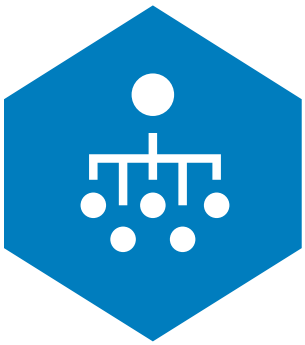

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Toward the Digital Economy

MARTIN MIKESKA AND TOMÁŠ URBÁNEK

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The Development of the Labor Market of Czech Small and Medium-sized Enterprises: Toward the Digital Economy

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Abstract: In the 2000s, Czech small and medium-sized enterprises faced competition in the new technologies and innovations associated with the implementation of the digital economy. Competitive advantages of the Czech economy based on cheap labor and low-cost production are in decline, and finding a new economic paradigm seems to be problematic. Our study has traced a significant degree of interaction between the structure of employee education and the sectoral classification of the company, with medium–high-tech, medium–low-tech and low-tech firms behaving differently from each other from the labor market perspective. Companies implement different strategies in terms of employee education as well as R&D. Thus far, Czech companies have focused mainly on the market follower approach, i.e., with little effort toward innovation. This conservative strategy brings lower risks but also lacks the high profit potential necessary to reach competitive advantages. In particular, the digitization of the midtech sector is crucial for the future growth of the Czech economy. The midtech sector possesses high potential for the development of new business opportunities if it can overcome its significant gap in the use of R&D, knowledge, and technology.

Keywords: Labor Market, SMEs, Czech Economy, Digital Economy, Innovation, Education

Introduction

The global economic crisis of 2008 fundamentally changed the map of economic world powers. The economies of developing countries such as China and India have risen significantly, whereas the influence of the major, mainly European, economies has weakened. The new power distribution weighs critically on the Central European economies, which are linked through their position of subsuppliers to the German and American markets. Such a perspective highlights the key role of small and medium-sized enterprises (SMEs) in nonmetropolitan regions that have a high concentration of labor-intensive industries, such as those in the Czech Republic. However, there are reasons to believe that Central European SMEs are, in fact, capable of becoming globally competitive.

To understand the current fall in competitiveness of European companies, it is necessary to return to the beginnings of the digital economy. Owing to changes in the global economy, the 1990s witnessed the formulation of two distinct approaches to economic growth. The first was a classical approach built on macroeconomic models prevalent in earlier years, known as the Solow model, which was the generally accepted basic model of economic growth. However, this model considered only the prerequisite of a generally unqualified labor force. It placed more stress on the capital factor and could not distinguish between qualified and unqualified labor. On the basis of the Solow model, Audretsch (2009, 80) has claimed that "increasing labor could increase the level of economic output, but not the rate of economic growth." Even though Solow later went on to include technological changes in his model, he considered these factors contributing to economic growth to be rather accidental. Following these theoretical developments, European economies are now searching for tools to aid in the development of

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human capital within currently operating mechanisms of monetary and fiscal policies. The results of these policies, however, have not been satisfactory.

The second growth model is the innovation-driven model (Braunerhjelm et al. 2009), a paradigm focused on the labor factor and its quality. This model elaborates on the motivational setting with the possibility to create a self-stimulating entrepreneurial environment in which knowledge flows freely among organizations and creates new economic growth, which is considered by Braunerhjelm et al. (2009) as well as Audretsch, Keilbach, and Lehmann (2006) to be the missing link toward European economic growth. The principal economy representing this growth model focused on the labor market was the United States, where priority was given to science and research, know-how, technologies, and investment in human capital rather than to hard investment in infrastructure (Siegel et al. 2003). Nevertheless, the conditions of the US labor market cannot be taken as a background for the strategic development of the Czech economy, because it focuses predominantly on the production of technologically unsophisticated products by SMEs. Despite the Czech economy's efforts to change its production, it is being challenged by current possibilities of the Czech labor market. In the Czech economy, determining a new economic paradigm, and specifically a new production profile, has been problematic.

With this problem statement in mind, the aim of this article is to describe the deficiencies of the current Czech economic paradigm based on cheap production and economies of scale. This is closely connected with the labor market requirements set by SMEs, which represent vitally important employers in the Czech labor market. These enterprises focus predominantly on a medium-qualified and thus cheaper labor force. This situation can be remedied through a rise in productivity via digitalization and knowledge, innovation, and technologies engagement, which can be developed by investing in science and research or purchased or imported from more developed economies. Following the example of the manufacturing industry, the major industry sector of the Czech economy, we demonstrate here that the development of the medium–high tech and high-tech sectors may bring the desired prosperity to the future Czech labor market (Český statistický úřad [Czech Statistical Office] 2017). Achieving this goal will in turn reset the future Czech economic paradigm, transforming it into a model in which sustainable economic growth is based on digital technologies and high added value.

Theoretical Background and Hypotheses

Digital economy and its links to a variety of economic phenomena have been researched in a number of studies. Clark et al. (2004a, 2004b) have shown a statistically significant dependence in regard to changes in market sales, local employment trends, and the adoption of process-specific technologies, in what is currently termed the digital economy. Porter (1998), Feldman (2019), and Storper (2000) understand competitiveness as rising labor productivity with the help of endogenous technological changes implemented through local information and knowledge networks.

New competitive strategies concerning modern economies were first formulated by Adam Smith, who in his classic work, *The Wealth of Nations,* in 1776, created a vision at the outset of the first Industrial Revolution of a new generation of specialists who raise productivity by knowledge engagement (Smith 2007). In the first half of the nineteenth century, Friedrich List elaborated on Smith's theories, claiming that growth and development depend on the possibilities of the environment, i.e., on the creation of a continual need to improve infrastructure to foster continuing development (List 2006). One of the most significant works of the first half of the twentieth century, which interconnected the phenomena of economic prosperity, business cycles, innovation, knowledge, and creative destruction, was published by Joseph Schumpeter in 1939. In *Business Cycles*, Schumpeter describes direct links between consumption, wages, and balance regarding consumer behavior, arguing for the importance of

these economic connections in terms of the overall economic growth and competitiveness of a country (Schumpeter 2006).

Contemporary approaches to interconnecting innovation, entrepreneurial strategies, and entrepreneurial activity, reflecting current conditions, still arise from theories of the first Industrial Revolution and the end of the nineteenth century (Sundbo 2003). However, these theories are limited by differences among the economies in which this type of implementation is attempted. For example, the theory of business cycles corresponds much better to the conditions of the United States, with its very strong entrepreneurial sector, than it does to the SMEs sector, which forms the basis of European economies.[2]

Searching for a New Czech Economic Paradigm and a New Labor Market

Social partners have been attempting to develop a new production profile in the Czech Republic for over thirty years. Trade unions, representing an important segment in the labor supply, consider the present-day industrial model of a low-cost economy as unacceptable. They claim that the orientation toward low production costs does not allow for the real possibility of the conditions and salaries of Czech workers rising to that of developed countries (Fassmann et al. 2019). Employers, representing labor demand, have attempted to resolve this situation by liberalizing standard labor relations toward further price reduction through decreasing labor costs. The discrepancy between the objectives on both sides is obvious. The contrast between the labor type (qualified vs. unqualified) and labor cost (well-paid vs. cheap) in the Czech economy has had a vital impact on the economic growth and the country's prosperity.

The unions argue that since the beginning of the economic transformation, in the early 1990s, the level of hourly wages has reached only one-third of that of neighboring developed economies. Even as the economic upturn of 2014–2017 persisted and the Czech koruna continued to strengthen, real economic convergence to developed European economies cannot be attained within a life span. Analyses by Czech trade unions (Fassmann et al. 2019) and the European Bank for Reconstruction and Development (EBRD 2017) suggest that the Czech economy finds itself in the middle-income trap. EBRD defines the situation as one in which a country has become relatively rich (typically to a level of one- or two-thirds of the USA's per capita GDP); however, the economic changes incurred have exhausted its existing competitive advantages—mostly in terms of cheap labor—and it has failed to find a new growth model. Baldwin (2016) adds that the middle-income trap in the economies approaching their technological frontier may be a reflection of the changing factors necessary to raise productivity. However, the trap may be closed by importing or imitating new technologies developed in more advanced economies, as claimed by Acemoglu, Aghion, and Zilibotti (2006).

Importing Digital Prosperity Based on Digital Economy

The definition of digital economy by Tapscott (2015) characterizes the phenomenon as a period of opportunities grounded in the digital revolution, which was a major single-generation event and which continuously influences the global economy, enables more effective business opportunities, raises production, and develops new enriching business models. Incorporating digital technologies into the production of goods and services has become a prime objective of all economic subjects. As Veber (2018) claims, the intent of such behavior is obvious: rising

[2] Attempts to compete with the American economy have led the EU to formulate the ambitious Lisbon Strategy. By 2020 the plan was projected to bring Europe to the position of the strongest international economy by implementing smart and sustainable growth measures, along with securing very low unemployment and high living standards. The primary goals were to ease the bureaucratic burden and institute reforms, leading to the creation of an environment that supports entrepreneurship and provides the formation of up to ten million new jobs (Europa.eu 2019). These effects failed to appear, and the situation is now known as the paradox of the European economy.

competitiveness. Understanding digital technologies, digitalization, and the digital economy allows us to claim that digital digitalization brings new and fundamental factors of competitiveness from both the microeconomic view (competitiveness of a company) and the macroeconomic view (national or international competitiveness).

In the sense of Tapscott's definition (2015), the explosion of the digital revolution within the global economy has approached the stage of the so-called digital transformation of individual economies, which can be summarized by the term "digitalization." Whether or not the process of digitalization is, in fact, under way is hardly debatable; the crucial factor is how fast it is taking place and whether too large a gap within various systems is being created as the trend continues. If companies greatly lag behind in developing their own strategic responses to this global trend, a digital gap can emerge, i.e., incompatibility with the ever-changing current digital system and subsequent loss of competitiveness of a company.

Macroeconomic Readiness for a Shift

The Czech Republic has had a strong industrial tradition as a result of considerable efforts that have been made to encourage the growth of industrial companies. During the first strong developmental period of the Czech economy, in the 1920s, several models were featured, through which, for example, farmers could collectively buy and use new technologies such as sowing and threshing machines or tractors. Industrial enterprises such as the Bata Shoe Company (1920s and 1930s) owned corporate banks whose employees could save money, and the companies used employee savings to finance further investment (Hunčová and Mikeska 2016). From the point of view of innovation, these were crucial and, at the time, revolutionary financial tools. Cooperatives such as Raiffeisen, and, later, the Cooperative Bank and the Trade Bank, were reestablished at the beginning of the first decade of the transformation process of the 1990s. After suffering through the transformation pains and after considerable regulatory efforts by the Czech National Bank (ČNB), following the great financial crisis of 2008, a new low-cost banking sector arose out of former cooperatives and credit unions. This new source of competition in the Czech banking sector offered affordable loans for both natural and legal persons (Hunčová and Mikeska 2016).

Cheap credit from these new banks along with the favorable monetary policy of ČNB after 2010 encouraged SMEs to invest in new technologies and other innovations. The solid macroeconomic environment of the Czech Republic facilitated economic growth along with increased employment and low inflation. The mood of consumers improved, with household consumption becoming the driver of Czech prosperity, especially in the automotive industry—the prime sector of the Czech economy (Vychytilová 2018). Research into stock market volatility has proved to be a positive influence on the current economic situation in terms of growth, especially in the automotive sector and its suppliers (Vychytilová et al. 2019). Despite such a positive economic situation, SMEs in the automotive sector remain highly conservative in their investments.

The Labor Market of Czech SMEs

The labor market of Czech SMEs comprises approximately 1.15 million legal and natural persons, i.e., 99.8 percent of all entrepreneurial subjects. Overall, these companies employ almost 60 percent of the productive labor force (Ministerstvo průmyslu a obchodu [Ministry of Industry and Trade] 2017). Table 1 provides an overview of the Czech manufacturing industry in 2017, showing a total of 175,894 companies employing 1.3 million people, or more than 90 percent of all employees within the Czech industrial sector. According to the Czech Statistical Office (ČSÚ), in 2017 the medium high-tech sector employed 480,000 people, the medium–low tech sector 450,000 people, and the low-tech sector 325,000 people. The high-tech sector

employed 68,000 people and represented only 5 percent of manufacturing industry companies. High-tech SMEs are represented mainly in the electro-technical industry, which employs 50,000 people. Overall, the high-tech sector is dominated by several large companies, which employ approximately 65 percent of all personnel in this sector.

Table 1: The Structure of Companies and Employees of the Czech Manufacturing Industry Divided in Terms of Technological Intensity (2017)

Manufacturing Industry Structure in CZ 2017		*Total*	*Micro (0–9)*	*Small (10–49)*	*Medium (50–249)*	*Large (250+)*
Total	Companies	175,894	163,424	8,497	3,088	885
	Employees	1,319,345	191,250	184,463	332,058	611,575
High-Tech	Companies	3,420	2,998	249	131	42
	Employees	68,632	4,061	5,421	14,356	44,794
Medium-High Tech	Companies	22,392	19,531	1,577	884	400
	Employees	478,947	24,968	36,547	99,025	318,407
Medium-Low Tech	Companies	74,160	69,133	3,558	1,178	291
	Employees	447,443	80,349	76,933	123,709	166,452
Low Tech	Companies	75,922	71,762	3,113	895	152
	Employees	324,323	81,871	65,562	94,968	81,922

Source: Český statistický úřad (Czech Statistical Office) 2017

Statement of Hypotheses

The strategy of competitiveness based on economies of scale most often chosen in the Czech Republic in the 1990s seems to be unsustainable from the point of view of employee needs and requirements. The majority of Czech SMEs operate as sub-suppliers (Fassman et al. 2019); in terms of business model, they accept orders only from established ordering parties. Unfortunately, orders are often connected with a given profit margin. A de facto given profit margin from the ordering party does not leave room for the maximization of the producer's profit or for securing effective wages or increasing investment. This situation has come to threaten the necessity of replacing human labor by automation, robotization, digitalization, and new technologies. This inertia seems to be hindering the Czech system from shifting toward the digital economy, comprising, among other features, a strong digital market, as well as a move toward industry 4.0 (Ministerstvo průmyslu a obchodu [Ministry of Industry and Trade] 2016) and society 4.0 (Úřad vlády ČR [Government of the Czech Republic] 2017).

The Czech economy managed to export itself out of the 2008 economic crisis, an outcome to which extensive intervention by the CNB contributed. However, this may not be possible in the future, especially owing to the weakening of the automotive industry (Schnabl 2008). During the economic boom following 2014, specifically in the SMEs context, a much more severe problem has arisen in the Czech Republic: exhausted supply in the labor market. The involvement of all available Czech labor factors resulted in a record unemployment level, even in comparison with the developed economies of the world. The unemployment level, which was 7 percent in 2013, dropped to 2 percent in 2019 (Český statistický úřad 2019). Even though the World Economic Forum has rated the Czech Republic in its Global Competitiveness Report as first in terms of the macroeconomic indicators[3] and stability, other indicators are not so favorable (World Economic Forum 2019). The Czech labor market ranked 48th compared with

[3] With only inflation and debt dynamics taken into consideration as macroeconomic factors.

other countries, its ICT adoption 42nd, its financial system 47th, and innovation capability 29th. A critical indicator is its 29th position in human capital skills, a category in which the Czech Republic earned the worst grade in the category "ease of finding skilled employees," a parameter that reflects its current state of labor market exhaustion.

On the basis of the lack of a cheap labor force, which limits companies to focusing primarily on the production of technologically unsophisticated products, we formulate our first hypothesis as follows:

H1: There is a statistically significant dependence between the manufacturing industry in terms of technological intensity and the effort to further develop its own business.

The ability of companies to innovate establishes linkages between employee education, i.e., enhancing their employees' ability to apply new knowledge and technologies, and the companies' capability to cover the cost of innovation (OECD 2016). Innovations play an important role in economic and social development, ensuring the competitiveness of an economy (Damanpour and Gopalakrishnan 1998). The contribution of innovations lies in the use of the latest knowledge and technologies in the production of high value-added products (Szabo, Šoltés, and Herman 2013). To reach the stage of an innovation-open environment, it is necessary to guarantee the freedom of knowledge sharing, i.e., support for developing innovations and strategies aimed at fulfilling the given goals. From the point of view of the Czech economy, which, as indicated, bases its competitive advantages mainly on the labor factor, it is vital to ensure continuous progress in ensuring the qualifications of its employees, including securing the further enhancement of their capabilities and skills, and to develop and support lifelong learning programs (Jáč 2006).

On the basis of the assumption that innovative contributions to high value-added production are conditioned by the ability of employees to use in practice their education in the latest knowledge and technologies, we formulate the second hypothesis as follows:

H2: There is a statistically significant dependence related to the education of employees and the production of high value-added products and services.

In terms of its labor market, the Czech economy ranks among the more conservative (Český statistický úřad [Czech Statistical Office] 2015). Although the Czech Republic lags behind developed countries in tertiary education, it also ranks among the countries with the lowest share of people in the labor market with solely a primary or secondary education. The share of the unqualified or low-qualified labor force in the Czech Republic is under 10 percent; in Germany it is approximately 20 percent, and the European average is almost 30 percent (Český statistický úřad [Czech Statistical Office] 2014). Although tertiary education is showing a rising trend (Mejstřík and Petráňová 2014), the share of graduates in technical fields is low, endangering the innovative capabilities of the economy (Národní observatoř zaměstnanosti a vzdělávání [National Observatory of Employment and Training] 2016). Despite this, in comparison with other EU countries, the Czech Republic had the lowest share of unemployed university graduates after the financial crisis of 2008 (Tuček and Mikeska 2011). Matošková et al. (2013) noticed, however, that in the context of Czech SMEs, knowledge and experience sharing among junior and senior employees is poor. Research relating to the period 1994–2012 (Mikeska 2013) demonstrates that employers tend to develop the practical knowledge of university students only when the capacities of people at productive age become exhausted. Whereas, for example, neighboring Germany uses a so-called dual educational system connecting universities and companies, an approach that enables practical knowledge acquisition, there is no such functional model in the Czech Republic. This has not always been so, because, historically, Czech entrepreneurs, e.g., Tomas Bata during the period of the greatest

industrial development between 1919 and 1939, devoted considerable attention to interconnecting education and practice (Mikeska 2013).

The third hypothesis rests on the assumption that the present-day Czech labor market features various strategies in employers' requirements for employee qualifications and that these depend on differences in the technological intensity of the companies' production.

H3: There is a statistically significant dependence in the manufacturing industry in terms of technological intensity and the required education of employees.

The strategy of using cheap labor leads to a lack of interest in new technologies and innovations, which is unsustainable in the long run for the Czech economy. This circumstance leads to a technological gap potentially leading to a complete loss of competitiveness. Our next hypothesis thus states that there is a dependence between the technological intensity of production and the willingness to invest in research and development. Mařík (2016) enumerates that less than 10 percent of small, less than 15 percent of medium, and approximately 30 percent of large companies realize their purchases and sales via digital data exchanges. Similarly, approximately 20 percent of SMEs, compared with 80 percent of large companies, use ERP systems. Customer relationship management (CRM) systems are used by fewer than 15 percent of small companies and almost 42 percent of large companies. The fact that a company does not use enterprise resource planning (ERP) or CRM suggests a lack of communication channels at the level of production planning as well as ill-formed links in supplier–consumer chains.

H4: There is a statistically significant dependence between types of manufacturing industry in terms of technological intensity and the decision to invest in research and development.

It can be deduced from the context of maintaining a low-cost economy that SMEs would accept university graduates into their labor force only under the condition that the graduates accepted the wage offered by SMEs, i.e., typically close to the wage level of a secondary-school graduate. Understandably, university graduates refuse these conditions, mainly because of the rising prices in the economy. The persisting strategies of cheap labor thus lead companies to import cheap labor from abroad. However, the importation of unqualified labor carries with it lower productivity based on low qualification, an effect that is reflected negatively in the wage level in the economy as a whole. The basis for the fifth hypothesis is the assumption that there is a link between technological intensity of production and the choice of business strategy.

H5: There is a statistically significant dependence between the manufacturing industry in terms of technological intensity and the choice of strategy between innovator and market follower.

It cannot be assumed that companies would voluntarily leave the existing paradigm in a time of economic prosperity; however, we can assume that during an economic crisis this paradigm shift will become unavoidable yet costly, because companies will not be profitable enough to cover the costs of new technologies. A solution can be offered by the models of paradigm shift in Finland, Denmark, and Ireland, where the change of basic models happened quickly and effectively. The basis for future Czech success can be laid in setting national strategies agreed on by the government, the employers, and social partners representing the employees, as well as in setting future economic, technological, and innovative trajectories of the economy.

Methodology

A questionnaire survey was employed as a method to meet the objectives of the study, which was purely quantitative. The survey was conducted via an electronic questionnaire, from which responses to five questions were excerpted for the purposes of this study (plus two questions used to classify the respondents). Overall, 1,709 questionnaires were collected between the years 2014 and 2019. The data, collected from managers of Czech SMEs, is primary and unique. The SMEs sectors was divided into the manufacturing sector, which comprises the largest part of Czech industry, and other sectors, labelled as SMEs but not classified by tech level. The companies were divided into four distinct subsectors, namely high tech, medium-high tech, medium-low tech and low tech. The respondents had a twenty-minute time limit to fill the questionnaire in.

The coding of the questions was standard, and all the variables were of nominal data type with the exception of questions regarding the structure of their employees' education, for which the point allocation method was used. The data were summarized and checked for extreme and missing values. A principal correlation analysis followed, with only the open questions from the questionnaire analyzed. To answer the main research question, a standard chi-square test of independence and a two-way analysis of variance (ANOVA) was used. Usage conditions were checked for every chi-square test, but in our case the groups were numerous, and thus the alternative Fisher's exact test was not necessary. A Tukey-adjusted comparison was used for multiple comparison after the ANOVA test. Statistical software R, version 3.6.1., was used for all the statistical calculations.

The main limitation of our study arises from the nature of the questionnaire. As it questions individuals (individual managers), the answers are subjective and may be purposefully untrue or incorrect with no malign intentions on the part of the respondents. Nevertheless, we believe companies are made up of and by people, so a certain degree of subjectivity is unavoidable in any study mapping the current state and future outlooks of enterprises.

Another technical limitation is represented by a particular practice of the Czech labor market in the high-tech sector. Sixty-two IT specialists classified according to CZNACE and NACE Rev.2 as belonging to the high-tech sector participated in the survey. These specialists act as both employees and entrepreneurs because they are self-employed (or work as holders of a trade license). Because our research focuses on companies, we excluded from the data set the questionnaires returned by self-employed specialists.

Results and Discussion

H1: Results and Discussion

Table 2 describes the correlation between the intensity of the production industry and an effort to further develop the business. The data indicates that companies devote a considerable effort to business development, with almost 94 percent of respondents claiming they focus their efforts on the advancement of their companies. A chi-square test of independence was used as a statistical proof of this finding, where χ^2 (3, N = 1,709) = 26.963, the p-value = .000059. As the p-value is lower than .05, we can refute the null hypothesis at the significance level of 5 percent. A statistically significant correlation between the intensity of the manufacturing industry and the effort devoted to company development is thus expected to exist.

Among Czech companies, 5 percent of respondents answered negatively the question of whether they invest their efforts in further developing their own business. A more positive perspective is seen in the high-tech sector. On the other hand, a less optimistic outlook can be observed in the technologically less demanding sectors.

Table 2: Results of Contingency Tables for H1 Hypothesis

Manufacturing Industry Technological Intensity	*Effort to Further Develop*		*Total*
	Yes	*No*	
Med-High Tech	311 (300)	6 (17)	317 (317)
Med-Low Tech	594 (581)	19 (32)	613 (613)
Low-Tech	201 (209)	19 (11)	220 (220)
SMEs Not Classified by Tech Level	514 (530)	45 (29)	559 (559)
Total	1,620 (1,620)	89 (89)	1,709 (1,709)

Note: Numbers in parentheses are expected values under the null hypothesis of no association
Source: Mikeska and Urbánek

H2: ANOVA Results and Discussion

Table 3 shows the ANOVA calculation for producing high-value products and the required employee education. Significant interaction can be noticed between producing high value-added products and employee education. As the *p*-value of the interaction is lower than .05, there is sufficient proof to refute the null hypothesis at the significance level of 5 percent. We can, thus, further assume that a statistical correlation exists between producing high value-added products and employee education.

Table 3: H2 ANOVA Calculation for Producing High-Value Products and Required Employee Education

	Sum Sq	*Df*	*F Value*	*Pr (>F)*
Production of High Value-Added Products	2.82e-06	1	6.6e-05	0.993
Education	65.75	4	384.14	1.15e-304
Production of High Value-Added Products: Education	7.28	4	42.52	2.25e-35
Residuals	364.35	8,515		

Source: Mikeska and Urbánek

As the values were allocated via the point allocation method, we have proved that an interaction exists between education and the production of high value-added products. One interpretation of these findings could be that a significant link exists between the type of production and the requirements for employee education. Figure 1 illustrates a considerable discrepancy between the requirements for employee education in companies producing standard products and products with high value added. Companies producing standard products mainly require a general certificate of secondary education and, secondly, a vocational certificate. The proportion of bachelor's and master's degree holders is similar to the number of unqualified employees with only elementary education.

In companies producing high value-added products, employees holding a general certificate of secondary education also represent a dominant group. However, these companies emphasize bachelor's and master's degree education, i.e., they require fewer unqualified employees. This discrepancy between employee education in two different types of production seems to be

crucial. We believe the discrepancy would be even more significant if the Czech educational system managed to better satisfy the Bologna strategy and if the orientation of Czech companies changed significantly toward high value-added products, for example, by incorporating digital technologies to a much greater extent.

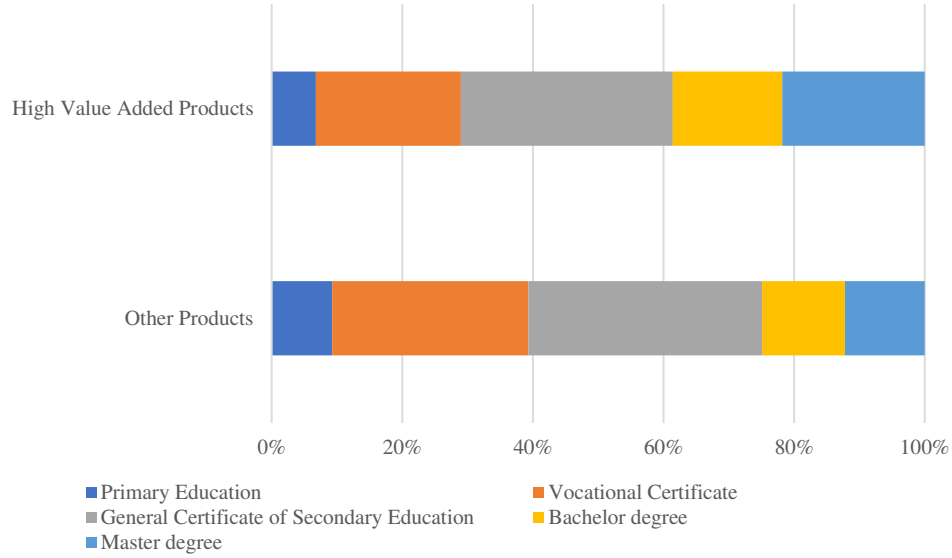

Figure 1: Production of High Value-Added Products Depending on Employee Education in Czech SMEs
Source: Mikeska and Urbánek

H3: Results and Discussion

Table 4 represents the ANOVA calculation for manufacturing intensity and required employee education. Significant interaction is noted between producing high value-added products and employee education. A significant effect was found with regard to the interaction of independent variable 1 and independent variable 2 on the dependent variable.

As the *p*-value of the interaction is lower than .05, there is sufficient proof to reject the null hypothesis at the significance level of 5 percent. We can thus further assume that statistical correlation exists between technological intensity of production and employee education. In companies producing high value-added products, the employees holding a general certificate of secondary education also represent a dominant group. However, these companies emphasize bachelor's and master's degree education, i.e., they require fewer unqualified employees.

Table 4: H3 ANOVA Calculation for Manufacturing Intensity and Required Employee Education

	Sum Sq	*Df*	*F Value*	*Pr (>F)*
Manufacturing Industry Technological Intensity	5.63e-06	2	5.63e-06	0.9999
Education	42.89	4	282.42	5.72e-222
Manufacturing Industry Technological Intensity: Education	7.93	8	26.09	5.24e-40
Residuals	217.76	5,735		

Source: Mikeska and Urbánek

This discrepancy between employee education in two different types of production seems to be crucial. One of the possible features that could make the discrepancy even more significant is a better adoption of the Bologna strategy by Czech educational system. The other one, we believe, is a more significant orientation of Czech companies toward high value-added products, for example, by incorporating digital technologies to a much greater extent.

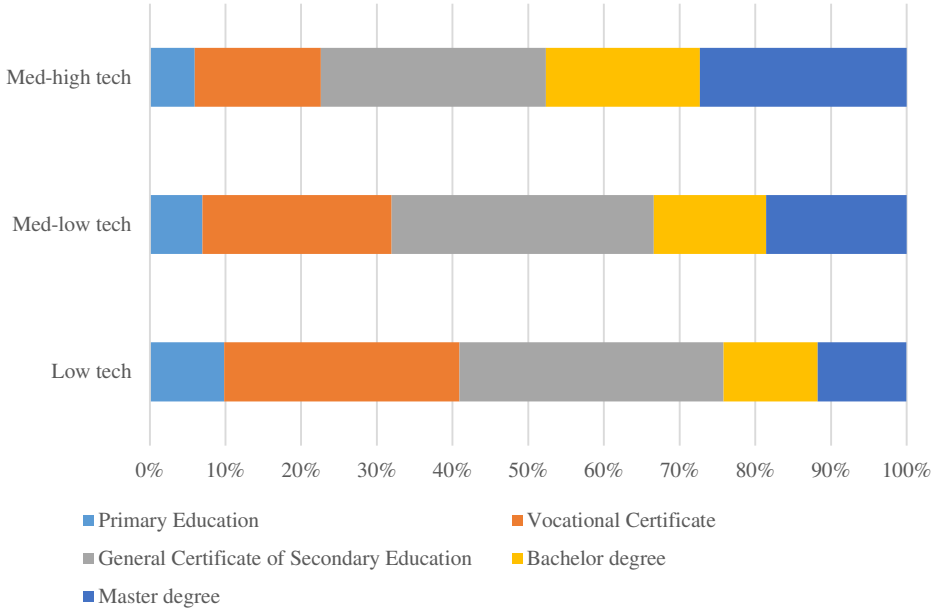

Figure 2: Structure of Required Employee Education of Small and Medium-sized Enterprises According to Manufacturing Technological Intensity
Source: Mikeska and Urbánek

The figure illustrates a range of requirements for employee education in various production sectors based on technological intensity. These sectors are labelled low-technology, medium-high technology and high-technology companies. This part of our study confirmed our assumptions that the least intensive production (low-tech) focuses on secondary-school graduates as well as on vocationally trained and unqualified employees. The ratio of university graduates is very low in this sector.

The medium-low sector ranks among the strongest in the Czech Republic, because most suppliers and subsuppliers of the automotive industry belong here. As Figure 2 shows, employers focus predominantly on secondary-school graduates and vocationally trained employees; however, they require far more university graduates. The medium-high tech sector is the only one with almost balanced needs for secondary-school and university graduates. It is only for unavoidable operational activities that the sector requires vocationally trained and unqualified people.

H4: Results and Discussion

Table 5 represents the dependence in terms of technological intensity of the manufacturing industry on the decision to invest in research and development. The table shows that medium-low-tech companies generally do not approve research and development investments. Only companies labelled medium-high tech are slightly more in favor of research and development.

A chi-square test of independence χ^2 (3, N = 1,709) = 154.5, p-value = 0, was used to statistically prove the link. As the p-value is lower than .05, there is sufficient proof to reject the null hypothesis at the significance level of 5 percent. We can thus further assume that a statistical correlation exists between the intensity of the manufacturing industry and the decision to invest in research and development.

Table 5: Results of Contingency Tables for H4 Hypothesis

Manufacturing Industry Technological Intensity	*Decided to Invest in Research and Development*		*Total*
	Yes	*No*	
Med-High Tech	163 (88)	154 (229)	317 (317)
Med-Low Tech	195 (171)	418 (442)	613 (613)
Low-Tech	28 (61)	192 (159)	220 (220)
SMEs Not Classified by Tech Level	91 (156)	468 (403)	559 (559)
Total	447 (477)	1,232 (1,232)	1,709 (1,709)

Note: Numbers in parentheses are expected values under the null hypothesis of no association.
Source: Mikeska and Urbánek

Every second company classified as medium-high tech that was surveyed has decided to invest in research and development in last five years. In the sector of medium low-tech companies, it was only every third company. Among low-tech companies, only every tenth company decided to invest in research and development. For the sector of SMEs not classified by tech level, roughly every sixth company invested in research and development. On average, only 30 percent of Czech SMEs invest in research and development. The reasons for not investing in research and development among the medium-high and medium-low tech companies are probably associated mainly with their being tied up in supplier chains as well as with lack of investment resources. Czech SMEs are essentially conservative in their attitude toward new technologies and, in many cases, do not feature sufficient capacities for the implementation of new technologies. They lack their own technostructure and must rely on external system integrators.

H5: Results and Discussion

Table 6 depicts the dependence between the manufacturing industry in terms of technological intensity and the choice of strategy between innovator and market follower. As can be noted in the table, SMEs more often decide in favor of the market follower strategy. Only medium-high tech companies are slightly more prone toward innovation, which indirectly supports the H2 hypothesis. A chi-square test of independence χ^2 (3, N = 1,709) = 110.6, p-value = 0, was used to statistically prove the link. As the p-value is lower than .05, there is sufficient proof to reject the null hypothesis at the significance level of 5 percent. We can thus further assume that a statistical correlation exists between manufacturing industry intensity and the chosen strategy of innovator or market follower.

Table 6: Results of Contingency Tables for H5 Hypothesis

Manufacturing Industry Technological Intensity	*Strategy*		*Total*
	Innovator	*Follower*	
Med-High Tech	178 (107)	139 (210)	317 (317)
Med-Low Tech	212 (206)	401 (407)	613 (613)
Low-Tech	40 (74)	180 (146)	220 (220)
SMEs Not Classified by Tech Level	145 (188)	414 (371)	559 (559)
Total	575 (575)	1,134 (1,134)	1,709 (1,709)

Note: Numbers in parentheses are expected values under the null hypothesis of no association.
Source: Mikeska and Urbánek

Approximately every second medium-high tech company states that its strategy is one of innovator, with the remainder understood to be mainly market followers. In the sector of medium-low tech companies, only every third company states that its strategy is to be an innovator. The situation is different among the low-tech companies, i.e., only one in five companies chooses the innovator strategy. In the sector of SMEs not classified by technology level, every fourth company follows the strategy of innovator. On average, only about one-third of Czech SMEs are willing to drive the market as innovators. On the basis of H4 and H5, we can state that if the company is willing to invest in research and development, it can also follow the path of an innovator. The tested companies have thus fulfilled the theoretical presumptions that in order to become innovators, they have to invest in research and development.

Conclusion

Czech SMEs, in the last decade, have faced competitiveness in the field of new technologies and innovations connected with the implementation of the digital economy. At the same time, the Czech economy finds itself in a period of boom, and this growth places it at the crossroads of two different types of economies: a low-cost economy and an economy based on high added value. The lack of a labor force together with the exhaustion of the economy's paradigm, which in the last thirty years has been based on competitive advantages derived from its cheap labor force and traditional or nondigital technologies, has become untenable. The Czech economy managed to overcome the 2008 crisis mainly because of the intervention of the CNB, yet an economy strongly dependent on the automotive industry may be endangered in the future, because this industry is weakening.

The principal discrepancy in the Czech labor market is the difference between labor supply and demand. Subjects on the supply side generally operate with a higher education and demand higher wages. Current labor market demand calls mainly for a lower qualification threshold necessary for traditional types of production, i.e., using nondigital facilities and technologies. The Czech economy thus finds itself in the middle-income trap. A possible way out may consist in overcoming production capacity limits by purchasing and importing new technologies from more highly developed economies. In the Czech context, this is complicated by the conservative approach of SMEs, which have so far relied on "good old procedures" and production. Even though the macroeconomic condition of the Czech economy is strong, with resources for new investments available, several SMEs do not seem to be in a hurry to invest.

The time to take advantage of this window of opportunity is running out for the Czech and other economies. A similar situation can be found in many other Central and Eastern European nations; thus, the Lisbon Strategy has failed in this sense. Some economists and researchers see the causes of the European economy paradox in the absence of a strong and creative entrepreneurial sector. Forging this missing link should be the key to creating a new engine of economic growth in the future, one based on interconnecting academic research, R&D, and investments in human capital.

On the basis of the findings of our study, it can be stated that the labor market of SMEs toward the digital economy is in transition in terms of development. Keeping this perspective in mind, the very makeup of the Czech labor market indicates the need to meet the demands of this economic paradigm shift, although the road to such a shift has yet to be determined. Czech SMEs believe that their entrepreneurship has a future, yet in the current period of economic boom, they have not abandoned the old paradigms of business based on cheap labor and low costs. Our study confirms significant differences between the old and the new requirements for employee education in terms of two strategies: remaining with the old standard production model and instituting changes that incorporate high added-value production technologies. Technologically more intense production requires higher qualifications and more advanced education of employees. A different structure of employee education is also required within various types of production based on technological intensity. Whereas the demands of technologically unsophisticated sectors are met by employees with lower qualifications, medium–high tech and medium–low tech sectors require more university graduates. The study has shown that very many employees with only a general certificate of secondary education remain a unique feature of the Czech market. Currently, these workers form the core of the current labor market and are the key employees for all sectors regardless of technological intensity. Most Czech companies have so far focused on the position of market followers, which, according to our study, corresponds to the unwillingness of companies to invest in research and development.

In terms of further research, one suggestion would be to examine exactly how this paradigm shift toward digitalization will be executed in Czech-type economies. Where and in what ways should the changes in institutions and enterprises begin? Should they begin with companies themselves changing their educational structure, favoring university graduates and expecting their new employees to develop new technologies? Or should the companies first invest in new digital technologies and solve the human capital problem later? Nevertheless, there is only one key question regarding the future sustainable growth of the Czech economy: what model should be instituted to foster the development of a new, self-confident, self-stimulating entrepreneurial environment in which knowledge and technology flow freely among the organizations, thus creating new economic growth?

We conclude by stating that Czech SMEs should not waste this unique opportunity for huge economic, technological and, eventually, social growth through economic digitalization. This economic paradigm shift can be executed relatively quickly and can remain sustainable in the long run with the implementation of digital technologies and R&D, along with their application and commercialization. Yet this engagement with technology can come only with increased investment in human capital. This kind of targeted economic paradigm shift has been brought about in countries such as Finland, Denmark, and Ireland, and examples like these can be studied with the goal of enhancing the positive impacts and alleviating negative ones.

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