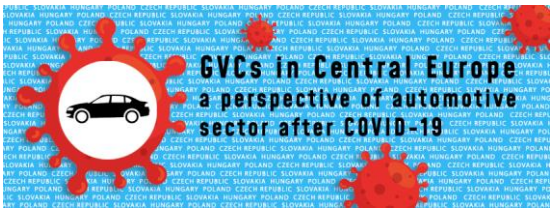

Visegrad Fund

Navigating the transformation of the bus industry in Hungary: expanding the product mix and upgrading along multiple dimensions

A case study by Andrea Szalavetz

The case was developed with support of the Centre of Economic and Regional studies (CERS), Budapest, Hungary and by the Visegrad Fund in 2021. It is intended to be used as a base for discussion in courses focusing on Global Value Chains, International Business and Management

The project is co-financed by the Governments of Czechia, Hungary, Poland and Slovakia through Visegrad Grants from International Visegrad Fund. The mission of the fund is to advance ideas for sustainable regional cooperation in Central Europe.

Facing compressed and declining margins, the owner of a Hungarian bus manufacturer decided to venture into the electric city bus business.

This company, once one of the largest bus manufacturers in the world, is currently medium-sized and in domestic-ownership. In 2019, the number of employees was 124, and turnover amounted to EUR 8.7 million (100 % domestic sales).

The owner's decision to diversify the product mix and develop electric buses was motivated by a perceived strong 'tailwind', promising a rapid improvement of business performance in a growing market.[1] It is no surprise that there have been multiple foreign direct investment (FDI) transactions in the V4 countries over the past couple of years, by investors establishing plants specialised in the manufacturing of electric buses and components. Examples include BYD in Hungary[2] and MAN in Poland[3]. Domestic-owned manufacturers have also entered the electric bus business (e.g. SOR Libchavy in the Czech Republic and Solaris in Poland (Solaris has been acquired by the Spanish company CAF), since the market for electric buses is characterised by considerably higher profit margins than the market for diesel buses.

To overcome its technical deficit in electric powertrains, the case company created a joint venture with a Chinese electric bus manufacturer, and developed the prototype of an all-electric bus. Although the new bus was based on a Chinese licence, this undertaking required considerable capability accumulation, since it had to be redesigned to obtain the necessary approval of the prototype. In order to achieve 50% local content, several components had to be replaced by European ones, the integration of which required additional development work.

Digital technologies have had an important role in the product development process, especially simulation software, digital documentation and document sharing solutions, and digital solutions enabling concurrent engineering.

Building on the synergy effect stemming from the complementary capabilities of the Chinese and the Hungarian partners in the joint venture, the development and the certification

[1] On one hand, strict European emission standards and the EU's Clean Vehicle Directive drive the growth of the market (according to the Clean Vehicle Directive, a minimum of 22.5% of all new buses ordered in 2021 across Europe will have to be zero-emission ones). On the other hand, generous government subsidies promote the adoption of electric buses. In 2019, 112 electric buses were manufactured in Hungary (https://autopro.hu/gyartok/negyedevel-nohet-iden-a-magyarorszagon-gyartott-elektromos-buszok-szama/370561)

[2] https://www.automotiveworld.com/news-releases/byd-opens-hungary-electric-bus-factory-targeting-400-year-capacity/

[3] https://www.electrive.com/2021/03/29/man-to-begin-articulated-e-bus-production-in-poland/

of the prototype took less than two years for the joint venture. However, irrespective of the significant production capacity at the Hungarian location and a marked growth of the local market for electric buses, the case company still has to struggle with commercial hurdles.[4]

Although the company was aware of the fact that developing electric buses is a high-risk undertaking even in a high-growth[5] market, since there are already several established players, and competition is rapidly increasing,[6] the owner had high hopes in the recently launched Green Bus Programme of the Hungarian government. This programme envisages the replacement of the municipal diesel bus fleet by electric buses in all Hungarian cities with a population of above 25,000. The government earmarked subsidies of EUR 100 million (over a period of ten years) to support this objective. Consequently, a series of pilot demonstration projects started in various Hungarian cities – projects that precede the launching of public procurement tenders.[7]

Apart from the performance of the prototypes tested during these pilot demonstration projects, bus companies and municipalities will have to weigh a range of other considerations. One issue is the purchase price of electric buses, which is on average 150% of a conventional diesel bus. Total cost of ownership is influenced among others, by the amount of subsidies, maintenance costs (compared to those of diesel buses), the range the electric bus can deliver on a single charge, and by the availability and price of chargers.

Buses are expected to be charged overnight at the depot or at the terminal station. However, since the range battery electric buses (BEBs) can deliver is lower than the distance these buses have commute a day, BEBs need to be recharged during the daytime. Furthermore, few bus companies have the necessary charging capacity at their depots, which is the most-difficult-to-overcome barrier for bus companies and municipalities in Hungary. The main problem is grid capacity: creating the necessary technical conditions for charging several buses at the same time may take several years and involve prohibitive costs.

---

[4] A quick review of the business press reporting about recent purchases of electric buses by Hungarian cities and transport operators indicates that these stakeholders have opted for foreign manufacturers, such as MAN, Mercedes, and Solaris, or BYD (the Chinese company with a manufacturing plant in Hungary) and not for the buses of the case company.

[5] Notable in this respect is the fact that the market for electric buses is highly concentrated. By 2019, there were over half a million electric buses in use around the world. However, 98% of them were located in China, and only 4,500 in Europe (Source: Amstrong, M. (2021). China Charges Ahead With Electric Bus Rollout. https://www.statista.com/chart/24462/electric-bus-stocks-by-global-region). Poland is the largest market within the V4, with 430 registered electric buses in 2020 (Source: https://www.statista.com/statistics/1081362/poland-number-of-registered-electric-vans-and-trucks/).

[6] According to Statista (Electrification of public transport report, 2019), in 2019, the number of electric bus manufacturers was 26 in the world.

[7] The case company participates in one of the Green Bus pilot demonstration projects, to test its newly developed electric bus in a large Hungarian city.

Therefore, if electric bus companies want to sell their products at the Hungarian market (in this respect, the situation is similar also in other countries), they have to diversify into developing and installing chargers for their buses. For example, when BYD delivered ten e-buses to public transport operator Tüke Busz in Pécs (a city in southern Hungary), it also took on the responsibility for designing and installing a charging infrastructure for these buses.[8]

Having recognised this imperative, the surveyed company decided to engage in developing a smart charging solution to be able to compete with a 'full package' solution. Development of a high-power DC fast-charging station involving e-bus batteries that can store and discharge energy started in 2020. This solution can integrate also alternative energy resources, e.g. solar power. Battery storage adds flexibility to the system by enabling it to avoid the prohibitive costs of peak hours charging.

The prototype of the charging solution is expected to be completed and certified by the end of 2021. Although the company has contracted German and Chinese R&D services providers for this project, the lion's share of the work is performed internally. For this sake, the company increased its headcount of software developers and engineers by more than twenty high-skilled employees.

According to the project manager interviewed, although charging stations are rightly considered tangible products, the dominant part of the related development is software development, including charging management, monitoring and control, and load balancing.

The software intensity of electric bus and charging station development conveys significant upgrading opportunities for the company in question. Software represents higher value added than manufacturing mature products.

In summary, the diversification of the company's product mix and the shift to electric bus production have not only enhanced its resilience in a rapidly transforming industry but have also entailed various upgrading opportunities. The case illustrates how *product upgrading* elicited *chain upgrading* (in terms of chargers) and *functional upgrading.* New, high-value activities include the management of the joint venture and the new product related open innovation activities; the monitoring of the global market for identifying component providers and technology providers; and the expansion of in-house software development activities. The

8 https://www.automotiveworld.com/news-releases/byd-completes-ebus-fleet-delivery-to-pecs-in-hungary; In a similar vein, when Solaris delivered five electric buses to the Polish city of Opole, it also delivered and installed charging equipment, e.g. three plug-in charging stations for the depot. https://www.electrive.com/2021/03/29/opole-oders-5-solaris-e-buses-charging-equipment/. A similar full-package business transaction was recently reported in Paks (Hungary) where Solaris delivered ten electric buses along with charging infrastructure. https://hvg.hu/gazdasag/20191121_paks_elektromos_busz_beszerzes

manager interviewed also made reference to *process upgrading,* involving the automation of specific manufacturing processes and the procurement of welding robots. Last but not least, notable is the upgrading of the product development process, achieved through integrating smart digital solutions that can augment engineers' work.

Questions related to the case study:

1. The case study argues that the market for electric buses is characterised by considerably higher profit margins than the market for diesel buses. Which factors account for this claim?
2. How can local content regulations enhance the upgrading of local subsidiaries?
3. Please explain the construct of 'complementary investments' necessary for profiting from innovation, based on the case of the bus manufacturer.
4. The case study argues that product upgrading is sometimes linked to chain upgrading and functional upgrading. Based on this case study, explain with your own words the relationship among different dimensions of upgrading.