PhD DISSERTATION THESES

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MAGYAR AGRÁR- ÉS ÉLETTUDOMÁNYI EGYETEM

ANALYSIS OF REGIONAL COMPETITIVENESS IN THE DEVELOPMENT OF KOMÁROM-ESZTERGOM COUNTY FOCUSING ON THE ROLE OF THE FOREIGN OWNED AUTOMOTIVE AND VEHICLE INDUSTRY

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CONTENT

BACKGROUND AND OBJECTIVES OF THE RESEARCH WORK

In recent years, Hungary has been characterised by a shrinking industry and a declining economy following a prolonged boom. Not only in Hungary, but also in neighbouring countries, the economy is heavily exposed to the automotive sector. The industry faces an uncertain future in many aspects. It is impacted by a combination of large-scale manufacturing transformation (Industry 4.0 trends, shortening supply chains, negative effects of COVID-19, labour shortages, transforming labour market, put into the limeline of the Environmental, Social and Governance (ESG) framework). Furthermore, the electric vehicle transition and global trade tensions (shortages of raw materials, microchips, dramatic increases in energy and transportation costs, changes in trade tariffs). The local resources of Komárom-Esztergom County (KEC) modernisation model based on export-oriented re-industrialisation with foreign direct investment (FDI) are being exhausted and its effects of breaking out of the periphery and catching up with the centre are fading (Lux, 2017; BSE, 2020; Cserháti et al., 2021;.EC, 2021; Goreczky, 2021; PwC, 2021). The question arises: how can this industry-based model be made smarter? How can we integrate at a higher level into global production and value chains, while creating a multi-legged, diversified regional economic structure, less exposed to external cyclical fluctuations, building primarily on internal (endogenous) endowments?

In my Dissertation, based on the available literature, I focus on the possibility of changing the emphasis of local economic development based on endogenous factors and the conditions that underpin this. Geographically, Komárom-Esztergom's position as the most industrialised county in Hungary today depends mainly on its role in industrial production networks, while - despite the sporadic availability of research materials and publications - the region has not really been researched with in a comprehensive, systemic manner in recent decades. Edutus University, which has a regional role, could play a key role in filling this gap (Peredy, 2020; 2021).

The above mentioned facts motivated me to start the research work on the topic of my PhD thesis, summarising the results so far, and besides the realised new scientific results to formulate some recommendations as well that can be implemented in practice. These can provide contribution to the sustainable, innovation-driven growth of the KEC improving its competitiveness, making Edutus University a regional hub of knowledge and entrepreneurship centre and strengthening network-based cooperations among economic actors in the county, including its interregional dimensions. In this context, I will also highlight further future research directions.

My research work is aiming to analyse the automotive and vehicle sector of KEC in broader regional context.

The subject of my research is broader regional analysis of the automotive and vehicle sector in KEC focusing on the following main research areas (based on international literature and my own experience):

1. Revealing the chronology of the regional economic development of the CEEC after the regime change (1990-2020) in a national comparison and to identify local specificities and factors influencing its effectiveness.
2. Mapping out and analyse strategic alternatives and models for the future development of the CEEC, based on its past development and existing assets, with particular attention to the central-peripheral situation of the region and the priority of the SME sector in the county.

3. Analysing the economic governance characteristics of the automotive sector in the CEEC, based on international literature and practices, and to outline the most appropriate adaptable model to local conditions.
4. Making assessment the impact of COVID in the analysis, selection, design and implementation of strategies and models.
5. Extending the impact assessment of the KEM Automotive Economic Management Model to cross-border cooperation.

My PhD Dissertation is aiming to formulate a set of interrelated research objectives in relation to the subject of the research, as shown in Table 1 below, which can help to define the research questions and hypotheses, and then to present the methodological background and main results of the research work to confirm or reject them, drawing conclusions on the basis of which the proposals are formulated according to the above criteria.

Table 1. Research objectives

Key Objective 1: To examine the regional development potential, capabilities (factors, conditions)	
Sub-goals	
1.1.	Map out the geographical and transport infrastructural conditions
1.2.	Assessing the contribution of public sector actors
1.3.	Examining the role and contribution of local government (regulations, regulators, incentives, economic governance models) in influencing the development of business interests.
1.4.	To identify the main features of the regional economic governance system of the automotive sector in the KEC region in the light of international practices and to examine what model can be outlined for this region.
1.5.	Examination of the region's development potential (factor supply, capacity analysis) - including the impact on the environment of the region and the companies.
Key Objective 2: Analysing the impacts on regional development of the domestic and foreign-owned companies settled in industrial parks and local institutions and NGOs	
Sub-goals	
2.1.	Economic impacts on the operation, conditions, constraints and development of SMEs in the region.
2.2.	The social impact on the development of the region (population retention of the population, number of jobs, employment, workers' income, human resources skills, quality of life), the impact of living with a large number of foreign (immigrant) workers (the large number of foreign workers affects local society and wages).

2.3.	Examining the impact of COVID-19 on local economic actors (production, supply chains, changes in work organisation methods and technologies such as digitalisation, automation, robotisation, Artificial Intelligence-based solutions) to see whether Komárom-Esztergom County could be a winner in the post-pandemic situation and the internal restructuring of the automotive industry.
2.4.	Impact on the region's education and training infrastructure
Key objective 3: Comparative analysis of the automotive and vehicle industry sector in Komárom-Esztergom County (Hungary) and Csallóköz (Slovakia) in terms of adaptability of usable practices (through company case studies)	
3.1.	Examining the differences (positive and negative) between the Slovak-Hungarian economic governance and regulatory system in order to draw lessons for the KEC.
3.2.	Interregional analysis of a specific sector, the automotive industry, which is not of Hungarian origin and ownership, in order to gain a deeper understanding of the KEC

Source: Own edition based on own research (2025)

Research questions, hypotheses

In order to achieve the multi-level research objectives presented in the previous subsection, Table 2 indicates the research questions for which I was seeking answers with my empirical research, aiming to reveal and explain descriptive and causal relationships.

Table 2. Research questions of the PhD Dissertation

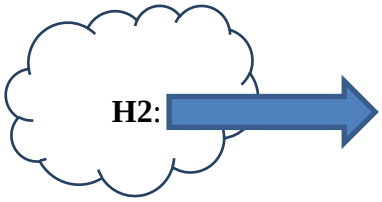
Research question 1.	What are the specific characteristics of network-based cooperations forms between the automotive actors in KEC, can these ones be described by a specific model of economic governance in the automotive sector, based on international benchmarks, which takes into account the specificities of the county, can be applied in practice and can be adapted to other sectors, in order to coordinate more efficiently the cooperation between local economic actors?
Research question 2.	What are the break-out opportunities and how can the KEC leverage them for further sustainable regional economic development?
Research question 3.	How did the COVID-19 pandemic affect the operations of SMEs, in what respect and to what extent were there significant differences between large firms and SMEs, what are the strategic alternatives for firms in the post-pandemic period?
Research question 4.	How can the added value of the activities of the local factories of the international companies that have set up in the industrial parks of the KEC be increased, and what are the opportunities for the local SME sector to become a supplier in this process and in which areas?
Research question 5.	What general lessons can be learned from the interregional analysis of the KEC-Csallóköz automotive sector, and what lessons and recommendations can be drawn for the KEC decision-makers by

	comparing and analysing the differences between the Slovak-Hungarian economic governance and regulatory system?
Research question 6.	What could the role of the HEI in Komárom-Esztergom County, the innovative, entrepreneurial Edutus University, be in the future?

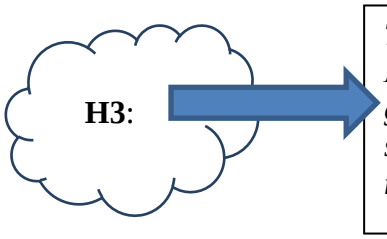
Source: Own edition based own research (2025)

In line with my research objectives and questions, and based on the literature and secondary information I have processed, I formulate the hypotheses shown in Figure 1. In the course of my research, I will test the following preliminary hypotheses in order to confirm, clarify or reconsider them.

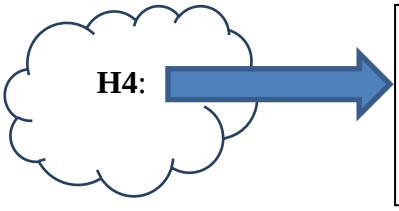
The favourable geographic and transport infrastructure of Komárom-Esztergom County (KEC) and the local government's activities inspiring business development have contributed significantly to the development of the region's development potential and capabilities.



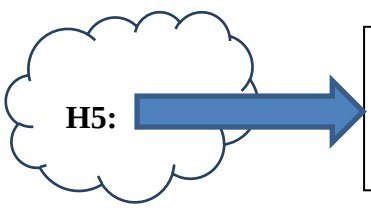
The local units of the MNEs that have settled in the industrial parks of Komárom-Esztergom County have been able to generate measurable positive social, economic and environmental impacts in the development of the region.



The regional economic governance system of the automotive industry in Komárom-Esztergom County generally follows the economic governance models of the European automotive regions, but it also has some different, unique features that can only be described by creating a new model.



Regarding the effects of the economic crisis triggered by COVID-19, there is no significant difference between companies in Komárom-Esztergom County - regardless the size of the company, its ownership structure.



The production of substitute products and the provision of high value-added services can be a point of entry for domestic SMEs into the value creation process of the large companies that have moved in.

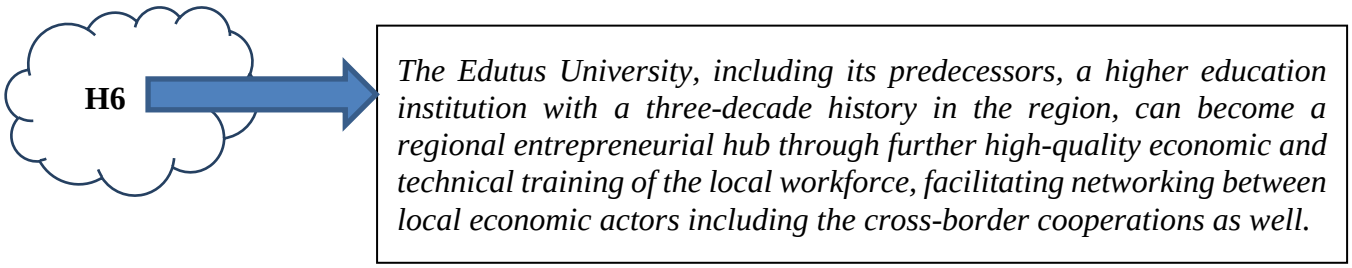


Figure 1. Hypotheses related to the research objectives (H1-H6)
Source: Own edition based on own research (2025)

The testing of the practical application of my preliminary theoretical hypotheses will take place within the framework of my empirical research. The findings of the hypothesis testing will be presented in a later chapter presenting the results of my interviews.

Expected scientific results of my research work:

A. Creation a unique regional economic governance model for the automotive industry, based on international benchmarks, which accurately describes the networked cooperation between the automotive industry actors in Komárom-Esztergom County, taking into account the specificities of the region and its economic development processes.
B. To clarify whether and in what form Komárom-Esztergom County could be a beneficiary of the post-pandemic situation and the internal restructuring of the automotive industry, based on the impact of the COVID-19 pandemic on local economic actors (production, supply chains, changes in work organisation methods and technologies - e.g. digitalisation, automation, robotisation, artificial intelligence).
C. To clarify, on the basis of the impact of the local presence of large international companies on the county's economy, to what extent the county is characterised by a concentration of higher added value activities in Western European industry, while lower added value activities are outsourced to East-Central Europe, including the KEC, thus "preserving" the centre-periphery situation, and whether this trend can be changed in the future
D. Exploring and interpreting the interrelationships between the characteristics of the automotive industry, a special sector of non-Hungarian origin and ownership, on the basis of an EU cross-border, interregional analysis.

MATERIAL AND METHOD

The research questions and hypotheses formulated in my thesis based on case study method. The case study is a qualitative research method involving primary (interviews with relevant economic and institutional actors) and secondary (documentary analysis: economic development, spatial development strategies, relevant publications, databases) data collection and analysis techniques to understand the relevant inputs and outputs and the interrelationships between them over a given time period, rather than using statistics to draw conclusions (Yin, 2003; Ábrahám, 2018). Case studies used to apply for testing, validating, verifying or comparing hypotheses or theories on a particular topic or theme, checking or comparing similar situations when it is not possible to work on a larger sample from cost or any other reasons, furthermore principle of triangulation can also be applied, i.e. the comparison and collation of information arising from different sources. In addition, results of scientific value, you can also

formulate practical suggestions and measures to provide valuable contribution to the decision making (Abraham, 2018; Shone, 2019; Katleen, 1989; Teiu et al., 2011, Shereia, 2016).

Primary data gathering and analysisi methods

Individual in-depth interviews and mini focus group interviews – as qualitative research - were conducted with economic actors from Komárom-Esztergom County. For the institutional and civil-professional organisations, as well as for MNEs and SMEs, different interview question outlines were prepared, which were sent to the stakeholders in advance, as follows (Table 3).

Table 3. Main focal points of interviews

Type of the local actors	Main questions of the interviews
MNEs local units and SME sector actors	• Your company's business strategy, business portfolio, operational processes and organisational structure • Opportunities for firms in the following areas (economic, social, educational, labour market, institutional/relationship, ESG) arising from the current "territorial/regional" characteristics of KEC • How have KEC's endowments by 2020 compared to the baseline years changed? What can the most likely reasons beyond this trend be? • What are the main challenges and break-out opportunities for the KEC domestically-owned SME sector? • Opportunities for cooperation with Edutus University • How could the length of the value chain in the activities of KEC firms be increased horizontally or vertically, and in what directions could the KEC economy be diversified more than it has been so far?
Institutional and NGOs actors	• How do you KEC's "territorial/regional" conditions of the beginnings in economic, social, institutional, cultural, educational, labour market areas see? • How have KEC's endowments by 2020 compared to the starting years changed? What can the most likely reasons beyond this trend be? • To the best of your knowledge, how and by what means did the then management of the KEC 'help' the county to exploit its existing potential after 1990 in order to attract companies to the county's industrial parks? Has your municipality been able to add a 'tailor-made' plus to these? • How do you the activities of the management of the KEC from 1990 to 2020 from your own point of view assess? • Summarise the future economic development vision for the KEC (and/or your municipality). • Opportunities for cooperation with Edutus University.

Source: Own edition (2025)

During the interviews I used the "semi-structured" interview technique. The interview sketches contained the topics and areas of interest, with a minimum number of closed questions, most of which were open-ended and could be "tailored" to the development of the interview. The interviews took place at agreed times and locations, and summaries were sent back to the interviewees for clarification and validation (independent persons also interpreted the text and data to avoid subjective bias).

A total of 31 interviews were completed with 45 experts from the organisations and companies listed in Annex 8.1 - Interviews between 4 November 2019 and 15 December 2023. Where specific persons are indicated in the interview codes, in-depth interviews were conducted, and where organisations are indicated, focus group interviews were conducted. The breakdown of interviews: institutional actors (municipalities, county-level economic governance organisations, local educational institutions, professional NGOs) 18 pieces; Memner of Parliament (MP) 2 pieces; large business actors: OEM and direct suppliers at TIER1 and TIER2 level) 8 pieces; SME sector 3 pieces.

Taking into consideration the outbroken COVID-19 coronavirus epidemic, it was appropriate to extend the scope of the earlier started research work involving the impacts of the epidemic on the economy and society of KEC. The interviews were also supplemented with a chapter on the epidemic (how stakeholders see a possible way out from this situation), updating the PhD research and increasing its relevance.

Due to the relatively small sample size and the mainly qualitative nature of my primary research, a non-probability, heterogeneous sampling procedure was used to select the interview subjects, rather than a purposive, expert-based approach in order to be representative. The guiding principle was to provide as accurate a description as possible of the regional economic development of KEC from the automotive and vehicle industry's point of view, to gain a deeper understanding of the interrelationships of socio-economic processes and trends relevant to the research objectives, in order to be able to draw generalisable conclusions.

Primary data from the interviews contributed to

- Creation of a proprietary economic governance model describing the interactions between the KEM automotive actors.
- Making comprehensive overview about spatial and economic development history of the different municipalities and industrial parks of the KEC, including the strengths of the county (favourable geographical and infrastructural conditions, conscious industrial park development, investment promotion and business-friendly strategies, one-stop-shop system, available workforce, adequate institutional background) and weaknesses (saturation of industrial park areas, limitations of the trust network for cooperation, weaknesses and low innovation potential of the local SME sector, "anomalies" in the local integration of large foreign manufacturing companies, the internal transport network of the KEC did not follow the needs of economic and regional development).
- COVID-19 epidemic impact on the automotive firms in the county and their adaptation at firm level.
- Understanding the competitiveness problems and future opportunities of the local SME sector.
- Revealing the contexts of interregional cross-border cooperations.

Secondary data gathering and analysing methods

For the secondary research, I have used relevant documents provided by the KEC regional actors, in addition to the analysis of the extensive national and international literature (scientific publications, books, book chapters, PhD Dissertations, Acts and other legal rules). I have also

involved „grey literature” as well. These were reports from city councils, industrial parks - for example, locally initiated settlement development, settlement marketing programmes such as "*Tatabánya where you can find your home" or "Don't spend your time travelling, work locally in Oroszlány" or "Komárom waiting for you - Build your future at home*!" "*Komárom, where you can make your own home*", chamber of commerce compilations, central labour office materials, the Employment Pact of the KEC, the Regional Development Concept of the KEC, the Tatabánya Integrated Settlement Development Strategy.

The literature was explored and analysed in a combined approach (Jalali-Wohlin, 2012). On the one hand, I used the “snowball method”, i.e. I searched for additional relevant literature needed based on some pre-selected literature (author or academic journal) and their references, as well as on additional ideas from my own existing information. On the other hand, I also searched for additional literature relevant to my research topic by using keywords and terms according to the research questions and hypotheses I had set.

I integrated the literature with data from various statistical databases (regional labour market statistics of the National Employment Service, regional economic statistics of the Central Statistical Office, and free company business reports for the years 2010-2022 available on https://e-beszamolo.im.gov.hu (Ministry of Justice). Although the subject of my study - the analysis of the period covering the 3 decades of economic development of the county (1990-2020), where it was possible to do so by extending the time horizon to 2022, the analysis of the business reports was done in a different time interval. The reason for this is that the first round of investments by local units of foreign-owned international corporations in the county's industrial parks were fully implemented and value-creating activities were launched and ramped up to full volume by 2010, followed by the second and third rounds of new capacity expansion investments, and then the arrival of new companies in the county after 2018.

The qualitative and quantitative data, statistics and time series analyses of the KEM, which can be considered relevant, reliable and up-to-date, have been integrated into the own work section.

The research questions, hypotheses and methods used to test them are summarised in Table 4.

Table 4: Correlations between the research questions, hypotheses and methodological tools of the thesis

Research questions	Hypothesis	Methodological tools
1. Research question	H1, H3	Interviews, literature, grey literature, statistical databases
2. Research question	H1	Interviews, literature, grey literature, statistical databases
3. Research question	H4	Interviews
4. Research question	H2, H5	Interviews, statistical databases, company business reports
5. Research question	H6	Interviews, grey literatures
6. Research question	H6	Interviews, grey literatures

Source: Own edition (2025)

In the literature review I considered the following theories of regional economics relevant to the research:

- Theories dealing with the causes of regional dispartities (Global Production Chains /GPN/; Global Value Chains /GVC/, evolutionary economic geography variables)
- Theories describing urbanization benefits (Christaller-Lösch Central Places, Thünen Circles, New Economic Geography Theory; New Neoclassical Urban Economics Theory
- The OLI paradigm summarising the reasons why set up branches of MNEs abroad
- Models of regional aspects of competitiveness (Porter's diamond and double diamond models, Three-factor model, Lengyel's pyramid model, Social Innovation Index, Competitiveness and Institutional Competitiveness Index (KIVI), Roland-Berger Industry 4.0 Maturity Index)
- Territorial development cooperation (regional economic growth models /Keynesian regional growth; neoclassical exogenous growth; neoclassical endogenous growth/, network cooperation for regional economic growth: industry districts, clusters, helicoid-based innovation ecosystems /three, four and five bolt models/, economic governance models)

An important aspect of my research was also the creation of a model of economic governance in Komárom-Esztergom County and the examination of its specific characteristics. The creation of a model and the subsequent testing of its operation is a well-known procedure in business, economic, scientific and technical practice. The economic governance model of the KEC automotive space was to develop an inductive, conceptual type model through a case study. In the European automotive and vehicle industrial regions, cooperation networks (industrial districts, clusters, various helicopter-based innovation ecosystems) between the relevant actors promoting regional economic growth and development coexist, exploiting economic development tools (e.g. industrial parks, infrastructure investments). However, multi-stakeholder networks between actors, organised from below, are increasingly moving towards 'top-down' economic governance-type cooperation organised by regional urban centres, determining the economic development activity of each region, exerting a significant influence on the processes organised from below, making them more efficient. These regional economic governance partnerships can be described by other types of models.

The role of large foreign manufacturing companies in the KEC's economy has also been major focus of my research.

The rapidly changing, increasingly complex and globalising business and economic processes are often driven by foreign direct investment (FDI) by large international companies. FDI is part of global production, trade, financial networks and knowledge and technology transfer activities. FDI also reaches less developed regions and countries, making many less economically developed peripheral regions highly dependent on local subsidiaries of international corporations (Lengyel, 2021).

In order to examine the role and importance of large foreign manufacturing companies in the CEE economy, I analysed company annual reports for the years 2010-2020, available free of charge at https://e-beszamolo.im.gov.hu (Ministry of Justice 2023). The reason for this is that although the Dissertation analyses KEM's regional economic development trends over the period 1990-2022. MNEs found their long-term calculations for setting up their establishment(s) in the region in this time period, the first round of MNEs investments that settled in the various industrial parks of the county were realised, and these local manufacturing and assembly unit production capacities reached the maximum level. During this time period, a change in approach was initiated in the second and third rounds of investment following the

earlier first-round investments by large foreign manufacturing companies, which were based on external factors and helped to boost economic growth in terms of costs and volume, and the arrival of new firms. There is also a shift towards quality-based growth (high quality, practice-oriented education, innovation), regional specialisation and endogenous development based on networks. I have taken into consideration to focus the analysis on the most important firms in terms of turnover, value added (GVA), profit after tax and employment indicators for understanding the processes at any given time in the period under study. In addition, the automotive and vehichle sector, which proved to be the dominant segment of the regional manufacturing industry, other large MNEs in the manufacturing sector were also included in the sample, allowing for a more articulated analysis of the role of foreign-owned large manufacturing companies in the county's economy.

Based on the indicators of firm GVA/KEC GDP, firm employed persons/KEC total employed persons, as well as the indicators of KEC population/KEC GDP and firm employed persons/firm GVA, conclusions were drawn on the economic impact of foreign manufacturing large enterprises in the county. The source of the KEC GDP data for the period under study was https://www.ksh.hu/stadat_files/gdp/hu/gdp0077.html, while the source of the county GDP per capita data was https://www.ksh.hu/stadat_files/gdp/hu/gdp0078.html.

In addition to MNE's local units, the sample also includes large companies (e.g. Coloplast, Grundfos, SKOH) that have establishments in other counties, but as a "simplification" the total output of these firms is accounted for in KEC. The present research was concerned with the role of large foreign manufacturing companies in the KEC's economy during the period mentioned above and did not include an analysis of the structural characteristics or multiplier effects of the automotive industry, nor did it address the question of diversification beyond the automotive industry. On this basis, the performance of foreign manufacturing firms in the county and their role and weight in the county's economy were analysed together (automotive and other non-automotive manufacturing firms combined). The distinction was not justified because, for example, based on the sub-sectoral classification according to the TEÁOR system, there are several foreign manufacturing firms whose original profile is not automotive but whose current dynamics are based on a closer link to the automotive industry (e.g. Zoltek Chemical Ltd.). Finally, I have also tried - as far as possible - to represent as many segments of the manufacturing industry as possible in the foreign manufacturing companies, and to describe the spatial relations within Komárom-Esztergom County as thoroughly as possible through the geographical location of foreign manufacturing companies located in or near the various industrial parks, although this was not always relevant (for example, the Almásfüzítői Industrial Park has been "avoided" by the MNE's during the analysed timeperiod).

The sample included the following large foreign manufacturing companies (with location and profile by sub-region):

Tatabánya/Környe Industrial Park:

Automotive and vehicle industry sector: Bridgestone Tatabánya Production Ltd.; AGC Glass Hungary Ltd.; Otto-Fuchs Ltd.., Sanmina-SCI Hungary Ltd. (each of these is a TIER1 supplier to several automotive brands, with business profiles ranging from tyres for passenger and commercial vehicles, front and rear side window and rear windscreen glass, extruded aluminium wheels, and the last company is a contract manufacturer of electronics - cables for driver assistance ADAS systems, airbag connectors).

Other manufacturing companies with different profile: Beckton-Dickinson Hungary Ltd.; Coloplast Hungary Ltd. (health industry – syringes, diagnostical reagents, stomata bags), Henkel Hungary Ltd. (chemical industry – adhesives); Grundfos Hungary Ltd. (machinery industry – producing pumps and submersible pumps).

Esztergom Industrial Park:

Automotive and vehicle industry sector: Hungarian Suzuki Corporation (OEM – currently, the company producing Suzuki S-Cross and Grand Vitara models); Kirchoff Automotive Ltd. (TIER1 level supplier, producing car body elements); Tyco Electronic Ltd. (TIER1 level suppliere, electronic connecting components); Summit D&V Ltd. (TIER1 level supplier: door upholstery, Front Suspension Frame (FSF) complete front steering and suspension system, right and left swing arm, assembled wheels - rims and tyres - for models manufactured by Hungarian Suzuki Corporation; Diamond Electric Ltd. (TIER1 level supplier, producing sensors, ignition switches and electronic control units for the automotive industry).

Oroszlány Industrial Park:

Automotive and vehicle industral sector: BorgWarner Oroszlány Ltd., WesCast Hungary Corporation; Philippine Hungary Ltd. (These actors are TIER1 and TIER2 level suppliers, their business portfolios in sequence: turbochargers, production of casting housings for these, as well as various integrated PUR foam interior body elements for several automotive brands).

Other manufacturing companis with different profile: Suez- Water Technologies& Solutions Hungary Ltd. (reverse osmotic membrane filters for water purification).

Komárom Industrial Park:

Automotive and vehicle industrial sector: BYD Electronic and Truck Hungary Ltd., SK Battery Hungary Ltd., Kayser Automotive Ltd. (these ones are TIER1 level suppliers with Chinese or South-Korean ownership, their primary actvities focus on the production of electric powertrains and their resources within the transforming automobile and vehicle industry. The South-Korean SK Innovation Group has 3 units in Hungary – two units locate in Komárom and one unit in Iváncsa. The three units were organised in one holding as SK on Hungary in 2023).

Other manufacturing companies with different profile: Mylan Hungary Ltd. (Pharmaceutical Industry)

Ács Industrial Park:

Other manufacturing companies with different profile: Hartmann Hungary Ltd. (packaging industry)

Mirelta Industrial Park (Tata):

Other manufacturing companies with different profile: Güntner-Tata Cooling Technics Ltf. (individual industrial air conditioning equipments).

Tata Industral and Logistical Park:

Autmotive and vehicle industrial sector: NKH Spring Hungary Ltd.. (Steering and brake system components, vehicle suspensions production, TIER2 level supplier), Gedia Hungaria Ltd. (production of pressed and welded body elements, TIER2 level supplier).

Nyergesújfalu Industrial Park:

Autmotive and vehicle industrial sector: Hungarian Toyo Seat Ltd. (production of car seats and exhausts systems)

Other manufacturing companies with different profile: Zoltek Chemical Industry Corporation. (chrmical industry, plastic industry).

Dorog Industrial Park:

Autmotive and vehicle industrial sector: GMD Cast Hungary Ltd. (high-pressure aluminum foundry producing vehicle parts).

Kisbér Industrial Park:
Autmotive and vehicle industrial sector: Mineba/U-Shin Europe Ltd. (automotive supplier - production of locking mechanisms, ignition switches, door locks).

MAIN RESEARCH FINDINGS AND THEIR DISCUSSION

Model of economic governance for the automotive and vehicle industry in Komárom-Esztergom County

In European automotive regions, cooperation networks between relevant actors (industrial districts, clusters, different helix-based innovation ecosystems) promoting regional economic growth and development coexist, exploiting economic development instruments (e.g. industrial parks, infrastructure investments). However, the bottom-up, multi-stakeholder networks between the interested actors are increasingly moving towards 'top-down' economic governance-type cooperation organised by regional urban centres. Regional economic governance increases economic development activity by coordinating cooperation between actors, making bottom-up processes more efficient. Their modelling required taking into account different aspects.

My research indicates that KEC is a re-industrialising region, which has become an Vehicle Industry Zone, where the automotive industry has played dominant role in the economic development of the region, with a diversified structure and integration into global value chains. The design of a regional economic governance model for the county, which is specific in terms of the size and development of its foreign-owned automotive sector, has required new and innovative challenges. It was necessary to assess precisely what future challenges the automotive sector in the county is facing, what requirements and tasks are involved in managing these challenges locally and more effectively, and how the sector will be integrated into industrial networks in the future. It was necessary to understand and map the relevant regional players, the possible links between them and the forms of cooperation that the sector is currently operating and will continue to operate on the basis of these links. The next step was to clarify whether these cooperation patterns could be described by an explicit consistent automotive economic governance model based on international benchmarks. and, if so, to what extent they are similar or different from the economic governance models of the European Vehicle Zones. Furthermore, how these specificities can be used to strengthen future cooperation between local economic actors and whether they can be applied to other sectors.

Figure 2 summarises the different types and depth of concrete programmes and initiatives implemented/planned in the cooperation between the county's automotive economic governance model’s actors. Each circle illustrate given actor segments of the regional automotive hub, with the common intersection of the different circles (I. – V.) correspond to the strategic partnerships planned or implemented between the different actors (these are described in detail in the subsections following the figure). The common intersection point VI. represents all activities that help to harmonise the cooperation between every interested stakeholders in the local automotive sector: harmonising the strategic visions of local economic actors with each othesr and with the strategic proposals of county and national level decision-makers, in order to identify future development opportunities and breakthrough points for the local economy, taking into practice the strategic visions coordinated by the urban agglomeration centres, and all types of strategic partnersjips that are not covered by the common intersections of the different circles I-V. Implementation of the renecessary policy formulation and toolbox system has been on progress.

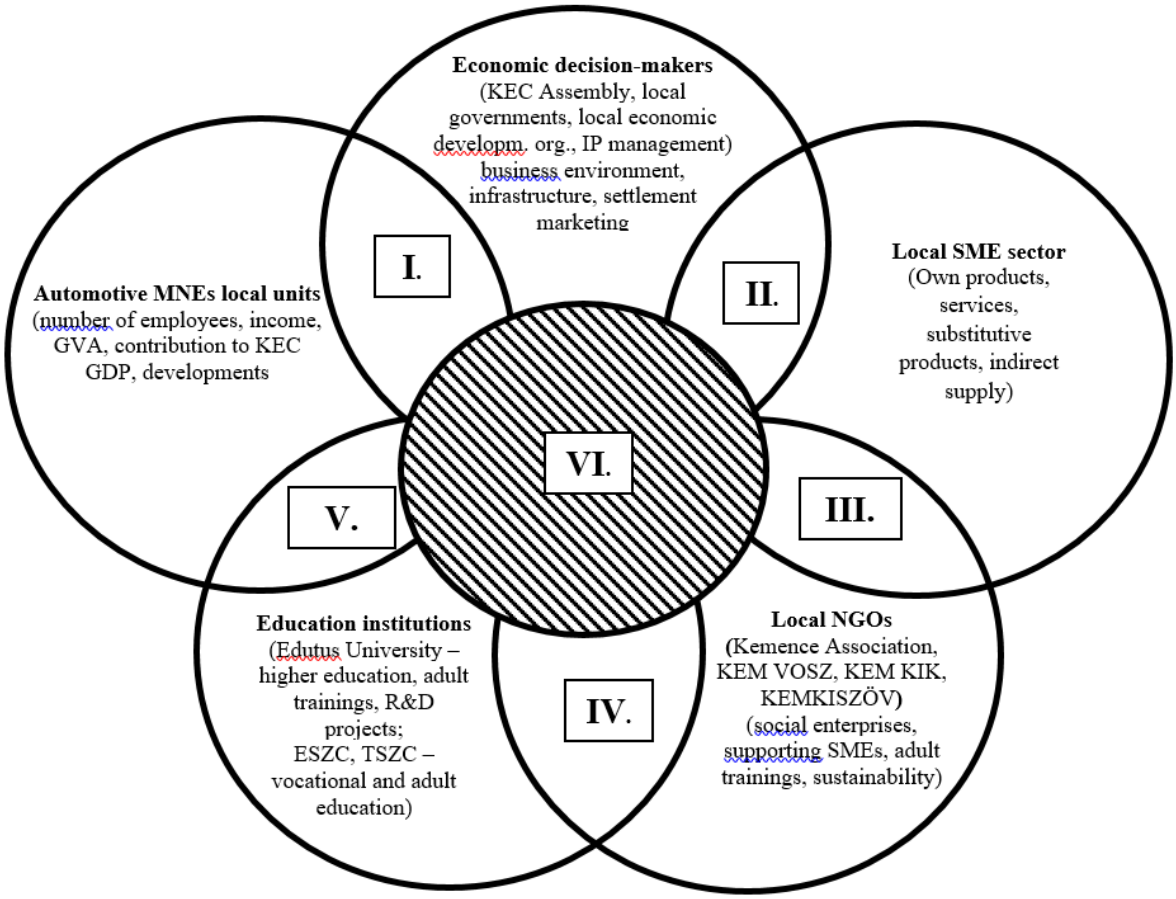


Figure 2. Created economic governance model for the network-based cooperations among the actors of KEC automotive and vehicle industry
Source: Own edition based on Interview3 (2020); Interview19 (2020); Interview1 (2021); Barina (2020), Inteview4 (2021); Inpark (2020), Interview6 (2021); Interview23 (2021); Interview8 (2022); Interview12 (2022)

Besides implementing consistent investment attraction strategies and operating a toolbox, regional economic governance decision-makers, should be place greater emphasis on implementing business-friendly support and incentive schemes to help the local SME sector, thus strengthening their competitiveness in the future. The current weaknesses of the local SME sector (lack of market and product development skills, modern management methods, organisational culture and strategic approach) and its low innovation potential may limit the success of cooperation with large companies and the success of the specialisation and diversification efforts of KEC efforts, which rely on endogenous resources (Interview14, 2021; Interview17, 2021; Interview28; 2021 Interview22, 2022).

However, availability of information and marketable knowledge, local municipalities generally lack resources (expertise, financial resources, volunteerism), and due to the specificities of their home country, social innovations at the central level are determined from above on the basis of various political and economic interests, without sufficient knowledge of local specificities. It is therefore necessary to develop a coordinated, integrated platform where interests, ideas, strategies and instruments at different levels - municipal, territorial and central - are systematically aligned to achieve tangible and sustainable shifts (e.g. avoiding the catch-up trap, moving up inside the GVC's integration level).

Current economic challenges - energy crisis, Russian-Ukrainian war, COVID crisis effects, employment difficulties.

Consequences:

- Disruptions in global, long-term supplier and supply chains (microchip, raw material and component shortages, search for alternative sources of supply, temporary shutdowns)
- Significant increase in production costs (energy, transportation, raw materials, overheads, wages)
- Narrowing of production capacities (temporary dispatch of hired labor, reduction of low-skilled, difficult-to-convert labor, decline in the number of foreign workers)
- Stagnation of economic growth (increased unemployment, postponed investments, decrease in the number of businesses)

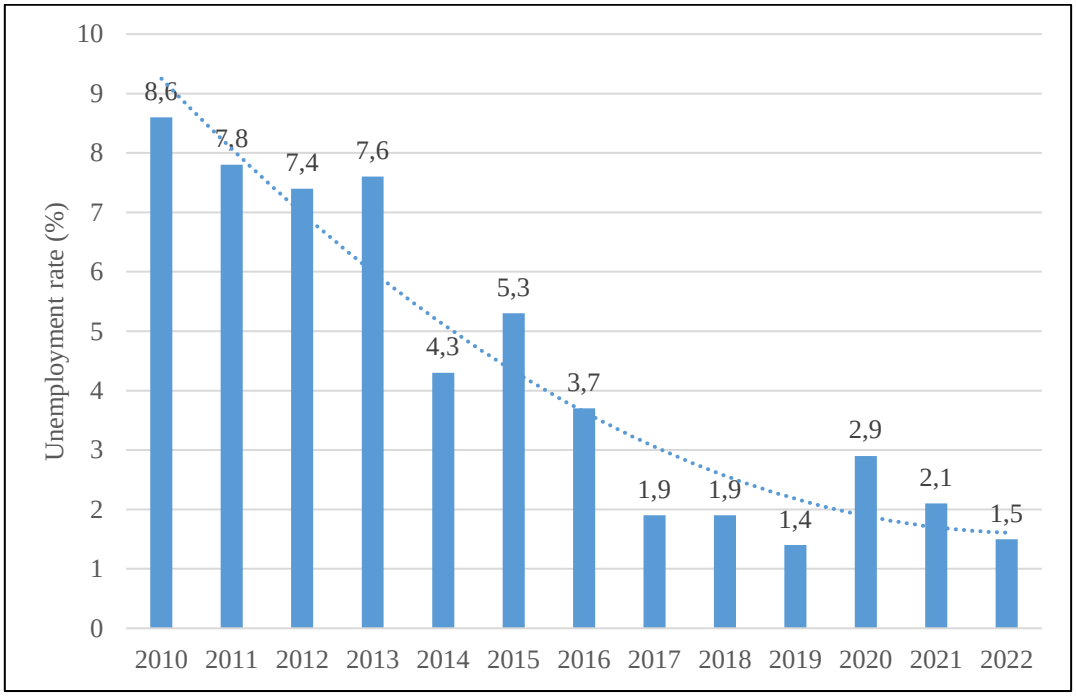


Figure 3. Unemployment data among the active population in Komárom-Esztergom County with the trend line (2010-2019)
Source: Own edition based on HCSO STADAT 6.2.1.11. Unemployment rate by county

This positive process was interrupted by the pandemic, and the local economic recession temporarily caused the unemployment rate to spike, especially in the local service sector. (Unemployment increased from 2,600 persons in 2019 to 5,934 persons in 2020, i.e. slightly more than twice the previous level, but in 2021 a recovery began to take place.

The volume of manufacturing investments stagnated in 2019-2020 due to the COVID-19 pandemic, when local units of large international companies had to rethink their business models, production organization methods, and labor needs. This period coincided with the global and county-level structural transformation of the automotive and vehicle industry (the rise of electric drives due to stricter sustainability and environmental regulations). In addition, the labor shortage that arose as a result of demographic processes has become characteristic of all segments of the county's manufacturing industry, and due to the adverse economic effects of the crisis situation caused by "COVID-19" on production, demand, and investments, technological trends related to the Industry 4.0 process have started, such as automation, robotization, digitalization, and artificial intelligence. With the resolution of the challenges

posed by the COVID-19 situation, FDI investments have gained momentum again, many companies are implementing their second and third round investments, but new, first-round investments have also started after 2020.

Examining the role of large foreign manufacturing companies within the economy of Komárom-Esztergom County.

Figure 4 shows the contribution (GVA) of local units of large foreign manufacturing companies to the county's GDP in percentage terms, as well as the proportion of employees of these companies in relation to the total number of employees in the KEC in percentage terms during the period under review.

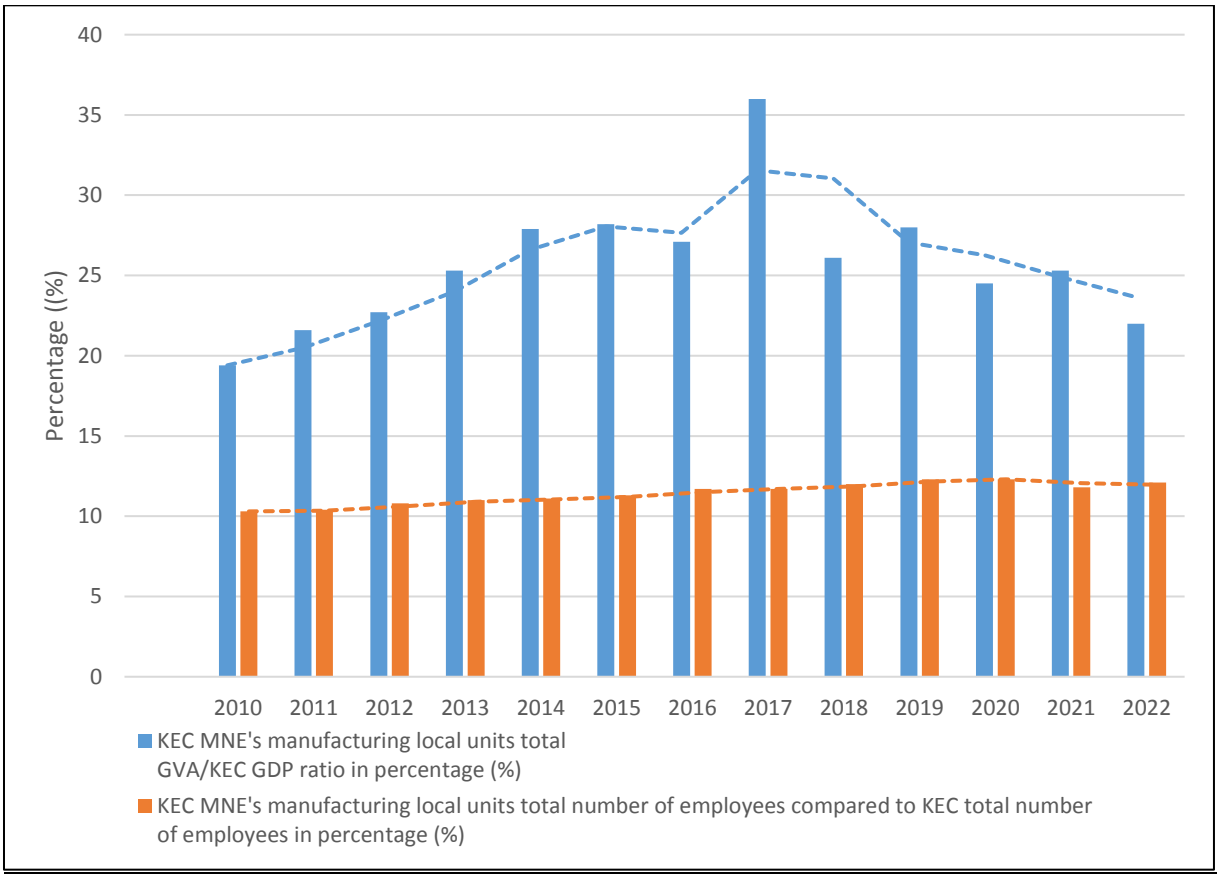


Figure 4. Contribution (GVA) of foreign manufacturing companies in KEC counties to the county's GDP and employment in percentage with trend lines (2010-2022)
Source: Own edition based on (Ministry of Justice, 2023; HCSO, 2023)

The value generated by large foreign manufacturing companies within the county GDP is comparable to the county GDP in the examined period at an aggregate level, representing an average rate of 24 percent within it. Until the COVID-19 pandemic, there was a generally upward trend between 2010-2019, and in fact this value exceeded KEC's average, in the post-pandemic period it decreased slightly, but still remained close to the previous high-level average. Compared to the total employment rate of the KEC, the share of employees of these companies is much smaller, representing an average rate of 11.4 percent in the examined period, without significant fluctuations.

Figure 5 shows the volume of added value produced by large foreign manufacturing companies (in million forints) by geography in the period under review.

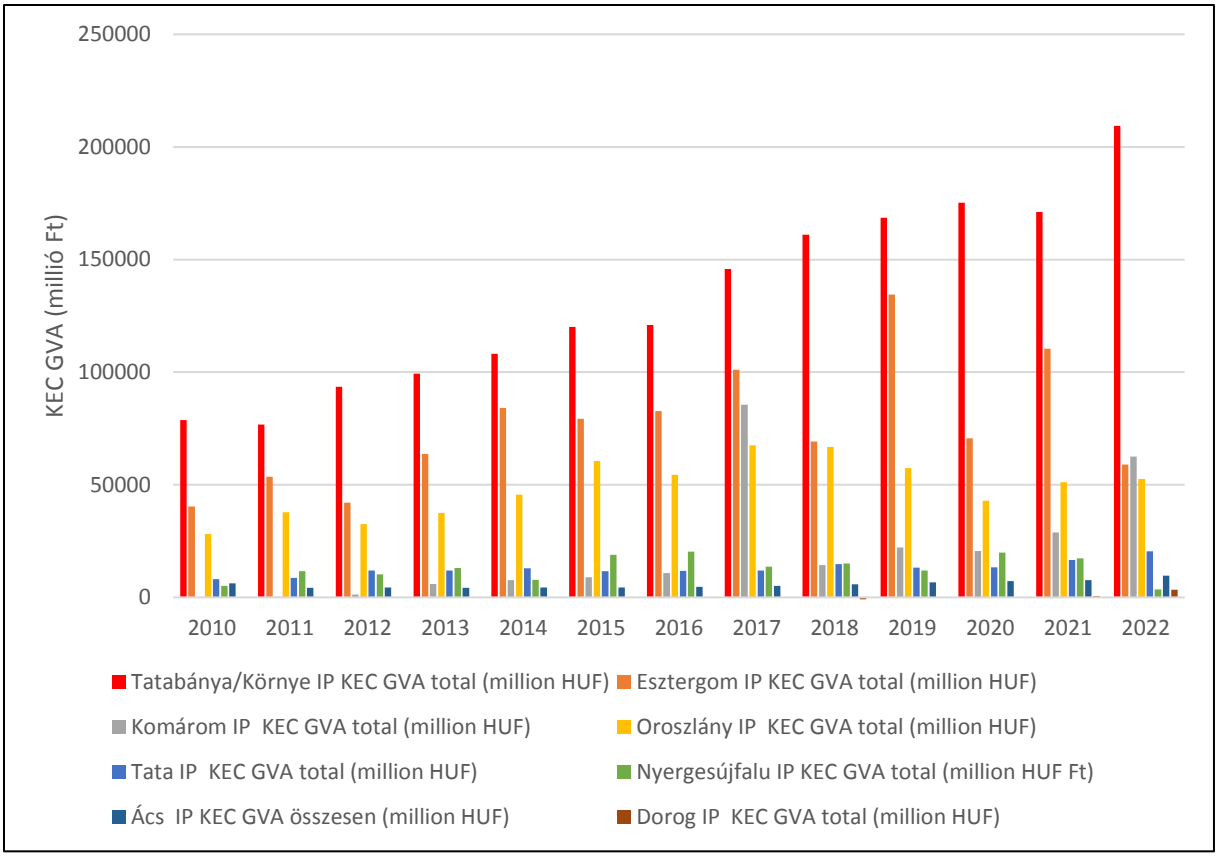


Figure 5. Geographical distribution of KEC GVA produced by large foreign manufacturing companies (million HUF) 2010-2022
Source: Own edition based on Ministry of Justice (2023)

The large foreign manufacturing companies present in the two largest industrial park areas (Esztergom, Tatabánya/Környe) produced two-thirds of the added value during the period under review. This proportion was not affected by the volume of added value produced by companies that later settled in the other industrial park areas or that were already there but increased their value-creating capacity as a result of second and third-round investments.

Figure 6. compares the productivity of the locations of large foreign manufacturing companies in the counties (GVA/total number of employees of local units of manufacturing companies) with the average productivity of the KEC (county GDP/total number of employees in KEC). It can be seen that the value produced per employee (million HUF/person) was on average 2.2 times higher in the local units of large foreign manufacturing companies than in the county average during the period under review. This difference has not decreased even with the increase in productivity of local KEC companies (small and medium-sized or large companies with Hungarian ownership interests).

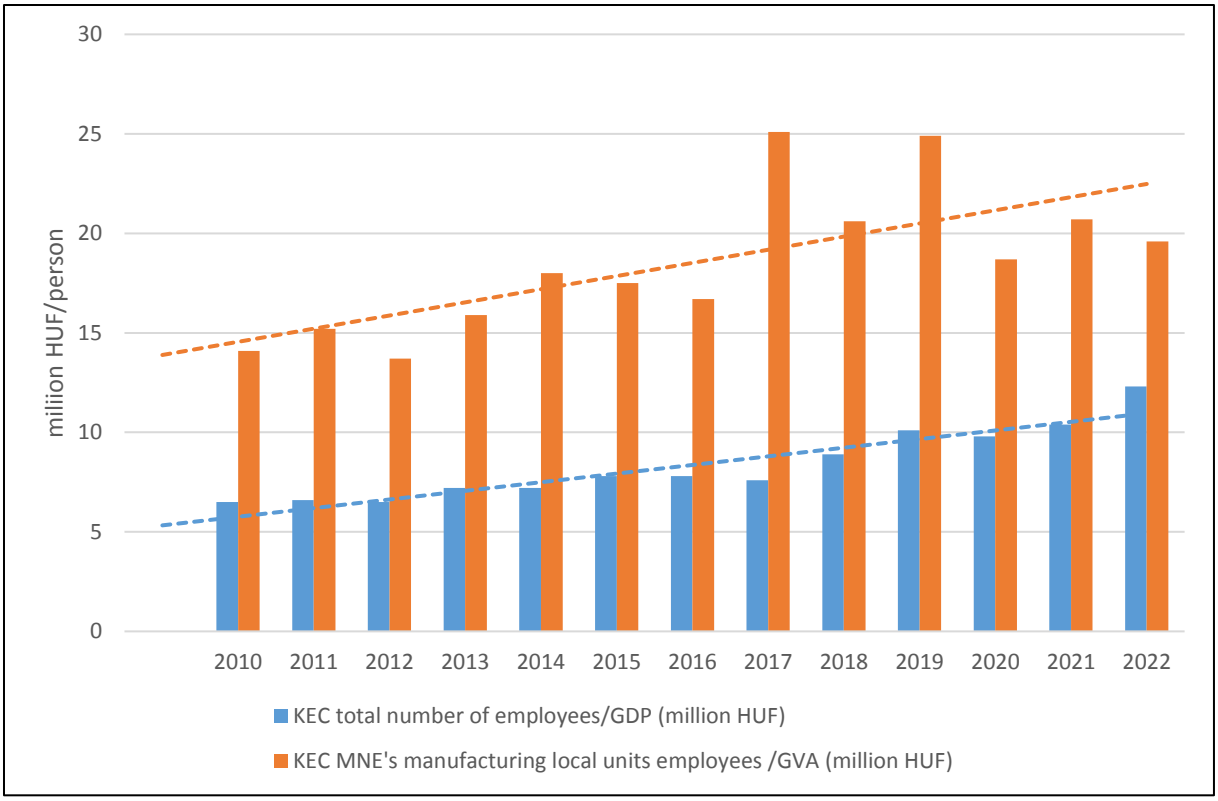


Figure 6. Productivity of local units of large foreign manufacturing companies in KEC compared to the average productivity of county companies
Source: Own edition based on Ministry of Justice (2023); HCSO (2023), NES (2023)

Based on the above research, it can be stated that the local manufacturing and logistics units of large foreign manufacturing companies (automotive and vehicle industry, packaging technology, healthcare industry, electronics, mechanical engineering, pharmaceutical industry, air conditioning and refrigeration technology, chemical industry) have indeed induced a measurable/tangible economic impact through their GVA contribution to the KEC GDP. In the period under review, this ratio was 24 percent on average, and in the period following the COVID-19 pandemic, the previously continuously increasing trend saw a slight decline (companies had to rethink their purchasing, stocking, production organization methods, business models and technologies due to disruptions in the supply chain, shortages of raw materials, energy prices and transport costs). Rest of the county's GDP is probably produced by local SMEs. This is consistent with the research of other authors, i.e. the proportion of FDI transfers from foreign-owned companies and the GVA creating reindustrializing, manufacturing county (Lengyel and Varga, 2018; Lengyel 2021; Lengyel et al., 2023).

The economic impact on employment is important, but cannot be considered significant: the proportion of employees employed by local branches of large foreign manufacturing companies to the total employment in the KEC was smaller, averaging 11.4 percent in the period under review (the rest is probably provided by local SMEs and public institutions). At the same time, the productivity of the local units of large foreign manufacturing companies (value added per employee (million HUF/person) is 2.2 times the county average (fewer employees produce more value). This is due to the previous conscious county economic development strategy, which aimed to diversify the county's economic structure, i.e. in the manufacturing industry, in addition to automotive and vehicle companies, the settlement of manufacturing companies was also encouraged (Peredy, 2023). On the other hand, the local units of these large foreign manufacturing companies operate production and assembly lines using modern technological

solutions (automation, robotization, sensors, big data and cloud-based solutions, real-time enterprise and production management systems - ERP, MES), and produce market-leading, modern products, despite the fact that these represent the lower added value, componentized, highly standardized activities in the value chain. These technological solutions and production organization methods require relatively less labor workforce, which is also an answer to the labor shortage caused by negative demographic trends, and to the question of why, the ratio of the total number of employees employed by these companies to the total number of employees in the KEC did not increase above 11.4 percent, despite the second or third round of capacity-expanding investments of the companies in the sample or the establishment of new companies during the examined period.

However, after 2020, after adapting to the challenges caused by the COVID-19 pandemic, the KEC investments of these international large companies gained new momentum, which is partly related to the transformation processes initiated within the global automotive and vehicle industry. These new first, or second and third round investments will result in the most modern technologies, higher value-added activities, so it is expected that in the case of KEC, it may be possible to avoid the "catch-up trap" of reindustrialization by overcoming the previous center-periphery situation. (The economic prosperity of manufacturing regions is temporary, a single significant investment can help their situation in the short term, but the value-creating capacities created as a result of these operate like islands, their economic growth and development transitions will stagnate after a few years, which may also hinder the country's catch-up. The Western European manufacturing industry carries out the higher value-added activities, and the rest is outsourced to, among others, Eastern and Central Europe. On the other hand, these processes tie up the local workforce, occupy valuable real estate, orient training, and crowd out local businesses).

Based on the research so far, the economic effects of newer, higher value-added activities on the counties have not yet been reflected in a significant increase in the volume of added value produced by large foreign manufacturing companies, nor in an increase in their share within the KEC's GDP. The possible reason can be the fact that the implementation of truly high value-added elements of the value chain, such as defining corporate strategy, product planning, design, brand building, and research and development, still does not take place in the counties. The local units of large foreign manufacturing companies currently have room for maneuver in the development of standardized (albeit state-of-the-art technological solutions) manufacturing, assembly, and logistics processes of the value chain, broken down into lower value-added elements, in the optimization of costs, and in social and non-financial aspects of operations (sustainability, social responsibility, transparent, ethical operations). In addition, the majority of these companies have not managed to fully recover from the recession in the post-COVID-19 period. In any case, a deeper examination of the issue of the catch-up trap requires further research work.

Challanges and opportunities of the KEC's SME sector

The majority of enterprises are sole proprietorships, the dominant type of partnership being the limited liability company (LLC). The county has a minimum number of enterprises in the large enterprise size category based on in terms of number of employees, balance sheet total and turnover. Challenges of the sector:

- Lack of capital reserves, capacity problems: they cannot meet the strict and high-level supplier requirements of large international companies (volume, specifications, deadlines), and they lag behind in productivity and efficiency compared to large international companies.

- Cultural lag (lack of market, product and modern management knowledge, lack of trust hindering network collaboration, lag in the introduction and application of Industry 4.0-based technologies).
- Growth constraints: lack of strategic vision, struggle for daily survival, lack of determination and ability to enter own markets with own products (even foreign markets), if a Hungarian company leaves its family or small business existence and starts operating as a medium-sized company, then foreign capital will soon arrive with acquisition intentions, which may not be favorable from the perspective of KEC.
- Access to funding sources. (It is necessary to ensure that they obtain revenues on which they can start potential product and market developments, closer links with vocational training and higher education in the field of education and service provision).

Opportunities

- Design, substitute products and services
- Entering into own markets with own products
- Entering into foreign markets - Hungarian Export Development Agency (HEPA) Export Coordinator Training
- Cross-border cooperation between KEC and Nitra County (Interreg CBC – Pons Danubii ETT /example TAPE NOVUM DANUVIUM/, Rába Duna Vág ETT; Ister-Granum ETT)
- Indirect supply chain integration: high value-added services; technological developments; development, production and sale of substitute products
- SMEs need to be prepared – with market and product development knowledge
- Managment and organisational development
- Short-term trainings, skills development
- Digitalization, skills, Industry 4.0 based technologies
- Network-based cooperations – creating trust and mutual interests

Edutus University, which operates as a inovative regional knowledge and entrepreneurial center, can also play a decisive role in these processe.

CONCLUSIONS AND RECOMMENDATIONS

H1: *The favourable geographic and transport infrastructure of Komárom-Esztergom County (KEC) and the local government's activities inspiring business development have contributed significantly to the development of the region's development potential and capabilities.*

Based on the analysis of the available relevant documents, databases and interviews with stakeholders, it was found that the conscious and coordinated efforts of local actors in the county, taking advantage of the favourable geographical conditions, succeeded in obtaining significant government support for the development of the institutional, intellectual and physical infrastructure necessary for economic restructuring. In addition to the development of transport infrastructure, industrial park developments have been carried out in the individual municipalities, and industrial park clusters have been created in Esztergom, Tatabánya/Környe, Tatai, Oroszlány, Komárom, and companies specialising in their operation have been set up. In addition, a decentralised institutional system for local economic development has been established with the "one-window client system", effectively helping to attract and retain investors in the region on a multi-stakeholder basis, generated higher value-added production activities, deploying cutting-edge technologies in KEC. Establishing intellectual and institutional infrastructure and municipal programmes to attract and retain labour have resulted in a change in the character of the larger municipalities (local services, recreation, liveable

environment, improved quality of life). These measures have put KEC on the map as highly prioritized destination for the FDI decisions of MNEs.

The future challenge is that the county's internal transport network has not met the requirements arising from the needs of economic development (Oroszlány-Tata-Tatabánya transport is inadequate, industrial parks are difficult to reach by public transportation mean). The potential of intermodality and cross-border cooperation (KEC and Nitra County) has not yet been sufficiently exploited, and the county's industrial parks are now full (new areas need to be developed and additional population needs to be attracted to alleviate labour shortages, in addition to automation). The investments inclusive industrial environment, the appropriate institutional, intellectual and physical infrastructure are available in KECy, and several new major investments are currently under way. Vehicle and component manufacturing activities will remain a key sector in the county, but probably with a different component/product portfolio.

Based on the above H1 can be confirmed.

H2: *The local factories of the international companies that have settled in the industrial parks of Komárom-Esztergom county have been able to generate measurable positive social, economic and environmental impacts in the development of the region.*

My research work revealed that local manufacturing and logistics units of international manufacturing companies (mainly automotive, but also in other sectors: packaging, health care, electronics, machinery, pharmaceuticals, air conditioning and refrigeration, chemicals) have indeed induced a measurable/measurable economic impact through their GVA contribution to the EME GDP. The local units of both automotive and international large companies in other sectors contribute about 24-25% of GVA GDP per year. (The rest of the county's GDP is probably generated by local SMEs. This is in line with research by other authors, i.e. FDI transfers and GVA generated by foreign-owned companies are relatively high, making KEM a re-industrialising, manufacturing stronghold. In terms of employment, the economic impact is important but not significant: the average number of employees directly employed by local units of large international companies in the automotive sector is 11.4% (the rest is probably provided by local SMEs and public institutions). On the other hand, the productivity of local units of large foreign manufacturing companies (value added per employee (million HUF/person)) is 2.2 times the county average (fewer employees produce more value). This is a result of the earlier deliberate economic development strategy of the county, which emphasised the diversification of the county's economic structure, i.e. the establishment of manufacturing firms in the manufacturing sector was encouraged, in addition to automotive and vehicle firms (Peredy, 2023). The local units of these large foreign manufacturing companies operate manufacturing and assembly lines using advanced technological solutions (automation, robotisation, sensors, big data, cloud-based solutions, real-time enterprise and production management systems - ERP, MES), producing market-leading, advanced products, despite the fact that these are highly standardised activities with lower added value, broken down into their components, in the value chain. These technologies and production organisation solutions require fewer workers, offering a solution to the labour shortages caused by demographic trends.

The present research focused on the weight of local units of large international companies in the county's economy, did not take into consideration spill-over effects, and the treatment of the headquarters-location problems of multi-location firms and Hungarian-owned large companies is also an open issue.

Based on the above, H2 can only be partially confirmed.

H3*: The regional economic governance system of the automotive industry in Komárom-Esztergom County generally follows the economic governance models of the European automotive regions, but it also has some different, unique features that can only be described by creating a new model.*

The European automotive hubs operate different economic governance models, influenced by the local units of large international companies that have set up in the region, as well as by local specificities. The economic governance models applied in each automotive hub can be classified into different categories according to the type of cooperation between local actors (centralised or decentralised) and the nature of the cooperation (political or economic dominance). The coordination and development of local economic and urban development strategies and instruments is a key element in the automotive economic governance model of the different regions, involving in the decision-making processes not only political actors but also representatives of the economic, civil and academic spheres in order to promote sustainable regional development. Based on my broader regional analysis of the KEC Regional Automotive Centre, I have identified and described the automotive industry actors, their activities, the types and levels of partnerships between them. In addition to the various forms of bottom-up, trust-building network-based cooperations between actors, in line with international trends, the county is also witnessing a strengthening of the role of regional urban centres, and a shift in urban and settlement development policies towards economic governance and coordinated economic development. A fundamental question is what governance structures can be used to describe the governance and economic development initiatives of individual urban areas. This challange is being addressed by stakeholders through less formalised partnerships, organised at regional level, with the coordination of regional city centres, which go beyond the administrative framework. These will focus on the coordinated implementation of economic development by harmonising the strategic visions of the various players (economic, civil, educational, political) in order to increase the involvement of local resources in urban development. A specific feature of the economic governance and economic governance models of these regional automotive centres is that they are implemented by urban regions, usually without government institutions, through coordination between the players involved. According to the preliminary plans, by 2030 the KEC would have "an urban region with a population of 200,000 people, centred on Tatabánya, including the towns of Oroszlány, Tata, Komárom and the primary catchment area settlements with high-quality industrial park services (12 of which are currently operating in the county), smart city settlement management systems, and a macro-regional economic weight in the Budapest-Győr-Bécs-Pozsony area. In addition, efforts should be made to develop multimodal cooperation with Székesfehérvár and Nitra, strengthening the position of the county within the Danube region. Priority should also be given to the re-skilling of the workforce needed for the production of GDP in the KEC, with a particular focus on a marked improvement of the conditions for the training of technical specialists at higher and secondary levels".

Based on the above, I saw it justified to attempt to create - as a missing task - a model of economic management of the automotive industry in the county, and within this framework to describe the economic management, restructuring and infrastructure development processes of the Regional Centre for the Automotive Industry of the county, and their socio-economic impacts. The main features of the model are basically in line with the economic governance models of different European automotive regions (mostly belonging to the category of non-centralised and non-politically dominated cooperation-based models, i.e. similar to the 'Baden-Württemberg' model), but with several different specific features. Some examples about the latter are:

- FDI inflows and economic development in the KEC region have followed a similar three-phase development phase to that of the European automotive regions, but not in equal 10-10 year periods.
- For diversification of the KEC economy, the county's economic management policy makers encouraged the arrival of companies from the automotive and vehicle industry, chemical industry, health industry and machinery industry sectors between 2000 and 2010, in addition to those from the automotive sector.
- To attract and retain workers, a media campaign and a town marketing programme were launched.
- Local units of large international companies are not fully embedded in the local economy and do not always rely sufficiently on local economic actors. Further research is needed to analyse this in more depth and to predict future trends

A precondition for future bottom-up networking cooperations between local actors is a "network of trust" between stakeholders. Based on my research, these can include six main elements: 1) Partnership between large automotive companies and local economic governance actors; 2) Partnership between local SMEs and local economic governance actors. 3) Partnership between local NGOs, professional organisations and the SME sector. 4) Partnership between large automotive companies and educational institutions. 5) Partnership between educational institutions and local NGOs. 6) Finally, activities to harmonise regional economic governance in the automotive sector and cooperation between actors, covering other areas not covered by the above partnerships. The development and strengthening of a network of trust requires a change in social attitudes, social and organisational culture.

In the case of the KEC economic governance model, the Hungarian-Slovak cross-border cooperation (Nitra/Csallóköz and KEC) plays a significant role in the KEC processes, and has a significant impact on them.

Based on the above H3 can be confirmed.

H4: *Regarding the effects of the economic crisis triggered by COVID-19, there is no significant difference between companies in Komárom-Esztergom County - regardless of the size of the company, its ownership structure.*

During the research, it became clear that, independently of the crown virus, a process of adaptation was initiated in local units of large international companies as well as in Hungarian-owned small and medium-sized enterprises in the county, repositioning their production, rethinking their labour capacity and its composition, the production chain structure, and inventory policy. These have helped economic operators to overcome the challenges posed by the negative effects of the COVID-19 pandemic without major shocks. The economic downturn caused by the virus (real economic and financial market uncertainties) led to a "slowdown", but flexibility and creativity helped firms to stay afloat (temporarily reducing production capacity, bringing forward annual planned maintenance, making necessary process and product improvements). Temporary lay-offs or unpaid leave of part of the workforce (mainly affecting temporary agency workers) have been used to a greater or lesser extent for relatively short periods, regardless of firm size. Following the pandemic wave, this "surplus free labour" was absorbed again as production capacity was increased. However, after 2020, following the adaptation to the challenges of the COVID-19 pandemic, the KEC investments of these international corporations have gained new momentum, partly linked to the transformation processes within the global automotive industry. These new first, or second and third round investments will lead to state-of-the-art technologies and higher value-added activities, and it

is expected that the KEC may avoid the "catch-up" trap of re-industrialisation and the emergence of a centre-periphery situation, although for the time being the high value-added elements of the manufacturing value chain are still not being implemented in the county. Local units of large foreign manufacturing companies can determine the sustainable growth path of the KEC economy and its chances of catching up.

However, creativity cannot be introduced at a systemic level into the multisegment of assembly, subcontracting, sub-dividing manufacturing processes and operating them according to internationally standardised, strict protocols. Innovation in the automotive industry is not in the OEM or TIER1 units here, but in their second or third-tier suppliers. It is advisable to attract as many of them as possible to the county, as they are where Hungarian ideas can be sold, since capacity development, the introduction of new technologies, product development and developments related to Industry 4.0 determine the development direction of SMEs, regardless of their size or ownership structure. The scarcity of available labour will force the more capital-intensive companies to step up investment in labour-intensive activities.

Based on the above H4 can be confirmed.

H5: *The production of substitute products and the provision of high value-added services can be a point of entry for domestic SMEs into the value creation process of the large companies that have moved in.*

Case study studies about automotive and vehicle industrial companies confirmed that large international automotive OEMs (Original Equipment Manufacturers), because of their lean approach, risk and cost sharing, only keep the design of individual models, final assembly of key modules, and "tailored" follow-up services after sales in-house. The production of each main module is outsourced to first-tier (system-level) suppliers (TIER1 level), which are themselves large, capital-intensive international companies with considerable knowledge and capacity. The first-tier suppliers subcontract the production of individual sub-modules and components to second and third-tier suppliers (TIER2 and TIER3 level). In addition to the OEM assembly plants, a number of actors in the supply chain contribute to the series production of a car model. The participants in the supply chain can be vertically (hierarchical) and horizontally (non-hierarchical) linked around a single large company. In the latter case, a business partnership is created between companies at the same level. The main advantage of vertical connectivity is the possibility to access international markets directly or indirectly through collaborations. Due to the complexity of automotive end-products (strict technical, technological, environmental, safety, ergonomic standards and consumer needs must be met simultaneously), standardised requirements are built on each other, which is laid down in the IAFT 19649 specifications. Another feature of multi-tier automotive supply chains, in addition to outsourcing, is modularisation. The production of parts and sub-assemblies in as small a range as possible but in as large a series as possible (for reasons of economies of scale) requires interchangeability and modularity, i.e. the ability to use the same components not only within the same model class but also across different car model classes. The production of individual components is carried out in regions 'specialised' in the production of the components concerned. Hungarian suppliers (local SMEs) can integrate at the lowest, third level of international supply chains. In order to be integrated into the supply chain, they must meet all the quality requirements imposed on them by the automotive manufacturing companies. This creates a closed and integrated supply chain, with a number of environmental, economic, manufacturing, organisational and information barriers that make it difficult to operate more efficiently and respond quickly and flexibly to change.

Domestic companies that have a proven track record in their area of operation can achieve supplier status. These companies have to meet the following criteria: technologies and

operational capacity to produce such products required by direct customers; adequate capital strength and company size; multilingual communication skills; to be empower R&D capabilities; financial strength and stability to cover their own entry and opeartional costs (machinery and other investments, management systems). If these are in place, the company can be involved not only in the supply chain but also in the first-tier suppliers or in specific stages of new product development (NDP) of OEMs.

It is essential that a company selects the most suitable supplier and, after proper negotiations, concludes favourable contracts. To select suppliers, products and services have to be constantly monitored, and it is also necessary to have clear understanding of the technological and quality requirements, the performance of suppliers, maintaining ongoing contact with suppliers and develop long-term, broad-based strategic partnerships as part of strategic supply chain management (SCM). In the case of direct sourcing, the result is incorporated into the finished product: (raw and auxiliary materials, parts, components, tools and services required for the direct production of products). This area involves the regular, high-volume and highly specified supply of a narrow range of suppliers. The result of indirect supplies is not incorporated in the finished product, but is necessary for the production of the finished product: additional materials, tools and services needed to keep the company running (e.g. specific target machines, materials for the maintenance of production lines/machines, service activities). Specific needs (completely different products have to be purchased from a heterogeneous range of suppliers, some of the purchases may be purchases that were not made in the previous year or two. For the local SME sector, successful involvement in indirect sourcing can be an opportunity for further progress and development.

KEC's strategy has a strong emphasis on diversification of the economic structure, design and substitute products, and exploiting the potential of indirect supply. Partnerships are being developed between local actors to create longer value chains, diversify the local economy, prepare local SME sector actors to become indirect suppliers, integrate at a higher level in supply chains, consciously prepare to enter their own markets with high quality local or substitute products of their own design, enabling the KEC economy to face future challenges. With the development of technology, the development and deepening of networking is easier than before and its importance is also increasing. The need to build a knowledge-based society is demonstrated by the presence in the county of a number of companies belonging to knowledge-based key sectors such as automotive, engineering, infocommunications and pharmaceuticals.

It should be noted that the current weaknesses of the local SME sector (lack of market and product development skills, modern management methods, organisational culture and strategic approach) and its low innovation potential may limit the success of cooperation with large companies and the success of the specialisation and diversification efforts of the KEC bottom-up, trust-building networking processes, which rely on endogenous resources. Empowering local SMEs requires a 'space-sensitive' development policy and raising awareness and preparedness for the Industry 4.0 trends.

Based on the above H5 can be confirmed.

H6: *The Edutus University, including its predecessors, a higher education institution with a three-decade history in the region, can become a regional entrepreneurial hub through further high-quality economic and technical training of the local workforce, facilitating networking between local economic actors including the cross-border cooperations as well.*

It is in the crucial interest of the Edutus University maintaining its competitiveness in higher education system and ensuring its long-term stable future, while strengthening its international

dimensions, to fully review possible directions for the EU Progaming Period 2021-2027, which can contribute to strengthening its regional role in the KEC region in the field of business exploitation of education-research-knowledge approach. In addition to its regional role (acting as an innovative regional knowledge and entrepreneurial centre or hub), the research has also focused on beyond the county borders in national (curriculum development of digital training modules for MIPA pilot programmes, knowledge transfer to different training venues and sectors) and international dimensions (dual degree courses, launching its own "branded" international workshop series). Exploiting the potential of international cooperation in the organisation of education and the development of proposals for social involvement should be coordinated with the ongoing monitoring of the capacities and situation of the KEC and the main requirements of the Edutus University Institutional Development Plan 2021-2024, which is a prerequisite for access to national and EU funding in the next Programming Period. These include increasing the interoperability and alternatives of higher education outputs, strengthening adult education and continuing vocational training activities, and renewing the content of higher education to adapt to the changing and evolving local labour market and local socio-economic needs. It is essential to find workable solutions for the commercial exploitation of the results of own R&D projects in various forms, to participate in the operation of various KEC innovation centres (e.g. Tata Innovation Park, Oroszlány Innovation and Technology Park and Oroszlány Digital Centre) through various network partnerships, to strengthen the third mission in the framework of social responsibility, together with the awareness-raising of various economic actors, and to ensure a contribution to EU objectives.

The proposals formulated during the research, which represented a breakthrough point for both the county and Edutus University, had to take into account the expectations of both national government and EU policy documents, as well as the current socio-economic environment of the KEC. They can serve as input for the University's management to help prepare for the challenges ahead. This hypothesis has projected the long-term future of Edutus University. The challenge for the period ahead is to find the resources and human resources needed to implement these proposals. Since the economic impact of the COVID-19 pandemic, which will be carried over to 2021, the economic crisis triggered by the outbroken Russian-Ukrainian war in Spring 2022, and the long-term trends of the shortage of raw materials cannot be predicted at this stage. There are also a number of uncertainties about the material and human resources needed to implement the proposals, and therefore implementation will require a great deal of flexibility in preparing decisions on targets and resource allocations and making changes as they arise, but even so, there is no guarantee that this objectivewill be fully achieved.

Based on the above H6 can only be partially confirmed.

Based on the results of the detailed primary and secondary data collection, data processing and analysis of the case study, further research directions can be formulated as a continuation of the extensive regional analysis work**:**

- *More detailed analysis of the created KEC automotive economic governance model's applicability in practice.*

Further data collection, in-depth interviews, and surveys will be needed to refine the model now created, and to broaden corporate partnership cooperation based on indicators that will be defined or developed in the future. It is also advisable to conduct a more thorough analysis of the effects of the global challenges of the automotive sector on the economy of the county – as an automotive industry center – (Russian-Ukrainian war, microchip shortage, disruptions in supply chains, maintaining production continuity, increasing costs of energy and

transporations). In order to strengthen the competitiveness of the local economy and "position" the SMEs of the KEC, it is advisable to conduct a more thorough analysis of the local SME sector in all economic sectors, as well as to collect primary data at the district level on the needs and expectations of the SME sector. It can also be useful to explore and analyse the links between the regional competitiveness, economic development, spatial resilience to economic shocks and responsible innovation. The latter is an not fully researched area in regional economic sciences.

- *Analysing the reasons for the different embeddedness level of MNE's local units in the economy of Komárom-Esztergom County and the possibilities for addressing the challenges arising from this*

In order for the KEC catching-up trends remaining to be sustainable, it is necessary to develop networked-based cooperations which can facilitate the embedding of local units of large international companies into the economy and society of the county (which is a multi-level and time-consuming process). On the other hand, facilitate closer, trust-building cooperation between local units of large international companies with local adult and vocational training, higher education institutions, civil organizations and the SME sector based on mutual interests. Promoting the local embedding of large international companies can also provide many potential opportunities for local SMEs. A multi-level cooperation must be developed to coordinate central, regional and local interests and strategic ideas. Encouraging efforts have been launched in this regard, but their analysis still requires further research. To this end, it is necessary to develop additional indicators to broaden corporate partnership cooperation, to determine the tools necessary for the embedding of large companies (not only in the automotive industry) into the local economy, and to measure the effects of embedding (improvement of the "resilience" and competitiveness of the local economy, reduction of global exposures).

- *A more detailed analysis of the possibilities aimed at avoiding the reindustrialization "catch-up trap"preventing the center-periphery situation in Komárom-Esztergom County*

The high value-added elements of the manufacturing value chain are still not being implemented in KEC. Local units of MNEs can determine the sustainable growth path and catching-up opportunities of the KEC economy, and to promote this, their regional embeddedness needs to be improved.

Eliminating the "island-like" effects of investments made by MNE's local units settling in the KEC industrial parks, attracting the highest value-added activities to the KEC, achieving the establishment of development activities or "tailored customer support activities ("after market services") in the county. In addition, it should be worth gaining deeper understanding about manufacturing and distribution activities and processes taking place in the local economy.

KEC's internationally connected manufacturing industry could be a winner in the realignment of global value chains, if the location closer to the European consumer market becomes more valuable in the decision-making of large international companies compared to the approach of outsourcing to Asia due to cost-effectiveness in the pre-coronavirus period. In the activities of KEC companies, there may be a realistic chance to increase the length of the value chain horizontally or vertically if the companies working on the same value chain cooperate closely with each other. (Raw material, production, assembly, design), for which trust building and strategic thinking: correctness, predictability, transparency, professionalism, predictable spatial planning can be the basis.

To verify to what extent the industrialization achieved as a result of new investments aimed at locating higher value-added activities in the county means higher value-added activities,

whether these can be suitable for avoiding the catch-up trap and if not, how this could be changed.

In this regard, it is necessary to address the issues of multi-site manufacturing companies in a more nuanced manner (using some methodology to determine performance sharing, for example, between Coloplast's Tatabánya and Nyírbátor sites, Grundfos' Tatabánya and Székesfehérvár sites, or SKOH's Komárom and Iváncsa sites).

It is also important to develop a methodology to distinguish between actors involved in and outside the automotive value chains and subsequently analyze issues of economic diversification beyond the automotive and vehicle industries.

- *ESG analysis of the business operations of companies in Komárom-Esztergom County*

ESG is the abbreviation for Environmental Social Governance (the process of examining environmental impacts, addressing social issues and making management decisions). The related social responsibility, environmental awareness and sustainability, as well as transparent corporate governance are related to the activities of a company. Large international companies and their local units are increasingly paying attention to identifying and reducing ESG risks not only within themselves, but also their suppliers when screening their supply chains and they will need to develop and implement a "tailor-made" ESG strategy (taking into account different weights of individual ESG elements) depending on the sector, size and business portfolio. ESG will increasingly become a determining element of corporate competitiveness and investor decisions in the near future.

- *Examining the possibilities of further strengthening the regional impact of Edutus University as a innovative knowledge and entrepreneurship center, taking into account ESG aspects*

Network-based cooperations between KEC economic actors can be facilitated by bottom-up clustering processes, but Edutus University must play a decisive role in these. It is necessary to explore the possibilities of further expanding and deepening existing corporate and institutional strategic partnerships (for example, corporate dual training, short-term training courses serving employee competency development, training courses granting micro-certifications, digital curriculum developments, professional assistance in the development of corporate ESG strategies), examining their expected returns and the necessary procurement, institutional infrastructure and human resource developments from a financial and sustainability perspective. In the latter, the ESG aspects mentioned in the previous point must also be prioritized.

- *Further research work should be carried out exploiting more effectively the hidden potential of Hungarian-Slovak (Nitra/Csallóköz and KEC) cross-border project-based cooperation.*

It is worth mapping out the potential of project-based cooperation across county borders and the Hungarian-Slovak border (Nitra/Csallóköz and KEC) more transparently than in the previous period and much better exploit them. These can also play a decisive role in KEC processes, exerting a significant impact on the subsequent operation of the KEC automotive industry economic management model.

- *District-level analysis of KEC's SME sector*

Weaknesses in the local SME sector and its low innovation potential can hindering the success of establishing mutually beneficial strategic partnerships with MNEs local units and the specialisation,d diversification efforts of the KEC based on exploitation of endogenous resources. This direction of further research will enable a deeper exploration of the spatial and

economic structure of the KEC, contributing to the development and implementation of a "spatially sensitive" development strategy necessary to strengthening the competetiveness of the local SME sector.

NEW SCIENTIFIC RESULTS

Based on my research work so far, the following scientific results have been manifested:

1. *I have created an economic governance model for the automotive and vehicle industy sector and its actors in Komárom-Esztergom County, based on my own research results and taking into account the theories and practice of international benchmarks.*

The region can be characterised by conscious economic development. Local industrial park operators, developers and economic development organisations cooperating with municipalities can be found alongside all regional clusters, and coordinated infrastructure development and a one-stop shop system attractive to investors have made the county a dominant factor in the decisions of foreign investors in Hungary and the V4 region. Non-centralised and non-politically dominated networking between regional actors in the business sector includes, for example, economic, practice-oriented dual and extra-school training, R&D services, shared infrastructure, networking initiatives (Business Clubs), and local civil society initiatives in the field of social entrepreneurship and sustainability. It was found that the economic governance model of the automotive actors of the KEC, which was developed taking into account international benchmarks, has several different specificities compared to the economic governance models of the European automotive regions:

- The inflow of FDI in KEC, the economic development occurred in a similar way to the three phases of development of the European automotive regions, but not equally divided into 10-10 year periods, and the first phase in the case of Tatabánya/Környe can be divided into two sub-phases: a) Low value-added, skilled labour electronics firms in 1990-2000, which disappeared after the South-East Asian crisis. The region shifted from mining to electronics, but this was also a one-legged stand; b) then, in order to diversify the KEC economy, the focus was on the entry of chemical, health and engineering firms in addition to automotive firms between 2000 and 2010.
- In Oroszlány there was also a three-phase phase, but with a phase lag compared to Tatabánya (lessons from the first phase suggest that the first round of investment was more targeted).
- Komárom did not have three phases. There was a steady flow of Round 1 investments in parallel with Round 2 and 3 capacity building investments.
- In Tata Industrial Park, the third period saw the arrival of automotive-related companies.
- In order to attract and "localise" the workforce, a media campaign was launched in conjunction with a town marketing programme: local firms also provide competitive working conditions for employees, and the liveable settlement (with quality services) helps to create housing.
- In the third phase, grass-roots networking between local economic and institutional actors has also started, but this is hampered by a lack of trust, past grievances and inadequate feedback mechanisms.
- The KEC regional automotive hub has a diversified economic structure with several legs, mitigating the risks of unilateral dependence on the automotive industry. The economic development strategy focuses on design and substitute products, exploiting the potential of indirect supply.
- There is a need to strengthen the role of Edutus University in the region - it is a "foreign body" in the KEC, efforts have been made to change this, but more needs to be done

- The Hungarian-Slovak cross-border cooperation (Nitra/Csallóköz and CEEC) plays a significant role in the CEEC processes and has a major impact on them.

None of the local units of large international companies can yet be said to be fully embedded. Either the local units of the Japanese-owned Magyar Suzuki Zrt. in the Esztergom Industrial Park, or the US-German BorgWarner Group in the Oroszlány Industrial Park, or the South Korean SK Innovation group (SK Battery Hungary Kft. and SK Manufacturing Kft.) in the Komárom Industrial Park are either not interested in the region or behave like "client" companies, i.e. they expect a return for their taxes paid. The local units of other large international companies (e.g. AGC Glass Hungary Kft. in the Tatabánya/Környe Industrial Park or Bridgestone Tatabánya Termelő Kft.) are more interested in the development of the KEM, and are taking advantage of the benefits of the site and reciprocating. They support regional causes, institutions and developments (e.g. cultural events, local infrastructure development or sponsorship of educational institutions), but they do not yet include local SMEs in their direct or indirect supply chains. Some companies, such as the US electronics contract manufacturer Sanmina SCI Hungary Kft, are interested in different levels of dual training, but are not open to different broader and deeper cross-sectoral strategic partnerships, such as joint R&D projects.

2) My research explored the economic impacts of the COVID-19 pandemic on the local automotive sector and its actors, and the ways in which the sector has adapted to the post-epidemic situation and the structural reorganisation necessitated by global processes, which may contribute to the future economic governance outcomes of the county.

The COVID-19 has significantly affected the automotive industry segment producing cars equipped with a conventional internal combustion engine (ICE), amplifying the problems of concentrated, long production chains spanning continents. At the same time, demand for electric vehicles has only fallen minimally, and their market share will increase significantly within the global vehicle market in the near future. This is likely due to increasingly strict climate and environmental regulations, efforts to green the economy, and state incentives aimed at the spread of EVs. Based on the trends of recent years, Hungary – where the automotive industry also represents a significant economic weight within the manufacturing industry sector – can exploit the opportunities arising from the structural reorganization within the automotive industry. Between 2018 and 2022, several major South Korean, Japanese and Chinese companies involved in EV production and the production of their power sources (LIB) have choosen Hungary (some of them local units are in KEC) as the European venue for their production capacity expansion. Based on the trends of recent years, Hungary - where the automotive sector also represents a significant economic weight within the manufacturing sector - may in the future take advantage of the opportunities arising from the restructuring of the automotive sector, but further detailed impact studies are needed to fully explore these opportunities.

Independently of the COVID-19 an adaptation process has begun among county companies, repositioning their production, rethinking labor capacity, production chain structure, and inventory policy. This contributed to their ability to resolve the challenges posed by the negative effects of the COVID-19 pandemic despite of the fact that not every company managed to overcome the recession yet. Due to the economic recession caused by the coronavirus (real economy and financial market uncertainties), flexibility and creativity helped companies maintaining their resilience. However, creativity cannot be introduced at a systemic level into the multi-segment that performs assembly and contract work activities, breaks down production processes into their components, and operates according to standardized protocols. It would be worthwhile to attract the smaller, TIER2 level supplier companies to the county instead of OEM or first-tier supplier companies (TIER1) (a detailed list of these should be made). Innovation in

the automotive industry does not take place at the local OEM or TIER1 units, but at their second- or third-tier suppliers. Hungarian ideas could also be sold here.

3) *Based on my research, I revealed the role and weight of MNES local units in the regional economy of Komárom-Esztergom County*

In different segments of the manufacturing industry the value-creating activities of local units of large foreign companies had a measurable/tangible economic impact through their GVA contribution to the KEC GDP. In the 2020-2022 time period, this ratio was 24 percent on average, and in the period following the COVID-19 pandemic, the previously continuously increasing trend saw a slight decline (companies had to rethink their purchasing, stocking, production organization methods, business models and technologies due to disruptions in the supply chain, shortages of raw materials, energy prices and transport costs). The rest of the county's GDP is probably produced by local SMEs. This is consistent with the research of other authors, i.e. the FDI transfers of foreign-owned companies and the GVA they create are relatively high, making KEC a reindustrializing, manufacturing-based county.

The impact on county employment is more modest. The proportion employees of MNEs local branches to the total number of employees in the county averaged 11.4 percent in the 2010-2022 period (the majority of jobs are likely to be provided by local SMEs and public institutions). On the other hand, the productivity of the local units of large foreign manufacturing companies (value added per employee (million HUF/person)) is 2.2 times the county average (fewer employees produce more value). This is due to the previous conscious county economic development strategy, which emphasized the diversification of the county's economic structure, i.e. in the manufacturing industry, in addition to automotive and vehicle companies, the settlement of manufacturing companies was also encouraged (Peredy, 2023). The local units of these large foreign manufacturing companies operate production and assembly lines using modern technological solutions (automation, robotization, sensors, big data and cloud-based solutions, real-time enterprise and production management systems - ERP, MES), and produce market-leading, modern products, despite the fact that these represent the lower added value, componentized, highly standardized activities in the value chain. These technologies and production organization solutions require relatively less labor, offering them a solution to address the labor shortage caused by demographic trends. This may be the likely explanation for why, despite the second or third round of capacity-expanding investments of the companies in the sample or the establishment of new companies during the examined period, the ratio of the total number of employees employed by these companies to the total number of employees in the KEC did not increase above 11.4 percent.

The economic effects of the newer, higher value-added activities on the counties have not yet been reflected in a significant increase in the volume of added value produced by large foreign manufacturing companies, nor in an increase in their share within the KEC's GDP. Among the probable reasons for this may be that the implementation of the truly high value-added elements of the value chain, such as the definition of corporate strategy, product planning, design, brand building, research and development, still does not take place in the counties. The local units of large foreign manufacturing companies currently have room for maneuver in the development of the production, assembly and logistics processes of the value chain, broken down into lower value-added elements, standardized (although using the most modern cutting-edge technological solutions), in the optimization of costs, in social and non-financial aspects of operation (sustainability, social responsibility, transparent, ethical operation).

4.) My research has pointed out the possibilities and reserves of the county's economic development in the cross-border, interregional dimension, taking into account the economic characteristics of the region and the role and importance of the foreign-owned automotive sector in the region.

From Nitra County side

Slovakia is trying to exploit the advantages of its tax system, which is different from Hungary. (The corporate tax rate is higher, but there is no business tax, and the taxed profit can be withdrawn from the company in the form of a 7% dividend tax, without having to pay social security or other contributions. This rate is less than half of the dividend tax in Hungary). In Hungary, from 1 January 2022, revised legislation will allow large companies to support capacity expansion investments in an existing facility in addition to their investments in establishing a new site. The regional investment support intensity for KEC companies is 30%. Investment incentives in the narrow sense show that job creation is the most important goal and vehicle production is a priority, but at the same time, problems in the education and training system and emigration have led to a serious shortage of skilled labor. The wage advantage of the V4 countries is starting to decrease due to rising wages due to the labor shortage. This has a compelling effect on shifting the emphasis from labor-intensive phases to knowledge-intensive production phases.

Nitra County (Slovakia) operates according to a highly centralized economic management and economic development model, which is less efficient in practice. The dual training model has not worked in Slovakia so far, there is no model similar to the Hungarian „ÁKK model", there are only company training places based on bilateral agreements. Dual training cooperation has started primarily at the level of vocational secondary schools and companies in the last 2-3 years, this does not really work between Slovak universities and companies. Furthermore, differing from KEC (Hungary), there are no local economic development organizations and Industrial Parks (clusters) operating organizations (decentralized model), which made KEC an unavoidable factor in terms of FDI. Slovak automotive clusters are not characterized by R&D located there, so they are only assembly plants. The reason for this is the inadequate financing of the R&D area, the directions and topics of applied research at universities and research institutes do not cover the needs of industry players, and the low ability to cooperate between R&D and corporate players. That is why the Jaguar Land Rover (JLR) Supply Chain Technical Support Center (STA Center) came to Budapest in 2019 (Hungarian R&D infrastructure, intensity and professional level are much stronger than Slovakia's). In Slovakia (Nitra County), cooperation between public institutions and MNE's local units is weak, grassroute cooperations and initiatives to promote networking among local actors have not really developed..

In order to attract newer investors into underdeveloped regions (for example, Nitra County), higher support intensity, subsidies for the development of infrastructure and job creation are not enough, but a suitably qualified workforce has also be provided.

From Komárom-Esztergom County side

„*In Komárom-Esztergom County, in addition to the Suzuki-based economy, the pharmaceutical, chemical, building materials and machinery industries are present in the Esztergom region, but the settlement of green and creative industries has also begun. In the case of Komárom, the city's industry is showing dynamic development, and in the field of electric vehicle production, it can become the county base for future industry. Komárom has significant tourist potential, and its area of attraction can be detected beyond the national border. The breaking point of both urban regions is the border location, the role of a gateway and the economic organizing*

power of the cross-border region, to which the Monostor Bridge has given great impetus. In the case of Esztergom, the construction of the M100 expected in the near future is a noteworthy development, which is essential for solving the spatially closed region" (KEC, 2021c, p. 25).

It runs along the western county border from the bridge capital Komárom to Bakonyalja, which is connected to the Oroszlány-Tatabánya-Tata junction area as well as the catchment area of Győr and Székesfehérvár. The importance of the axis is given by the close cooperation of the twin cities of Komárom-Révkomárom, their shared infrastructures, and the high-capacity cargo ports, which also radiate to the banks of the Danube, which is traditionally associated with the city pair. The developments taking place in the bridge capital Komárom have a positive impact on both regions. The economy of the Komárom axis is diverse and multi-faceted, and in addition to the food industry, there are many SMEs related to the mixed-profile vehicle industry and sectors of the energy sector. With the diverse development of the axis, the region can preserve its complex character and produce stable growth, even by building a cross-border catchment area" (KEC, 2021c, page 42).

Nitra County is considered an area lagging behind in terms of infrastructure, and there is no higher technical education in the area, which could be an exploitable niche market for the Tatabánya-based Edutus University.

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