



Prof. Iman El-Mahallawi
Professor of Materials and Metallurgical Engineering at the Faculty of Engineering, Cairo University

Developing the metal industries for Africa's socio-economic transformation: Towards creating opportunities through education and training

The African continent is gifted by some strength points, which are population of about 1.216 billion people, rich material and energy resources, and capacity for water supply and raw environment. However, the current state of beneficiation and optimization of those gifts and resources is surely beyond the continent's expectations. Challenges in water and energy supply, job opportunities, decent standard of life for the population are some, amongst many others. This article discusses the options and challenges presented by developing the sector of metal industries in Africa for socio-economic transformation.

Africa prides itself in being a great resource for minerals. The ten most important are: petroleum oil and natural gas, gold, Diamonds, copper, coal, platinum – group Metals, uranium, aluminum, bauxite and iron and steel. See [Link](#) . Many countries in the continent have started to change their image from a crisis centre to a potential emerging market. The macro economic factors strongly indicate positive changes that will lead the continent to be the next emerging market. The growing young population together with economic growth on the continent lead to a growing labour force and cities which lead to a significant increase in middle class. Furthermore, the continent is pushing towards manufacturing and automation as this sector remains as the continent weakest link. Also, constant rise in foreign direct investment over the past decades is further boosting the economy not only in financial terms but as well in terms of knowledge, expertise and technology. Industries of almost all kind will experience a rapid growth due to this economic boom, however the African market is still very diverse as the continent hosts 54 countries. See [Link](#).

The metal industry is unique in being capable of providing thousands of jobs and chances for national investment as well as small investors. The development of this industry requires the development, dissemination and implementation of modern technologies for mineral exploitation and manufacturing industries; as well as developing human technical knowledge and skills. The strength of metal industry lies in the fact that it is not a single activity, boosting the metal industry means boosting several industries and human activities, as well. For

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example, agriculture, which is the most important activity in Africa is based on a wide range of tools and machinery. The majority of these tools and machinery are based on manufacturing of spare parts. The petroleum industry, which is an emerging power resource for Africa, also, relies on a range of metal industries including pipelines manufacturing, welding and inspection. The envisaged development in African agriculture cannot be achieved without a parallel development in the metal industries to enable the progression of manufacturing industries needed for the machinery and equipment upon which this industry depends. Labor-intensive manufacturing industries led the economic transformation of many of the most successful developing countries, but it has not fared well in Sub-Saharan Africa. Trained and skillful labour is essential for this action. Yet, developing technical labour skills in the relevant fields to metal industries may not be achieved without technological support embedded within the social and economic constitution of the African countries.

Partnerships between the metal industry, its suppliers, and its customers will be critical to successfully meet the competitive challenges of the industry. Technology advancement plays an important role in lowering production costs, improving energy efficiency, enhancing environmental quality, and creating innovative new cast products. Intense competition within the industry for historically low-value-added, low-profit-margin markets, as well as competition with other materials and processes, limits resources for R & D investment. The future competitiveness of the metal casting industry requires the combined resources and talents of industry, academia, and government. The roadmap is based on the following items: i) products and markets; ii) materials technology; manufacturing technology; environmental technology; human resources; profitability and industry health; partnerships and collaborations; and relevant industry R&D projects.

The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) coordinates and implements skill enhancement workshops for university faculty, students and other stakeholders in higher education; with special focus on Agricultural and Rural Innovations. In this context RUFORUM will have a great input in presenting a route for technological knowledge and knowhow covering technical, manufacturing and training that will be used as a guide for African metal industries, based on price, energy consumption, quality and type of products. Consumption and utilization of locally available materials and energy resources, building technological knowledge and knowhow and skillful labour training are some challenges that could be only met by RUFORUM. This is Africa's opportunity to develop its metal industry to compete with products from other markets based on price, energy consumption, quality and type of products. The African universities should agree on building regional training centres in their universities offering short and long training courses in order to provide the necessary high level and quality training for its population, which is designed and conducted by African

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scholars. Training courses on exploration, mining, metal extraction and processing, casting, welding, inspection, steelmaking and many others are on the list.

Finally: I Agree with Judith Ann Francis, a Member of the RUFORUM International Advisory Panel, “For greater accountability, effectiveness and efficiency: RUFORUM must not be afraid to do things differently. Be bold! Be creative!”

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About the Author

Prof. Dr. Iman El-Mahallawi earned her first degree BSc in Engineering from Cairo University in July 1981, MSc from Cairo University in December 1983, PhD degree from The University of Leeds in Jan 1987. Currently, Professor of Materials and Metallurgical Engineering at the Faculty of Engineering, Cairo University and an adjunct Professor at the Mechanical Engineering Department in the British University in Egypt (BUE). Founding Director of the Centre for Renewable Energy CRE at the British University in Egypt. She holds CEng and CSci titles, as well as being a Fellow Member of the IOM3 Royal Institute. H index number is 12 with (71 peer reviewed papers Scopus cited publications). She has attended and presented invited papers in more than 60 international and national conferences. She earned Cairo University Excellence Award in 2014 and Distinguishment Award in 2018. Prof. Dr. El-Mahallawi has been teaching and conducting research and industrial services relevant to the steel, casting and metal industry, since she earned her PhD degree in 1987. She has managed to keep teaching/ research/ industry balanced through her career. She also received an Award for best submission for innovation in teaching by Unit of Teaching and Learning Projects, Ministry of Higher Education, Egypt. She is a Leader of many research groups on a number of significant topics in the fields of Steel making, Foundry, manufacturing and heat treatment, 2) Advanced alloys and materials and nanodispersed composites and 3) renewable energy materials.

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