

EÖTVÖS LORÁND UNIVERSITY  
FACULTY OF EDUCATION AND PSYCHOLOGY  
DOCTORAL SCHOOL OF EDUCATION  
ADULT EDUCATION PROGRAM



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**INNOVATIVE ADULT EDUCATION AND HUMAN RESOURCE MODELS IN THE DOMESTIC  
AUTOMOTIVE INDUSTRY: NEEDS AND IMPLEMENTATION**

***Role of Organizational HR Processes and  
External Cooperations in Evaluating Innovation***

Doctoral (Ph.D.) Dissertation Theses

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2020.

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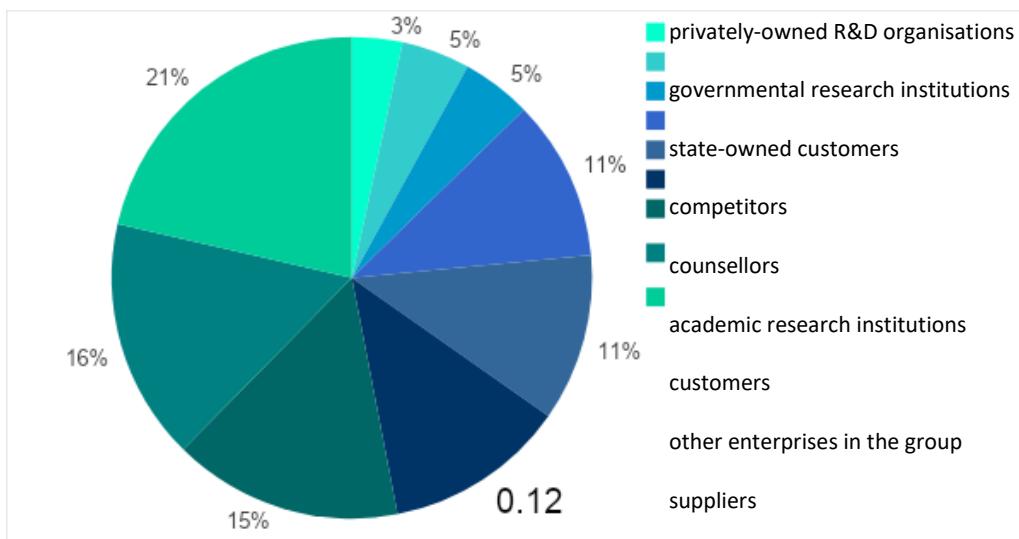
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## I. TIMELINESS OF THE TOPIC

Rapid changes in our environment—technological development and globalization—require immediate solutions from company managers who are expected to operate their organization successfully amid altered circumstances. The most important factor for companies is attaining the best possible market position, that is achieving and maintaining competitiveness through continuous innovation. An essential condition for creating innovation is a human resource factor adapting to change. Today, in the era of the Fourth Industrial Revolution, the tendency for the labour market to accommodate to changing competence requirements much more flexibly has accelerated (OECD, 2017). In parallel with labour market changes, individual learning and self-development have become an essential part of improving employees' knowledge, skills and competencies (Zachár, 2001; Benedek, 2003; Csapó, 2005; Szép, 2010; Kálmán, 2013). Now, work-integrated learning has turned into an important area of adult education (Csehné Papp, 2018). Irrespective of location, all formal, informal or non-formal learning activities that take place in or near the workplace and relate to the individual's work are considered to be work-integrated learning (Stéber & Kereszty, 2015). In the workplace, routine tasks are being slowly marginalized, replaced by special skills, and the importance of digital skills is growing (Benedek, 2014; OECD, 2017, 19). In addition to special skills, the labour market increasingly prefers the so-called “soft skills”, such as ability to communicate, teamwork, leadership, problem solving and self-organization (Deming, 2015; Fazekas, 2018). Studies on the economic return of adult education (Varga, 1995; Polónyi, 2004; Juhász, 2004) see investments as being justifiable and rewarding, both in terms of the individual and society, thus targeted development of employees necessarily plays a fundamental role in maintaining companies' competitiveness, and this activity is effective mostly in an organizational culture fostering learning (Kraiciné, 2009).

An organization can only gain information and knowledge in a timely manner to make immediate decisions if it is capable of utilizing all of its resources, and specifically its human resources in a proper and efficient way, and is also able to replace them promptly via an external relation. With regard to external knowledge relation, cooperation between industries and universities is a key factor in the European Union's policy as well as in domestic

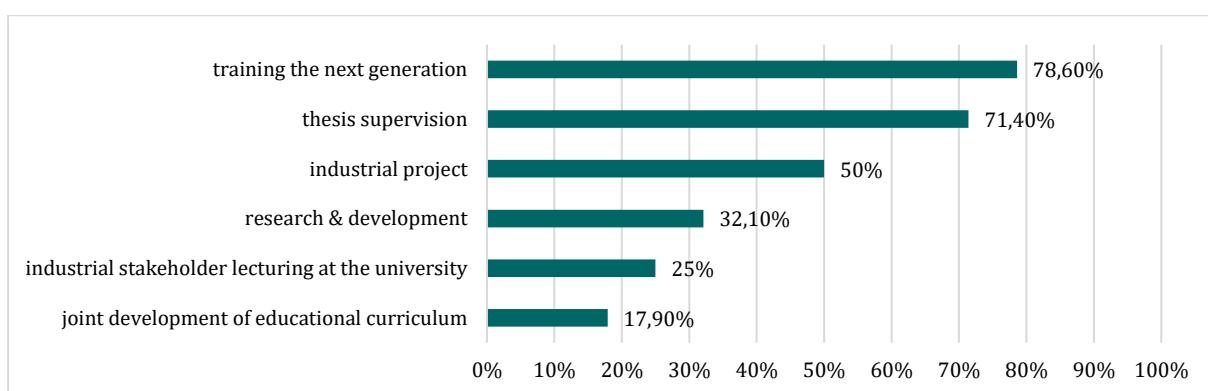
development plans, as social and economic policy interests necessitate that both sides representing competitiveness from a theoretical and practical point of view produce rapid results for the economy. There are two major fields of researching cooperation in professional literature: one of them examines the subject from the viewpoint of regional economic development (Lundvall, 1992; Rechnitzer, 1993; Cooke 1998; Szépvölgyi & Farsang, 2013), while the other one in terms of innovation and knowledge management (Porter 1999; Lengyel, 2000; Grósz, 2001; Inzelt & Bajmóczi, 2013). Besides international analysis of the relations between automotive industry and universities (Fekete, 2015), several domestic examples (Rechnitzer & Kecskés & Reisinger, 2016) demonstrate the benefits arising from the university-industry cooperation. According to Grósz (2008), a well-functioning innovation system builds upon the fact that each participant of the innovation process joins the network, and if the level of cooperation is high within the system, then the activities of the participants translate into increased competitiveness and economic development (Inzelt, 2004; Tilinger, 2009; Grósz, 2012). Today, industry actors are becoming increasingly interested in the ongoing improvement of higher academic education as well as corporate practices. My study on the automotive industry has also shown that theoretical knowledge and practical applicability are often far apart, and among the several reasons responsible for this, the poor funding structure of higher education institutions is particularly prominent, which has forced universities to make self-sufficiency their primary objective, relegating many other factors to the background. The performance of university researchers is evaluated by the number of their publications, while the industry wants student knowledge that can be utilized and applied immediately, and focuses on achieving rapid development results. This conflict of interests also reduces the frequency and effectiveness of collaborations. This is also confirmed by a survey conducted between 2014 and 2016. Its data revealed that Hungarian innovative companies cooperate with suppliers (21.40%) to the greatest extent, while this figure is 12.2% regarding higher education research organizations, a very low number compared with international benchmarks. (Fig. 3)



1. FIG. 1: INNOVATION COOPERATION OF COMPANIES IN 2014-2016

Source: EÖTVÖS 2020+ PROGRAM Fehérkönyv az MTA kiváló kutatóhelyeiről és az innovációról (White Paper on Innovation and Excellent Research Locations of the Hungarian Academy of Sciences) Editor: Zsolt Boda  
 Contributors: Zsolt Boda, Ádám Dénes, Károly Fazekas, Attila Havas, Miklós Illésy, Zsolt Körtvélyesi, Balázs Muraközy, Eörs Szathmáry Hungarian Academy of Sciences Budapest, 2020  
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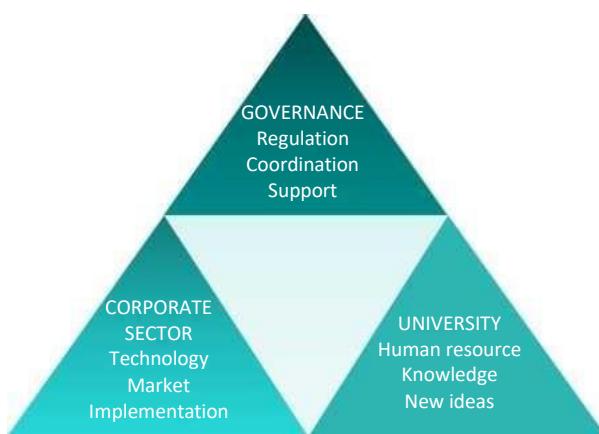
According to my 2018 research's survey results, 75% of companies cooperate with universities, businesses cooperate with higher education institutions in quite a high proportion to ensure supply (78.6%), at the same time the percentage of cooperation for innovation purposes is also lower, amounting to 32.1% (Fig. 2)



2. FIG. 2: INFORMATION ITEMS FOR INDUSTRY-UNIVERSITY COOPERATION OF AUTOMOTIVE COMPANIES—2018

Source: own research  
 (self-produced)

Collaboration systems should be analysed within the increasingly used threefold relation system of external relations, utilizing the Triple Helix model (Etzkowitz, 1997; Leydesdorff, 2006; Markkula, 2013). Consequently, the same is true for analysing knowledge transfer cooperation of companies and forms of support in which all three participants of the above mentioned model—industry, education and government—engage jointly, as the Triple-Helix model is a representation of a theory that incorporates fundamental aspects and principles of division of labour and directed collaboration between science, economy and government.



3. FIG. 3: ROLES BASED ON THE TRIPLE HELIX MODEL  
(self-produced)

Kotsis & Nagy (2009) states that besides education and state R&D, innovation activities of companies are also affected by innovation policy through various subsidies and incentives. Subsidies of the 2014-2020 tendering period (GINOP, FIEK) enhance education, research, and industry-university cooperation at research locations. The tendering framework aims at “coordinating university and corporate research and development in a new institutional context, and accelerating practical adoption of results.” In my opinion, this type of support will yield a significant opportunity for universities in the long term.

## II. DESCRIPTION OF RESEARCHING THE TOPIC

### II/a. Objectives of the Research

The survey looked into the internal knowledge management system and organizational culture of Hungarian automotive companies, as well as correlations of external relations and incentives for tendering with respect to the companies' willingness to cooperate, and their organizational innovation potential.

My thesis aims at examining how an organization's ability to innovate is affected by human resource management, effective methods of adult education, and knowledge use governed by external relations. My primary goal is to assess the extent to which companies dominant in the domestic labour market apply potential opportunities inherent in human resources, and what external relations they utilize to fill knowledge gaps in their organization.

### II/b. Structure of the Thesis

In my doctoral thesis titled "*Innovatív felnőttképzési és emberi erőforrás modellek a hazai járműiparban: igények és megvalósítás*" (Innovative Adult Education and Human Resource Models in the Domestic Automotive Industry: Needs and Implementation) I explored factors driving domestic automotive companies' competitiveness in the context of the Fourth Industrial Revolution, with respect to macro and micro factors. I began the research in 2014, and extended it to 2018. During this period, the focus of the study shifted increasingly towards a deeper examination of innovation and industry-university collaborations, resulting in the following subtitle for the thesis: "*A szervezeti HR folyamatok és a külső együttműködések szerepe a vállalati innováció megítélésében*" (Role of Organizational HR Processes and External Cooperations in Evaluating Innovation).

In the first part of the study, I review innovation as a concept, and the role of innovation in corporate development processes.

In the second part of the thesis, I present the role of university-industry collaborations as a response to continuous change by examining external knowledge relations of companies, focusing primarily on these cooperations, then through the threefold relation system of government-industry-university. In my research, I also examine whether tendering opportunities have boosted the participating companies' willingness to collaborate when forms of targeted support had been created for universities to assist in research needs of industry actors.

In the survey, I look for answers to questions I have been induced to ask by my many years of practice and experience as an education, then organizational development manager. My current job as an innovation manager specifically requires continuous research and efficiency measurement in the changing industrial, economic and social landscape resulting from the Fourth Industrial Revolution.

The topic inherently implies a complex, multidisciplinary approach dominated by education science, however I also cover questions and assumptions formulated in the research from organizational development, sociological and economic viewpoints, and attempt to answer them based on my industry experience. My choice of topic is also justified by the fact that, with respect to educational science, relatively few surveys have been conducted on the examination of the Hungarian automotive industry.

## **II/c. Questions of the Research**

Being a corporate organization development professional, I was deeply concerned with the question of what soft factors prove to be decisive for maintaining and improving competitiveness for automotive companies, which ultimately led to starting my research. In addition to utilizing the most advanced technologies and responding promptly to rapidly changing market needs, what other factors are behind continued success?

To answer the foregoing, I formulated the following research questions:

1. What measures do the companies participating in the examination take in order to keep labour force?
2. What type of professional cooperation do they create with higher education institutions primarily for the labour supply demanding engineer degree?
3. To what extent do they take the support of the EU and the Hungarian government, and to what extent and how do the companies cooperate with one other in order to realize the above goals in order to keep labour force, to operate the labour supply and the cooperation with the higher education institutions?
4. What effects the differences of the organizational culture between the higher educational institutions and the industry players have on the extent and the frequency of cooperation?
5. To what extent do the internal organizational factors and the external cooperation determine the innovation potential of a company? Can open innovation solutions be observed besides the internal organizational innovation solutions at the companies?

## **II/d. Hypotheses**

We composed the below hypotheses based on the wide scope of literature:

H1: In order to insure their innovative operation, the Hungarian companies elaborated complex programmes for keeping and improving human resource, of which training is one of the basic part (Varga, 1995; Polónyi, 2004; Juhász, 2004; Kraiciné, 2009).

H2: The common work in the course of the cooperation with higher education institutions plays an important role in the supplement of labour force at companies. The companies chose their future employees through project tasks (Pogátsnik, 2017).

H3: In order to insure their innovative operation, the Hungarian automotive companies participate together in elaborating organizational development and good practices (Chesbrough, 2003; Inzelt, 2004; Nyíri, 2009; Csizmadia-Grósz, 2012).

H4: According to the stand point of the Hungarian automotive companies, the organizational culture at universities and in industry differ, and this hinders cooperation (Handy, 1985; Schein, 1989; Pakucs-Papanek, 2005).

H5: The EU and R+D state supports have positive effect on the long-term development cooperation of industrial companies and universities, the responders exploit the potential in tenders (KOTSID and NAGY, 2009).

## **II/e. Target Group of the Study**

A well-known example for the development of the domestic automotive industry is my workplace, Suzuki. The factory operating for 30 years now has allowed me to experience recent changes in automotive development and innovation directly, where a substantial part of human resource development has been aided by education, vocational training and cooperation practices established with universities in an increasingly close and mutually effective manner. Automotive industry is among those being at the forefront of innovation, there is fierce competition between manufacturers, whose developments require cutting-edge technology.

As Fig. 4 illustrates, vehicle manufacturing accounts for more than a quarter of total industrial production over the past 10 years. Continuous development is confirmed by the fact that while the production value of this industry was HUF 4,000 billion (EUR 11,5 billion) in 2010, this figure exceeded HUF 8,000 billion (EUR 23 billion) by 2018. Automotive industry amounts to 20% of Hungary's total volume of exports, and 4.5% of domestic GDP. In Hungary, this industry employs 175 thousand people in more than 900 enterprises (Central Statistical Office's (CSO) data from 2017, 2018, 2019).

Industry	2010	2018	2019	
Mining, quarrying	0.4	0.5	0.5	
Electricity, gas, steam supply, air conditioning	6.1	4.0	3.9	
Processing industry	93.5	95.5	95.6	
<i>Vehicle manufacturing</i>	<i>17.7</i>	<i>26.7</i>	<i>27.6</i>	100%

4. FIG. 4: SECTORAL STRUCTURE OF INDUSTRY BASED ON PRODUCTION VALUE DISTRIBUTION (%)

Source: CSO data (2010, 2018, 2019)

(self-produced)

## II/f. Research Methodology

Apart from covering the topic through professional literature, I also conducted document analysis utilizing educational policy documents, publications, expert studies published by OECD, as well as European Union and domestic strategy documents. I compiled data on companies based on records from the Central Statistical Office and EUROSTAT.

I started the research with half-structured and deep interview surveys. I made an interview with the top managers, HR and training managers of automotive companies. Eighteen company leaders participated in the research whom I invited to the interview personally. I made a deep survey with one of the representative of the government site. After conducting the interviews, I checked the material together with the participants, then I asked for their written consent to anonymously publish what they had said during the interviews.

Because of the experimental nature of the research, we combined different analysis techniques. I categorized the texts, that is, we grouped certain parts of the texts along the research questions based on the viewpoints composed in our hypotheses, searching for recurring patterns and divergences in the text. I aggregated the data in those cases when the responders gave numerical data. Above this, we tried to determine along the research questions the proportion in percentage of the responders who represent the responses composed by themselves relating to the questioned viewpoints.

While analysing the interviews, we found several divisive topics which we can further specify and reveal the correlations in more details within the frame of a quantitative survey.

The survey is suitable for collecting data from the Hungarian automotive companies that may be considered representative, this is the most frequently applied method during researches, too. In order to examine the questions and the hypotheses of the thesis, we chose questionnaire-based survey the main method of the research.

After composing the questionnaire, I tested its questions and structure during a test search in the frame of focus group examination, then, I made the necessary changes, this is how the final survey was completed in 2017.

I started the questionnaire-based research at the beginning of 2018. The questionnaire includes 4 demographic, 12 general organizational and 65 professional questions. The group of professional questions can be divided into two parts, the first part is aimed at the organizational internal knowledge development, the second part is aimed at the company cooperation. Attitude surveying questions including Likert-scale composed the major part of the questionnaire which map the relation of the responders to the organizational innovation and to the external university cooperation and the connection of these variables with the internal strategy of an organization of training and improving human resources in the topic of the above two large topic. In the course of the research, I composed a standardised questionnaire, and we strove to the comparability of the found data.

I have informed participants that the research was anonymous, they could cease participation any time, and I would process data and information obtained during the research confidentially, without disclosing them to third parties. I have informed those completing the questionnaire as well interviewees in writing on the above.

### III. PRESENTING RESEARCH RESULTS

#### III/a. Results of Qualitative Interview Research

To gain a broad understanding of the research questions, I conducted exploratory interview research using semi-structured interview questions, with the aim of obtaining answers to questions asked at the beginning of the research. The research questions and assumptions were supplemented during the research, as respondents of the first structured interview data collection revealed correlations between organizational knowledge management and organizations' tendering relations—with higher education institutions and other industry stakeholders—, which gave rise to the need for taking a more in-depth look at the relationship between organizations' internal knowledge management and external relations.

Summary of responses based on the qualitative research:

- I. What measures do companies participating in the research take to retain staff?
  - 1) Is HR able to identify problems that weaken the ability to retain staff? Does it have any practical (and proven) solutions to reduction of staff?

As for retaining staff, respondents consider the following problems to be the most serious: staff reductions due to cost cuts cannot be avoided. Several respondents considered wage development and bringing remuneration into line with that of the competitors to be the most important factors. They perceive other motivational tools, such as moral recognition (employee of the month), as being less effective. In addition to the importance of wage, some respondents believe that the companies' staff retention ability can be improved substantially through trainings. Many respondents emphasized that having a personal target agreement for every employee might have incentive and retaining effects with respect to knowledge workers.

- 2) Where would you position staff retention capacity of trainings on a scale ranging from 0 to 10?

In this regard, respondents also point out a difference between blue collar and white collar workers—while the efficiency of the trainings is rated to be 2-3 on average with regard to the former, in case of white collar workers the figure can be as high as 7-8.

3) Does it make any sense to use trainings for reducing staff turnover?

The majority of respondents claimed that staff turnover constitutes a major problem regarding skilled and unskilled workers alike. Most respondents underlined the existence of vocational training, they also try to pay more attention to improving the so-called soft skills, although this is still in its initial phase. 20% of respondents believe that training plays a role in operating the company and ensuring uninterrupted manufacturing, rather than reducing staff turnover.

II. What kind of professional cooperation do you establish with higher education institutions to ensure supply for positions primarily requiring an engineering degree?

4) As an employer, do you consider participation in dual education to be effective for establishing industrial-university cooperation?

Opinions on dual education are mixed, some see it as being too burdensome for students. In addition to dual education, other forms of cooperation also exist, like cooperative training and internships that have become very popular in recent years. Respondents claim that the latter are more effective regarding selection of prospective employees: many respondents underlined that supervising a thesis provides an opportunity to learn about prospective employees who on average spend three years at the company after recruitment, and approximately 50% of participating students become an employee later. Some companies engage students in project tasks as well. Other respondents pointed out that their company's employees also undertake educational activities at universities, and this is where the company's university relations result from. The majority of companies involved in this kind of cooperation have relations with multiple higher education institutions. The respondents emphasize the objective of ensuring supply in key jobs.

Lack of this kind of cooperation (30-40% of respondents) is primarily justified with the size and geographical location of the company. In other cases, scarce capacity is indicated as a root cause (performing tasks related to organization, education, and administration), alongside with the fact that there is no R&D taking place at the respondents' company, and only a low

number of jobs require a degree—which in turn may result from the shortcoming of R&D activities. Overall, attitude towards such collaborations is positive, however companies often do not know whom and how to cooperate with, as universities provide little information that is also difficult to access.

- 5) To what extent does your company engage in university cooperation to ensure the supply of young professionals?

Some respondents see cooperation as being more effective in ensuring the company's continuous renewal ability and innovative thinking, rather than ensuring supply. A number of them are also involved in new, completely novel joint developments (e.g., autonomous cars, electromobility), while others state that there is no R&D at all at their company, or it takes place at a small scale, and is restricted to laboratory measurements. Companies claim that should higher education institutions devote more energy to collaboration, they would be able to build more relations with companies. Some respondents emphasized they had difficulties in dealing with circumstances related to establishing cooperation, which made them abandon their plans for creating other forms of cooperation.

- 6) What criteria, values and expectations play a role in selecting a prospective colleague during the implementation of a project? What are the competencies they are expected to have?

According to respondents, a common problem lies in the fact that students are not adequately trained to meet industry requirements. Although they are generally content with theoretical preparedness, companies consider foreign language skills and low levels of practical problem solving to be main deficiencies, so they train graduates entering the profession in an organized manner. Respondents listed a number of issues linked to university cooperation, claiming that universities have no interest at all in assisting hands-on training. Companies struggled as they had no knowledge about university processes, or university bureaucracy proved to be time-consuming, causing an excess of communication with the university.

At the same time, other respondents considered university cooperations to be very important with respect to ensuring supply of young professionals, and when building higher education curriculum, they strive to foster these cooperations by lending their professionals to give

trainings in the hands-on part of the dual education, who also take part in developing course material. This would create an advantage in recruiting primarily engineering students.

They also mention difficulties of dual training: not all students can be involved, introduced into business processes, and their interest has often decreased.

In light of the results, I formulated additional research questions to reveal correlations between the previous research question and this one: it is assumed that openness to university R&D cooperation projects of automotive companies, the importance of the topic, and the recognized innovation potential of the companies are interlinked to each other (Van Haverbeke, 2012), and the willingness to cooperate with higher education institutions is all the stronger the more it is important for a company to support professional development and individual career goals of its employees.

III. To what extent can best practice sharing at conferences and professional forums get into corporate life?

7) How effective do you consider the involvement of universities in a joint EU tendering programme? Is long-term development cooperation typically implemented at a material-technological level, or does it involve aspects of human resource development as well?

Many believe that the amount of invested work in and the awarded grant for the applications are not in proportion with one another, the conditions of participation are not optimal for the company. Disadvantages arising from company size may also hinder potential participation, but in many cases, the conditions of tendering schemes are not optimal. Meeting conditions and deadlines present further difficulties. In many cases, companies do not explicitly need cooperation with higher education institutions, they only participate to receive grants; nevertheless, they acknowledge that these programmes lead to improved education and workforce. Besides research & development, asset acquisition is the main attractiveness of the programme, especially for companies that report no R&D activities. Many complain about the lack of incentive schemes in the dynamic of these types of cooperation – companies gain less from them.

IV. How and to what extent do companies cooperate to achieve the above mentioned objectives?

- 8) Is there a cooperation between various automotive companies? If yes, how do you rate its efficiency?

Suppliers have a specifically close relationship with one main partner, other cooperation programmes focused on 1 specific project. There are clusters that focus on development but in many cases, it leads to competition, although the relationship itself is not hostile, interdependencies appear. Cooperation is often motivated by access to programme funds. Many do not see any kind of cooperation, or if they do, it is not a real R&D framework. They cite the lack of organisational culture as the reason for the low level of cooperation.

- 9) To what extent can best practice sharing at conferences and professional forums get into corporate life?

Companies often see these cooperation programmes as a burden, without any interest to or positive effect on them, they have negative experiences, and information from conferences cannot always be put into practice. Responses reflect very diverse attitudes, as 25% of respondents still have a positive approach: they believe conferences and professional forums can be sources of knowledge, as indicated by feedback from colleagues. New information also finds its way into corporate operations in its original, transformed or modified form to boost efficiency.

- 10) Based on past experience, what impact does best practice sharing have on your relations in the automotive industry?

As we have not received many responses to this question, our main conclusion is that a company's internal organisational structure as well as operational model and culture determine whether these best practices can be of use. In many cases, even the companies themselves do not understand and manage this perfectly.

Companies have different ideas about best practice sharing, and based on the interviews, I have come to the conclusion that companies involved in R&D activities are more open toward these types of cooperation programmes than companies that are not engaged in them.

### **III/b. Statistical Analyses**

#### a. study: The impact of internal organisational factors on innovation

In the study, my primary focus was on identifying the factors that are related to the innovation potential perceived by managers and employees, and to the strengths of the organisation's knowledge management system. I also examined how external factors—such as market and economic situation as well as future prospects—impact the human resource management strategy of the company.

A significant association is detectable between organisational innovation and internal organisational factors. Due to the low number of sample units, the number of significant correlations was lower than expected, but based on the direction of the correlation coefficient, we can deduce potential associations. There is a significant, moderate uphill correlation between professional development and organisational innovation  $r=[0.382]$   $p=[0.04]$ . The importance of employee satisfaction is exactly at the significance level of 0.05, but this also suggests a moderate uphill correlation  $r=[0.373]$   $p=[0.05]$ . Individual career support fails to reach the strict significance level of 0.05 as well, and the correlation coefficient in this case indicates a moderate uphill relationship  $r=[0.358]$   $p=[0.06]$ . The result of the importance of practical experience is further away from significance, but we can assume a moderate uphill correlation in this case as well  $r=[0.333]$   $p=[0.08]$ .

Significant relationships are detectable between cooperation with universities and internal organisational factors. The strong uphill correlation between cooperation with universities and innovation  $r=[0.545]$   $p=[0.003]$  is the most important connection, meaning that the more important the cooperation with universities is for a company, the more innovative the company considers itself to be. The importance of professional development also shows a significant, moderate uphill correlation  $r=[0.473]$   $p=[0.011]$ , meaning that companies that consider the professional development of their colleagues and employees important are also open to potential cooperation with universities as a form of professional development. A significance above the level of 0.05 was found in connection with individual career support, which indicates a moderate uphill correlation  $r=[0.356]$   $p=[0.063]$ . The importance of

employee satisfaction also shows a moderate uphill correlation  $r=[0.319]$   $p=[0.098]$ . On the other hand, there was no connection between the perception of the company's prospects and that of the importance of practical experience or employee development.

- b. study: The connection between a company's external connections and corporate innovation

Significant connections are detectable between innovation and external factors. There is a moderately strong uphill correlation between universities' willingness to cooperate and innovation  $r=[0.411]$   $p=[0.030]$ . The link between corporate innovation and the competencies of fresh graduates is also a moderately strong uphill correlation  $r=[0.405]$   $p=[0.032]$ . That is, the more positive the perception of the importance of cooperation and the competencies of students are, and the more open the respondents of the surveyed companies perceive higher education institutions to such cooperation to be, the more open they see the company.

Significant relationships are detectable between cooperation with universities and external organisational factors. There is a strong uphill correlation between the importance of cooperating with universities (on the corporate side) and the willingness of universities (on their own side)  $r=[0.634]$   $p<[0.001]$ . The correlation with fresh graduates' competencies shows a similarly strong uphill trend  $r=[0.655]$   $p<[0.001]$ . The following section shows that the more cooperation is important to respondents, the more open they perceive universities to be toward cooperation, and they also evaluate university students' knowledge more positively. This may indicate that hiring students and positive impressions may have an impact on whether companies view cooperation as important.

### **III/c. Summary of Hypothesis Testing**

**H1:** We can state that the curriculum may be an important element in retaining workforce and to the innovative capacity of the organisation through the process of sharing knowledge, thus *we can consider the first hypothesis justified*, but the question whether it is equally valid for both the physical and intellectual workforce remains open.

The interviews also reveal that it would be worthwhile to examine whether there is a direct link between the perceived innovative potential on one hand and employees' professional development and training or employee satisfaction on the other, as there is strong disagreement among respondents how much employees require and enjoy training opportunities.

**H2:** Based on the above, we can consider *the second main hypothesis justified*: the vast majority of companies participating in cooperation programmes between universities and the industry can utilise the training forms (dual, cooperative training, internship programme, and projects) to get to know their prospective employees and hire them based on this experience. Some companies involved in internship programmes evaluate the cooperation positively, and they believe that during their internship, students contribute to the activities of the company with their knowledge. Others criticise the practical aspect of their competencies. The question arises whether students' competence level may potentially influence companies' willingness to participate in cooperation programmes if these programmes focus so strongly on training the next generation. Based on the interviews, some of the companies involved in R&D activities are more open to these types of cooperation. This gives rise to a new hypothesis, namely that the professional relevance of university research to corporate activity is an important aspect in the implementation of efficient cooperation models between the industry and universities (*Hippel, 1988*), i.e. cooperation potential is better if the activities of the two parties are connected, and ensuring labour supply is not the only goal.

**H3:** *The third hypothesis has been justified only partially* – smaller companies whose activities are mainly focused on and limited to manufacturing have no capacity for this and miss out on the common knowledge sharing. My research has proved that the size of companies greatly influences their operation and their external relation network, and thus has an impact on the amount and depth of relations between universities and the industry.

**H4:** Several interviewees justified the fourth hypothesis, which states that the organisational culture lacks the elements that would promote these cooperation programmes to the majority of respondents, and where already implemented, the bureaucratic system of universities and

the complicated processes faced by companies often discourage and undermine cooperation initiatives.

Based on the above, *the fourth hypothesis has been proved*, according to which the different organisational processes and objectives of higher education institutions and industry participants may hinder the establishment of cooperation.

**H5:** Regarding the fifth hypothesis, it is established that even though programme funds often motivate the parties to participate in the cooperation, interviewees acknowledged positive effects beyond the funds as they experience an increase in quality on both sides following the projects. *Based on the findings, the fifth hypothesis was only partially proved.*

The following table summarises the justification of the hypotheses based on responses to questions raised at the start of the research and the results of quantitative research:

Hypotheses	Sub-hypotheses	Justified	Justified only partially	Not justified
H1		✓		
	H1a	✓		
	H1b	✓		
H2		✓		
	H2a	✓		
	H2b	✓		
	H2c	✓		
	H2d		✓	
H3				✓
H4		✓		
H5			✓	

1. TABLE: SUMMARY OF HYPOTHESIS TESTING  
(self-produced)

#### IV. THE MOST IMPORTANT FINDINGS OF THE RESEARCH

Based on the results, it can be concluded that internal organisational factors, such as employees' career support, satisfaction and the importance of their training, as well as the effectiveness of cooperation with external institutions, are linked to the innovative potential of the organisation, and its willingness to participate in external cooperation programmes. Despite the low number of sample units, significant and moderate correlations with internal factors are detectable.

Descriptive statistical data show that the organisations constituting the sample follow different strategies in training employees doing physical and intellectual work.

External factors are in strong uphill correlation with both innovation and the importance of cooperation with universities, which indicates that even though the internal knowledge management of an organisation has a key role in utilising its innovation potential, external motivators and external participants are linked more strongly to innovation (*Vanhaverbeke, 2012*). Here, the idea that governmental and grant assistance aimed at innovation programmes and cooperation is an important strategic challenge (*Kotsis & Nagy, 2009*) is proved. Results also demonstrate that a majority of companies have already participated and intend to keep participating in such programmes.

Workplace knowledge management, supporting the professional training of employees and facilitating their career development increase competitiveness and promote corporate innovation, thus the more innovative a company perceives itself, the more it emphasises the above mentioned factors.

Solving the problems of lifelong learning is not the only task of higher education, it must also prepare students that the period of learning does not end when receiving their degree. Learning is an important element of workplace integration: getting to know the work tasks, acquiring knowledge specific to the organisation and the practical application of theoretical knowledge are among the basic expectations of the corporate side, and establishing relationships with students of up-to-date knowledge is one of the most important benefits of the cooperation with universities. Technological development and the rapid changes in market expectations are reflected in the daily tasks of organisations as well, and consequently, as the tasks of a given position change continuously, the employee's competencies and

knowledge must adapt accordingly. When the two systems mutually influence each other, curriculum must reflect expectations formulated by the companies, and the practical part of trainings must be adapted to the real requirements of the labour market.

The cooperation between universities and the industry is not only in the participants' interest but also serves as a mechanism that promotes economic and social development. As a result of the impact of economic and economic policy interests, the number of cooperation programmes between the industry and research sites as well as the content quality of relations have improved in recent decades, formed through long-term joint reflection based on trust.

The government encourages research and development cooperation between companies and research sites through relationship development programmes and targeted tendering schemes. An important question arises as to whether the support funds incentivise companies to cooperate, and whether these cooperation programmes will continue once the mandatory elements of the tendering period have been completed. Will a long-term commitment be established based on the "cooperation of excellence" brought to life by significant programme funds?

In the case of educational collaborations, university-industry cooperation relations are typically established between institutions and individuals, while R&D collaborations are established between institutions.

Issues stemming from company size, work overload and communication, as well as the already tough conditions and tender structure, become even more inflexible, and makes it difficult to attract new participants into the programmes. As a consequence, there may be more willingness to cooperate that does not reach practical implementation.

At the individual level, only half of the respondents are actively involved in the selection of students (*Markkula*, 2013; *Pogátsnik*, 2017), and the harmonisation of objectives could also improve the success of R&D collaborations, as the results show that two thirds of companies cannot really integrate knowledge and information received from university research sites into the organisation's knowledge base and knowledge management system (*Hippel*, 1988). As revealed in my research, organisational culture may be an obstacle to initiating cooperation, because no matter how open both sides are, different cultural backgrounds make it difficult for cooperation programmes to work effectively (*Kotsis & Nagy*, 2009). Almost twice as many existing and working collaborations have been initiated by universities as by

companies. We would like to remark here that despite its apparent hindering effect, organisational culture is important to employees, and its shaping could have a key role in creating further collaborations successful in all dimensions.

## V. RECOMMENDATIONS BASED ON THE RESEARCH RESULTS

- More intensive and structured communication is needed to harmonise the needs and requirements of universities and companies. Universities must improve their marketing activities so that their “research offer” is clearly available to companies.
- Universities need to change their approach to ensure efficient cooperation with the industry, and to that end, university researchers should be given the opportunity to regularly participate in industrial practice and thus learn about the operating mechanisms of the corporate side.
- Study programmes in higher institutions should better prepare students for practical work, especially for project management. To achieve this, universities should initiate cooperation more intensely with industrial partners.
- It would also be worthwhile for small and medium-sized enterprises to set up tender schemes that would not require such a heavy administrative burden.
- By changing the organisational culture and the internal training and knowledge management system of small and medium-sized enterprises, companies could become more willing to participate in R&D collaborations and tender schemes between universities and industry.
- Large companies should cooperate more intensively with small and medium-sized enterprises in their internal development and training processes, supporting them primarily in the development of management skills.
- It would be useful to set up tendering schemes requiring significantly less administration, in which large companies and small and medium-sized enterprises would work in the framework of long-term, even networked, cooperation to implement and share best practices, involve research institutes and universities more closely, and solve real-life problems.
- I consider it important to provide expert assistance along with state aid to understand the industrial interpretation of the conceptual framework of innovation, as most companies are not aware of the innovation content in their processes.

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