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NEW AND EMERGING MATERIALS TECHNOLOGIES

THEIR POTENTIALS AND IMPLICATIONS ON THE MARKET AND DEVELOPMENT FOR KEY AFRICAN MINERALS, AND BUILDING AND CONSTRUCTION MATERIALS

NEW AND EMERGING MATERIALS TECHNOLOGIES: THEIR POTENTIALS AND IMPLICATIONS ON THE MARKET AND DEVELOPMENT FOR KEY MINERALS, AND BUILDING AND CONSTRUCTION MATERIALS

1. The potentials, challenges and implications of new materials' technologies on the market for key raw materials and products of the African region have been studied in this document. The raw materials covered are of mineral origin, including building and construction materials. The study highlights a number of technical and policy issues of interest to African policy-makers and makes appropriate recommendations.

2. As such the following issues are looked into:

(1) Overview of African minerals, technology and industrial development.

(2) Examination of the potential of minerals, building and construction materials in Africa in the light of new materials and products.

(3) Identification and assessment of the new and emerging technologies in these areas.

(4) Implication of the new emerging materials technologies on the market of African minerals and materials; and

(5) Recommendations and conclusions for policy action.

3. It is known that the driving force behind the advent of new and frontier technologies in the developed industrialized world is the need to be less and less dependent on raw materials that they have to import from developing countries, and thereby shift the base of their economy. Since Africa is basically an exporter of raw minerals and importer of processed materials, the advent of new technologies and their exploitation in the developed world have reduced the importance of African commodities and thereby negatively affected their market. Unless Africa masters these technologies and uses them to advantage by enhancing their market value through processing, income from export of pure raw materials will gradually decline, and the economy will go from bad to worse.

4. The economy of each African country is unfortunately precariously tied to the export, in most cases, of a single commodity. Thus Zambia and Zaire depend heavily on copper; Algeria, Gabon and Nigeria on crude oil; Guinea on Bauxite, Liberia on iron ore. New materials developed in the North often replace

these minerals, and thereby reduce their market value. Moreover the technologies for their exploration, extraction and processing are archaic, and the advent of new technologies for these has yet to be taken advantage of.

5. In the area of building and construction materials, Africa is rich in building stone, limestone, gypsum, granite, sand, asbestos, fibres and wood. Modern conventional building materials include cement, bricks, concrete, plaster, steel, glass and wood-based composites. Most of these are imported, with little produced locally in some countries. As such, they are utilized by the well-to-do urban population. We also have the so-called traditional materials like earth, stone, thatch and bamboo, which are utilized by most of the population. Finally a third category of building materials has evolved through research and development, like pozzolona, earth-stabilized blocks, ferro-cement, bamboo reinforced concrete, etc. These, however, have yet to be popularized through deliberate policies by governments, as they can offer cheap alternatives to imported material, and can be quite efficient.

6. There is need for a symbolic relationship between the government policy makers, the public and private productive sectors, and those involved in research and development with stress towards the exploitation of research results. Energy-saving and cost-saving high performance materials will substitute conventional metals and building materials. Ceramics, optical fibres, synthetic and composite materials and high performance metallic alloys are coming on the market, and African R & D have to reorient themselves towards the blending of these with conventional materials and exploit them commercially.

7. Rare earth minerals have enormous potentials now and for the future for use as raw materials for photovoltaic, photonic, sensors, new fine ceramics, special plastics, and superconductive, magnetic and functional electronic materials. Fortunately Africa has an abundance of these rare earth minerals in the form of silicon, titanium, tungsten, barium, magnesium, zirconium, beryllium, lanthanum, chromite, strontium, yttrium, zeolite and others. What is required is a systematic inventory of these and their extraction and exploitation, as they are likely to pay high dividends in the future.

8. The same is the case for non-metallic minerals which are in high demand as they are being used in mineral-filled plastics and low-cost polymers.

9. In the area of building and construction materials, the potential is immense, and the technologies affordable. The conventional building materials like cement, concrete tiles and plaster, as well as wood-based products, presently drain as much as US$ 4 billion annually in foreign exchange. Domestic building materials industries based on locally abundant raw materials like sand, clay, limestone, granite, gravel, pozzolana, fibres, bamboos, wood, and gypsum, are a priority for the materials technologists and entrepreneurs in the region. In order to increase structural stability, compressive strength and resistance to water, stabilized soil bricks using fibres, cement, lime and bitumen can be manufactured at much reduced costs and popularized. There is much scope for development and exploitation of improved burnt-clay bricks, lime, pozzolana cement and fibre reinforced concrete materials.

10. The new and emerging technologies in the area of new materials and products relevant to African minerals and building materials are: ceramics technology, optical fibre technology, new polymeric materials technology, typical composite and metal-matrix composites technology, micro-biological new materials technology, new metal processing and production technologies, functional electronic materials technologies, and small diameter wood technology. A few developing countries outside Africa are already mastering many of these technologies for their own survival.

11. In order to avoid negative impacts of these new and emerging materials technologies on the market of African minerals and raw materials, African member States should prepare themselves with the training of requisite manpower, set up new institutional infra-structure for materials science and technology and improve their production processes using these technologies. Planning for a short, medium and long term is necessary, as a start.

12. World market trends indicate a reduction in the demand for certain raw materials, while there is an increase in demand for others. Thus there has been a decline in the consumption of iron ore in steel making as a result of improved technologies in iron and steel making. The average steel content in motor vehicles is gradually decreasing and new composite materials are replacing the steel. Similarly there is growing decline in the use of copper, tin, lead and zinc, while demand for nickel, cobalt and titanium is likely to increase. The replacement of metallic mineral ores with advanced new materials will definitely affect the mineral market adversely in Africa.

International Level

15. ECA in co-operation with relevant UN and other international organizations, should:

1. Provide assistance to African countries in their establishment of a network of R & D and technology innovation institutions.

2. Encourage and assist relevant regional institutions to set up materials research, development and technology production programmes within their mandate.

3. Organize seminars and workshops for policy-makers, planners and entrepreneurs in the area of materials technologies.