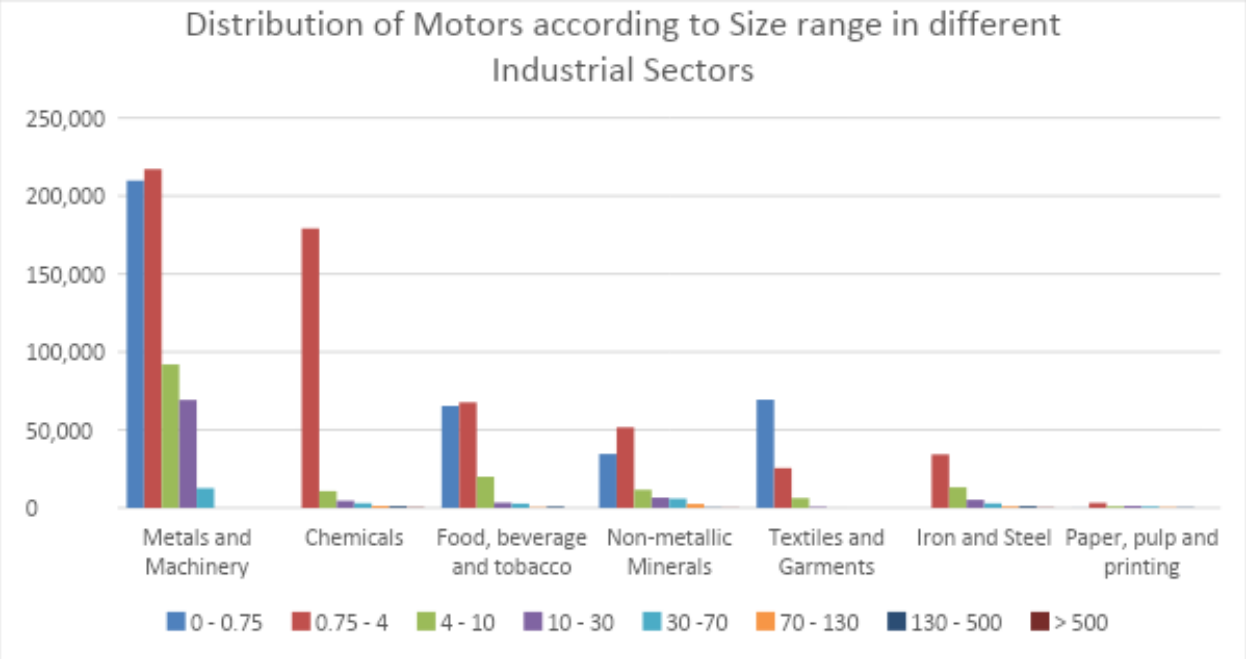

Figure 18: Distribution of motors according to size range in different industrial sectors (for the 1.24 M motors)

However, this should not be confused with amount of energy consumption or dollar value of each bracket. Fractional motors tend to work for less number of hours per day and also represents a lower dollar value. As presented in Figure 19, the percentage of installed base by financial value is higher above 10 kW. This means that while the number of motors above 10 kW is smaller (only 11% of number of installed motors) than below 10 kW, they represent 48% of the financial value in the market. The range of 0.75 kW to 10 kW includes 62% of the installed motors and only 46% of the financial value. The market above 70 kW includes a limited number of motors of about 9,300 motors however captures 8% of the financial value[16].

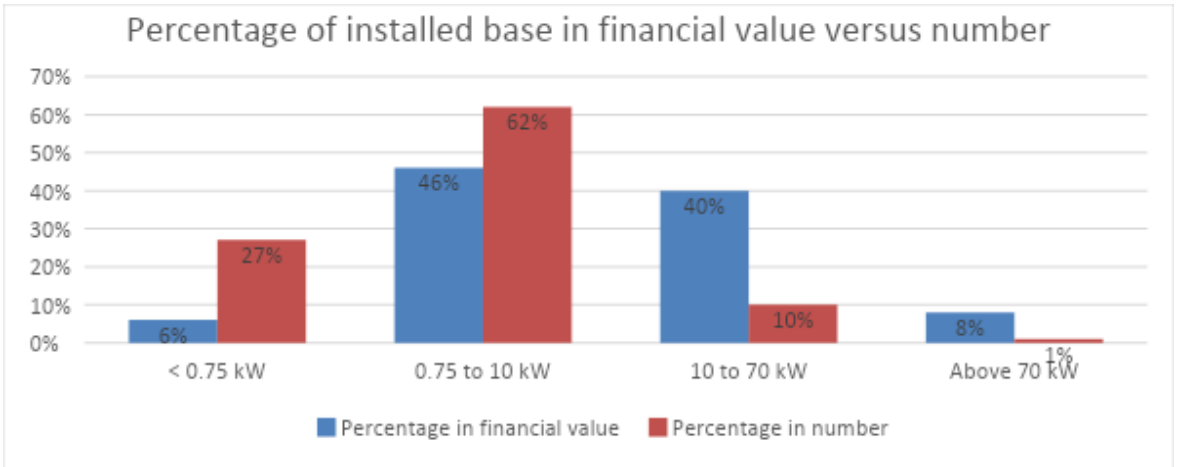

Figure 19: Percentage of motors installed base in Egyptian industry by financial value and number as of 2019

[16] *Pricing data collected from key suppliers*

Tracking the electricity consumption in the industrial sector through EEHC reports can provide an estimate of how the number of motors in Egyptian industry grows as can be seen in Figure 20. Assuming a stock model with 15 years lifetime will lead to 45% of the motors in the Egyptian industry older than 10 years old[17].

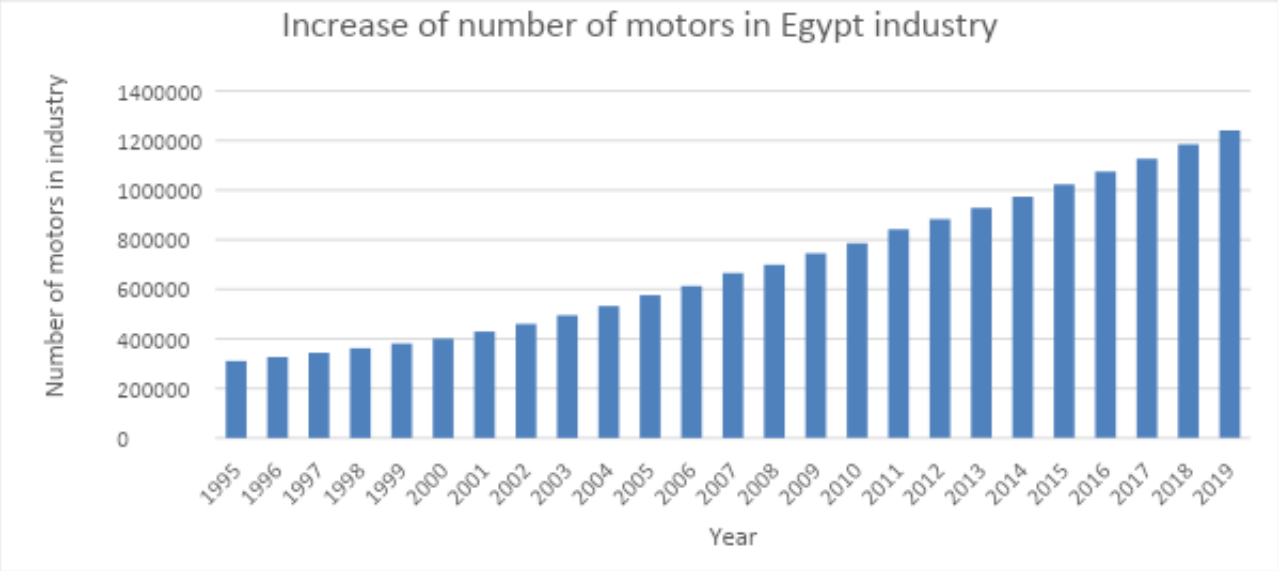

Figure 20: Increase of number of motors in Egyptian industry

Besides, Figure 21presents the average motors prices in terms of EGP/kW for various power ranges. IE3 motors are considered as they are mainly supplied to the market (either imported or manufactured) after the decree is applied. This average cost was used for market size estimation and cross validation when needed. The motor prices were collected from various key motors suppliers in the Egyptian market.

[17] *In agreement with IFC presentation in STEP project with 50% of motors in 2017 – MEPs design for Egypt*

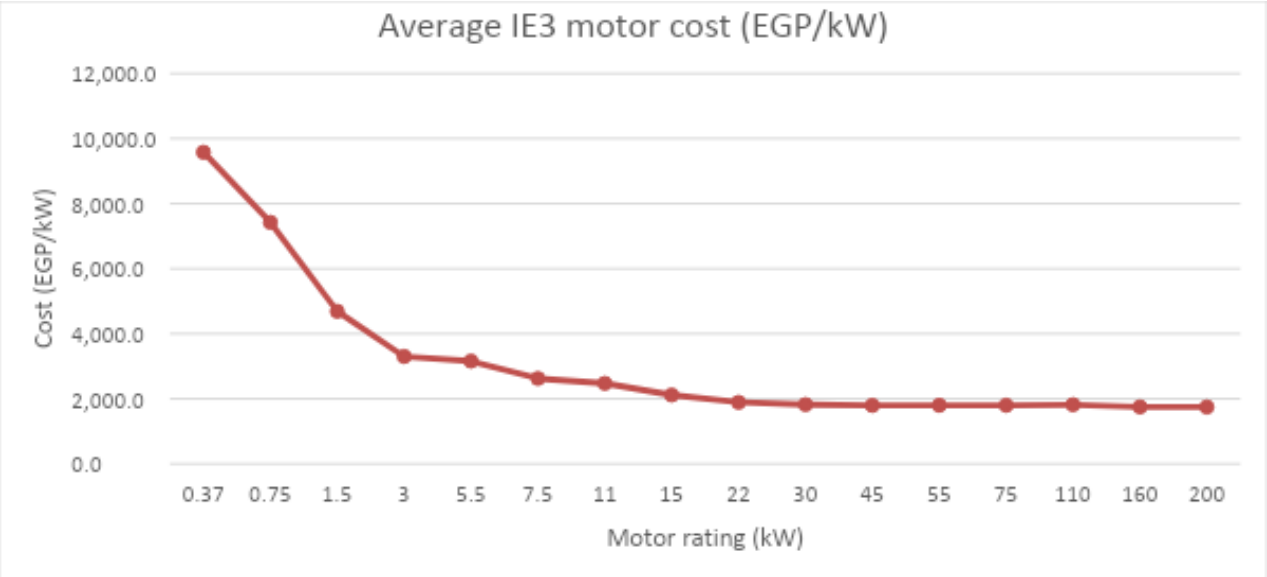

Figure 21: Average motors prices per kW for various power ranges [18]

[18] *Average is calculated based on data collected from various key motors suppliers in the Egyptian market. These average values are indicative only and may vary from a supplier to another. In addition, the collected prices are applied to various market instability factors, such as effect of global shortage in raw material, shipment issues, Russian-Ukrainian war, as well as the fluctuation of EGP value versus USD.*

Annex 2 – List of interviewed stakeholders

#	Entity Name	Role in value chain	Name of interviewed representative	BOM Interview	Roadmap interview
1	Kandil Steel	Steel	Eng. Mohamed Sabry	X	X
2	El-sewedy cables	Windings	Eng. Hadi Eldewik	X	X
3	Techno Pyramids	Shafts	Eng. Ahmed Naguib	X	X
4	Fresh - Motors factory	Motors / whitegoods	Eng. John Safwat	X	X
5	Daoud Motors	Motors / pumps	Eng. Ahmed Daoud	X	X
6	Comet	Pumps	Eng. Mohamed Fahmy	X	X
7	Kheir Group	Pumps	Eng. Mohamed Kheir Eng. Akram Kheir	X	X
8	Tanta Motors	HVAC	Eng. Alaa Abu Freikha	X	X
9	ABB	Motors supplier	Eng. Yasser Salah		X

Annex 3 – Local manufacturers interview template

Basic Entity Information								
Entity Name								
Address								
Provided service/activity								
Contact person	Name							
	Title							
	Phone							
	Email							
Deploying EE motors and MSO								
Do you manufacture/use EE motors in your products?			If Yes, Give percentage					
Do you consider the EE and MSO practices within the provided equipment? (If Yes, highlight which part)			Coupling					
			Inverter					
			load (fan, pump, compressor, etc.)					
Barriers of deploying EE motors (give score 1-5, with 1= low barrier and 5 = high barrier)			1	2	3	4	5	
	Clients/ End user awareness							
	Effective Policies and Regulations							
	Access and availability of talented labour and technicians							
	Access to capital and finance							
	Absence of an effective Association for Motor testing and labeling							
	Access to know-how and technologies							
	Others:							

Development of Local Manufacturing			
Barriers to increasing the local manufacturing of motors (give score of 1 to 5, 1= low barrier, 5 = highest barrier) And what are the proposed interventions/actions to overcome these barriers?	Barrier	Intensity (1-5)	Proposed intervention / action
	Absence of reliable market data		
	Weak interlinkages between value chain entities		
	Lack of trust in local products by consumers and consultants		
	Absence of local know-how		
	Low customs awareness		
	Absence of local manufacturing support		
	High customs for imported materials and equipment (customs issue in general)		
	Excluding local motors (components) from public tenders		
	Others		

Updating Roadmap							
Intervention/ Action	Priority (1 to 5)	Responsible	Lead by	Duration	Success factors	Threats	
Create a level playing field for compliant Egyptian products							
Raising customs awareness of energy efficient motors							
Replace inefficient motors in industry with efficient motors							
Provide support for investments increasing Egyptian production capacity of electric motor (components)							
Streamline procedures: Faster, more streamlined procedures to obtain manufacturing licenses							
Review customs benefits for (partly) locally manufactured products							
Organize networking events							
Develop a platform and create a database of manufacturers, products and specs							
Keep market and roadmap data, and potential additions, up-to-date							
Expand market data							
Facilitate ad-hoc support (trainings, capacity building, partnerships, etc.)							
Improve quality (Quality Assurance, certificates of local products, etc.)							
Promote "Made in Egypt"							
Stop exclusion of Egyptian products in public tenders							
Stimulate public procurement with preferential treatment to local products							
feasibility study (for exports and fore in markets)							
Include motors (and components) exports in trade missions							
Establish testing lab strategy							

Business Opportunities								
Proposed investments opportunities (give score 1-3 for each indicator) 1= low, 3 = high	Availability of skilled labor (1-3)	Availability of supplier (resources (1-3)	Market size (1-3)	Market diversity (1-3)	Capacity to mitigate risks (1-3)	Presence of local capacity to innovate (1-3)	Required Investment (1-3)	Economies of scale (1-3)

Annex 4 – Local Manufacturing Updated Roadmap Validation Workshop

A workshop was held on ***Wednesday 9th March 2022***, to present the market assessment updates and the updated local manufacturing roadmap of motors in Egypt. The discussed topics during the workshop included:

- The objectives of the workshop and work approach
- The updates in market assessment based on the recent market dynamics, particularly to reflect the Covid-19 impact and the launch of the decree 463/2020
- Current barriers and proposed opportunities of the local manufacturing market according to market dynamics
- The updated roadmap policy actions and recommendations

The proposed roadmap actions were discussed, and the feedback of the attended stakeholders was considered in developing the roadmap. A separate detailed report describing the key discussions and activities of the workshop is attached with this document. (Attached the meeting minutes of the workshop as Supplementary document_1)

Table 5 presents the list of attendees of the workshop.

Table 5: List of attendees of local manufacturing roadmap workshop

#	Organization	Full Name
Private Sector		
1	ABB	Mohamed Reyad
2	Al-Araby	Mahmoud Khairy Abdelazim
3	Arab Cables	Mohamed Hamid
4	ARAB COMMERCIAL GROUP S.A.E - ACG	Sameh Attia
5	ARAB COMMERCIAL GROUP S.A.E - ACG	Essam Attia
6	Daoud	Emad Halawa
7	El Abd Group	Sameh Saad Abd El-Hameed
8	El Araby Group	Abdelnaser Tahoun
9	El Sewedy cables	Khalil Elnoury
10	El Sewedy cables	Ahmed Halaby
11	EL Sweedy	Yasser Saleh
12	Elmarwa Group	Amr Fathy
13	Elmarwa Group	Raghda Saeed
14	Elnasera group	Osama Ishak Fawzy
15	Elsewedy	Khaled Abdelazim
16	Elsweedy	Amr Abdelkader
17	Fresh Electric Co.	John Safwat
18	Mac Carpet	Mohamed Nouh
19	Tanta Motors Co.	Ahmed Sharawy
Governmental		

20	ECO-FEI	Hassan Mohamed Aboelatta
21	EGAC	Ayman Fathy Farag
22	ENCPC	Mohamed Sabry
23	Engineering Export Council	Mohamed Samy
24	EOS	Seham Tawfik
25	EOS	Marwa Ibrahim
26	EOS	Salama Shahat
27	ERI	Sherine Abdelkader
28	GOEIC	Wael El Nagomi
29	ICA	Azza Hassan
30	IDA	Noha Amin
31	IDA	Mohamed Eissa
32	IDA	Mohamed Hesham Ahmed
33	IMC	Akram Samy
34	NREA	Mohamed Zeinhom Abdelmawgood Elgarery
35	NREA	Kareem Abdelaaty Abdelsalam
36	NREA	Mahmoud Abdelaal