



Regional Innovation Strategy for the Pilsen Region

**Regional Development Agency
of the Pilsen Region**



EVROPSKÁ UNIE
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Regional Innovation Strategy for the Pilsen Region

2nd update

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Introduction

As in all other regions of the Czech Republic, the Pilsen Region has created a Regional Innovation Strategy for Smart Specialisation (RIS3) in response to an initiative of the Government of the Czech Republic and the European Commission. The RIS3 is an annex to the Czech National Innovation Strategy. Its aim is to regionally increase the importance of research, development and innovation (RD&I) for economic competitiveness and provide for more efficient use of public resources. Although the impulse for preparing RIS3 came from outside the region, the characteristics of development in the Pilsen Region and changes in industry, employment and education brought on by digitalisation and robotics clearly represent a strong argument in favour of changing the existing approach towards supporting economic development in the region.

Preparing and implementing RIS3 is the interest and task of the institutions and companies that make up the Pilsen Region's innovation ecosystem. The Regional Authority plays an invaluable role in creating an environment for regional collaboration in RD&I, as this topic affects the broader context of economic development and the lives of citizens of the Pilsen Region. And as the contracting authority of RIS3, when implementing the strategy, the Pilsen Region primarily acts as the main partner for other RD&I stakeholders whose activities have contributed to implementing RIS3.

Pilsen Regional Authority is only able to directly perform a relatively small portion of proposed activities, e.g. those in human capital or infrastructure. The remaining activities are implemented (based on agreements and in partnership with the Pilsen Region) by other RD&I stakeholders, either as guarantor of the activities or of the collaborating subjects. Ways in which the Pilsen Region supports these activities include marketing, preparing the projects, and obtaining external resources.

The entire process of updating RIS3 is based on communication, mutual understanding of needs, and finding consensus among major stakeholders. The conclusions and recommendations have been discussed with key players. A number of active corporate and institutional representatives in the Pilsen Region Council for Research, Development and Innovation and the council's cross-sectional platforms have been involved in the RIS3 preparation process. RIS3 will also serve as a foundation for finding synergies between relevant ministries, government agencies and the Pilsen Regional Authority.

This document, the second update to RIS3, has focused on developing RD&I within a broader context. To this end, a medium-term vision for RD&I development in the Pilsen Region has been formulated within it. Meanwhile, the process of defining the main innovation and research topics for which the region has the ambition of breaking through nationally or throughout Europe (the smart specialisation process) has been launched successfully. The outputs of these tasks have been used in the second RIS3 update as part of the Smart Accelerator project in 2019.

We must stress that in the course of the smart specialisation process and the second update to the Pilsen Region's RIS3 strategy, we have successfully deepened cooperation among the stakeholders and verified new forms of communication among them. Simultaneously, we have increased other major stakeholders' interest in deeper cooperation, which is another condition for successful RIS3 implementation.

A. Analysis Section

1 The Pilsen Region's Position within the Czech Republic

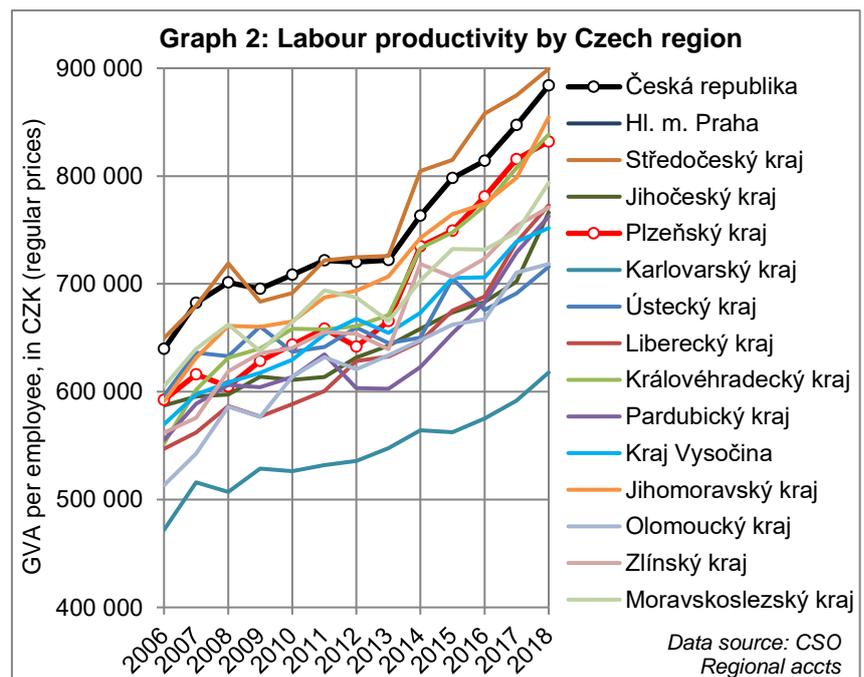
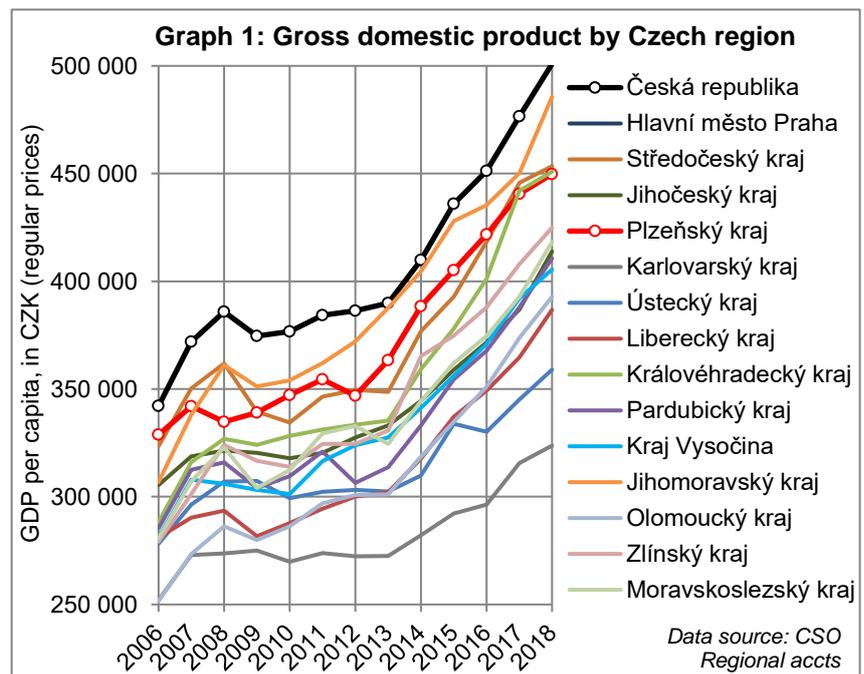
To properly evaluate the status and development of RD&I in the Pilsen Region, it is essential to first determine the region's national position in respect to selected social and economic characteristics. This chapter therefore describes the Pilsen Region's position as regards economic performance, the labour market, population trends, levels of education and the educational system.

1.1 Economic Performance in the Pilsen Region

The region's economic performance is attested to by its Gross Domestic Product (GDP), which is one of the highest among the regions, even though it remains below the average for the CR (see Graph 1; Prague is outside the range). In 2018 the per capita GDP of the Pilsen Region was 450,000 CZK.

The economic crisis led to a drop in the GDP per capita in 2008–2012. However, this was followed by a sharp increase starting in 2012 (the average yearly growth rate in 2012–2017 was 4.9%). The region spent a long time in 3rd place for this indicator (after Prague and the South Moravian Region); in 2017 and 2018, however, it dropped to 5th place.

In terms of work productivity and average GDP per employee, the Pilsen Region has fluctuated long-term between 5th and 10th place among the regions (see graph 2; Prague is outside the range). After a previous improvement in position under this indicator in 2016 and 2017, Pilsen Region ranked 5th in 2018. In 2018, the region's gross added value per 1 employee as measured by the Czech



Statistical Office (CSO) was CZK 832,000.

Labour productivity growth in real terms was seen in 2006–2018 for the majority of sectors within the Pilsen Region (see Graph P1 in the appendix). A decrease was only seen in the Information and Communication sector. A sectoral comparison of labour productivity among regions shows that the Pilsen Region's aggregate position in the tertiary sector improved (from 10th to 4th place in the regional comparison).

1.2 The Labour Market in the Pilsen Region

For the entire monitored period, unemployment (serving here as a primary indicator of the labour-market situation) was significantly below average in the Pilsen Region compared to other regions (see Graph P2 in the appendix). The Pilsen Region ranked the most poorly among the Czech regions during the economic crisis, from the spring of 2008 until late 2010 (5th place).

Unemployment in the region has remained below 4% since May 2016, and in mid-2017, it was even hovering near 1.9%. In 2019, despite the region's very low share of unemployment, its rank deteriorated somewhat (below the Pardubice, South Bohemian and Prague regions).

The Pilsen Region is also unique within the Czech Republic with regard to the structure of employment by CZ-ISCO major group in 2018, as demonstrated in Graph P3 in the appendix. Whereas Technical and Specialist Workers (main group 3) and Craft and Related Trades Workers (main group 7) have the highest share in employment nationwide and in most regions, the Pilsen Region is instead dominated by Plant and Machine Operators and Assemblers (main group 8 – 19%). A similar situation exists in the Liberec and South Bohemian regions. This indicates a greater share of less qualified labour in the region.

Professionals (main group 2) have the 4th largest share in employment within the Pilsen Region. In its share of Employment Specialists, the region ranks 6th out of the nation's 14 regions with a value of 13.8% for 2018 (a rise from 9th place in 2017).

Wage trends are another important indicator of the situation on the labour market. A comparison of the regions shows that overall and in select groups of employees, the Pilsen Region has ranked 4th here among the nation's regions in recent years, and yet it has usually also been below the national average (see Graphs P5 in the appendix). The wage-growth tempo in the region has developed favourably; in 2013–2017, it was the fastest (5.6% on average per year) compared to other regions and the nation overall (4.1%).

In 2018, the average gross monthly wages in the region amounted to CZK 33,000, with wages for Professionals (CZK 47,400) being the 4th highest among regions; the situation was similar for ICT Specialist wages (CZK 43,300) (see Graphs P4 in the appendix). Comparing the rate of wage growth among individual groups of professions in the Pilsen Region between 2014 and 2018, we can state that average monthly wages grew faster (annual average +6.2%) than among Professionals (+4.6%). The labour shortage that the region is currently experiencing, particularly in the less-qualified professions, is leading to more rapid wage growth in those groups. However, the increase in ICT Specialist wages (+6.9%) was higher than the average rate of growth in the region.

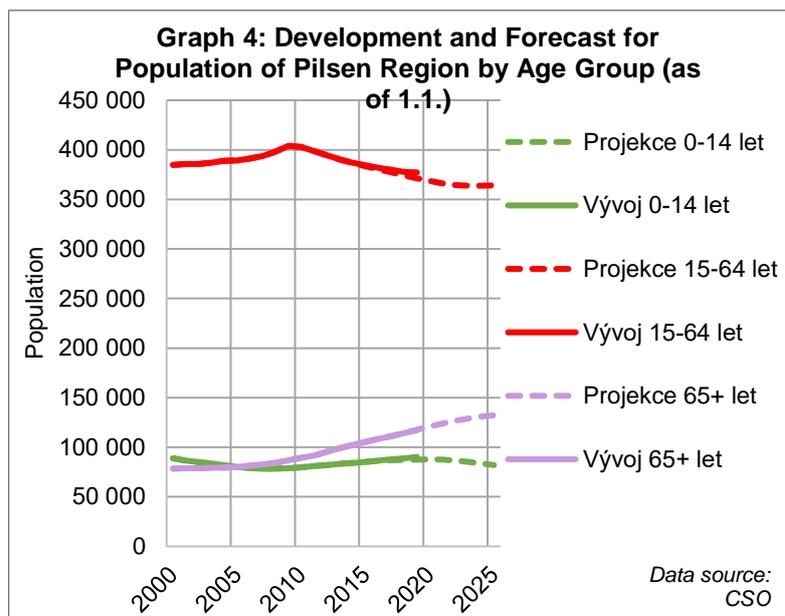
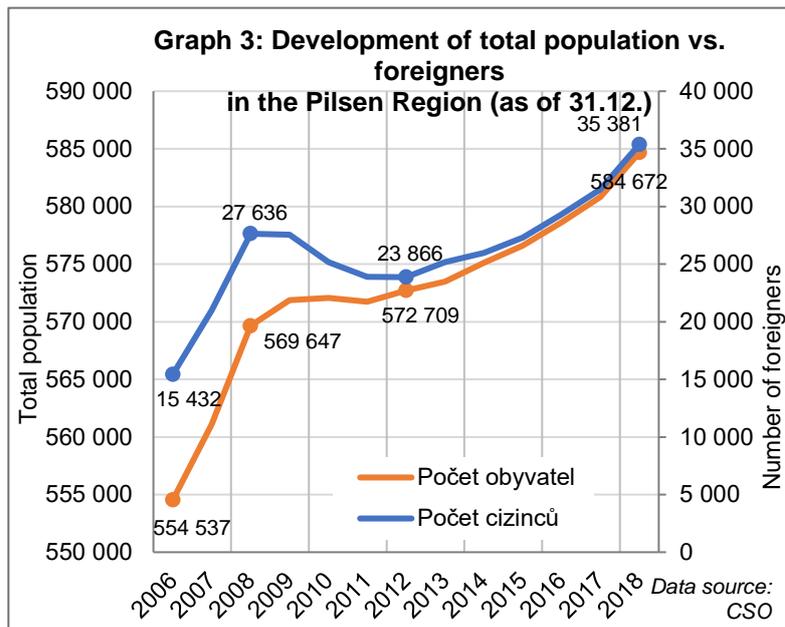
1.3 Human Capital in the Pilsen Region

1.3.1 The Pilsen Region's Population and Its Expected Trends

The Pilsen Region's population has been growing continuously since 2005. From 2005 to 2018, it increased from 551,500 to 584,600 (see Graph 3). This amounts to an increase of

33,100 – i.e. 6% of the population in 13 years. The most rapid population growth was between 2005 and 2009, when the population grew by nearly 20,000. International migration played a significant role in this growth. In 2018, the Pilsen Region was already home to 35,400 foreign residents.

Graph 4 shows the real development of the Pilsen Region's population levels (both overall and for persons below working age) over a broad timespan (from 2000 to 2019). Graph 4 also shows the projected development from 2013 to 2025 (dashed line). It can be seen that the number of persons of working age (15–64 years old) has been decreasing since 2009, and according to the demographic forecasts of the CSO (incl. migration), this decrease will continue. From 2009 to 2019, the number of residents of working age in the region fell by nearly 7%. Intense growth (46%) was seen for the category containing persons who were past working age (over 65 years old) in 2005–2019. With respect to education, it is important that the number of residents of pre-working age, i.e. 0–14, in the Pilsen Region has risen slightly since 2007, and in 2019 it displayed (as of this writing) the strongest growth of the entire monitored period. In future, this same peak will advance to the secondary school and university ages.



The difference between the actual and predicted population for the Pilsen Region in 2019 was roughly 8,000, bringing it above the expected figure for 2025. The reason for the Pilsen Region's more favourable demographic development lies primarily in the current economic growth, which has led to a greater migration balance in the region's favour. Due to this, the regional population projections need to be updated based on the CSO's new forecasts, which will be published at the end of 2019.

1.3.2 The Educational Structure of the Pilsen Region's Populace

Our assessment of the educational structure of the Pilsen Region's populace is based on the Population and Housing Census (CSO); it provides region-level data that is the most

comprehensive and is sufficient for our purposes (see Table P5 in the Appendix). In 2011, the share of persons who had completed their secondary education was 27%, representing the 5th largest share among the regions. In the ranking by share of university-educated residents, the region dropped from 4th place in 2001 (7.8%) to 8th place in 2011 (10.4%).

Based on a forecast of educational structures (Mazouch and Fischer, 2011) a further drop in the Pilsen Region's ranking for the share of its population with a university education can be expected in the coming years. The declining student count at the University of West Bohemia in Pilsen (see below) confirms the reality of this threat.

Within Eurostat's assessment of level of education according to share of the population with tertiary education aged 30 to 34, the Czech Republic ranked down in 26th place in 2018, with a mere 33% (see Table P6 in the appendix). However, in 2007–2018, the Czechs saw the 3rd largest growth in this share among all 35 of the states that Eurostat monitored. In term of NUTS 2 territorial units, the Southwest was down in 5th place out of the 8 such units in the nation (29.2%) and in 238th place out of a total of 298 evaluated NUTS 2 units within the EU.

The structure of the age groups based on the results of PHC 2011 enables us to predict long-term developments in fields of study among university graduates (see Graph P7 in the appendix). The total numbers of university graduates living in the Pilsen Region increase with decreasing age past the 40–44 age group (past years of birth between 1967 and 1971). In the 25–29 age group, graduate numbers were 60% higher; this is connected with the increasing student admittance at universities.

Among the larger groups of fields of study, the numbers of graduates of Engineering and, in the past 25 years, Education show relative stability. However, the shares of each of these groups fell. In absolute and relative terms, gains were primarily seen in Social Sciences; among the less numerous groups, gains were seen in Business and Administration, Humanities and Social Services; and in the sciences there were increases in Computing, Mathematics and Life and Physical Sciences.

The rising number of female university students was a main contributor to the overall growth in the number of university-educated residents and in the number of university-educated residents who had studied a non-science subject. Starting with the generation of women born around 1980, the number of female university graduates now exceeds the number of male graduates (all in Graph P8 in the appendix).

1.4 Education in the Pilsen Region

In the 2018/19 school year, secondary education in the Pilsen Region was offered by a total of 55 secondary schools (SS), with most of these having been founded by the region (43); 9 were private, and 3 were parochial. The Pilsen Region also hosts four post-secondary vocational schools (colleges) founded by the region and one private college. About half of the schools of these types are concentrated in Pilsen (26 secondary schools and 3 colleges).

Pilsen is also home to the University of West Bohemia (9 faculties) and Charles University's Faculty of Medicine in Pilsen, and the Prague-based private Metropolitan University (Metropolitní univerzita Praha, o.p.s.) has a branch here as well.

1.4.1 Secondary School Graduates in the Pilsen Region

The main outputs of secondary schools with relevance for the development of RD&I in the region are graduates of secondary schools with a government-certified examination (treated here as GCEs). Their numbers have been falling since 2007 both inside and outside of the

Pilsen Region; this is caused partly by the unfavourable demographic development of this age group, and partly by the introduction of mandatory national GCEs.

While the number of graduates with GCEs fell nationwide between the 2011/12 and 2017/18 school years by over 27%, in the Pilsen Region this drop was smaller (24%) and was the 4th smallest drop among the regions (see Table P9 in the appendix).

The largest numbers of graduates in the 2017/18 school year by groups of disciplines (see Table P10 in the appendix) were in Gymnasium schools, followed by Economics, Business, and Enterprise (372) and, in third place, Natural Science (186), represented primarily by graduates of ICT fields.

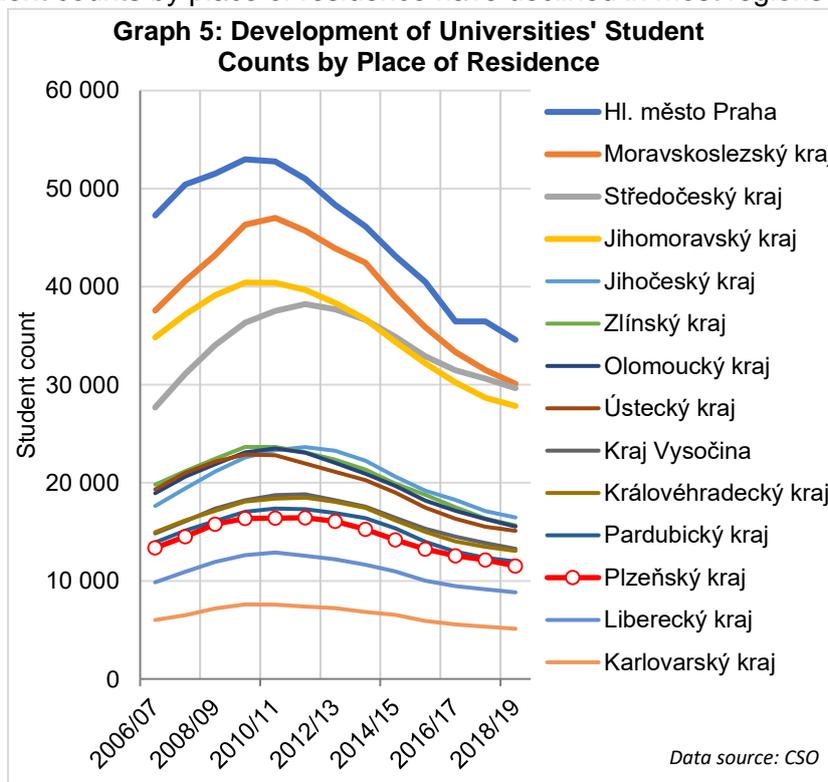
In addition to Natural Sciences, Medical and Health Care disciplines (+60%) saw the greatest increase in secondary school graduate numbers in the Pilsen Region for the 2011/12–2017/18 period. Among technical disciplines, only the number of graduates from the mechanical engineering and engineering-based manufacturing fields experienced slight growth (+2.1%), although this group dropped by 24% within the nation overall in the same period.

The greatest drop in graduate counts in the region was registered in the Electrical Engineering, Telecommunications, and Information Technology groups of disciplines (-47%, partly under the influence of moving the information-sciences disciplines into the natural sciences), Other Technical Fields (-43%), Construction and Architecture (-54%), and Economics, Business and Enterprise (-36%).

1.4.2 University Students Living in the Pilsen Region

In recent years, university student counts by place of residence have declined in most regions (see Graph 5). The Pilsen Region experienced a 30% decline between the 2011/12 and 2018/19 school years, which is higher than the nationwide average (26%). The Pilsen Region was in 12th place in 2018, with 11,600 university students residing here permanently. Several regions with lower populations (Hradec Králové, Pardubice, Vysočina) have a higher number of university students.

The largest resident student counts were reached primarily in the 2011/12 school year (6 regions incl. the Pilsen Region). In other regions, the student counts reached their maximum in the previous two years.



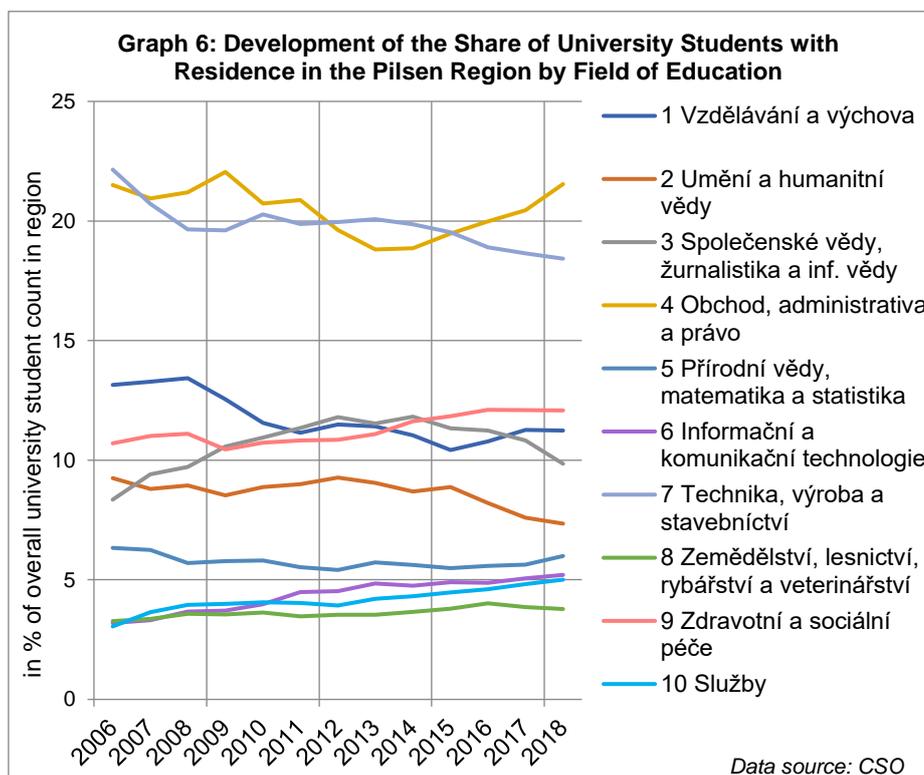
The causes for the reduced university-student figures are a demographic drop in the number of students of university age, as well as a reduction in the share of students in the 20–24 age group (see Graphs P11 and P12 in the appendix). This drop in share concerns all the regions

and seems to have been caused by the Ministry of Education's efforts to avoid further increasing the proportion of university students and graduates in the Czech Republic.

In the Pilsen Region, a decrease by 11,200 persons occurred in the 20–24 age group in 2008–2018, which represented a 30% decrease in the given age group. Based on the share of resident university students in the population aged 20–24, the Pilsen Region placed only 11th in 2018, with a figure of 43%. The region has long been under the nationwide average here.

Students at Czech universities living in the Pilsen Region in 2006–2018 most frequently studied Business, Management, Law, with an increasing share in recent years (a 22% share of university students permanently residing in the region in 2018 – see Graph 6). In 2012 through 2014, the greatest share of students studied Engineering, Manufacturing and Construction (18% in 2018). The largest growth in share was seen by Information and Communication Technologies (from 3.1% to 5.2%), which even managed to be the only discipline in the region in which the absolute numbers of university students grew during the monitored period. The share for Humanities and Social Services is growing as well; its figure of 12% put it in 3rd place among the disciplines studied by university students permanently residing in the Pilsen Region. Meanwhile, however, a significant decrease occurred during the monitored period for the Education and Training discipline.

Compared to other regions, the share of Czech students studying the natural sciences is lower relative to the population aged 20–24 (see Graph P13 in the appendix). In the monitored period, the region ranked between 9th and 13th place, significantly below the Czech national average and increasingly behind the average due to stagnation. The increase in the Czech national average is increasingly influenced by foreign students.



When looking at the internal structure within the Natural Sciences, Pilsen Region excelled primarily in the share of students in mathematics and statistics (see Graph P14 in the appendix).

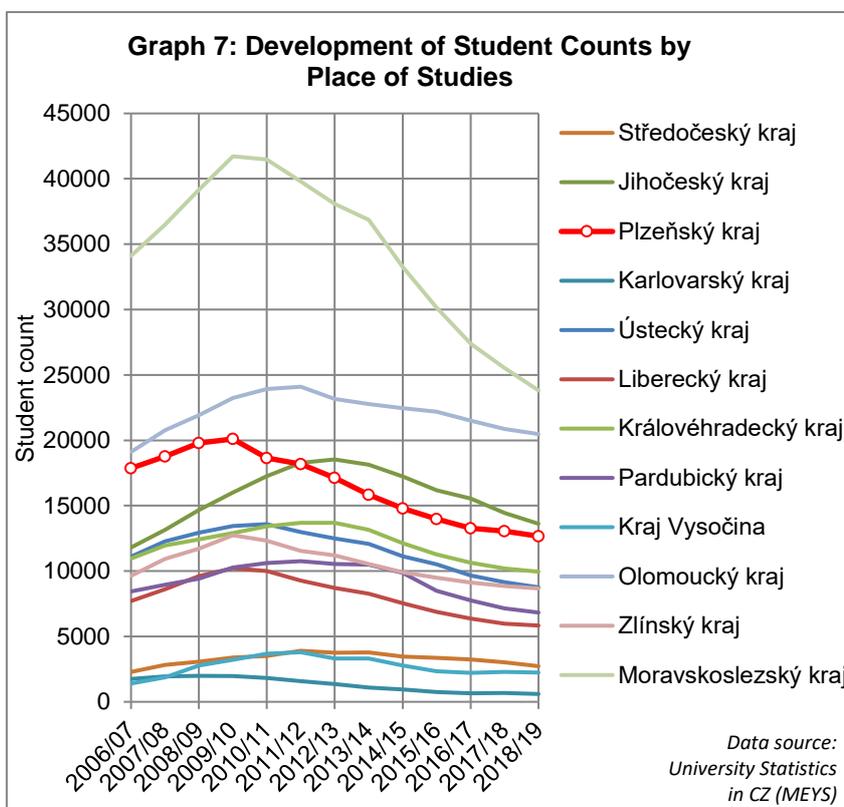
With respect to students studying in technical fields at universities in the Czech Republic, the Pilsen Region's position is better than it is for Natural Science. Although the share of students with this focus in the Pilsen Region is lower than the Czech national average, the region ranged between 4th and 9th place (see Graph P15 in the appendix). The persisting interest in engineering subjects is likely caused by the region's history of industry and technical universities. Among the technical disciplines, the region is exceptional especially in the fields of engineering and mechanical engineering, where the share of students is above the Czech

average and is in 2nd place compared to other regions, behind the South Moravian Region (see Graph P16 in the appendix).

1.4.3 Universities and Faculties in the Pilsen Region

The Pilsen Region is home to the University of West Bohemia in Pilsen with its 9 faculties, and to Charles University's Faculty of Medicine in Pilsen. The Prague-based private Metropolitan University (Metropolitní univerzita Praha, o.p.s.) has a branch here as well.

A regional comparison of the trend for the number of university students by place of studies from 2006/7 to 2017/18 is depicted in Graph 7 (it does not include the 2 regions with the largest numbers of university students – Prague, South Moravian Region).



During the monitored period, all the regions saw a period of growth – but also one of decline – in the numbers of university students by place of studies. The differences among the regions here were primarily in the intensity of changes and in the year in which this indicator peaked for the region – and when it reached its nadir as well.

The university student count in the Pilsen Region peaked in the 2009/10 school year (20,100 students); this count has been falling continuously since that time. In the 2018/19 school year, 12,700 students were studying here, amounting to roughly a loss of 7,400 students (-37%) in the course of 9 years. Only 4 regions saw a larger relative drop in their numbers of university students (the Karlovy Vary, Vysočina and Moravian-Silesian Regions). The neighbouring South Bohemian Region had much more favourable trend lines in terms of its university student count than the Pilsen Region did.

Besides the demographical drop, growth in the share of people leaving the region for university studies elsewhere play a role in the drop in student counts at universities in the Pilsen Region (see Graph P17 in the appendix). One thing that can be viewed positively here is the stabilising number of students commuting from other regions, which increased the share of those studying in the Pilsen Region in the last few years (from 48% in 2012/13–2013/14 up to 53% in 2018/19).

The trends for the numbers of university students in the Pilsen Region by individual faculty are shown in Table P18 in the appendix. From 2006/7 to 2018/19, Charles University's Faculty of Medicine in Pilsen had a very favourable trend line here. It maintained stable student counts of around 2,000 throughout the entire monitored period. In terms of the number of students, the significant important university in the Pilsen Region was the University of West Bohemia.

Meanwhile its student count dropped from 18,000 in the 2009/10 school year to 10,400 in 2018/19, i.e. a 42% drop.

Out of this university's faculties, only the newest, the Ladislav Sutnar Faculty of Design and Art, has maintained relatively stable student counts. In the last monitored year, the Faculty of Health Care Studies – another relatively new faculty – achieved the highest number of students, exceeding the Faculty of Electrical Engineering. The Faculty of Mechanical Engineering had a relatively favourable trend as well. The student counts at the Faculty of Electrical Engineering and the Faculty of Arts, on the contrary, dropped by less than one half.

The development of the share of women within the overall university student count by place of studies is documented in Graph P19 in the appendix. In the 2006/7 school year, the share of women in the total number of students at universities in the Pilsen Region was 48.6%. This share went on to rise all the way to 55.2% in 2018/19. This amounted to an improvement from 13th to 8th place in the regional comparison. In certain regions, the share of women significantly exceeds 60%.

The trend for the shares of students from abroad as classified by universities' regions is shown in Graph P20 in the appendix. In the Pilsen Region, this share did not begin to grow quickly until 2012/13 (4.8%). By 2018/19, it had reached 8.8%. Other regions had similar trends for the share of students in their total university student counts.

From the standpoint of the future development of RD&I in the Pilsen Region, one very fundamental point is the structuration of the fields of study of university students in the region, with respect to both place of residence and place of studies. Table P21 in the appendix shows this data for the Pilsen Region in 2018 in comparison with the entire country, classified by fields of study based on the International Standard Classification of Education, for bachelor's and master's studies, with no differentiation by subsequent master's studies. The counts are totals, with no differentiation by type of studies.

In total, the Pilsen Region has roughly a 4% share in the nation's university students by place of residence, even though its share in the population is 5.5%. There are large differences in the shares of students studying in the regions of the CR depending on education level. The Pilsen Region has a 3.8% share in students of bachelor's fields, it has a 5.4% share in students of master's fields, and it has a total share of 4.3% (including doctoral studies).

From the standpoint of the structure of students' fields of study by place of studies, the Pilsen Region has the highest share in the nation primarily in certain groups of technical, medical and artistic fields – but also in certain of the social sciences and in law.

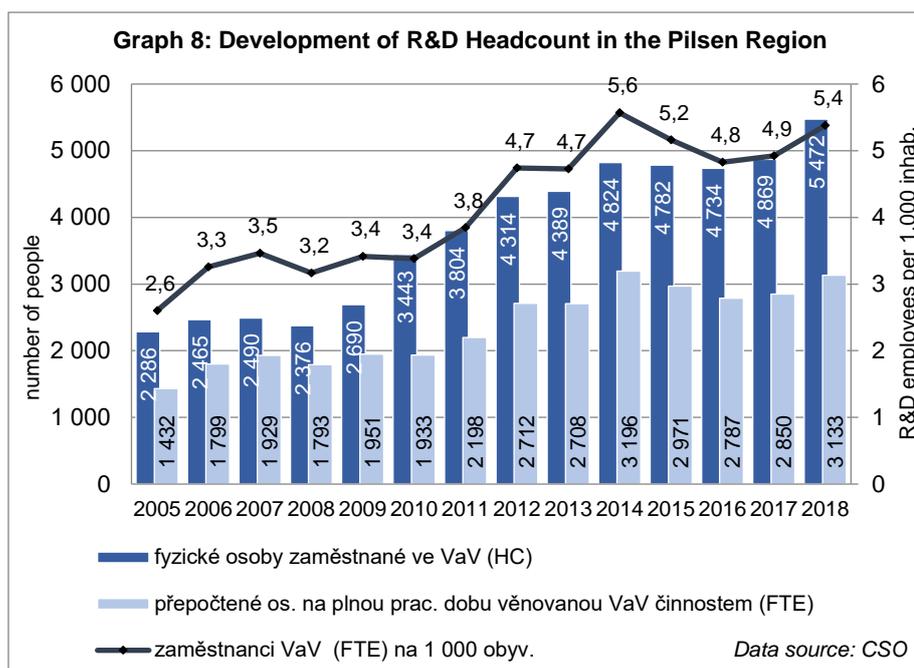
With respect to the structure of fields of study by place of residence, the region has the largest shares in the nation in master's studies in Interdisciplinary Programmes and qualifications encompassing education; it has the largest share in bachelor's studies in Teacher Preparation for Preschool Education, it has the largest share in master's studies in Mathematics, it has the largest share in both bachelor's and master's studies in Electronics and Automation, it has the largest share in master's studies in Nursing Care and Delivery Assistance, Medical Diagnostics and Treatment Techniques, and it has the largest share in bachelor's studies in Law.

2 Research, Development and Innovation in the Pilsen Region

This chapter describes the current status and future developments for RD&I in the Pilsen Region. The main information source here is data from the CSO, or in certain cases Eurostat.

2.1 Employment in Research and Development

Employee counts in R&D in the Pilsen Region have shown a long-term growth trend (see Graph 8). In 2010–2014, the number of R&D employees rose significantly; the Pilsen Region was the fastest-growing compared to other regions, apparently partly as a result of the newly established R&D centres at its universities.



In 2015 and 2016 there was a slight decrease in the number of full-time equivalents in R&D (FTEs¹), while the headcount of people employed in R&D (HC)² stagnated, signalling a reduction in the hours worked by R&D employees. This is apparently related to a drop in investments from public funds from abroad, especially in the university sector (see below). This trend also continued in 2018, with the headcount of people and FTEs both increasing.

In 2018, the overall number of employees in R&D in the region grew to 5,500 people (HC) and 3,100 employees (FTE). As a result, Pilsen Region neared its 2014 high in share of employees (FTE) per capita and in regional ranking (4th place – see graph P22 in the appendix).

In terms of the sectoral distribution of R&D employees, over 60% of them (FTE) work in the business sector (see Graph P23 in the appendix) and 34% are employees in the university sector. In 2006, these shares were the opposite. Considerable numbers of R&D employees still work in the governmental and private sectors.

Rapid growth in the number of persons employed in R&D in the business sector was especially seen in 2008–2012. Employee numbers in the university sector have been also stabilising in recent years.

The region has a significant share of R&D employees in engineering (72%); over the last 10 years, their numbers have doubled. 11% work in natural science, 7% work in the humanities, and medicine employs 7% of the region's R&D employees (see Graph P24 in the appendix).

The region's employment structure for R&D (FTEs) by prevailing economic activity is as follows: 33% of the employees in R&D work in education; 31% in industry; 22% work in research and engineering; and 8% work in information and communication (see Graph P25 in the appendix). In the Information and Communication sector, the decrease in the number of R&D employees that had been registered for the previous 2 years came to a halt in 2018.

¹ R&D employees (FTE) – Full-time equivalents working in R&D activities

² R&D employees (HC) – Individuals employed in R&D

Compared to the structures in other regions, the Pilsen Region shows a lower share of employment in R&D in industry and construction and a higher share in education.

2.2 Research and Development Sites

In 2018 the CSO registered a total of 140 R&D sites in the region, amounting to 4.5% of the total number of sites in the country (see Graph 9). In the long term, the total number of R&D sites in the region is growing, but the number of sites for which R&D is the main activity is stagnating somewhat. Nine such sites were on record for the region in 2018.

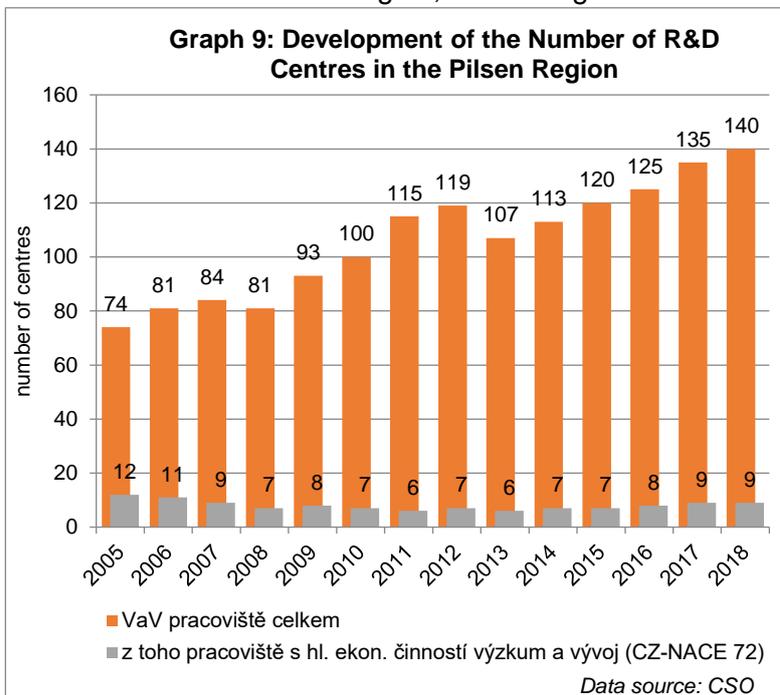
The largest number of sites was concentrated into the business sector (114 in 2018) and the education sector (17); there were 6 sites in the government sector and 3 in the private non-profit sector.

Compared to the size structure for R&D sites in the other regions, this structure has a higher concentration of large R&D sites within the Pilsen Region (see Graph P26 in the appendix), while on the other hand it has the 4th lowest share of the smallest sites, i.e. those with fewer than 5 staff members (just under 49%; the Czech average is 50%).

Most of the sites in the region (86 of them) are focused on engineering. However, the strongest growth was displayed by sites for the natural sciences (from 6 sites to 31 sites in 2018). The humanities had 8, social sciences 6, and medicine had 5 sites (see Graph P27 in the appendix).

In terms of the prevailing economic activity (see Graph P28 in the appendix) nearly half of the R&D sites in the region are in the Construction and Industry sector, 18% of the sites are in Information and Communication and 12% are in Professional, Scientific and Technical activities, and 11% in Education. The Pilsen Region also has a fairly diverse R&D-site structure in comparison with the remaining regions. Compared to other regions, the Pilsen Region has higher shares of sites in the Information and Communication sector and the Education sector.

Over the last 4 years (2015–2018), there has been an interesting development in the Information and Communication sector. The number of R&D sites has increased from 16 to 25, while the number of R&D employees (FTEs) has dropped by more than 100.



2.3 Financing Research & Development

R&D expenditures in the Pilsen Region have grown intensely, above all in the 2009–2014 period (see Graph 10).

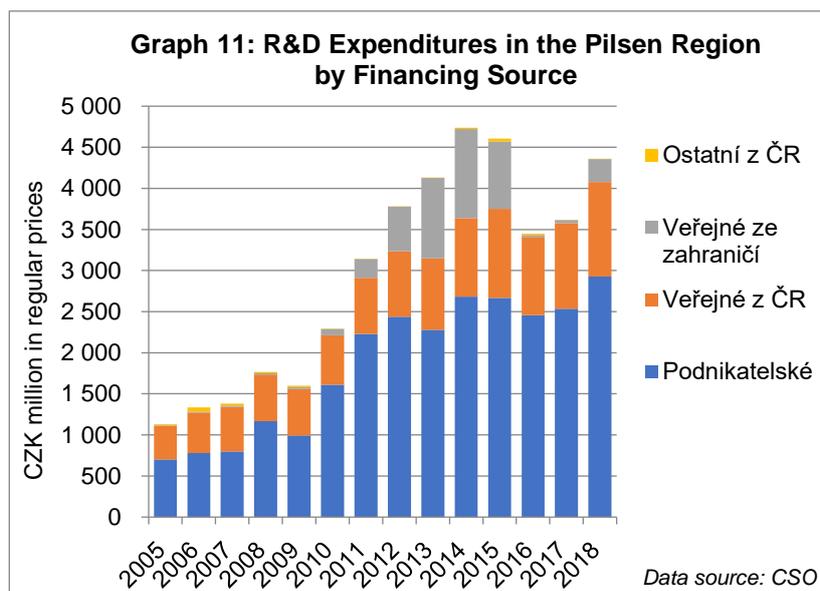
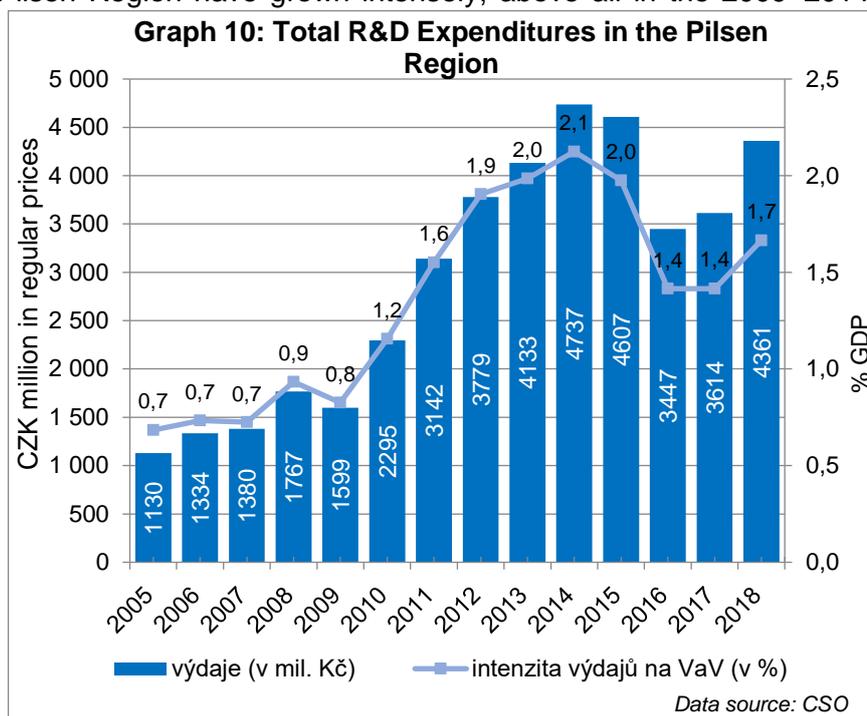
The region saw the largest R&D expenditures in 2014 (roughly CZK 4.7 billion). There was a slight decline in 2015, while in 2016–2017, R&D expenditures fell significantly. This was part of a nationwide trend connected with a drop in EU investments into the public sector, but between 2015 and 2017, the Pilsen Region saw the largest year-to-year drop in R&D expenditures (by CZK 1.0 billion, i.e. -22%). In 2018

total R&D expenditures in the region grew, as was the case in all other regions of the Czech Republic.

The intensity of R&D expenditures (measured as the ratio of R&D expenditures to the regional GDP) saw gradual evolution within the region during past years (see Graph P29 in the appendix), and with respect to this indicator, the region lay in 3rd place among the regions. After the recent reduction in expenditures, the region dropped to 6th place in 2017 and 2018 (1.7% of GDP in 2018).

According to one of the goals of the Lisbon Strategy, which was also accepted into the current Europe 2020 Strategy, investment in R&D should be at least 3% of GDP. However, only the South Moravian Region has made it past this 3% line in 2012–2015. Meanwhile, the nation overall peaked in 2014 at only 2.0%. For comparison, in 2017 the intensity of R&D expenditures nationwide was 1.8%, putting the Czech Republic at 10th place among the states of the EU (the highest place among the new member states other than Slovenia – see Table P30 in the appendix).

R&D expenditure trends by source in the Pilsen Region (see Graph 11) show that by 2009 the business sector, which over

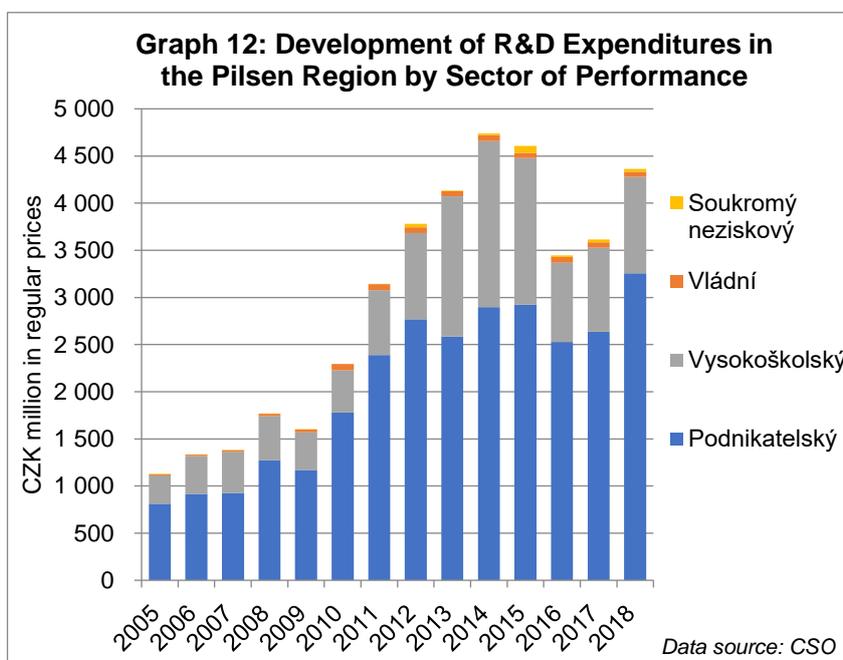


the long term has had the greatest share in funds, had already increased its R&D expenditures. Public funds from abroad were only injected after 2010, and they also supported an increase in public funding from the Czech Republic. In 2016–2017, expenditures made by public funds from abroad decreased significantly, leading to both a decrease in overall expenditures and a change in their structure.

The most significant sector – business – financed two-thirds of the R&D expenditures in 2018 (only 58% in 2015). Czech public sources amount for 26% of the expenditures in the region, and the remaining 6% are public funds from abroad. Meanwhile, in 2013 public funds from abroad comprised nearly 24% of the total R&D expenditures in the Pilsen Region.

Graphs P31 and P33 in the appendix show the evolution of the intensities of expenditures for individual financing sources. After 2014, the intensity for public funds from abroad dropped significantly, with the region dropping from 2nd place to 13th place in 2017. The level for public funds from the Czech Republic has been growing slightly over the long term. In 2018 the Pilsen Region held fast in 7th place among the regions. Since 2014, the intensity of expenditures from the business sector has fallen slightly. In 2011–12 the Pilsen Region even outdid all the other regions. However, in 2018 it was in 6th place in the Czech Republic according to this indicator.

In 2018 nearly 75% of the region's R&D was performed in the business sector and only 23% if R&D was carried out in the educational sector (see Graph 12). The governmental and private non-profit sectors are insignificant in this regard. In connection with the decline in investments from abroad, there has been a drop in R&D primarily in the university sector (a drop from CZK 1.7 billion in 2014 to CZK 1.0 billion in 2017).



Over the course of 2005 to 2018, there were changes

in the structure of R&D expenditures in the Pilsen Region by type of expenditures (see Graph P34 in the appendix). By 2010, salaries and other regular expenditures were in equal measure, and capital expenditures were minimal. Capital expenditures for R&D grew until 2014, while after this there was a sharp decrease in investments, in connection with the drop in public R&D funding from abroad. In 2018 capital expenditures recovered t CZK 525 million CZK, representing 12% of all R&D expenditures in the region.

In 2018, the largest volume out of the R&D expenditures in the region was devoted towards engineering (83% of R&D expenses), 8% went towards natural sciences and 4% towards medicine (see graph P35 in the appendix).

2.4 The Level of Collaboration in the Business and University Sector

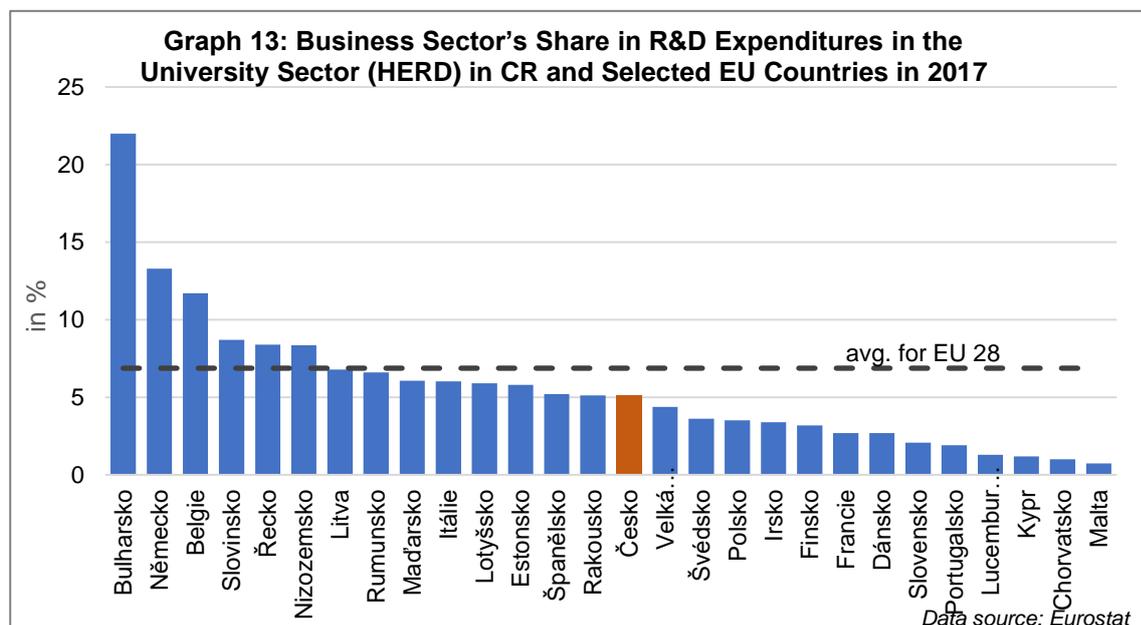
Despite growth in recent years, the level of R&D collaboration between the business and university sectors in the Pilsen Region remains very low (see Table P36 in the appendix). In 2018, only 2.3% of funds from businesses were directed towards the university sector for performing R&D, where these funds accounted for 6.6% of the overall funds. In comparison to other regions in terms of the share of the business sector's expenditures into R&D performed at universities, the Pilsen Region with its 2.3% in 2017 shared 5th place with Prague, while the Czech average was 1.9% (graph P37 in the appendix).

In absolute terms, the business sector's expenditures into R&D that is performed in the university sector have grown in recent years. In 2012, these expenditures amounted to CZK 18 million; by 2017 they had grown to CZK 74 million – the 4th highest value among the regions (see Graph P38).

Despite the absolute growth for this type of expenditure, the Pilsen Region's share in the nationwide figure decreased, primarily due to growth in the South Moravian Region. The region's nationwide share of the business sector's expenditures made in the university sector dropped from 20% in 2011 to values hovering around 7% in recent years.

The dominant sources for university R&D in Pilsen Region were public funds from the Czech Republic (84% in 2018). The business R&D performance sector utilised public funds to only a small extent (7% from the Czech Republic and 6% from abroad).

When one compares collaboration between the business and university sectors in R&D among the countries of the EU (see Graph 13), it is clear that the level of participation by businesses



in the financing of Czech university research is still below the average for the EU (15th place). The situation did, however, improve when the nation advanced out of 26th place in 2011. The largest shares are, as usual, held by Germany and Belgium (13%); leaders among the new members of the EU are Bulgaria, Lithuania, and Slovenia.

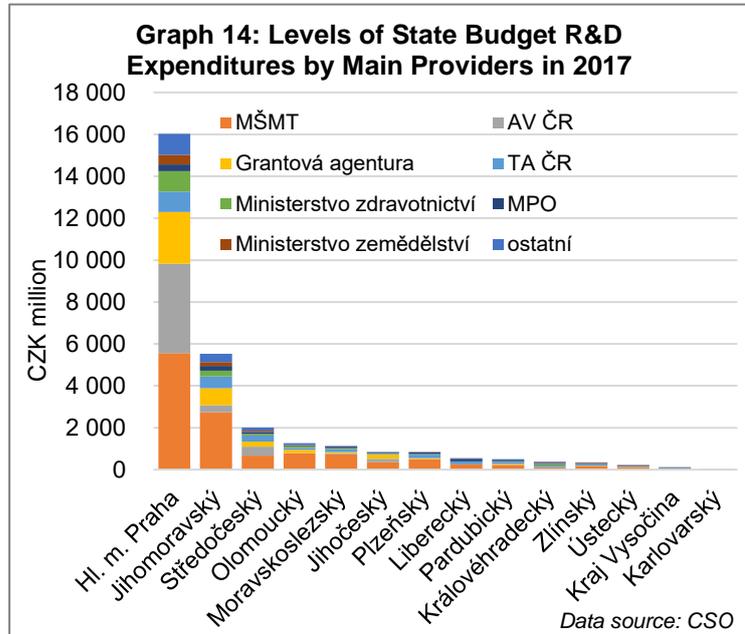
Table P39 in the appendix, meanwhile, contains a comparison among EU countries of the shares of business-sector expenses for R&D flowing towards universities on the one hand with the business sector's overall R&D expenditures on the other. The Czech Republic was below the EU average for this indicator as well, but not as much – it was only in 11th place. One very positive fact here is that the Czech Republic has advanced the most out of the EU in the last

10 years. The top ranks are occupied by the Baltic countries, where the university sector has traditionally had a high share of overall R&D expenditures.

2.5 Support for Research and Development

2.5.1 State Budget Expenditures

State budget expenditures into R&D play an especially major role in the university sector and public research institutions. In 2017, the state provided R&D support in the amount of CZK 30 billion, representing one third of all R&D expenditures in the nation. Over half of the state-budget expenditures on R&D go towards Prague; meanwhile the Pilsen Region is down in 7th, with a share of 2.7% and a figure of CZK 832 million (see Graph 14). State-budget revenues flowing into R&D in the region make up 23% of overall R&D expenditures. Targeted support (CZK 499 million) in the region exceeds institutional support (CZK 333 million), with over three quarters of state support going towards the university sector and only 16% ending up in private companies (see Graph P40 in the appendix).



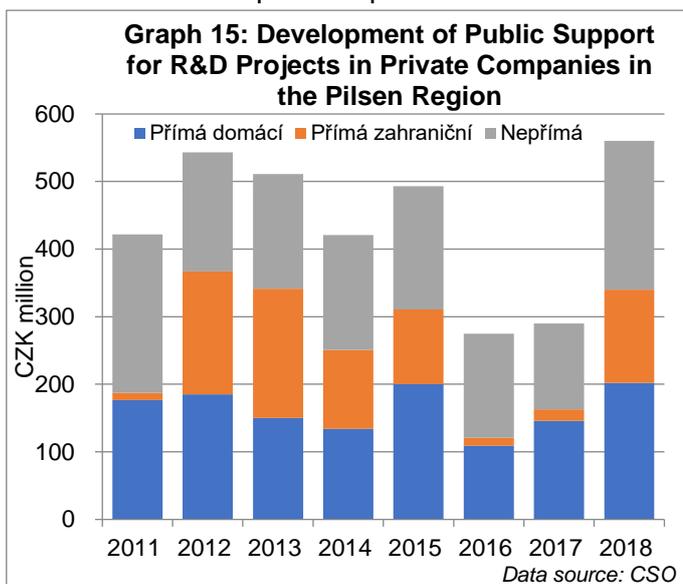
The main providers of state support for R&D in the region include the Ministry of Education (60%), the Technology Agency of the Czech Republic (20%), the Ministry of Industry and Trade (9%) and the nation's Grant Agency (5%). (See Graph P41 in the appendix.)

With respect to the structure of state support by major social and economic goals of R&D (see Graph P42 in the appendix), nationwide nearly 60% of expenditures go towards research that is general or has no specific orientation. In this area, the Pilsen Region primarily excels in engineering, mathematics and computing. Another major R&D direction is Industrial Production and Technologies (30% of state support in the region).

2.5.2 Public Support in Private Companies

Public support for R&D at private companies in the Czech Republic is provided either as direct support from public budgets, or as indirect support in the form of a tax deduction for deductible R&D expenditures. In 2018, the Pilsen Region ranked 7th in the nation in its number of companies that used public support (see Graph P43 in the appendix). In terms of the amount of support used, the region ranked 4th.

The overall public funding inside the region in 2018 was CZK 561 million (Graph 15), which was the highest for the monitored period and two times more than in previous years.



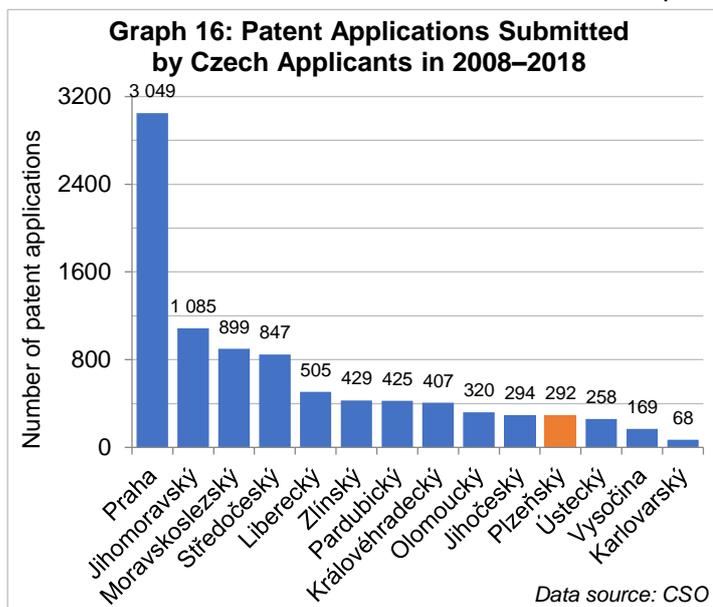
In terms of the structure of public funding for private enterprises in the region, in 2018 direct domestic support comprised CZK 202 million (36 for 34 companies), direct foreign support was CZK 138 million (25% for 23 companies), and indirect support was CZK 220 million (39% for 47 companies). Direct domestic funding oscillated long-term around CZK 150 million per year. Direct foreign support in the region culminated in 2012–2013 and then fell to a minimum. Indirect support in the form of tax write-offs grew after declining over the last two years.

The ratio of indirect support to GDP in private enterprises in the region has fallen since 2011 to the Czech average in 2017 see Graph P44 in the appendix). In 2018, Pilsen Region returned to among the regions with the highest figure for this indicator.

With regard to funded companies' sizes by number of employees, in 2017 80% of indirect support in the region went towards large companies (over 250 employees). Indirect support saw the most use by companies under foreign control; however, measured by amount of support, domestic companies predominated here (63%). Measured by the sectoral classifications of companies with tax deductions, 60% of the region's companies were in the manufacturing industry. These received 85% of the indirect support in financial terms.

2.6 Outputs of Research and Development

Measured by the number of applications submitted to the nation's Office of Industrial Property (OIP), the patent activity in the Pilsen Region is somewhat below-average (see Graph 16 and Table P45 in the appendix). For 2008–2018, an average of approx. 27 applications per year are on record for the region. The highest application count was registered for 2014. There has been a decline since then, here as elsewhere in the country. The drop in patent applications submitted to the OIP by Czech applicants is primarily due to a change in public universities and public research organisations (a change in the methodology for compiling the results of R&D evaluations).



In 2018, 20 applications were on record for the region (3% of the applications in the nation). Relative to R&D headcount, the region has long been ranged from 11th to 14th place among the regions (see Graph P46 in the appendix). The average time from a patent application's submission until the patent is granted is around 3 years.

The Pilsen Region ranks similarly for patents granted as it does for patent applications submitted. Over the last 11 years an average of 15 patents have been granted per year, leaving the Pilsen Region down in 11th place among the regions (see Graph P47 in the appendix). Based on the number of valid patents per 1,000 R&D employees, Pilsen Region has long been below the Czech average, ranging from 10th to 14th place. It is currently becoming more and more common for entities to avoid submitting either a patent or a utility model so as to protect their internal know-how.

In 2018, a total of 144 valid patents were on record in the Pilsen Region for applicants from the Czech Republic, with most applicants coming from businesses (61%); 29% were from public universities and 9% were individuals (see Graph P48 in the appendix). When applying abroad, Czech applicants most often make use of the United States Patent and Trademark Office (USPTO); in 2017 they used it a full 3x more often than they used the European Patent Office (EPO).

Another general trend seen here is growth in the number of granted or validated patents for foreign applicants on Czech territory. Over the last 20 years, the number of patents thus granted or validated has grown by over 6 times. In 2017, 7,570 patents were granted/validated on Czech territory, with over one quarter of these pertaining to applicants from Germany – 3x as many than per Czech applicant (just 8%).

A similarly unfavourable development in Pilsen Region can also be seen for utility models (UV), which are an alternative to patents that is faster and less expensive but has a lower level of legal protection. Since 2013, the year which saw the highest number of recorded utility models (73) and during which the region was above the national average, there has been a significant

decline. For 2018, only 36 utility models are on record for applicants from the Pilsen Region (see Table P49 in the appendix).

The numbers of utility models on record are still significantly higher than the numbers of patents granted both nationwide and in the Pilsen Region. At the end of 2018, applicants from this region has 218 valid utility models (11th place – see Graph P50 in the appendix). Of this, the largest shares were held by companies (48%) and individuals (27%), followed by universities (24% – see Graph P51 in the appendix).

In 2011–2018, the Pilsen Region was among the most successful in terms of income from licensing fees, and it resided in 2nd place in 2013–2015 (with Prague in 1st – see Graph P52 in the appendix). 2017 then saw a decline and a bottoming out of the region’s share for both license count (9 licenses; 1.4% of the national total) and licensing fees (CZK 2 million; 0.1%). (Prague has long been the destination for a full 90% of the income from licensing fees.)

2.7 Innovation

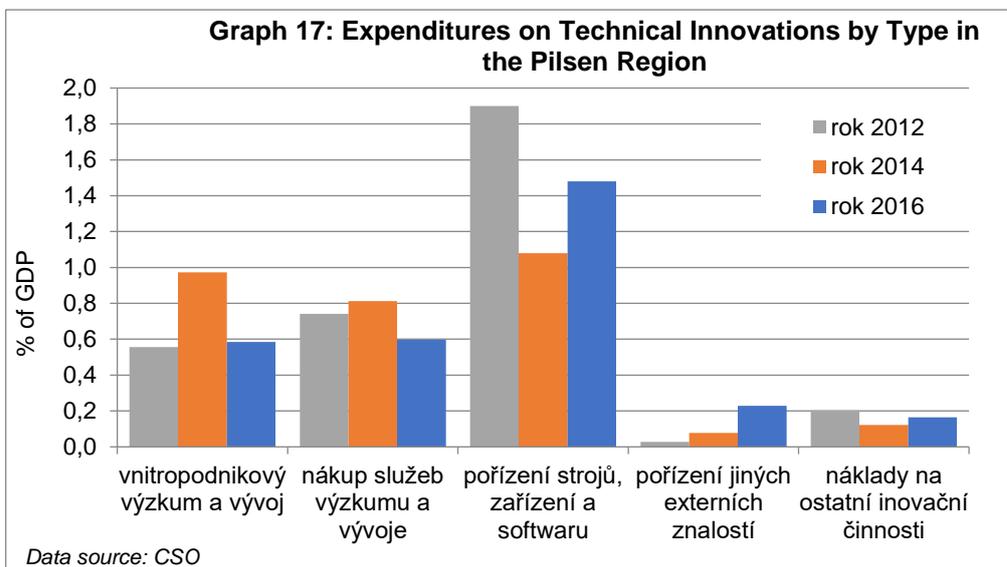
Over the long term (2008–2016), the Pilsen Region has had a very low share of innovation companies (see Table P54 in the appendix). For the most recent period, 2014–2016, the share of innovation companies in the region was 34.3%. The Pilsen Region has long ranked between 11th and 13th among the regions by share of innovation companies. Things are similar when grouping by type of innovation. The region was in 12th place by technical innovations and in 13th place by non-technical (marketing or organisational) innovations.

Measured by expenditures for technological innovation at enterprises (so as to enable comparison relative to GDP), the Pilsen Region had a very good long-term position within the Czech Republic. It ranked between 2nd and 4th place with a stable share of expenditures towards technical innovation at companies, ranging between 3.1% and 3.4% of GDP. The largest spending was primarily on acquiring machines, equipment and software; this was followed by spending on companies’ internal R&D and the purchasing of R&D services (see Graph 17).

In terms of revenues for products newly on the market or that were new for a given company, the region has seen a decline in recent years in both absolute and relative terms. While in 2014 the revenues for

innovations in the region were CZK 160 billion and the region was in 5th place, by 2016 it had dropped to 11th place among its peers (CZK 141 billion)

By intensity of technical innovations, i.e. the share of expenditures for technical innovations in the overall revenue of companies with technical innovations, the region has ranked well over the long term. It advanced from 5th to 2nd place in 2014–2016.



3 Main Innovation System Stakeholders

The main innovation system stakeholders are:

- Research organisations
- Enterprises carrying out R&D
- Application sector – companies with potential for applying the results of research, development and innovation
- Innovation infrastructure – organisations and equipment
- Public administration.

3.1 Research Organisations

The University of West Bohemia and Charles University's Faculty of Medicine in Pilsen are the two largest public research and development (R&D) organisations in the Pilsen Region. Their research is primarily focused on the fields of study represented at these universities, i.e. the disciplines taught at individual faculties and departments. The full list of scientific research centre facilities also includes research centres, which represent the main facilities for university and faculty research.

Research organisations in the Pilsen Region also primarily include COMTES FHT a.s., Research and Testing Institute Pilsen, and Řež Research Centre.

The **University of West Bohemia in Pilsen (ZČU)** comprises more than 70 scientific, research and development teams, and currently provides facilities for approximately 11,000 students pursuing bachelor's, master's and doctoral degrees. These are specialists in the fields of mechanical and electrical engineering, applied sciences, economics, education, law, medicine, the humanities and art.

ZČU's key research facilities are the following:

- **New technologies** – a research centre with the acronym NTC is a university institute of the University of West Bohemia in Pilsen, which has been dedicated to research, development, and innovation for industrial applications since 2000. NTC is focused on promising green material technology and solutions for environmentally friendly sources of energy, smart vehicles, and the quality of human life and health.
- **NTIS** – New Technology for an Innovative Society – the mission of this centre of excellence is research, development and innovation in two priority directions: Information Society and Material Research.
- **RICE** – Regional Innovation Centre for Electrical Engineering – concentrates all scientific potential into a single research programme titled Smart Industrial Systems, focusing on new propulsion and advanced technology designs for transport technology, material research, energy and industrial systems, diagnostics and testing.
- **RTI** – Regional Technology Institute – the mechanical engineering and technology research centre of the Faculty of Mechanical Engineering. Research and development is primarily focused on modern vehicle design, including drive systems, production machinery (including modernisation), shaping and metalworking technology.

A research facility for more than 300 specialists is located at **Charles University's Faculty of Medicine in Pilsen**. The faculty is one of 17 faculties of Charles University in Prague. and is strongly tied to University Hospital Pilsen. It focuses on research in the field of medical applications that represent a significant shift in patient care. To support research at LF UK, a regional research **Biomedical Centre** was constructed; it is primarily focused on organ

replacement and regeneration. LF UK's research activities have an immediate impact on the quality of education for medical professionals and on patient care. Excellence extending beyond the region's borders affect select disciplines, such as research into infectious diseases, including antibiotic resistance, molecular oncology, assisted reproduction, and neurophysiology.

COMTES FHT operates the West Bohemian Material Metallurgy Centre – a regional research centre focused on research into promising metal materials and technologies for manufacturing these metals in industry.

The primary mission of **Řež Research Centre** is research, development and innovation in the energy industry, particularly nuclear energy. As part of the SUSEN (SUStainableENergy) project, since 2012 the centre has conducted research into materials for nuclear and traditional energy and into new, unconventional methods for obtaining energy.

VZÚ Pilsen is focused on research, development and accredited testing. The company's most important activities include research and tests focused on increasing the operational reliability and lifespans of energy equipment and road and rail vehicles, and research and development for thermal spraying.

One implication of the above facts is that between 2014 and 2016, the set of research institutions in the Pilsen Region was significantly reinforced by new research-centre facilities at ZČU (CENTEM, NTIS, RICE, RTI), LF UK (Biomedical Centre) and COMTES FHT a.s. (West Bohemian Material Metallurgy Centre) that were supported from RD&I.

3.2 Enterprises Performing R&D

All companies that develop new products or introduce product and process innovations can be considered, in the broader sense, as active corporate participants in the Pilsen Region's innovation system. For the purposes of the RIS3 analysis of the Pilsen Region, innovation system stakeholders from the corporate sector are those who:

- Build or expand research and development facilities using support from public sources (i.e. they obtained support from the OPEIC – Potential programme), or
- Develop new technologies and implement new prototypes, specimens, methods or software using OPEIC – Applications, or
- Bring innovated products to market using support from public sources (i.e. they obtained support from OPEIC – Innovation), or
- Make use of the services of research organisations for their innovation activities (they have obtained support from Innovation Vouchers, Infrastructure Services, Knowledge Transfer Partnership – OPEIC, or Business Vouchers), or
- Conduct progressive activities in information technologies – OPEIC – ICT programme, or
- Use tax deductions for R&D, or
- Manage RD&I projects supported from public sources (i.e. they obtained support primarily from the Tip, Alfa, Trio, Epsilon, Application, Eureka and Eurostars programmes or the EU framework programmes), or
- Are members of centres of competence, technological platforms or clusters.

Within the **Potential** – OPEIC programme, during the EU programme period that began in 2014, 18 entities from the Pilsen Region implemented a total of 23 projects with total generated expenses exceeding CZK 1 billion. Major projects were implemented by the following companies: Daikin Industries Czech Republic s.r.o., ZF Engineering Plzeň s.r.o., Škoda

Transportation a.s., Value 4industry s.r.o. and TGS nástroje-stroje-technologické služby spol. s r.o.

Within the **Application** programme, 24 entities from the region implemented a total of 31 projects, with total generated expenses of just under CZK 700 million. Major projects were implemented by the following companies: ILC Factory a.s., Škoda Electric a.s., SMS CZ, s.r.o., Škoda Transportation a.s. and ETD Transformátory a.s.

Within the **Innovation** programme, 39 entities from the region implemented a total of 42 projects, with total generated expenses of over CZK 1.2 billion. Major projects were implemented by the following companies: Technické pružiny Scherdel s.r.o., Pebal s.r.o. and Shape Corp.

Within the programmes for supporting **research partnerships**, 58 entities participated with a total of 82 projects; total generated expenses amounted to over CZK 320 million. The most important projects within this programme were implemented by COMTES FHT a.s. Infrastructure Services (the COMTES FHT Science and Technology Park) and Vědeckotechnický park Plzeň, a.s. (development of the Pilsen Science and Technology Park and support for its operations). The following companies had noteworthy projects as well: Nanoprogress, z.s. (Collaboration – clusters), Česká technologická platforma Strojírenství, z.s. (Collaboration – technology platforms) and Sofo Advisory s.r.o. (Proof of concept). Innovation vouchers from the given sources saw performance totalling CZK 22 million of generated expenses.

The **ICT – OPEIC** programme saw the involvement of 15 entities with a total of 25 projects, with total generated expenses of nearly CZK 390 million. Important projects were implemented by the following companies: Exon s.r.o., P.V.A. systems s.r.o., Marbes Consulting s.r.o., UBK s.r.o. and Vigour Gama spol. s r.o.

Approximately 130 companies make use of **tax deductions for R&D**. Since 2014, innovation activities using public support to purchase services from research organisations (regional vouchers, programmes supporting collaboration among research organisations (RO) and companies from OPEIC) have been carried out by another approximately 160 companies.

Direct financial support for companies' applied research and experimental development in the Czech Republic is provided through the individual programmes of the Technology Agency of the Czech Republic and the departmental programmes of the Ministry of Industry and Trade. In the period since 2015, this has primarily meant the Epsilon and Trio programmes, and to a minor extent Gama – Subprogramme 2 and the Delta programme.

The Epsilon programme is mainly focused on improving the position of Czech – and more globally, European – industry through support for applied-research and experimental-development projects. The outputs of these projects have high potential for rapid application in new products, manufacturing procedures and services. Projects supported within this programme are or have been implemented since 2015. In 2015, this programme was replaced with the newer Trend programme.

The following institutions were the main investigators within this programme (with some of them having used it several times): The University of West Bohemia in Pilsen (7x), Pilsen Tools s.r.o., SMS CZ s.r.o., Compo Tech Plus s.r.o. (2x), spol. s r.o., AZS 98, s.r.o., GTW Bearings s.r.o., Embitron s.r.o. (2x), Škoda Transportation a.s. (2x), Raptech s.r.o., Mecas ESI s.r.o. and Plzeňská teplárenská, a.s.

The **Trio** programme's mission is to support industrial research and experimental development activities that make use of, and further expand upon, the potential within Key Enabling Technologies (KETs).

The following institutions have participated in this programme as primary investigators: CertiCon a.s. (3x), Embitron s.r.o. (2x), LaserTherm spol. s r.o. (2x), Mecas ESI s.r.o., Škoda Machine Tool a.s., TGS nástroje-stroje-technologické služby spol. s r.o., Škoda Transportation a.s., Elis Plzeň a.s., CertiCon a.s., Hofmeister s.r.o., GTW Bearings s.r.o., Compo Tech Plus s.r.o., AZS 98, s.r.o. and Czech Precision Forge a.s.

Companies from the Pilsen Region are also active at centres of competence supported by the "National Centres of Competence" programme, whose 1st call was announced by the TACR in 2018. This programme is focused on supporting long-term cooperation between the research and application sectors and strengthening the institutional foundation for applied research. The programme's aim is to synergistically interconnect existing successful centres that were created with the support of the TACR (Centres of Competence), the Grant Agency of the Czech Republic (Centres of Excellence) and operational programmes (primarily "RD&I Centres") with other research centres and units into a single integrated system – National Centres of Competence.

There are a total of 13 centres bringing together a total of 230 entities (including 25 cases of participation at public organisations and 22 such cases at universities) focused on promising sectors of the Czech economy according to the National RIS3. Companies from the Pilsen Region are active in 7 of these centres. They are primarily centres whose fields correspond to the region's industrial focus and to new areas of specialisation:

- The **National Centre for Energy** (COMTES FHT a.s., Doosan Škoda Power s.r.o., Škoda JS a.s., Výzkumný a zkušební ústav Plzeň s.r.o., The University of West Bohemia in Pilsen and ZAT a.s.)
- The **Mechanical Engineering Centre of Competence** (COMTES FHT a.s., GTW Bearings s.r.o., Proinno a.s., Škoda Machine Tool a.s., Wikov Gear s.r.o. and the University of West Bohemia in Pilsen)
- The **Josef Božek Centre of Competence for Land Vehicles** (Škoda Transportation a.s., Research and Testing Institute Pilsen and the University of West Bohemia in Pilsen)
- The **National Centre of Competence – Cybernetics and Artificial Intelligence** (CertiCon a.s., LaserTherm spol. s r.o., The University of West Bohemia in Pilsen, ZAT a.s.)
- The **National Centre of Competence for Aeronautics and Astronautics** (Compo Tech PLUS, spol. s r.o.)

The other national centres of competence with participation by subjects from the Pilsen Region are:

- The Biotechnology Centre for Plant Genotyping (Vesa Velhartice, a. s.)
- The Centre for Advanced Materials and Efficient Buildings (AZS 98, s.r.o.)

The **corporate research and development** facilities in the Pilsen Region are the domain of large and mid-sized companies, primarily those that build upon fields that have been historically strong in the Pilsen Region – mechanical engineering, electrical engineering and energy, and vehicles. Often these are manufacturers that are directly descended from Škoda Pilsen (such as Škoda Transportation, Brush SEM, Škoda Electric, Doosan Škoda Power and

Wikov Gear), but there are also others, primarily companies defined as high-tech or medium-tech entities grouped for statistical purposes into CZ-NACE classifications 26 through 30.

Business entities from the Pilsen Region are also involved in **international R&D projects** receiving support from the Horizon 2020 programme and in some cases from Eureka, Eurostars and Interreg. These cases of participation are, however, in the single digits. They include e.g. the international project named Flexturbine that is supported by Horizon 2020. This project is coordinated by Doosan Škoda Power. Other participants in the region include COMTES FHT a.s. and the University of West Bohemia in Pilsen.

Support for international R&D from the Delta programme of the TACR has been utilised since 2015 by 4 entities (SmartMotion s.r.o., COMTES FHT a.s., REX Controls s.r.o. and the University of West Bohemia in Pilsen).

Over the past ten years, new **investments focused on research and development** have also been made in the Pilsen Region in companies with foreign capital (e.g. ZF Engineering Pilsen s.r.o.; MBtech Bohemia s.r.o. Technology Centre; Daikin Industries Czech Republic s.r.o.'s development centre).

The activities of COMTES FHT a.s. are notable here; it is the force behind e.g. the “Research Centre of Forming Technology” and “COMTES FHT Science and Technology Park” projects. Entities building their own research and development facilities include companies in the automotive industry that are traditionally viewed as primarily manufacturing companies – e.g. International Automotive Components Group s.r.o.

3.3 Application Sector

The fields with a strong history in Pilsen Region are **mechanical engineering, electrical engineering and energy**, but it would be amiss not to mention the food industry (beverages) and the ceramics industry (kaolin mining and production of ceramic building material). Currently some of the largest companies in the region include those that manufacture components for the automotive industry, which has developed significantly given the proximity of both Germany and manufacturing facilities in the Czech Republic. The investment by Panasonic, which for over 20 years has produced consumer electronics at Borská Pole industrial zone in Pilsen, must be mentioned as well.

Mechanical engineering, mechatronics, and electrical engineering and energy are seen as successful fields in the Pilsen Region that have potential for the application of research findings. One other sector with potential for growth and opportunities for use is information and communications technology. In terms of NACE codes, this primarily includes the groups and major businesses listed below (we are citing only the most important examples of companies and their products).

CZ-NACE 27 Manufacture of electrical equipment (MD Elektronik, RSF Elektronik – cable bundles for the automotive industry; Brush SEM – electric generators; Škoda Electric – electric motors and propulsions; ETD Transformátory – manufacturing of transformers). The manufacturing of equipment for the energy industry has historically been a knowledge-intensive field in Pilsen and in the Pilsen Region; production of cable bundles is a field that is strongly associated with supplies for the automotive industry, and it is dominated by large companies with foreign ownership.

CZ-NACE 28 Manufacture of machinery and equipment (Daikin Industries Czech Republic – air conditioning; Škoda Machine Tool – machine tools; Doosan Škoda Power – development and production of steam turbines). Besides the above companies, approximately 50 more

foreign and domestic companies here are oriented towards R&D. The field is directly tied to traditionally regionally strong areas of higher education (technical faculties at ZČU).

CZ-NACE 29 Manufacture of motor vehicles (except motorcycles), trailers and semi-trailers (International Automotive Components Group, Borgers, Ideal Automotive Bor, Grammer CZ – manufacturing of components for the automotive industry). This is a field that has seen significant manufacturing and employment growth over the last 20 years. Moreover, it is a field that holds promise for expected significant impacts in the framework of Industry 4.0. The field has a strong impact on employment in the region, with a dominant contribution from foreign-owned companies. Innovation activities are often sparked by demands for optimising production and reducing production costs. Companies in this field have long reported a manufacturing labour shortage.

CZ-NACE 30 Manufacture of other transport equipment (Škoda Transportation, Faiveley Transport Czech – transport equipment; Safran Cabin CZ – formerly Zodiac Galleys Europe – aircraft interiors). The development and production of rail vehicles and trolleybuses has a long tradition in the region and is tied to traditionally strong areas of higher education (ZČU in Pilsen).

CZ-NACE 61, 62, 63 Information and communications technology is represented in the Pilsen Region by a small number of large companies with over 100 employees (Socialbakers, Eurosoftware) and by a large number of micro-enterprises and small companies. The development of ICT firms is significantly influenced by the region's educated workforce capacities.

In the Pilsen Region, mechanical engineering and electrical engineering, including the manufacture of transport equipment, continue to be viewed as the primary fields for applying knowledge acquired from research, development and innovation. Companies producing components for the automotive industry (which are primarily foreign-owned companies) represent an opportunity for applying knowledge gained from research development, although in the global environment these processes are usually shared within parent companies for the entire group and obtaining excellence in a specific area presents a major challenge.

ICT fields are generally on the rise and represent promise for new knowledge and technologies, particularly in connection with the expected development of automation, robotisation, and smart technologies with application in both the private and public sectors. However, further development stumbles in part against the low numbers for high-quality facilities for use by large companies in Pilsen.

3.4 Innovation Infrastructure

The most important subjects offering support services for the development of RD&I in the Pilsen Region are BIC Pilsen, Regional Development Agency of the Pilsen Region and Pilsen Science and Technology Park. With respect to the promotion and popularisation of R&D in the Pilsen Region, Techmania Science Center is the absolute leader. DEPO2015 supports the creative industry. The ICT Administration Office of the City of Pilsen operates the Dronet technology centre and Robotics Centre.

The Regional Chamber of Commerce in the Pilsen Region, the Mechatronics Cluster and Smart Pilsen Region can also be counted among the Pilsen Region's innovation infrastructure.

Pilsen Science and Technology Park (STP) is a company established by the City of Pilsen to support the commercialisation of research and development and to increase the competitiveness of small and mid-sized companies by injecting them with innovation; this project offers jobs and an opportunity for creative development, particularly to young university

graduates. Pilsen STP operates spaces for RD&I companies to locate. Implemented along with BIC Pilsen and the City of Pilsen, “Pilsen Science and Technology Park” has significantly increased the supply of space for innovation companies. Currently the total area for innovation companies is in excess of 15,000 m².

COMTES FHT a.s. also completed the construction of a technology-focused science and technology park. It offers companies laboratories, workshops, a multifunctional hall and additional infrastructure. The science and technology park is located in Dobřany and has support from both the city and the Pilsen Region.

Since 2017, **Czech Technology Platform Engineering** (CTPE) has been implementing a project co-financed by the European Union as part of the Operational Programme Enterprise and Innovation for Competitiveness. Titled “Development of CTPE activities”, this project supports involvement in Industry 4.0 in the European context.

BIC Pilsen supports the establishment and development of innovation companies in the Pilsen Region. This company was established in 1992 and is a partner in the Enterprise Europe Network. Although the company is owned by the Chartered City of Pilsen, its activities extend beyond the borders of the region. The company provides consulting for other companies and operates a business incubator – BIC Pilsen is a member of the Czech Association of Science and Technology Parks.

Regional Development Agency (RDA) of the Pilsen Region provides specialised consulting to regional government in the Pilsen Region and supports the region’s economic and social development. It is a co-implementer of the Pilsen Region Smart Accelerator project, which addresses regional support for research and development.

Techmania Science Center is active in the area of informal education and works to narrate developments in specific fields of human knowledge and demonstrate how that knowledge is applied in technology. Activities range from holding educational competitions and seminars to creating educational materials, organising topical exhibitions dedicated to the potential of science and technology centres, and coordinating major events. Škoda Investment a.s. and the University of West Bohemia in Pilsen were behind the launch of this project in 2005.

DEPO2015 is a project by the City of Pilsen that supports the creative industries, provides infrastructure for coworking activities, operates a creative incubator, and holds a number of events and exhibitions in the area of interconnecting art, new technology and current topics.

The ICT Administration Office of the City of Pilsen (ICTCP), an organisation established by the City of Pilsen, operates the **Dronet** technology centre, which is focused on the unmanned aircraft industry. ICTCP’s activities also include the **Robotics Centre** (Digital Skills House), which is focused on education featuring cutting-edge technology for people of all ages.

The **Regional Chamber of Commerce of the Pilsen Region** works to develop the region’s business environment. Besides advisory and consulting activities, they provide a wide range of services for businesses, non-business legal entities, and for the general public.

Clusters provide a bridge between the education and business sectors in the region. The **Mechatronics Cluster** is focused on a discipline that encompasses precision mechanics, electrical engineering and intelligent computer-controlled electronics.

The **Smart Pilsen Region Cluster** works to develop the concept of a “smart” region in the Pilsen Region with the aim of increasing the quality of life by connecting public services with new information technology and creating conditions for implementing this technology. Within this cluster, Omexom GA Energo s.r.o. operates a smart polygon for demonstrating and testing the possibilities offered by smart technologies.

Technological Initiative Pilsen is an independent volunteer association of legal entities active within the Czech Republic and other states of the European Union whose main goals are to collaborate in research and development, share resources, optimise members' manufacturing, economic and business conditions, and provide business support.

The capacity for support services in the Pilsen Region is primarily concentrated within the activities of BIC Pilsen. Although BIC was established by the City of Pilsen, it also provides services at a regional level with an impact extending beyond the region's borders. The region's technical infrastructure for innovation companies is of high quality thanks to the STP Pilsen project and STP COMTES FHT. Nevertheless, currently there is no available capacity for large corporate R&D projects – e.g. in the area of shared services – either in terms of quality space for lease or in terms of land where public or commercial entities could construct suitable buildings.

3.5 Public Administration

Two main public administration entities are active in the Pilsen Region – the Pilsen Region and the Chartered City of Pilsen. Both the Chartered City of Pilsen and the Pilsen Region influence the regional innovation system via organisations that they have established for this purpose (such as BIC Pilsen, RDA Pilsen Region, Pilsen STP).

With respect to support of RD&I activities, the most active departments in the Pilsen Region are the Department of EU Funds and Programmes and the Department for Regional Development. The Pilsen Regional Authority is responsible for making and updating the Regional Innovation Strategy and is the implementer of the Smart Accelerator project. The Pilsen Region provides specific RD&I support via a “business voucher” programme to support collaboration between research organisations and the practical sphere.

The **Chartered City of Pilsen** is the founder of two organisations active in supporting RD&I: BIC Pilsen, DEPO2015, and VTP, a.s. (STP). With respect to support of RD&I, the most active departments in the City of Pilsen are the Urban Planning and Development Institute of the City of Pilsen, the Department for the Coordination of European Projects of the City of Pilsen, and ICTCP. The City of Pilsen is also active in supporting collaboration between research organisations and the practical sphere via business vouchers. Innovation projects also concern current activities in supporting smart applications for the city.

The structure of public activities in the Pilsen Region involved in the economic development and RD&I support process is clear. However, it is equally clear that, particularly at the regional level, economic development and the support of innovation are the focus of only a limited number of individuals working in departments that have a far broader agenda.

The City of Pilsen has access to the services of economic development specialists. As a result, there is room for closer cooperation between the city and the region in supporting promising fields, research, development and innovation. One specific demonstration of this may lie in coordinating sub-activities, such as providing support via “business vouchers”, which are currently granted separately by both the city and the region.

4 Public Authorities and Their Role in the Region's Innovation System

Support for research, development and innovation is a topic of European, national and regional importance. It involves the development of activities ultimately aiming to evoke an increase in the economic performance of the EU as a whole and at the levels of individual countries and regions. Support is aimed at strategy preparation as well as at developing research and development infrastructure, implementing research activities, and giving rise to and developing innovation enterprises.

4.1 Strategy Documents with the Support of Research, Development and Innovation

Regional Innovation Strategy (BIC Pilsen, RDA Pilsen Region, 2004)

This document is aimed at analysing the state of research, development and innovation in the Pilsen Region and at creating a platform for developing innovation in the region. At the time of drafting of this Strategy, it was not possible to allocate or claim regional sources for the proposed measures. This Strategy was primarily fulfilled in the area of building technical infrastructure for innovation by developing the Pilsen Science and Technology Park.

City of Pilsen Strategic Plan (CPDP, Urban Planning Institute of the City of Pilsen, 2004, 2018)

The City of Pilsen's goal, set within its strategic plan, is to develop a promising labour market and link the educational system with practice, to support effective development of human resources and to create conditions for providing business support. This topic area is the subject of strategy goal no. 2, intended primarily to support innovative, knowledge-intensive companies (science and technology parks, incubators and innovation companies) in being created or located in the region – companies that create highly qualified job positions and employ primarily persons with university and professional education. There is simultaneously also a need to support the development of small and mid-sized enterprises, beginning entrepreneurs and cooperation between companies and the academic sector. And likewise a need to create the conditions for these companies to locate here. A high-quality education system and an ability for the individual stakeholders to communicate comprehensively on the local level, enabling flexible reactions to changing needs in the labour market, are also an important factor.

RIS3 – Regional Annex for the Pilsen Region

This document was implemented based on a joint methodology in cooperation with the Ministry of Education in the first wave of compiling Czech regional strategies, and it was approved by the Pilsen Region Council in 2015. Except for the innovation voucher programmes, no funds have been allocated for the proposed measures in the Regional Annex thus far. In 2018, a newly drafted RIS3 was approved within the implementation process for the Pilsen Region Smart Accelerator project. One part of this new RIS3 is an Action Plan that contains nearly 50 projects; among other things, this document serves as a foundation for the Pilsen Region's participation in the financing of selected RD&I projects. The **National Research and Innovation Strategy for Smart Specialisation of the Czech Republic (National RIS3)** is a strategy document ensuring effective targeting of European, national, regional and private funding for activities that help to strengthen research and innovation capacity and concentrate these funds into promising priority-marked areas at the national and regional level, with the goal of making maximal use of the nation's knowledge potential. This document was updated in December 2018. The national RIS3 is also a prerequisite for engagement in interventions in

the regional policies of the European Union (the European Structural and Investment Funds – ESIF) in the area of support for research, development and innovation.

Long-Term Objective of the University of West Bohemia in Pilsen

This is an important strategy document for the only university in the region offering a broad range of disciplines. The document is directly tied to the Pilsen Region's RIS3. In addition to education, it also focuses on RD&I. It is drawn up for a five-year period and is updated once a year.

The Czech Republic's Innovation Strategy for 2019–2030 (Czech Republic: The Country For The Future)

This RIS3 was approved through Czech Government Resolution no. 104, dated 4 February 2019. This is a strategy framework plan that serves as a blueprint for the government's policies in the area of research, development and innovation and should help the Czech Republic to advance to a place among Europe's most innovative countries over a 12-year period.

This national innovation strategy comprises nine interconnected pillars that contain starting points, basic strategy goals and tools leading to their fulfilment. The following areas are treated here as pillars: Financing Research and Development, Innovation and Research Centres, National Start-up and Spin-off Environment, Science and Technology Education, Digitalisation, Mobility and the Construction Environment, Intellectual Property Protection, Smart Investing and Smart Marketing. The innovation strategy was drafted by the government's Council for Research, Development and Innovation in close cooperation with a team of over thirty persons from among entrepreneurs, researchers, academics and representatives of public administration.

4.2 Programmes Supporting Research, Development and Innovation

4.2.1 National Programmes

Through its programmes, **TACR** provides long-term and systematic support to applied research and collaboration between companies and research organisations. These are the Epsilon, Omega and Gama programmes. There is also the Delta programme, serving for cooperating with foreign technology agencies (collaboration with Taiwan, Vietnam, China and Korea). The Gama-Seal of Excellence programme (sub-programme II) is offered for small and mid-sized enterprises (SME) and facilitates support for applied research, experimental development and innovation for SMEs that have received the EC Seal of Excellence in SME Instrument – Phase 1.

The **Czech Ministry of Industry and Trade** (MIT) has performed several calls for applications within the Trio/Trend programme, which is focused on industrial research and development. The programme is focused on developing the potential of the Czech Republic in the field of key technologies (KETs) like photonics, microelectronics and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials and advanced production technologies. For the conditions of use in the Pilsen Region, projects in the field of advanced production technologies are particularly relevant.

In 2010 **CzechInvest** launched programmes for supporting innovation start-ups. These are the CzechStarter, CzechAccelerator, CzechDemo and CzechMatch programmes, where entities can apply for financing to develop innovation enterprises. These programmes fund consulting services, training, marketing and other operational costs of developing companies for a limited time period needed to launch those companies' dynamic growth. These are select programmes that support only the most promising projects.

Interest in national R&D programmes exceeds the possibilities offered by these programmes, but not all projects submitted in regional entities may be supported, even if they have been properly prepared and formally approved with respect to the programmes' conditions. Financing is the subject of competition within individual calls.

4.2.2 RD&I Support from European Structural Funds

The main sources for financing RD&I activities are EU structural funds, specifically Operational Programme Enterprise and Innovation for Competitiveness (OPEIC) and Operational Programme Research, Development and Education (OPRDE).

OPEIC is aimed at a broad spectrum of activities for supporting innovation enterprises, including support for small companies and acceleration. The main programmes relevant for RD&I support are primarily: Potential, Innovation, Application, Knowledge Transfer Partnership, Innovation Vouchers and Patent.

OPRDE deals with financing, primarily for public research organisations. Its main themes are improving educational processes and supporting collaboration between research organisations and the practical sphere. The support of long-term interdisciplinary collaboration is a very promising area.

These programmes are each in their project implementation and conclusion phase (until 2022), and discussions are ongoing regarding the structure of the new operational programmes for the period from 2021 to 2027.

4.2.3 International Research and Development Support Programmes

Business entities may also obtain support implementing research and innovation activities from international programmes. Given corporate R&D almost exclusively concerns industrial and applied R&D, the programmes that can be considered mainly include Horizon 2020, Eureka and Eurostars.

Horizon 2020 (H2020) is the largest and most important programme designated for financing science, research and innovation at the European level in 2014-2020. Horizon 2020 builds on the 7th Framework Programme for research, technological development and demonstration (2007–2013), and differs in its greater emphasis on supporting innovation. The programme is designated for scientific staff at universities, research institutes and industrial companies, but also for companies that may find in Horizon 2020 a tool for financing cutting-edge research activities and technology.

The programme has four priority areas, and the opportunity for business entities to receive support for R&D activities primarily lies in priority 2 – Leading Position of Industry. This is focused on supporting activities aimed at improving the competitiveness of European industry, particularly via ground-breaking technologies, and at supporting financing for research in industry and at SMEs. The “Leading Position of Industry” priority is further divided into three areas:

- 1 Ground-breaking and industrial technology.
- 2 Access to risk financing.
- 3 Innovation in SMEs

The **Eureka programme** has been in place since 1985 and supports transnational collaboration between industrial companies, research institutes and universities, thus creating conditions for increasing the performance and competitiveness of European industry and developing Europe's common infrastructure. There are no pre-set specified themes for Eureka

projects, but the projects do stem from the priority directions of developing areas of industry. In general terms, Eureka projects are focused on the following areas:

- Information technology
- New materials
- Environment
- Biotechnology and medical technology
- Robotics and automation
- Communications technology
- Energy
- Transportation
- Lasers

The **Eurostars programme** is focused on supporting SMEs that, in addition to their manufacturing or service operations, also conduct their own research and development.

In one of its objectives, **Cross-Border Cooperation Programme Czech Republic – Free State of Bavaria Objective ETC 2014–2020** supports strengthening cross-border activities in the field of research and innovation and improving the involvement of SMEs into research and innovation.

4.2.4 Regional Programmes

The core of support for regional programmes is focused on two areas: support for locating starting and growing innovation companies, and support for collaboration between universities and the practical sphere.

One tool supporting the locating of startups is the **Pilsen Science and Technology Park**. Thanks to the City of Pilsen's participation in the "Prosperity" programme, discounted rent is provided as part of the transfer of the grant to the final recipients of the support. As a result, support is provided in the amount of approximately CZK 10 million per year. Beyond this, advisory services are provided, such as: finding new technology that suits the needs of companies; identifying new knowledge that can be transferred; consulting on intellectual property protection; interconnecting the research and application sectors; providing assistance in developing collaborative relationships; informing about opportunities to obtain support for applied research and development; identifying suitable support programmes; preparing applied research and development projects; and assisting in the development of international collaborative relationships in the technology sector, etc., in a total value of CZK 2 to 3 million per year.

Support for collaboration between universities and the practical sphere in the Pilsen Region is implemented via **Business Vouchers**, which are a subsidy for services provided by a research organisation to the benefit of a company making use of those services. The programme is focused regionally – the main provider of specialised services is the University of West Bohemia in Pilsen. This is funded by the Pilsen Region and the City of Pilsen. Since 2013 over 130 projects have been supported with a total subsidy level exceeding CZK 11 million.

5 SWOT Analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> - A growing number of IT graduates at the region's sec. schools and an uptick in the share of region's university students studying science, incl. computing. - The region's improving position in terms of the number of R&D employees, especially in tech and science. - The region's high economic performance within CZ. - Significant reinforcement of companies' research facilities, esp. in the historically strong areas of mechanical and electrical engineering. - New research centres at ZČU in routine operation. - Development of research at Charles University's Faculty of Medicine in Pilsen + connected to University Hospital Pilsen. - Involvement of regional entities in RD&I centres in progressive fields (Centres of Competence and Excellence). - Established (BIC, STP, TSC) and new activities for support of RD&I in Pilsen (SmartEduHouse – Robotics Centre, Dronet; DEPO 2015 – creative incubator). 	<ul style="list-style-type: none"> - Significant drop in ZČU student-body numbers. - ZČU's technical faculties are below their capacity due to low interest. - Little collaboration among RD&I stakeholders in the region. - Business sector uses region's R&D facilities at universities only minimally. - Limited scope of R&D facilities in region in key technologies (KETs). - A low share of companies undertaking innovation, especially product innovation. - Low patent activity in the region to date. - A lack of prepared infrastructure to help major investors in services to enter the market (shared services, R&D, etc.). - Uncoordinated marketing in RD&I in the region.
Opportunities	Threats
<ul style="list-style-type: none"> - The development of progressive multidisciplinary study programmes at ZČU. - Effectively appealing to potential ZČU applicants abroad (e.g. in-country admissions process). - Attracting high-quality foreign specialists via suitable marketing and support. - Higher efficacy of marketing results for new research centres. - Increasing the share of companies producing first-class final outputs, incl. start-ups. - Getting involved in global initiatives that support the creation of innovation and start-ups. - Coordination of activities of the Pilsen Region and the City of Pilsen that support economic development. - Intensive development of research collaboration among institutions and 	<ul style="list-style-type: none"> - Deterioration of the region's position in the percentage of residents with university education. - The growing share of less-qualified professions in the region. - The departure of top specialists from the region. - The region is falling behind in implementing high tech. - High-complexity manufacturers and technologies are relocating abroad / Society 4.0; shortage of labour and suitable space. - The responses of research facilities towards progressive trends are not flexible enough. - The region is too dependent on historically strong fields in the manufacturing industry and R&D.

<p>coordination of RD&I support with Bavaria and Upper Austria.</p> <ul style="list-style-type: none"> - Connecting formal and informal education to increase interest in technical and scientific fields. 	<ul style="list-style-type: none"> - A lack of motivation to establish start-ups (due to the current period of high employment). - The deteriorating competences of school graduates.
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B. Strategy Section

6 Foundations of the Strategy Section

6.1 Methodological Foundations of the Strategy

The aim of this document, the second update to RIS3, is to place RIS3 within its broader context. For this reason, alongside an update to its analysis and strategy portions, it contains a reformulation of the vision for research, development and innovation in the Pilsen Region between now and 2035. A special Vision working group was created for this purpose. Representatives of research and educational institutions and of the corporate and public sectors have equal shares within it.

At this group's three working meetings, the group successfully named the region's R&D strengths, defined the main areas where changes are needed, and formulated a shared medium-term RD&I vision for the region based on the above. They also successfully defined a research, development and innovation mission for the Pilsen Region.

In addition, the Vision group updated the strategy framework of the Pilsen Region's RIS3 as a follow-up to the above step. This framework contained the RIS3's main goal and strategy goals. As a part of drafting the update to the strategy framework, its formulations were revised with regard to the vision and mission for research, development and innovation in the region. During its drafting, the five strategic areas of the then-applicable RIS3 for the Pilsen Region, i.e. the RIS3 in its state after the first update, were considered as stable.

Both the vision and mission for research, development and innovation in the Pilsen Region and the proposed strategy framework for the Pilsen Region's RIS3, were approved by the Pilsen Region Council for Research, Development and Innovation. This produced a stable framework for drafting the updated RIS3 at the level of specific goals and model activities.

The update to the specific goals and model activities was produced at meetings of the cross-sectional platforms **Human Resources for RD&I** and **RD&I Facilities**. The foundation for the updating of each specific goal was an evaluation of its fulfilment in the previous period based on indicators. The main foundation for the update to model activities was an evaluation of the utilisation of priority activities within the projects of the Action Plan. In both cases, the main matter under consideration was how relevant and realistic the existing wordings were.

By discussing the strategy framework, the specific goals and the model activities for the following period, the stakeholders reached a consensus for the region regarding a long-term comprehensive RD&I strategy wherein each of the stakeholders is motivated to fill its role in the innovation ecosystem. For this same reason, the model activities' descriptions have been supplemented with guarantors for each given activity.

6.2 The Pilsen Region's Research, Development and Innovation Vision and Mission

The Pilsen Region's research, development and innovation vision between now and 2035:

- High-quality education, first-rate research and the application of the latest technology trends along with trust and communication among RD&I stakeholders all create a favourable environment for the region's economic development.

This vision emphasises the high-quality education and research being performed within the Pilsen Region. It meanwhile highlights the application of new technology trends that are key for bringing a primarily manufacturing-oriented region into the ranks of knowledge-based regions. Well-functioning communication among RD&I stakeholders based on mutual trust is essential for making these processes more effective. The main RD&I goal is the economic development of the Pilsen Region.

But a broader formulation of the region's research, development and innovation goals can be found in the mission. The mission emphasises the importance of RD&I for individuals, business and the entire region.

The research, development and innovation mission for the Pilsen Region:

- Research, development and innovation in the Pilsen Region supports:
 - o citizens' personal development,
 - o companies' competitiveness,
 - o the region's sustainable development.

6.3 Objective Foundations of RIS3 – Problem Analysis Summary

The problem analysis builds on a summary of analytical findings concluding with a SWOT analysis, and it forms an objective foundation of the strategy section of the Pilsen Region's RIS3. The section was formulated during a period of significant demographical changes, intensive economic growth, a general labour shortage, and initial changes caused by the more intensive application of digitisation and robotics. The purpose of this chapter is to define the key areas of change that RIS3 should focus on based on the main conclusions of the analyses.

In the past, Pilsen Region's success was very closely connected with industry, and it appears that also into the near future the development of industrial technologies will be of determinative significance for the Pilsen Region. In parallel with the transformation of industry, select tertiary sectors became successful, with considerable achievement in the medical fields. The Pilsen Region's successes in research, development and innovation (RD&I) are based on experiences in historically strong fields, on the presence of universities and research organisations and their collaboration with businesses, and lastly but importantly, on business investments with a significant share of innovation activities.

Shortcomings in the Pilsen Region were identified at the level of relationships and collaboration among stakeholders in RD&I, as well as in the range and availability of the necessary infrastructure for knowledge-based development. Although a number of beneficial projects have been implemented, such as Pilsen STP, BIC, STP COMTES FHT, or the TechTower objective currently in progress, the need to supplement this range with new services remains very current – not only in Pilsen and the immediate vicinity. These findings are an indication of the as-yet underdeveloped innovation ecosystem in the Pilsen Region, and it is therefore necessary to systematically focus on further cultivating the environment for RD&I.

The most important prerequisite for the development of RD&I is the involvement of highly qualified professionals. The lack thereof has recently become one of the most important limiting factors. The main problem in developing human capital for RD&I in the Pilsen Region has been the sharp decline in student-body numbers at ZČU, which was formerly one of the largest public universities in the Czech Republic. This decline was sharper than the decline in the university-age population within the region. A major drop in the number of students coming in from other Czech regions to study at universities in the Pilsen Region was a further contributing factor. At the same time, over the intermediate term Pilsen Region's position in terms of residents with a university education is worsening. Among the positive effects that have been detected are, in contrast to other regions in the Czech Republic, a relatively significant increase in university students' interest in the natural sciences, including information science. This indicates an opportunity given the generally dwindling interest in the study of science and technology. It is clear that one of the most fundamental topics is the field of education, its connections to RD&I, and the maintenance of sufficient and high-quality professionals.

The completed analysis indicates that the growing importance of research and innovation has manifested itself in Pilsen Region through extensive investments into research infrastructure with involvement by both the private and public sectors. National and European funds supported these investments significantly. Both public universities in the region have implemented projects to build regional research centres. Major employers have also significantly increased their expenditures towards research and development, leading to a major increase in the number of research and development employees. Despite this, the level to which the results of research are applied in practice has been relatively low. The reasons for this can be found in regional companies' low demand for external services, in the limited capacity of the local market, in relatively low capability to succeed at the international level, and in the low intensity of support measures (vouchers, infrastructure, etc.). Research and development facilities and their use for regional development are another key topic of the Pilsen Region's RIS3.

Pilsen Region's economy is characterised by the predominance of somewhat larger employers and the significant presence of industry. The largest industrial companies are majority owned by foreign owners, and ties to development projects in the local environment are less intense. These appear to be the reasons why Pilsen Region is assessed as a region with a low number of innovative companies. If we can trust the assumption that small and mid-sized enterprises are flexible and effective at furthering innovation, it would be in the Pilsen Region's best interest to create the ideal conditions for the establishment and growth of innovative SMEs capable of gaining a foothold on global markets. The implementation of innovation projects in Pilsen Region is currently limited by the shortage of labour as well as of available infrastructure for supporting the establishment and placement of innovation projects. However, the existing facilities for locating innovation companies are used to full capacity, and there is a lack of additional buildings for locating highly innovative business projects or shared infrastructure for start-ups in Pilsen and elsewhere in the region. Implementing innovation is another key issue affecting the Pilsen Region.

The implementation of necessary changes in the topics listed above requires consensus among RD&I stakeholders to take a problem-solving approach and have individual stakeholders adopt the role of actively cooperating partners. The steps being considered also foresee changes in the perception of the Pilsen Region as an attractive site for activities connected with RD&I for professionals, companies and institutions operating at the supra-regional level; one suitable tool may be stakeholders making concerted efforts towards quality communication and the formation of the Pilsen Region's image as an attractive region in the world of RD&I. The marketing activities of RD&I stakeholders in the region currently

remain fragmented, and thus less effective. Their coordinated development is a fundamental requirement for the successful implementation of the strategy for developing RD&I in the Pilsen Region.

7 The RIS3 Strategy Framework – Main Goal and Strategic Goals

7.1 Main Goal

This strategy framework is based on the vision for research, development and innovation in the Pilsen Region and on a summary of analytical findings. These findings suggest that a lack of communication and coordination among major stakeholders' activities continues to be identifiable as one of the main barriers to implementing RIS3 in the Pilsen Region more broadly.

They are addressed in the main goal of RIS3 for the next period (until 2027), which focuses on cultivating the environment and creating the groundwork for advocating RD&I themes as key tools in the Pilsen Region's economic development. Achieving clarity and comprehensibility for the work of all stakeholders in the regional innovation ecosystem, maintaining their consensus on common priorities, and providing for functioning communication, collaboration and capacities for their coordination represent the main change here.

The key stakeholders in the private and public sector work in the fields of education, research, innovation, marketing and communication. The result of their involvement will be an attractive and inspiring environment for those interested in a promising education, scientific activity used in practice, and innovation-based business. The communication of RD&I successes will strengthen the identity and perception of the Pilsen Region as a region with excellent economic perspective based on RD&I.

The main goal of the Regional Innovation Strategy for the Pilsen Region until 2027:

- **Create a well-functioning environment for developing research, development and innovation in the Pilsen Region.**

7.2 Key Areas of Change and Strategic Goals – Intervention Logic

Building upon the main goal of RIS3 are strategic goals that have been formulated for 5 key areas of change, the basic structure of which are defined in chapter 6.3 Objective Foundation of the Strategy. These are:

- Human resources for RD&I – Securing a sufficient amount and quality of human capital for RD&I
- Environments for RD&I – Developing relationships, infrastructure, and additional conditions to contribute to the growing importance of RD&I in the development of the Pilsen Region
- R&D facilities – Developing research site facilities and their utilisation for practical application
- Innovation – Developing innovation activities in various sectors
- RD&I marketing – Strengthening Pilsen Region's RD&I marketing communication

The basic principles of the proposed solution are provided below for individual key areas of change, i.e. the basic intervention logic of RIS3. This is expounded on in another chapter.

If the competitiveness of the Pilsen Region is soon to be based to a greater extent on the outputs of research, development and innovation, a high level of **human resources for RD&I** and regional education are a must. Their prerequisite is that there are universities with an

attractive range of educational options, making it possible to foster the necessary quantity and quality of specialists with respect to the economy's current and future needs. In this respect, it would be desirable to reverse the tide of dwindling student numbers at the University of West Bohemia in Pilsen. These changes should be primarily focused on increasing the attractiveness of the range of study programmes and associated services for both domestic and foreign applicants. The greatest effects can be anticipated in connection with expanded opportunities to study in a foreign language and with taking advantage of the broad range of disciplines on offer. The strong potential of universities is tied to a range of highly acclaimed study programmes, to disciplines of regional specialisation, and to the ability to respond to new opportunities for expanding the range of study programmes – such as those provided by digitisation and robotics. Employing the potential of the region's human capital in RD&I requires quality and functioning collaboration among all levels of education. In this field it is necessary to focus on strengthening the number and quality of teachers and developing an integrated system of care for talented pupils and students.

The environment for RD&I as a strategic area highlights the need to improve the conditions for developing RD&I activities as the main tool for supporting the region's economic development. This requires greater involvement by regional and local governments in this area. The main coordination tool is the preparation and update of the RID3 Strategy, including securing the necessary capacity for implementing the strategy. Public sector intervention should particularly be directed towards supporting collaboration among RD&I stakeholders, strengthening the role and quality of institutions that provide services that support economic development, and creating an environment that is fertile for international cooperation and the implementation of research and innovation projects in our region. Promoting the concept of smart specialisation of the region, involving companies, research facilities, and other institutions, aims to exploit the Pilsen Region's greatest potentials in the interest of increasing its competitiveness in the broader sense.

In the field of **R&D Facilities** we are responding to the need for broader utilisation of R&D facilities built in recent years, particularly through applying their results in practical applications. A network of relationships has not been built that would pave the way to greater use of R&D sites with respect to the needs of the private and public sectors both inside and outside the region, thus increasing the quality of commercialising the results of R&D. Stability and growth in the quality of research facilities. can be effectively supported through a greater level of research facilities' involvement in international networks and research workers in international teams.

The level of business activity and the share of innovation companies are still relatively low within the Pilsen Region. The key area of changes in **Innovation** thus zeros in on the need to change the business structure towards increasing the share of innovation companies in the economic base. The establishment of new companies, more innovation activities at existing companies, and the arrival of significant innovation investments may all contribute to increasing the share of innovation companies. A fundamental change in the system for supporting the establishment of new companies should be ushered in by coordinating and improving the continuity of relevant stakeholders' business services, but also by introducing new tools focused on supporting the establishment of innovative business projects. The growth of existing companies and reinforcement of their position in value chains can be supported through the use of national and European support programmes and professional advisory services focused on the field of innovative business support. The region's interest in new investment should focus on projects with significant employment of RD&I and with the creation of jobs with a

greater share of qualified labour. The range of infrastructure, associated services, and essential marketing support must be adapted to this purpose.

RD&I marketing can significantly support the implementation of RD&I strategy in all of the aforementioned areas. Just as it is important to present the region to the outside world, it is also important that an inner identity be created for the Pilsen Region in RD&I. The public authority of the Pilsen Region plays a fundamental role in communicating and promoting the main topics for RD&I. The main requirements are advocating the topic of RD&I as a standard part of regional marketing, including corresponding organisational and financial capacities, and achieving cooperation among key stakeholders in fulfilling the joint Marketing Strategy. Marketing activities should use the region's main strengths and opportunities in RD&I to communicate with target groups, thus strengthening the perception of the region's main values.

Overview of Key Areas of Change and strategic goals:

	Key Areas of Change	Strategic Goal
1	<u>Human resources for RD&I</u>	Increase the attractiveness of studies and stabilise the number of university students in the Pilsen Region
2	<u>The environment for RD&I</u>	Improve infrastructure and collaboration among RD&I stakeholders in the Pilsen Region
3	<u>R&D facilities</u>	Bring about more intensive use of the research and development facilities in the Pilsen Region
4	<u>Innovation</u>	Increase the number of companies with high innovation potential in the Pilsen Region
5	<u>RD&I marketing</u>	Strengthen the Pilsen Region's reputation in the world of RD&I

8 Key Areas of Change

Based on the strategic framework, key areas of change are developed into specific goals and model activities.

8.1 Key Area of Change 1: Human Resources for Research, Development and Innovation

The key area of change Human Resources for RD&I is focused on setting the foundation for the successful development of RD&I in the Pilsen Region, i.e. on the quality preparation of human capital for this area. Given the rapidly declining number of university students at ZČU in Pilsen in recent years and the falling share of university students living in the region per resident in the corresponding age group, this entire area is focused on stabilising the number of students by increasing the attractiveness of studying at universities in the Pilsen Region. Several steps and changes must be taken to do this, which will be reflected in individual specific goals in this key area of change.

The first specified goal is focused on **increasing the internationalisation of education**. Part of the proposed activities here relate to expanding study options for foreign students (expanding classes taught in foreign languages; foreign recruitment of university students). Other activities proposed in this area are aimed at acquiring foreign experts. For both groups, support for their activities in the region is expected. The proposed activities are also aimed at increasing the mobility of local academic staff and students, which increases their expert capacity, expands their language skills and other skills and helps them to acquire new experience. Persons so engaged will help to spread international awareness of the region's universities.

The second specific goal is targeted at **expanding the selection of multidisciplinary study programmes at universities and secondary schools** in the region. Besides increasing the attractiveness of university studies in the Pilsen Region, this goal is a response to the anticipated need for broader knowledge among university graduates in connection with the penetration of digitisation into all sectors of the economy and people's daily lives. This digitalisation process will significantly alter relationships both within and outside the economy. In addition to specialised education, it is therefore necessary to provide university and secondary school students with broader theoretical knowledge in other areas as well. This can be supported by greater involvement in instruction for specialists from the practical sphere or by strengthening students' ability to gain practical experience in the public or private application sector.

The third specific goal in the area of human resources for RD&I is addressed by **systematic work with talent, including talent hunting**. If various institutions' currently somewhat fragmented efforts to support talented students can be interconnected and coordinated, a very attractive and inspiring environment will be created in the Pilsen Region for developing talent. It is useful to work with talents as early as possible, which requires collaboration among all stages of education and the involvement of other educational and research institutions. This will also strengthen the relationship that talents have to the region. The proposed activities are focused primarily on expanding opportunities for developing talent and on broader use of existing facilities at various institutions (specialists, equipment, etc.) both inside and outside the classroom. Separate mention is made of popularising activities for research and development, which are deeply important for increasing interest in regional university studies and the regional research careers that follow them. As follow-ups to large and established events, there should be additional systematic events that further develop the aroused interest.

The fourth specific goal is focused on **increasing the attractiveness of training specialists for research, development and innovation and expanding the possibilities for their practical employment**. These activities concern programmes both motivating RD&I specialists towards further education and enabling them to increase their competencies within lifetime education courses. The activities are also aimed towards improving conditions for doctoral and post-doc students and towards the accreditation of professional doctoral studies. There is also an expectation here for companies to assist in preparing topics for qualification works and in assigning student projects, which will lead to greater integration between studies and practice and, as a result, will help students to apply themselves better in practice.

The fifth specific goal is a response to declining interest in studying to become an educator and the expected retirement of large numbers of teachers, which could considerably affect the functioning of the region's education system. Activities aimed at **increasing teacher motivation and improving teacher training** are targeted at modernising early and further teacher training, at connecting them more closely to the practical sphere, and at R&D support in the educational sciences. Action is also expected here for expanding methodology support for teachers so as to improve the quality of their teaching activities, thereby improving the education provided to their students.

Strategy goal 1: Increase attractiveness and stabilise the number of university students in the Pilsen Region

Indicators:

- Number of university students studying in the Pilsen Region, total
- Proportion of students studying at a university in the Pilsen Region and residing in the Pilsen Region to the total number of university students residing in the Pilsen Region

Specific goal 1.1: Make education more international

Indicators:

- Number of foreign university students in the Pilsen Region
- Number of students, academic, and other university staff in the Pilsen Region sent on study abroad programmes

Model activities:

- Expanding instruction in foreign languages, including German [ZČU]
- Recruiting foreign students for regional universities [ZČU (FAV, FEL, ...), LF]
- Improving facilities for foreign experts [ZČU, LF]
- International internships for academic staff [ZČU, LF]
- Increasing student mobility for PhD and post-doc students (create jobs at universities and research organisations) [ZČU, LF UK, research organisations]
- Promoting ERASMUS and supporting administration costs for ERASMUS participants [ZČU, LF]
- Supporting the activities of foreign students and experts [ZČU, LF]
- Supporting international events such as hackathons etc. [ZČU, research organisations, companies, Pilsen (ICTCP)].

Specific goal 1.2: Expand the range of multidisciplinary study programmes at universities and secondary schools

Indicator:

- Number of specialists from the practical sphere contributing to university instruction in the Pilsen Region

Model activities:

- Prepare and accredit multidisciplinary study programmes (e.g. Society 4.0) [ZČU, LF UK]
- Get specialists from the practical sphere involved in teaching activities [ZČU, LF UK]
- Strengthen students' ability to gain practical experience in the application sector [ZČU, LF]
- Ensure cooperation among educational institutions for identifying and preparing professionally oriented study programmes [ZČU, LF]
- Deepen educational cooperation between ZČU and UK

Specific goal 1.3: Strengthen the network of collaboration among educational institutions of all stages and research organisations in seeking and developing talent

Indicators:

- Number of members of the Pilsen Regional Talent Support Network
- Number of supported entities in the Pilsen Region under the Ministry of Education grant programme– Support for Talented Primary and Secondary School Pupils

Model activities:

- Develop systems for competitions and camps for all stages of education [region (Ed Dept.), ZČU, Pilsen]
- Broader student involvement in national and international competitions [region (Ed Dept.), ZČU, LF UK, Pilsen]
- Use schools' specialised facilities and spaces to teach extracurricular activities at lower education stages [region (Ed Dept.), ZČU, LF UK, Pilsen]
- Get research organisation specialists involved in instruction and in extracurricular activities [region (Ed Dept.), ZČU, LF UK, Pilsen]
- Involve institutions of informal education more broadly in seeking and developing RD&I talent [TSC, LC]
- Popularise research and development [region (OŠMS), ZČU, LF, research organisations, Pilsen]
- Coordinate activities to support RD&I talents in the region and provide a comprehensive selection of these activities to the target groups [ZČU].

Specific goal 1.4: Increase the attractiveness of preparing RD&I specialists and the scope of possibilities for their employment

Indicator:

- Number of doctorate study graduates from universities in the Pilsen Region

Model activities:

- motivation programmes for preparing RD&I specialists [ZČU, LF]
- improving conditions for doctoral and post-doc students [ZČU, LF]
- cooperating with companies to formulate topics for qualification works and student projects [ZČU, LF]
- accrediting professional doctoral studies [ZČU, LF]
- further training for specialists within RD&I-oriented lifetime education courses [ZČU, LF, research organisations]
- support for internal study by post-graduate students [ZČU, LF].

Specific goal 1.5: Increase teacher motivation and improve teacher training

Indicator:

- Number of participants in continuing teacher training courses organised by entities in the Pilsen Region (ZČU, RECLS)

Model activities:

- Improving the quality and attractiveness of pre-graduate teacher education [ZČU (FPE)]
- Motivational support for students of teaching in select qualifications (such as scholarships) [region]
- Broader connection between teachers and practical application (show & tell days, get specialists from the practical sphere involved in preparing school educational programmes, teacher internships at companies, etc.) [ZČU (Fac Ed, possibly Fac Arts, Fac Sci)]
- Continuing education and methodology support for teachers (see above) [ZČU (Fac Ed), RECLS]
- Support for research and development in the educational sciences (such as a grant scheme) [region].

8.2 Key Area of Change 2: Environment for Research, Development and Innovation

The main goal of this key area of change is to improve collaboration between key stakeholders and RD&I infrastructure in the Pilsen Region and thus contribute to producing a creative, functioning environment in this area. Support for RD&I, which is largely executed at the national level, will be supplemented in this area to include essential activities at the regional scale.

The first specific goal addresses activities **for applying the results of the smart specialisation process in RD&I development**. Thus one major activity here will be work by individual innovation platforms in the areas earmarked during the region's smart-specialisation identification process. Steps will also be taken to ensure communication among RD&I stakeholders in the region, via both information sharing and e.g. an annual conference on smart specialisation. Stakeholders' activities will lead to the preparation of shared projects in the enterprise and research sector for the specialisation topics. Due to the need for up-to-date knowledge of the status of the RD&I activities and environment in the region, systematic monitoring of the situation in this area will be developed further. The results will be reflected in strategic documents concerning RD&I.

The second specific goal is the **strengthening of the system of collaboration in the area of research, development and innovation**. Fulfilment of this goal includes a number of activities that require closer collaboration between key research organisation stakeholders and companies, the public sector, economic development support organisations and chambers of commerce. Cooperation among the main stakeholders will lay the groundwork for sharing information and training activities and preparing joint projects. This cooperation will also include partners from regions of cross-border cooperation. Lastly but importantly, there are plans to establish clusters and platforms (including interdisciplinary ones) that interconnect a broad spectrum of research facilities both from inside and outside the region.

The third specific goal includes activities necessary for **improving RD&I support**. These are e.g. methodology support activities surrounding the application of the outputs of collaborative research or activities that support the involvement of regional RD&I in programmes of the European Union. Care will be taken to intertwine the RIS with other strategies and RD&I-

focused programmes that are active in the region, e.g. the ITI programme of the Pilsen metropolitan area and the programme for cross-border cooperation.

The fourth specific goal includes measures for **strengthening research, development and innovation infrastructure**, e.g. by preparing spaces or premises with the goal of continuing in activities such as science and technology park development. Current trends and studies also confirm the need to build specialised shared infrastructure for prototyping, testing and demonstrations (hubs), e.g. in the framework of new economic phenomena (Industry 4.0).

The fifth specific goal includes activities intended to **take advantage of the opportunities that digitalisation provides for the region's development**. The development and building out of high-speed data infrastructure and the use of big data to improve the workings of public administration – including the development of tools for digitalising communication between public administration and citizens – are expected here. In connection with this, there is also a need for education activities for institutions, companies and citizens regarding digitalisation topics. The possibilities for supporting the use of digitalisation will be covered as well – especially in regard to small and mid-sized enterprises. This requires activities for creating a system of services for these enterprises, such as building a regional digital innovation hub and setting up its services.

Strategy goal 2: Improve infrastructure and collaboration among RD&I stakeholders in the Pilsen Region

Indicator:

- Number of entities collaborating with the Pilsen Region on RD&I (members of RC RD&I, participants in platforms/expert groups organised by the region)

Specific goal 2.1: Apply the results of the smart specialisation process in RD&I development

Indicator:

- Number of sector priorities approved by RC RD&I

Model activities:

- Expand the system for ongoing monitoring of RD&I in the region [region (Smart); RDA]
- Account for specialisation during regular updates to the strategy documents of the region and other entities [region]
- Organise an annual conference on the region's smart specialisation [region (Smart)]
- Arrange the operation of and provide contents for field innovation platforms [region (Smart)]
- Ensure communication and information exchange between the corporate and research sector concerning intelligent-specialisation topics [region (Smart)]
- Prepare projects from the enterprise and research sectors within smart-specialisation topics [ZČU, LF, research organisations, BIC].

Specific goal 2.2: Strengthen the system of collaboration in RD&I

Indicator:

- Number of platforms in the Pilsen Region focused on the subject of RD&I

Model activities:

- Strengthen the region's interest and facilities in RD&I – human resources, activities of the Pilsen Region Council for Research, Development and Innovation, organising platforms, coordinating marketing, etc. [region]

- Expand the activities of the regional centre for supporting RD&I – topic workshops, information sharing, institutional networking, support for preparing projects [region (Smart)]
- Strengthen the region's collaboration with, above all, Bavaria and Upper Austria – public administration, research organisations, application sector [region, Pilsen, IHK, ZČU, LF, research organisations]
- Establish and support the activities of research networks and enterprises at the regional level (platforms, clusters etc.) [ZČU, KHK, IHK]
- Organise interdisciplinary platforms for identifying RD&I opportunities – linking technical, medical, social, economic and other sciences [region (Smart), ZČU, LF]
- Strengthen contacts between research organisations and companies' management teams [KHK, IHK, research organisations].

Specific goal 2.3: Improve support for RD&I

Indicator:

- Number of entities in the Pilsen Region involved in HORIZON 2020 projects

Model activities:

- Provide methodology support for preparing RD&I projects and using results of collaborative research [ZČU, research organisations]
- Support the involvement of regional RD&I facilities in EU programmes (motivation for participation, consulting support, contribution towards preparations) [ZČU, BIC, COMTES FHT]
- Interconnect the RIS3 with the ITI programme of the Pilsen Metropolitan Area and with programmes for cross-border cooperation [region (Smart), Pilsen (ÚKEP)]
- Support the creation of RD&I projects for the Cross-border Cooperation Programme [ZČU, LF, COMTES FHT].

Specific goal 2.4: Strengthen infrastructure for RD&I

Indicator:

- Number of STP and other shared infrastructure in the Pilsen Region

Model activities:

- Preparation of spaces and buildings for developing STP-type projects and shared locations (Pilsen, other cities/towns)
- Construction of shared infrastructure for prototyping, testing and demonstrations – hubs [STP, BIC, ZČU, research organisations, TSC]
- Build science and technology parks, innovation centres and similar facilities [Pilsen, research organisations].

Specific goal 2.5: Take advantage of digitalisation's opportunities for regional development

Indicator:

- Number of active access points in the Pilsen Region to fixed internet according to technology used

Model activities:

- Develop and build up high-speed data infrastructure (e.g. 5G and IoT) [Pilsen (ICTCP)]
- Make use of big data to improve the functioning of public administration – strategy management, higher effectiveness, communication [Pilsen (ICTCP), region]

- Develop means for the digitalisation of communication between municipalities (public administration) and citizens [Pilsen (ICTCP), region]
- Provide targeted education for institutions, companies and individuals in the area of digitalisation [ZČU, Pilsen (ICTCP)],
- Support the digital transformation of small and mid-sized enterprises (e.g. Digital Innovation Hubs) [ZČU].

8.3 Key Area of Change 3: R&D Facilities

The main goal of the key area of change R&D Facilities is to bring about more intensive use of the region's existing research facilities. The activities recommended here will primarily lead to greater utilisation of research and development facilities in the region for practical applications and for cooperation with companies. The proposed sample activities and measures are about improving the environment for cooperation between research facilities and the application sphere. Other proposed activities will help to strengthen international bonds and to make regional facilities more international.

The first specific goal highlights **involving research organisations in international teams**. Cooperation at the European level is the best proof of the excellence of R&D organisations' activities (such as projects in the EU's framework programme for research, development and innovation). Activities here are focused on developing the involvement of regional R&D facilities in EU programmes, European technology platforms, and/or project teams and networks. Other activities, meanwhile, will help to deepen foreign specialists' integration into research and development activities in the region and reinforce local experts' international experience.

The second specific goal emphasises **collaboration between research organisations and the application sector**. Broader involvement of R&D facilities for the needs of the corporate sector (not only in the regional context) can be assisted at the regional level via motivational financial tools that have already been used in the past (business vouchers). Further activities here relate to cooperation from R&D facilities to aid the public administration, which generates broad demand for addressing social challenges. To increase the use of R&D facilities, organisational measures boosting cooperation between research teams and companies and measures strengthening the positions of technology transfer and contractual research are proposed. These endeavours also supplement activities for sharing information on research and development projects, map out the collaboration potential and needs of the application sphere, and clarify key competences of R&D in the region.

The third specific goal is to **deepen the commercialisation of outputs from research organisations**. From the regional standpoint, this is an area where fulfilment has been very difficult so far. It is proposed that greater use be made of successful examples to highlight possible paths as to how research and development outputs can be commercialised and to what effect. The region's performance will meanwhile be monitored in relation to similar Czech or foreign regions so as to enable comparisons. Specific commercialisation activities supported will include spin-off companies and patent sales and/or licensing and the provision of research services outside of subsidy projects (i.e. with the involvement of non-public funding).

Strategic Goal 3: Increase the intensity of utilisation for research and development facilities in the Pilsen Region

Indicator:

- Volume of university research in the Pilsen Region financed by the business sector

Specific goal 3.1: Increase the efficiency of research organisations' involvement in international teams

Indicator:

- Number of projects with entities involved from the Pilsen Region in international collaboration programmes

Model activities:

- Evoke the participation of regional RD&I institutions in international RD&I collaboration programmes (complete support for preparing and implementing projects etc.) [ZČU, LF, COMTES FHT, BIC]
- Support the involvement of the region's RD&I specialists in international organisations, networks etc. [ZČU, LF, research organisations]
- Participate in European technology platforms [ZČU, LF, research organisations]
- Engage research organisation teams in international teams [ZČU, LF UK, BIC, research organisations]
- Ensure internships by foreign specialists at research organisations in the region [ZČU, LF, research organisations]
- Send research workers on internships abroad [ZČU, LF, research organisations].

Specific goal 3.2: Increase collaboration between research organisations and application sector

Indicator:

- Volume of contracted research, consulting and advising at universities in the Pilsen Region

Model activities:

- Provide financial support for collaboration between research organisations and the application sector (support programmes) [region, Pilsen]
- Arrange short-term internships between research organisations and the application sector [ZČU, research organisations, region],
- Improve the position of technology transfer and contractual research at ZČU so as to ensure a comprehensive selection of solutions and services (facilities, personnel) [ZČU]
- Create a catalogue of key competences in R&D in the region (region)
- Map out the needs and cooperation potential of the application sector [ZČU, VO, business federations]
- Provide support for regularly sharing information on current projects and results of research organisations – informational website, bulletin [ZČU, LF, region (Smart)].

Specific goal 3.3: Intensify commercialisation of results of research organisations

Indicator:

- Amount of income from sales of licences to entities in the Pilsen Region

Model activities:

- Benchmark the commercialisation of outputs from the region's research organisations relative to comparable regions in the Czech Republic [region (Smart)]

- Gather and evaluate examples of successful commercialisation of R&D outputs [region (Smart)]
- Ensure transfer of experience with commercialisation of R&D outputs [ZČU]
- Support the establishment of spin-offs [ZČU, LF, BIC]
- Support the sale of patents and provision of licences [ZČU, LF, research organisations]
- Develop research services by involving non-public resources in research [ZČU, LF, research organisations].

8.4 Key Area of Change 4: Innovation

The aim of the key area of change Innovation is to expand the ranks of companies with high innovation potential in the Pilsen Region. The studies in the analysis phase have suggested that the Pilsen Region is not a significantly innovative region. Emphasis is therefore being placed on activities supporting the establishment of new and especially innovative companies and on reinforcing innovation activities at existing companies. Lastly but importantly, the option of bringing new investments with high innovation potential into the region is being pursued. The example activities and projects are directed both towards using existing infrastructure and resources to support business and towards developing support services. This area also counts upon support for projects with a high innovation potential in the framework of strategic cooperation at the regional or national level.

Its first specific goal is related to broadening the ranks of **new domestic innovation-based companies** and corresponds with the fact that Pilsen Region is generally presented as a region with low business activity. The current high supply of jobs further decreases the otherwise low interest in entrepreneurship. However, the greatest benefit for the region always comes from companies whose owner is based in the region. To motivate people, and especially younger people, activities all the way down to the school level (business schools and camps) as well as informal projects (“business hotseat” events) are proposed here. Consulting and educational services, coaching, and professional assistance in overcoming problems and risks during the starting phase of business (financing, legal matters, intellectual property protection, market access etc.) build upon these activities.

The key point for supporting the establishment of innovation companies is securing financing for the startup period, whether by providing grants, loans, or venture capital. One area in which Czech and regional companies have significant room for improvement is business models and relationships. In this area it is fundamental to provide access to information on target markets and support the presentations of innovative companies and their potential clients. The option of using shared infrastructure (incubators or less formal coworking centres) for startup firms is also an essential part of this set of activities for supporting the early phase of business.

The second specific goal is focused on **strengthening innovation activities at existing companies**. Although expenditures towards research and development in the Pilsen Region are increasing continuously and the corporate sector reports more than 75% of these expenses, companies in the Pilsen Region still have unexploited opportunities for increasing their innovation performance. It has been shown that significant opportunities are offered by the broader involvement of newly constructed research infrastructure and experts in companies’ activities. e.g. by providing information on the latest available technology or getting involved in the knowledge transfer process. One essential prerequisite is securing funding to support innovation. Obtaining European and national funding is thus useful for supporting the provision of specialised services. There is also the option of considering the use of innovations during the assigning of public-administration tasks, so as to apply innovation companies’ capacities towards public-sector tasks as well.

The third specific goal is targeted at **obtaining major investments with high innovation potential**. The findings show that locating these investments requires a special approach that is significantly different from the experiences obtained from supporting the placement of investors in industrial zones or logistics centres. A suitable presentation of the region or access to these investors from regional or local governments is a key ingredient which, in synergy with government agencies for the support of investment, could positively enrich the region's economic environment. It is also essential to support communication among investors and the public administration in meeting the region's priorities with respect to employment structure, connections to public infrastructure, and the necessary structure of qualifications. Support from the region and from cities and towns should also be directed towards preparing suitable spaces or locations and locating strategic projects.

Strategic Goal 4: Increase the number of companies with high innovation potential in the Pilsen Region

Indicator:

- Share of companies with technical and non-technical innovations

Specific goal 4.1: Increase the number of new domestic innovation-based companies

Indicator:

- Expenditures on technical innovation

Model activities:

- Motivation programmes ("business hotseats", business schools, sector-focused camps, business models in schools, etc.) [region, Pilsen (ICPCP), DEPO, ZČU, LF UK, BIC]
- Consulting and educational support – consulting assistance, coaching, mentoring, vouchers for expert assistance, etc. [BIC, CI]
- Discounted access to business services (finance, law, IPR etc.) [BIC]
- Access to sources of funding (mediation of grants, microloans, venture capital, capitalisation of public support, etc.) [BIC, CI]
- Support for the development of business relationships – presentation of plans to larger companies, at trade fairs, etc.[KHK, PCC, IHK, CI]
- Discounted access to infrastructure for start-ups (coworking, incubator, etc.) [BIC, STP, Pilsen (ICTCP), DEPO, COMTES FHT]
- Connecting large companies with startups and beginning entrepreneurs [BIC, CI].

Specific goal 4.2: Strengthen innovation activities at existing companies

Indicator:

- Expenditures on technical innovation

Model activities:

- Providing information about the latest technologies available [BIC, ZČU, LF]
- Involving companies in programmes for the development of highly innovative projects [BIC]
- Securing financial support to develop RD&I facilities (business RD&I, access to ESIF/ITI funds, etc.) [BIC]
- Supporting the transfer of knowledge (purchasing licences, getting external specialists involved in innovation projects at companies) [ZČU, LF, BIC]
- Consistently including innovation requirements in tasks assigned by public entities [region]

- Motivating the use of innovation support programmes at companies that do not have their own innovation activities [BIC].

Specific goal 4.3: Acquire major investments with high innovation potential

Indicator:

- Number of new innovative companies or branches in the Pilsen Region with foreign investment or with a parent company outside of the region (entities from the past 3 years, 20 or more employees and CZK 50,000 or more added value per employee, and with 5% or higher average growth in added value per employee)

Model activities:

- Strategically cooperating with government agencies focused on supporting investments with high innovation potential [region, Pilsen]
- Defining suitable spaces for implementing investments with a significant share of RD&I [Pilsen, other cities/towns]
- Supporting strategic business plans with high innovation potential from the region and local governments [region, Pilsen, other cities/towns].

8.5 Key Area of Change 5: RD&I Marketing

The strategic goal of the key area of change RD&I Marketing is to strengthen the Pilsen Region's reputation in the world of RD&I. A Marketing Strategy for the Pilsen Region in RD&I has already been drafted within this goal's initial fulfilment phase. A Communication Plan for the Pilsen Region in RD&I has also been created for the fulfilment of the Marketing Strategy. The main focus in the area of marketing is now to implement the Marketing Strategy's activities with the aim of building the region's identity as a region that supports innovative business.

The first specific goal is aimed at **creating the conditions for performing the region's innovation marketing activities**. They are organising regional innovation marketing (RIM) within the region's existing organisational structure, founding and creating individual RD&I promotional tools using the region's own media (website, newsletter etc.) and last but not least updating analyses, surveys and the region's own Marketing Strategy, Communication Plan etc. Structures and mechanisms created in connection with the drafting of the Pilsen Region's RIS3 will be used for this to the maximum extent.

The second specific goal addresses **strengthening the Pilsen Region's identity as a region with high-quality education and first-rate research**. This is marketing aimed at target groups within the region with the goal of strengthening the region's internal identity and the general perception of the region as having high-quality education and research. This goal will mainly be achieved by presenting the successful results of good practice in research and innovation and/or presenting the target groups with important research and innovation personalities who have a connection to the region. For the performance of "internal" marketing and campaigns, the region's brand will be used consistently, in its current or updated form. To fulfil the goal of strengthening regional identity, the region will mediate the provision of information and contacts for important research and innovation entities – primarily their provision to regional media.

The third goal has the task of **changing the perception of the Pilsen Region as one of innovation** outside of the region. It will be based on presentations of both traditional and new values and opportunities; also expected here is the interconnecting of the presentations of innovation companies with the region's self-presentation, as well as the use of ambassadors to spread the region's good name nationally and abroad. For this goal as well, marketing tools

and campaigns will be put to work in addressing target groups nationwide and abroad – including presenting the Pilsen Region as an innovation region at selected major conferences and fairs. Likewise, the region will pass on information on RD&I successes in the Pilsen Region to national and foreign media more intensively than before.

Strategic goal 5: Strengthen the Pilsen Region's reputation in the world of RD&I

Indicator:

- Number of repeat visitors to the website www.inovujtevpk.cz

Specific goal 5.1: Create conditions for the region's innovation marketing

Indicator:

- Number of entities collaborating in regional innovation marketing (RIM)

Model activities:

- support for the functioning of the RIM system [region (Smart)]
- creation and development of tools for promoting RD&I outputs (region's own media) [region]
- updating of surveys, Marketing Strategy and Communication Plan [region (Smart)].

Specific goal 5.2: Strengthen the Pilsen Region's identity as a region with high-quality education and first-rate research.

Indicator:

- Number of articles in media on the topic of RD&I in the Pilsen Region

Model activities:

- Present successful examples of research and innovation outputs in the region [ZČU, LF, research organisations, region]
- Ensure new forms of presentation for attractive fields of study in the region [ZČU, LF]
- Present important research and innovation personalities who have a connection to the region [ZČU, LF, research organisations, region]
- Involve important research and innovation personalities into communication with the region's target groups [ZČU, LF, research organisations, region]
- Ensure consistent brand use by important entities [ZČU, LF, research organisations, region]
- Maintain the campaign's image in the eyes of the target groups [region]
- Arrange regional media's access to information and contacts for entities that are important for RD&I in the region [ZČU, LF, research organisations, region].

Specific goal 5.3: Change the perception of the Pilsen Region as a region of innovation

Indicator:

- Number of marketing campaigns on the topic of RD&I in the Pilsen Region

Model activities:

- Ensure regional self-presentation based on both traditional and new values and opportunities in the region [region]
- Connect presentations of innovation companies with the region's self-presentation [region, companies]
- Make use of national and international contacts to spread the region's good name (ambassadors) [ZČU, LF, research organisations, region]

- Arrange marketing campaigns aimed at target groups nationwide and internationally [region]
- Present the region at important conferences, fairs etc. [ZČU, LF, research organisations, region]
- Promote information on the region's RD&I successes in national and international media [ZČU, LF, research organisations, region].

9 Sector Priorities – Realms of Specialisation in the Pilsen Region

9.1 Definition of Smart Specialisation in the Pilsen Region

The smart specialisation concept has recently been employed in economic development strategies in a number of regions in the EU. Specialisation primarily requires the proper identification of promising sectors and their systematic support and economic use. These should be sectors in which the region has the potential to excel and which may represent a significant factor for the region's future economic competitiveness. Specifically these include traditionally successful sectors, unique professional knowledge, long-term cutting-edge programmes at research and educational institutes, etc. These help to develop businesses, establish new companies, and obtain business investments for which specialised knowledge is an advantage, a stimulus, and/or a reason to locate development objectives in a particular region.

In the preparatory stage of smart specialisation in the Pilsen Region focusing on identifying sectors for smart specialisation in the region, the entrepreneurial discovery process (EDP) as well as data analysis were consistently applied. The entire process and its results, incl. justifications, are listed in the study titled Smart Specialisation of the Pilsen Region 2019.

Data analysis was focused on identifying promising sectors in the Pilsen Region with respect to the economic base, research and development, and education as a supplement. Based on selected indicators, the most promising sectors were identified for research and development, the economy, and education in the Pilsen Region, including connections to these (see following table). This intermediate result was verified in follow-up discussions.

The actual entrepreneurial discovery process in identifying the Pilsen Region's sector priorities was launched with a questionnaire survey on smart specialisation in the Pilsen Region conducted among professionals in the business and research sectors. The principles of the Delphi method were employed in the questionnaire survey while placing emphasis on a balanced representation of business and research professionals and balance according to sector. The result was an expert proposal of promising topics and technical directions for the Pilsen Region.

This expert proposal was further discussed at a conference on smart specialisation in the Pilsen Region, which was held in May 2019. The conference presented the results of the previous two steps and discussed the results with professionals in the business, research and public sectors. The aim was to define the sector priorities of Pilsen Region on the basis of these discussions – i.e. sectors in which the region has exceptional potential for the economic application of the results of research & development. The result is that four sector priorities or “realms” were defined (see following table).

The table below also summarises the results of the entire process, as it compares the results of data analysis regarding promising sectors in the Pilsen Region with the results of entrepreneurial discovery. It thus provides a framework definition for the relationship of the most promising economic, research and educational sectors in the region for individual sector priorities. A more detailed description of the Pilsen Region's priority sectors is contained in the next chapter.

A sector innovation platform has been created for each of the sector priorities in the Pilsen Region. Representative of the business, research and public sectors are involved in the platform, and together they seek additional concrete opportunities for collaboration. It can be expected that among other things, the activity of **sector** innovation platforms will further specify the focus of the Pilsen Region's sector priorities.

Comparison of Pilsen Region’s sector priorities with promising sectors of the economy, research and development, and education

Sectors with above-average potential in the Pilsen Region			Pilsen Region Realms ²⁾			
Education	Research & development	Economy ¹⁾	New materials	Smart manufacturing systems	Smart mobility	Biomedicine and Technology in Medicine
SW and application development	Computer science and IT			X	X	X
Electronics and automation	Electrical engineering and	Electronics industry	X	X	X	
Mechanics and metalworking	Mechanical engineering	Electrical equipment industry	X	X	X	
Therapy and rehabilitation	Medical engineering	Automotive industry	X		X	
Human Medicine	Clinical medicine, General medicine, Health sciences, Other medical sciences	Material engineering and nanotechnology	Other vehicles	X		X
			Mechanical engineering industry	X	X	
			Air and spacecraft industry	X		
			Manufacture of medical and dental instruments and supplies	X		

¹⁾ Application sector in terms of production, not use of product

²⁾ Corresponding to the sector innovation platforms

9.2 Sector Priorities in the Pilsen Region

New materials

Preferred promising directions	<ul style="list-style-type: none"> - Materials with advanced properties - Materials for additive technology - Special steel
Research organisation examples	COMTES FHT, ZČU (+NTC, RICE), VZÚ Pilsen
Company examples	MBtech Bohemia, Doosan ŠKODA Power, ŠKODA Transportation, ŠKODA Electric, ZF Engineering, ŠKODA JS, Murr Elektrotechnik
Associated sectors (CZ-NACE)	Electronics industry (26), Electrical equipment industry (27), Engineering industry (28), Automotive industry (29), Air and spacecraft industry (30.3), Other vehicles (30.3 + 30.4. + 30.9), Manufacture of medical and dental instruments and supplies (32.5)
Connection to the national RIS3 realm	Advanced machinery/technology for strong and globally competitive industry
Anticipated connections with other sectors	New material for 3D printing, materials for healthcare, materials for electromobility and energy, materials for increasing efficiency and lifespans etc., materials for sensors

Smart manufacturing systems

Preferred promising directions	<ul style="list-style-type: none"> - Smart diagnostics and maintenance - Smart production management - Embedded intelligence - Big data - Neuron networks and machine learning - Models, control, trends and predictions using AI - Sensors, sensor control technology
Research organisation examples	ZČU (incl. Fac Sci, NTIS, Fac Mech, ...), COMTES FHT
Company examples	Klastr Mechatronika, Doosan, ŠKODA Power s.r.o., ŠKODA Electric, Aimtec, Konplan, Value4Industry, Openmatics, ZAT Plzeň, Kontron ECT design
Associated sectors	Electronics industry (26), Electrical equipment industry (27), Engineering industry (28), ICT services (61 + 62),
Connection to the national RIS3 realm	Digital market technologies and electrical engineering
Anticipated connections with other sectors	The topic itself is connected with artificial intelligence and the Internet of Things (see preferred directions) – e.g. for smart diagnostics and maintenance

Smart Mobility

Preferred promising directions	<ul style="list-style-type: none"> - New vehicle concepts - Autonomous mobility - Charging systems for electromobility - Transportation planning and modelling - Transportation monitoring and control - Shared transport
Research organisation examples	ZČU Fac EE (RICE), ZČU Fac Sci, ZČU Fac Mech, ZČU NTC
Company examples	ZF Engineering, MBtech, City of Pilsen/PMDP, ICT Administration Office, InnoConnect, Plan4all, Pilsen Region/POVED, Omexom GA Energo, Smart Pilsen Region Cluster, ŠKODA Transportation, ŠKODA Electric, ZAT, Kontron
Associated sectors	Electronics industry (26), Electrical equipment industry (27), Automotive industry (29), Other vehicles (30.3 + 30.4. + 30.9), ICT services (61+62)
Connection to the national RIS3 realm	Vehicles for the 21st century
Anticipated connections with other sectors	Artificial intelligence, Internet of Things, cybersecurity, new materials

Biomedicine and Technology in Medicine

Preferred promising directions	<ul style="list-style-type: none"> - Oncology - Infectious diseases and antibiotic resistance - Multidisciplinary medicine - Reproductive medicine - Technology for preventative medicine - Organ replacement - Medical diagnostics - Medical materials
Research organisation examples	Charles University Faculty of Medicine in Pilsen, Biomedical Centre of LF UK in Pilsen, Faculty of Health Care Studies at ZČU in Pilsen, Faculty of Applied Sciences, or other parts/facilities of ZČU in Pilsen
Company examples	University Hospital in Pilsen, Cheiron, AbCheck, Embitron, Biopsy Laboratory, Genetika Plzeň, Ofta, NATALART s.r.o., Pilsen Regional Hospital, Mulač Hospital, PRIVAMED Hospital
Associated sectors	Manufacture of medical and dental instruments and supplies (32.5), ICT services (61+62), Human health (86)
Connection to the national RIS3 realm	Healthcare, advanced medicine
Anticipated connections with other sectors	If there is a focus on new medical materials, it is recommended to particularly invite NTIS and COMTES FHT.

10 Implementation of RIS3

The Pilsen Region's RIS3 is a fundamental development document that supports research, development and innovation activities in Pilsen Region. The implementation of RIS3 is reflected in the management and financing of entities active in RD&I and in preparations for projects in this field. The existence of this document is a general condition for drawing on ESIF funds.

To implement RIS3, it is fundamental that an organisational chart be established, including an overview of essential activities and a description of the organisation, organisational structure and activities of individual divisions involved in RIS3.

The fulfilment of Pilsen Region's RIS3 requires the following activities:

1. Strategy implementation management
2. Project preparation and implementation
3. Monitoring of strategy implementation
4. Updates to the strategy

To manage RIS3, the existing mechanisms and structures used in implementing the Pilsen Region Smart Accelerator project, the mission of which is to draft and update the strategy and contribute to its implementation, will be utilised to the maximum extent.

10.1 Management of RIS3

In terms of the hierarchy of management, implementation of the strategy can be divided into:

- Strategic management
- Operative management

The **strategic management** of RIS3 is in the full competence of RIS3's contracting authority, i.e. the Pilsen Region and specifically the region's leadership. The strategic management of RIS3 for the region encompasses:

- Creating the RIS3 strategy
- Updating RIS3 (see below)
- Evaluating the implementation of RIS3 (see below)

The **Pilsen Region Council for Research, Development and Innovation** (RC RD&I) will provide the region's leadership with significant support in the strategic management of RIS3. RC RD&I is an advisory body to the Pilsen Regional Council regarding research, development and innovation. Its main mission is to coordinate RIS3 creation and implementation in the Pilsen Region. RC RD&I plays the role of a steering group (of the RIS3 platform) in accordance with the European Commission's S3 Guide.

It is useful to get a broader circle of persons from all areas relevant for RD&I involved in the strategic management of RIS3. For this purpose, the cross-sectional platforms created as part of the implementation of the Smart Accelerator project are included in strategic management; these platforms are:

- Human resources for research, development and innovation in the Pilsen Region
- Research, development and innovation facilities in the Pilsen Region
- The Marketing working group.

The number and structure of platforms and/or working groups may change in the future. It is expected that meetings between the Regional Council, platforms and working groups will be

held at least twice per year. This is important to maintain stakeholders' interest in RIS3, to actively involve various organisations and persons in implementation, and to pass on findings and experience to the RIS3 strategic management level.

The **operative management** of RIS3 implementation is provided by the Pilsen Region Smart Accelerator project team until 2019. The team comprises staff from the Pilsen Regional Authority and staff from RDA Pilsen Region.

The operative management of RIS3 primarily encompasses:

- Supporting activities' preparation and implementation
- Meeting partners – activity guarantors
- Monitoring project preparation and implementation
- Communicating with other subjects (e.g. at the national level, companies, etc.)
- Educating and informing
- Coordinating activities
- Ensuring that the organisational structure is functioning

Besides project preparations, implementation and monitoring (see next chapter), operational management will also include ongoing communication with public and private subjects, including obtaining feedback about RIS3's current status towards the drafters of the National Innovation Strategy (NIS3 ČR) and other entities at the national and regional level. At the same time, educational and information events will be carried out in the area of RD&I support at the regional level (conferences, workshops, popularisation and marketing events, etc.). An essential part of operative management is the coordination of all activities, incl. ensuring the functioning of the organisational structure.

For presentations and current information, the websites of the Pilsen Region, key partners and the Smart Accelerator project www.inovujtevpk.cz will be used.

10.2 Project Preparation and Implementation

Project preparation and implementation is primarily connected with performing activities in individual strategic areas, drafting Project Fiches, identifying external sources of funding, and communicating with the guarantors of individual activities. Organising project preparations is the job of the Smart Accelerator team, working in close conjunction with the guarantors of the activities in the Action Plan.

One of the outputs of operative management of Strategy implementation is monitoring the status of preparations and implementation of the projects and, if applicable, other activities. This is also the basis for strategic management, especially for evaluating the implementation of RIS3 (see below).

10.3 Evaluation of RIS3's Implementation

As part of the regular evaluation of RIS3, the fulfilment of the Action Plan in connection to RIS3 will be assessed once per year. The results will be processed in the form of a report.

The report will contain the following sections:

- a) Overview of projects under preparation, underway and completed
- b) Comparison of the projects with the Action Plan and RIS3
- c) Assessment of fulfilment of the goals of RIS3 based on indicators
- d) Evaluation of developments in the region's RD&I based on context indicators

- e) Proposal to update of priority activities in the Action Plan for the next period
- f) Proposal to update RIS3, if applicable (see below)

The Pilsen Region Department of EU Funds and Projects (DFP) ensures that the report is prepared with support from the Smart Accelerator team, and it submits the report to RC RD&I for discussion. DFP submits the result of the meeting with RC RD&I, including recommendations, to the leadership of the Pilsen Region for further discussion.

The report, which has been commented on by RC RD&I and Pilsen Region authorities, will subsequently serve as the specifications for updating the Action Plan or for updating RIS3 itself.

10.4 Updating of RIS3

It would be practical to make additional updates based on the assessment of the implementation of RIS3 (see previous subchapter). The basis for the update process is always the last report evaluating the implementation of RIS3, which details the results and, if applicable, the impacts of completed projects as well as changes in the external conditions.

Certain segments of RIS3 are candidates for receiving updates:

- The main goal and strategic goals form the stable framework of RIS3; updates to them are contingent on discovering significant changes in the region's development.
- Specific goals may be updated, i.e. cancelled or supplemented, based on an assessment of whether they are still current and relevant given the region's development.
- Examples of activities are updated in connection with a review of the measures or based on new needs that are identified, for example, when discussing the annual evaluation of RIS3 implementation.

11 Financial Support of RIS3

The purpose of this chapter is to present the financial planning structure for fulfilling RIS3 and to establish the main financing sources for implementation. A definition of the sources and evaluation of their accessibility should also be included in decision on priority activities, which will result from the Action Plan preparation process. Establishing the precise amount of funding needed to implement RIS3 in its full scope by 2020 is the subject of the Action Plan (i.e. a set of select projects with estimates of time, technical and financial requirements).

Funding needed to implement RIS3 up to 2020 can be identified in two main areas: management of RIS3 and project preparations and implementation. The situation will remain similar after 2020, when financing will be based on new programmes for new programme periods.

11.1 Management of RIS3

RIS3 implementation requires that facilities for managing implementation be secured, particularly: monitoring and evaluating developments in the main indicators in the spheres of action of RIS, systematically coordinating regional partnership in RD&I and forming a joint consensus about key priorities. Another essential part of RIS management is monitoring and providing organisational support for complementarity between the roles and processes of the stakeholders in the regional innovation ecosystem. Important associated activities can also be included in this category, particularly those connected with arranging for a regional contact point in RD&I, which covers the bonds and processes connected with RIS3 implementation.

To a certain extent, management of RIS3 is one of the key elements for a functioning innovation ecosystem. The public administration, and particularly the Pilsen Region, which is considered the lead manager of RIS, has a key role in securing funding for this area.

Beyond its own funds, it currently secures the funding needs for OPRDE via the Smart Accelerator project, which Pilsen Region is implementing in partnership with RDA Pilsen Region and other subjects. This project largely secures the funds for managing RIS3 up to 2019. In cooperation with representatives of the region and central institutions (the Government of the Czech Republic and the Ministry of Education, Sports and Youth of the Czech Republic (MŠMT)), discussions are underway on possible support for implementing RIS management as part of a continuation of the Smart Accelerator project even after 2019. At the end of 2019, a proposal for a 3-year Smart Accelerator II project for the Pilsen Region was submitted to the Smart Accelerator II – support for individual projects from the Research, Development and Education Operational Programme (MŠMT) – call for proposals, so as to secure funding for RIS3 strategy activities in 2020–2022.

Besides this systemic tool for securing funding for RIS3 management, it would be good to seek additional sources, e.g. by involving regional partners in relevantly focused grant projects of European cooperation.

11.2 Development Project Preparation and Implementation

The performance of most development activities in RIS3 falls under the responsibility of individual stakeholders in the regional innovation ecosystem (see identification of subjects responsible for proposed activities in RIS3). Priority activities should become part of these entities' strategic and financial plans.

Given the anticipated financial needs of implementation, it can be foreseen that besides the stakeholders' own sources and with respect to current capabilities, it is necessary to use

external sources. It is therefore desirable to come to an agreement at the RIS financial plan level regarding individual stakeholders' responsibility to take care to obtain these available resources. In this regard it is also essential that the agreement created regarding the content and objectives of RIS be used in the preparation and regional focus of existing or prepared development programmes and measures (e.g. preparation of ESIF 2021+, ITI, focus of TACR national programmes, etc.). Internal public sources (such as regional and local budgetary funds) should be used especially in cases where the responsible entity is unable to secure the fundamental priority of RIS from its own funds, or if this priority cannot be secured from external financing.

To create a framework summary of external sources under consideration for funding RIS3 in connection with its goals, the following table has been created:

Specific RIS Goal	Programme	Examples of Supported Activities
SG 1.1: Increase internationalisation in education	OPRDE, PA2 (SO5) / after 2020: subsequent programme	International mobility of research workers
	ERASMUS+	International internships for instructors
	Cross-Border Cooperation Programme Czech Republic – Free State of Bavaria Objective ETC 2014–2020 PO3	Cross-border linking of education options and mutual coordination of educational programmes and qualification requirements – Development of joint education strategy, language education, etc. – Cross-border instruction and joint specialist courses and study programmes at universities – Scientific studies and analyses in the field of cross-border education – Exchange of information and experiences among Czech and Bavarian educational system stakeholders
	Horizon 2020, PA1, “Excellent Science” / Horizon Europe	Marie Skłodowska-Curie, Exchanges (Research and Innovation Staff Exchange, RISE), Individual scientific research residences for experienced research staff
SG 1.2: Expand the range of multidisciplinary study programmes at universities and secondary schools	OPRDE, PA2 (SO5) / after 2020: subsequent programme	Development of research-oriented study programmes Preparation of new study programmes
SG 1.3: Strengthen the network of collaboration among educational institutions at all levels and research organisations in seeking talent and developing talent in RD&Is		
SG 1.4: Increase the attractiveness of preparing RD&I specialists and the scope of possibilities for their employment	OPRDE, PA2 (SG5) / after 2020: subsequent programme	Increasing the qualifications of research and technical staff at research organisations
SG 1.5: Increase teacher motivation and improve teacher training	OPRDE, PA3 / after 2020: subsequent programme	Implementation of the Regional Action Plan

SG 2.1: Apply the results of the smart specialisation process in RD&I development	OPRDE, PA2 (SO5) / after 2020: subsequent programme	Smart Accelerator
SG 2.2: Strengthen system of collaboration in RD&I	OPRDE, PA2 (SO5) / after 2020: subsequent programme	Smart Accelerator
SG 2.3: Improve support for RD&I	OPRDE, PA2 (SO5) / after 2020: subsequent programme	Smart Accelerator
	EUPRO II (Ministry of Education, Sports and Youth of the Czech Republic)/ INTER-EXCELLENCE	Assistance in preparation and administration of international research projects, e.g. activity of RCO at ZČU
	OPEIC, PA1 / after 2020: subsequent programme	Development of services (consulting).
SG 2.4: Strengthen infrastructure for RD&I	OPEIC, PA4 (SO4.1) / after 2020: subsequent programme	Building high-speed internet network
	OPEIC, PA1 SG 1.2 / after 2020: subsequent programme	Infrastructure services (development of science and technology parks, incubators)
SG 2.5: Take advantage of digitalisation's opportunities for regional development	OPEIC PO 4 (SG 4.1, SG 4.2) / after 2020 subsequent programme /DIGITAL EUROPE PROGRAMME	Development of high-speed network access to the internet and ICT Expand coverage of high-speed access to the internet Increase exploiting the potential of the ICT sector for economic competitiveness
SG 3.1: Increase the efficiency of research organisations' involvement in international teams	OPRDE, PA2 (SO5) / after 2020: subsequent programme	International mobility of research workers
	OPRDE, PA1, SO1 / after 2020: subsequent programme	Research teams of excellence, Teaming, Phased projects, Excellent research, Research infrastructure, Teaming II 2017, Excellent research 2018
	OPRDE, PA2, SO2 / after 2020: subsequent programme	Pre-application research 2017, Long-term cooperation 2017, Pre-application research 2018
	Horizon 2020, PA1, "Excellent Science" / Horizon Europe	Marie Skłodowska-Curie, Exchanges (Research and Innovation Staff Exchange, RISE), Individual scientific research residences for experienced research staff (incl. return of research workers)
	EUPRO II (Ministry of Education, Sports and Youth of the Czech Republic)/ INTER-EXCELLENCE	Assistance in preparation and administration of international research projects, e.g. activity of RCO at ZČU
SG 3.2: Increase collaboration between research organisations and application sector	OPRDE, PA1, SO2 / after 2020: subsequent programme	Long-term cooperation between companies and research organisations
	OPRDE, PA2 (SO5) / after 2020: subsequent programme	Building expert facilities – transfer of technology (CTT)
	OPEIC PA1 (SO1.1) / after 2020: subsequent programme	Support for developing RD&I facilities in companies (Potential, Innovation, Application)

	OPEIC, PA1 (SO1.1) / after 2020: subsequent programme	Innovation vouchers, proof of concept, knowledge transfer partnerships (purchase of consulting, expertise and support services in innovation from organisations for research and disseminating knowledge and from accredited laboratories)
	Horizon 2020 / Horizon Europe, Eureka, Eurostars	Support of international applied research and experimental development projects (collaborative research, collaboration between research organisations and practical sphere)
	Cross-Border Cooperation Programme Czech Republic – Free State of Bavaria Objective ETC 2014–2020 PO1	Support for research, technical development and innovation by strengthening cross-border activities in the field of research and innovation, support for applied research i.e. the transfer of research, innovations, and technology to the economic sector, represented by regional SMEs
	TACR programmes, Country of the Future, and programmes of individual resorts, e.g. Trio – MIT	Support for applied research and experimental development projects, particularly at the national level Achieving patents, prototypes, functional samples, industrial designs and utility models, semi-industrial verification of technology, software.
SG 3.3: Intensify commercialisation of results of research organisations	OPEIC, PA1, SO1.1, Innovation Programme / after 2020: subsequent programme	Projects for protecting intellectual property rights
	TACR, Gama programme	Support for commercialising the results of RD&I achieved at research organisations
	OPEIC, PA1 (SO1.1) Proof of Concept Programme / after 2020: subsequent programme	Verification of the commercialisation of RD&I results (designated for SMEs)
	Horizon 2020 / Horizon Europe, SME Instrument/ EIC Accelerator, TACR, Gama programme	Verification of the commercialisation of RD&I results with international potential (designated for SMEs)
	CzechInvest programmes, esp. CzechStarter, CzechDemo, CzechAccelerator and CzechMatch	Support for the establishment of start-ups (including spin-offs) with international potential (activities such as coaching, mentoring, participation in prestigious international conferences and trade fairs, residence at prestigious business centres, etc.)
SG 4.1: Increase the number of new domestic innovation-based companies	OPEIC PA2 (SO2.1) / after 2020: subsequent programme	Support for enterprises using innovation infrastructure, consulting support, provision of capital, support during expansion
	OPEIC, PA1 SO1.2 / after 2020: subsequent programme	Infrastructure services (development of science and technology parks, incubators)
	OPEIC	Marketing support for operating on international markets.

	PA2 (SO2.2) / after 2020: subsequent programme	
	CzechInvest programmes, esp. CzechStarter, CzechDemo, CzechAccelerator and CzechMatch	Support for the establishment of start-ups (including spin-offs) with international potential (activities such as coaching, mentoring, participation in prestigious international conferences and trade fairs, residence at prestigious business centres, etc.)
	CMZR Bank	Discount loans, loan guarantees
SG 4.2: Strengthen innovation activities in existing companies	OPEIC PA1 (SO1.1) / after 2020: subsequent programme	Support for developing RD&I facilities in companies (Potential, Innovation, Application), incl. purchasing equipment, technology and intellectual property rights
	Further programmes listed for SO 3.3. focused on companies	Support of RD&I projects
SG 4.3: Obtain major investments with high innovation potential	CzechInvest, MIT	Programmes supporting preparation of infrastructure, investment incentives.
SG 5.1: Create conditions for the region's innovation marketing	OPRDE, PA2 (SO5)	Smart Accelerator
SG 5.2: Strengthen the Pilsen Region's identity as a region with high-quality education and first-rate research		
SG 5.3: Change the perception of the Pilsen Region as a region of innovation		