Observatoire Europe-Afrique 2030

Case Study 17

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Industrializing sub-Saharan Africa[1]: Proposal of Business Model for a Hydrogen Powered Buses Manufacturing Cluster

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Summary

Over the past two decades, "traditional" development models have not been able to create a dynamic in Sub-Saharan Africa that is conducive to the emergence of economically viable manufacturing clusters in high-tech sectors. This case study proposes an "atypical" model, based on the example of the hydrogen powered bus manufacturing sector in Nigeria. This project would be an opportunity for this country to achieve industrial autonomy in a strategic sector. The proposed model consists in allocating part of the current French aid (grants or loans) to directly finance the purchase of hydrogen powered buses, as the demand is largely insolvent. By stimulating domestic demand, the production level of the cluster will be compatible with the competitiveness requirements linked to economies of scale. This business model, which breaks with the usual schemes based on direct aid to manufacturing companies, could trigger a virtuous mechanism and provoke a "snowball" effect.

[1] The Europe-Africa Observatory 2030 aims to promote the development of competitive and sustainable manufacturing sectors in Africa.

A sector with a strong environmental impact

The exponential growth of car traffic in sub-Saharan Africa in the next twenty years, under the combined effects of growing urbanization and rate of motorization, will generate a very sharp increase in pollution in major cities, with dramatic consequences as observed today in some Asian megalopolis such as Jakarta, Beijing or New Delhi.

To combat this foreseeable deterioration of the environmental situation, one solution would consist to develop an industrial sector for the manufacture of urban and interurban hydrogen powered buses[2] in one or more sub-Saharan African countries. Initiatives based on this technology are multiplying around the world.

The purpose of this case study is to propose a model for the development of a hydrogen powered buses manufacturing cluster in sub-Saharan Africa. Concretely, it would be a question of creating:

- A Hydrogen powered buses manufacturing cluster[3], with a wide range from minibuses to high-level service buses for which African cities are expressing a growing interest (Dakar, Abidjan, Lagos, Dar es Salaam)[4]

- Hydrogen production, supply and recharging systems for fuel cells that equip buses

- Priority roads in highly congested urban areas.

An essentially geostrategic issue

This project would result in extremely positive effects for many economic actors and for the community:

- For the sub-Saharan African countries concerned, this is a real opportunity ***to access industrial autonomy*** [5] in the key sector of transport vehicle manufacturing.

[2] A hydrogen powered bus ("Fuel Cell Electric Vehicles", FCEV) is an electric bus whose engine is powered not by batteries, but by a fuel cell. Like lithium-ion battery buses, they run without any polluting emissions: hydrogen is injected into the battery, where it reacts with oxygen from the air. FCEVs emit 45% fewer emissions than vehicles equipped with internal combustion engines. Hydrogen buses can currently go 150% further than electric vehicles (500 km versus 200 km). Modern FCEVs charge 10 to 15 times faster than electric vehicles. In addition, fuel cell electric buses do not require additional permits or urban infrastructure works other than a centralized hydrogen refueling station at the bus depot.

[3] A cluster is a geographic concentration of interconnected firms, suppliers, and institutions in a particular field.

[4] "Financing atypical urban transport in exploding African cities" - La Tribune Afrique – 20 July 2021.

[5] As early as 2016, the G20 summit in Hangzhou put Africa's industrialization on its list of priorities. The African Union's Agenda 2063 also supports this initiative. In 2017, the UN General Assembly resolution proclaimed 2016-2025 as the third decade for Africa's industrial development. Not a quarter goes by without a European head of state proclaiming the urgency of industrializing Africa.

- It would improve the quality of the urban and interurban mobility services in the large agglomerations concerned, with buses more comfortable, less noisy and faster.

- From an environmental point of view, buses would hardly pollute anymore and would emit almost no greenhouse gases, with the result that externalities would be significantly reduced.

- Economically, the cost required to finance this cluster would be offset, at least in part, by reductions of externalities, jobs creation and the positive impact on trade balance as a result of reduced imports of buses.

A huge but insolvent market

The challenge concerns at least the 100 cities with more than one million inhabitants that will exist in 2025 in sub-Saharan Africa. The need is probably much higher since in 2020, 41% of the population of sub-Saharan Africa already lived in urban or peri-urban areas, or about 450 million inhabitants[6]. The potential market for replacing existing diesel buses is tens of thousands of buses (or even hundreds of thousands) across sub-Saharan Africa[7]. The domestic markets of Nigeria, South Africa or the Democratic Republic of the Congo alone would justify the creation of hydrogen powered buses manufacturing units in each of these countries.

However, and this is a key point, while there is a clear need to replace existing fleets of diesel buses with cleaner and more efficient buses, the transport operators that operate these fleets do not have the financial capacity to make such an investment.

Existing business models are not suitable for this type of project

Take the example of Nigeria. With the exception of the oil sector, no major high-tech industrial cluster have emerged in recent years. European and American "locomotive" manufacturers do not risk investing in local manufacturing plants. Thus, despite its very high market share in mobile phones, Samsung has not followed through on its factory project in Nigeria[8]. Similarly, despite several large contracts for the supply of railway equipment, General Electric has not developed a local manufacturing plant.

The key question is: What business model would be appropriate to convince stakeholders (technology providers, public authorities, financial institutions) to embark on this type of project?

[6] Source: World Bank.

[7] For comparison, new registrations of coaches, buses and trolleybuses reached 33400 vehicles in 2019 in the European Union (source: Eurostat).

[8] In 2018, Samsung abandoned the idea of establishing a manufacturing plant in Nigeria because its market share in the country is not large enough. The company's Africa CEO said that manufacturing a mobile phone requires 400 components and none are available in Nigeria.

Let's proceed by elimination:

- The assembly plants for imported parts or modules (CKD or SKD) are of very little interest to the host country: low added value, no transfer of know-how, lack of sustainable perspective.

- An investment of the "Tanger Med" type, with an output almost exclusively focused on export, is not adapted to the context of Nigeria, which needs to industrialize to supply its domestic market in priority.

- The model of "Chinese" factories in Africa, based on extremely low wages (1 euro/day in textile factories in Ethiopia) is not compatible with the need for skilled labour required for the design/manufacture of products with a high technological content such as hydrogen powered buses.

- The business model used for investments in mass consumption in Africa (agri-food, hygiene products, plastics processing) corresponds to a solvable final consumer demand, which is not the case for the bus market.

Inventing a new model

A business model appropriate to the context of a high-tech investment in Nigeria could be based on the following proposal:

- The public authorities of the host country make available a logistically optimised, secure and serviced site, close to a large and easily accessible seaport.

- Financial institutions:

  1/: Finance the purchase of hydrogen powered buses through a system of grants (or loans) spread over several years. Indeed, the cluster will have to have sufficient production capacity to benefit from economies of scale. However, the potential demand for buses exists, but the companies that operate the urban and intercity bus fleets do not have sufficient financial means to renew their fleet at a pace compatible with the cluster's production capacity. It is therefore necessary to finance, or even subsidize, the purchase of hydrogen buses.

  2 /: Finance the system for producing, supplying and recharging hydrogen for the fuel cells fitted to buses, as well as priority routes in particularly congested urban areas[9].

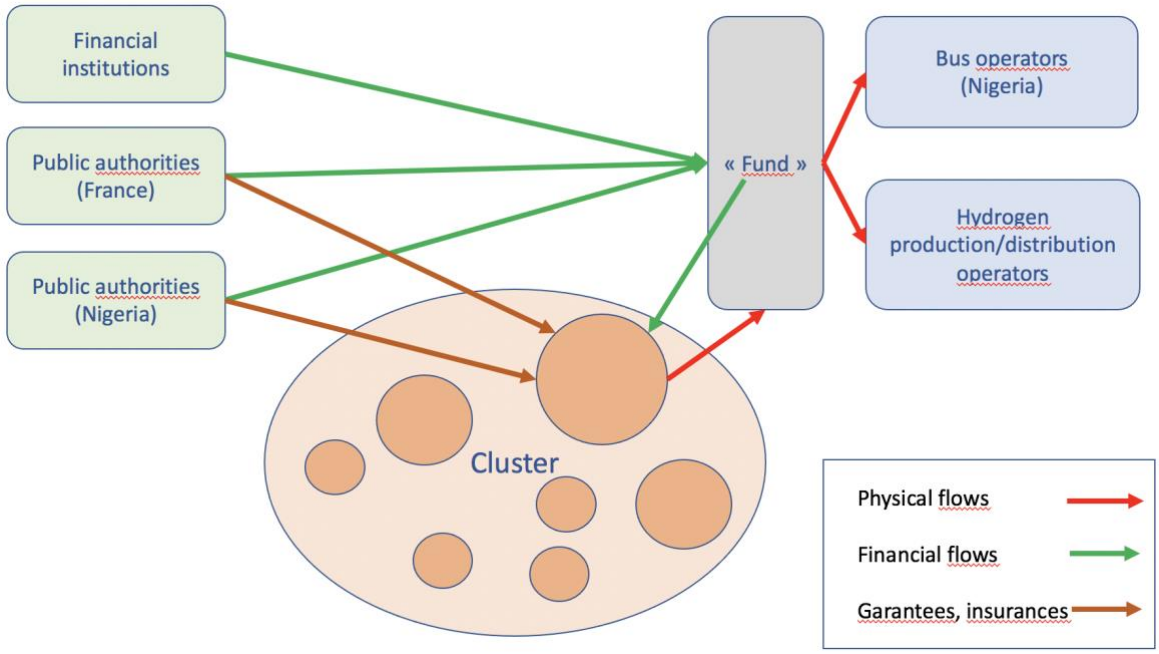
- In coordination with financial institutions, the French and host country public authorities co-manage a "Fund" with four purposes:

[9] On this subject, see the case study: "Promoting a third generation mini-grid design / manufacture / installation sector in Africa" – Observatoire Europe-Afrique 2030 - August 10, 2020.

1/: Dispatch hydrogen powered bus production optimally between the road passenger transport operators.
2/: Remunerate the cluster's enterprises for each bus produced, with a minimum commitment over 5 to 10 years of production. This remuneration is indexed to the prices of equivalent buses offered for import.
3/: Manage a bonus system which applies as the local integration rate of production increases.
4/: Propose an appropriate risk hedging system which makes it possible to mitigate the consequences of possible fluctuations in the institutional environment of the host country[10].

- On the supply side: European manufacturers bring the technologies necessary for the development of the sector (hydrogen production by hybrid mini-grids, hydrogen powered bus supply systems, buses, fuel cells) and transfer their know-how in order to quickly achieve a high rate of local integration, so that the industrial sector is able to develop autonomously. Finally, and this is probably the most important, the sector must imperatively have an internationally competitive cost structure, on the one hand to resist competition from imported buses, on the other hand to allow part of the production to be exported in the long term.

The diagram below summarizes the interrelationships between various profiles of actors.



[10] "Case study n°7: Promoting the development of export-oriented manufacturing poles in sub-Saharan Africa" - Europe-Africa Observatory 2030 – November 2018.

Break with the "classic" investment models

The experience of the last twenty years shows that "traditional" schemes have failed to create a dynamic conducive to the development of economically viable clusters in high-tech sectors in sub-Saharan Africa.

The model proposed in this note breaks with the usual schemes based on targeted aid (grants, loans) to manufacturing enterprises. In the medium term (5 to 10 years) the challenge consists to stimulate demand in order to trigger a virtuous mechanism and cause a "snowball" effect. The mechanisms of risk coverage and bonus on the local integration rate aim at reassuring investors and convincing them to take the step. In the longer term, we must bet on the fact that the economic context of Nigeria will change profoundly, under the effect of the deployment of the AfCFTA and the expected strength of future economic growth.