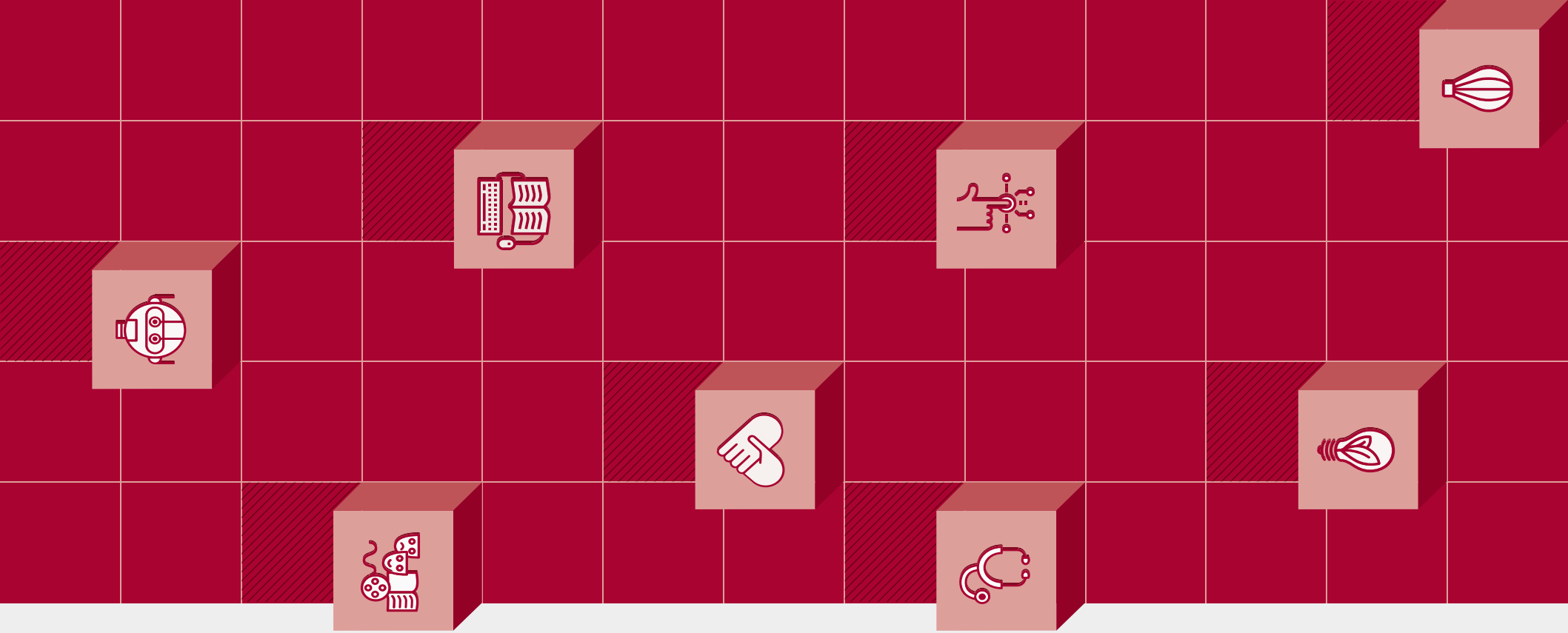

productivity report 2020

IMAD

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Responsible person: Marijana Bednaš, MSc, Director

Editor: Peter Wostner, PhD

Authors: Barbara Bratuž Ferk, MSc, Tanja Čelebič, MSc, Lejla Fajić, Tina Golob Šušteršič, Matevž Hribernik, MSc, Alenka Kajzer, PhD, Katarina Ivas, MSc, Mateja Kovač, MSc, Rotija Kmet Zupančič, MSc, Janez Kušar, MSc, Urška Lušina, MSc, Iztok Palčič, PhD, Jure Povšnar, Urška Sodja, Metka Stare, PhD, Nataša Todorović Jemec, MSc, Ana Vidrih, MSc and Peter Wostner, PhD; in collaboration with Valerija Korošec, PhD.

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Editorial board: Marijana Bednaš, MSc, Lejla Fajić, Marta Gregorčič, PhD, Alenka Kajzer, PhD, Rotija Kmet Zupančič, MSc, Janez Kušar, MSc.

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The key messages

The Covid-19 crisis started after a decade of faltering productivity growth, which fell from 3.0% in 2000–2008 to 0.6% in 2009–2019 (or to 1.4% in times of buoyant economic growth between 2014 and 2019) and thus also slowed the pace of convergence with more advanced countries. In the medium term, the possibility of increasing economic growth by higher employment will be limited due to demographic change. Slovenia will thus be able to achieve GDP growth almost solely by increasing productivity growth, but this will have to accelerate significantly for Slovenia to achieve the level of development in the EU-27 or countries such as Austria.

Successful transformation is possible only on the basis of a proactive development policy aimed at promoting innovation-driven economic growth.

The transformation of global value chains could benefit Slovenia in this respect. Compared with competitor countries and regions, Slovenia has so far retained its relative comparative advantages with regard to knowledge and intangible capital, which will be ever more important in times of the fourth industrial revolution, but the advantage is gradually fading away. Successful transformation and thus an increase in well-being is therefore possible only on the basis of a proactive development policy aimed at promoting innovation-driven economic growth by exploiting the opportunities offered not only by digitalisation but also by the transition to a low carbon and circular economy. Due to accelerating climate change, both processes will need to be managed in parallel but also, where possible, in a complementary fashion.

Time to move is now, as an intensive transition to industry 4.0 is already expected before the middle of this decade.

Time to move is now, as an intensive transition to industry 4.0 is already expected before the middle of this decade, which means that the period of the transition will be extremely short. Clinging to existing production methods and business models is therefore extremely risky, especially for the parts of the business sector functioning as suppliers. This holds true not only because of the productivity premium enabled by the digitalisation of production processes, but mainly due to the benefits arising from digitally driven innovation, new business models and higher-quality and different products or services, which are at the heart of digital transformation.

With an estimated 26%, Slovenia is in the group of countries with the highest share of jobs at high risk of automation, but the actual impact on the labour market will depend on the ambition and speed of the digital transformation. Studies based on microdata indicate a positive correlation between digitalisation or robotisation and employment, which means that companies that transform first not only achieve faster growth but also accelerate employment.

However, ambitious and rapid digital transformation also requires enhanced social dialogue and prior social contract on how to maintain social and territorial cohesion, i.e. how to manage the digital transition to increase well-being. It is vital to bear in mind that non-action is further augmenting the risk of increasing social and territorial polarisation. For example, for a successful transition and prevention of an increase in social inequalities, a timely and massive reskilling will be of particular importance, a challenge for which Slovenia is not sufficiently prepared. The same applies to the territorial aspect: the future development and employment prospects of Slovenia's industrially oriented, i.e. non-central regions, will be relatively more dependent on their digitalisation, which means that a successful digital transformation is also a precondition for more balanced regional development.

Slovenia still ranks only slightly below the EU average according to the Digital Economy and Society Index, but the gap is gradually widening. The business sector is lagging behind in investment in both ICT equipment and software and databases, particularly in manufacturing. Manufacturing survey data otherwise point to a gradual increase in investment in digitalisation and informatisation, but a large part of it goes to sustain existing business operations.

Large enterprises tend to be more successful in introducing basic digital operations, while small and medium-sized enterprises are lagging behind and are at the EU average. Survey data also indicate that Slovenian enterprises need to improve their mastery of existing (3.0) technologies before they can introduce 4.0 solutions. Nevertheless, more than a quarter of enterprises show a high readiness for industry 4.0, which is encouraging and a good basis for further stepping up of efforts to introduce smart factories. Slovenian manufacturing companies, however, are focusing mainly on traditional product sales, while servitisation business models are insufficiently explored. It is therefore necessary not only to speed up innovation, but also to deepen digital transformation so that it will be more strongly reflected in higher revenues from the digitisation of products and services, stemming from digital mindset and digital and more open business models, servitisation and organisation.

Although increasing gradually, the digital knowledge and skills of adults are still relatively low in international comparison, which is slowing the digital transformation of society and the economy. People in Slovenia positively assess the impact of digital technologies on the economy, while the share of those who positively assess their impact on society is the lowest in the EU. This could explain firms' assessment that low readiness for change represents a serious obstacle for their digitalisation. In digitising public services, the key problem is services for businesses. There are also difficulties in the use of e-government solutions.

Repercussions for the public sector with economic policy recommendations

Given the complexity of the challenges, the country needs to act strategically, i.e. in a comprehensive and coordinated manner and with a long-term perspective. This will be possible only on the basis of an open, integrated approach and in collaboration with the business sector and society at large, which also enables an appropriately responsive and adaptive development policy. As the enabling conditions are complex and complementary, a long-term, stable, predictable and credible development policy is crucial, which requires:

Digital transformation programmes in Slovenia's competitors are generally more ambitious and in the most advanced countries even significantly more ambitious than in Slovenia.

1. **A more ambitious approach to boosting digital transformation deployment.** Digital transformation programmes in Slovenia's competitors are generally more ambitious and in the most advanced countries even significantly more ambitious than in Slovenia. That said, in the recent period Slovenia has developed a range of financial and advisory measures, which should be upgraded and in particular strengthened. The government should also increase other, complementary, investment, particularly in R&D and innovation, but also in other types of both intangible and tangible capital. On the public sector side, it is necessary to further accelerate the provision of efficient digital public services to citizens and particularly to businesses, while strengthening direct support on the demand side via public procurement and other instruments.

2. **Strengthening the business environment and the digital innovation ecosystem.**
   The quality of the business environment, which is conducive to growth and allows rapid entry of highly productive companies and rapid exit of less productive ones, remains a precondition for competitiveness in the digital age. For the transition to digitally driven growth, the government should also ensure a more coordinated, systemically supported, long-term and targeted digital innovation ecosystem, which actively fosters innovative, cross-sectoral and multidisciplinary approaches, in addition to counselling and promotion of collaboration among stakeholders.

3. **Development of skills adapted to medium-term needs.**
   In the area of lifelong learning, Slovenia should increase adult participation in lifelong learning, expand retraining programmes and promote participation in these programmes, strengthen lifelong career planning schemes and encourage corporate investment in education and training. In the area of higher education, the priority is to increase the number of available enrolment places at study programmes important for digital transformation and strengthen the links between higher education institutions and the economy. At the same time, it is necessary to make education more responsive to the needs of the economy and society, which requires high-quality and up-to-date information on current and future skills needs.

4. **Further investment in digital infrastructure, cybersecurity and open data.**
   In terms of connectivity, Slovenia is losing its advantage over the EU average, the main problem being the lag in introducing next generation technologies, which are crucial for digital transformation. Given that large companies have already been forced to enter the 5G era, while medium and small companies are expected to do so by 2023 or 2024, Slovenia cannot afford to lag behind in this area. It will also have to pay more attention to cybersecurity, increase the responsiveness and flexibility of the regulatory framework and place even more emphasis on data availability and (industrial) standardisation.

5. **Mobilisation of society for change and an inclusive transition.**
   For a successful transition, broader social and cultural conditions for change need to be ensured on the basis of an ambitious development policy and a clearly defined strategy, which also mobilise the economy. At the same time, technological development and changes on the labour market call for a reflection on the new social contract, including provision of stronger safety nets, which is necessary from an economic point of view, since relative security of the population enables a faster and more ambitious digital transformation.

Repercussions and recommendations for the business sector

Digitalisation is changing the very nature of the innovation process, as it requires even greater (flexible) specialisation of companies, a shift from a sectoral to an ecosystem approach, and a greater emphasis not only on rapid response, but also on own disruptive innovation. A successful digital transformation of companies therefore requires:

1. An immediate and strategic approach to digital transformation based on clearly defined, possibly niche, key competences and functions within the changing global value chains;

2. Intensive investment in the (lifelong) learning of employees and the establishing of a "digital mindset and culture";
3. Acceleration of investment in digital projects and their upscaling, including by accelerating investment, particularly in R&D and innovation;
4. A transformation of companies' organisation and business models with a greater emphasis on an agile, multidisciplinary, multifunctional and open, collaborative approach, including through stronger cooperation with the business support environment, the research community and also with start-ups.

1 Introductory remarks

In 2018, the Institute of Macroeconomic Analysis and Development (IMAD) started to carry out the functions of a National Productivity Board in accordance with the Council Recommendation on the establishment of National Productivity Boards (Official Journal of the EU, C 349/1) and the Ordinance on the organisation and responsibilities of the Institute of Macroeconomic Analysis and Development (Official Gazette of the RS, No. 28/18), which formally broadened its scope of work. The tasks of National Productivity Boards also include the publication of an annual productivity report.

This year's report, the second such, has been prepared in the midst of the coronavirus crisis, which has significantly increased the already very complex impact of megatrends on the competitiveness and productivity of countries and regions. The literature predicted, even before the crisis, that over the course of this decade we would be witnessing an intertwining of the effects of digital transformation with the transition to the fourth industrial revolution, demographic change, and the transition to a low-carbon economy and society (CISL 2020), which might be reflected in changes of extraordinary speed, breadth and depth (OECD, 2019) or even in a disruptive transition marked by "greater macro turbulence and volatility than seen in decades" (Bain, 2018, p. 42). The coronavirus crisis has added a new dimension to the already quite dramatic predictions on the basis of which the phrase "transition to a new normal" was coined (Bain, 2020; McKinsey, 2020; Roland Berger, 2020). In preparing this report, we have tried to address the consequences of the coronavirus crisis to the greatest possible extent, though a significant part of the studies and analyses come from the period before the crisis.

Given the far-reaching consequences of the combination of all the effects mentioned above, we have paid them great attention in the Productivity Report 2020, which this year focuses on digital transformation, whose consequences are already expected to be felt in this decade and which has been identified by some sources as the most important factor for future economic growth and future levels of well-being. An intensive transformation of global value chains is underway, due not only to megatrends but also to the coronavirus crisis. This means that the future performance of individual regions and countries will depend far more than before on the success and foresight of the responses of all stakeholders and especially development policies to these challenges, which is therefore given special weight in the report.

The second chapter first presents the situation and trends in productivity and competitiveness, followed by an analysis of the main factors causing these trends. This time, we not only compare Slovenia's performance with the averages (usually the EU average), but also often present comparisons with leading countries in specific areas or with the group of innovation leaders as defined by the European Innovation Index (Sweden, Finland, the Netherlands, Luxembourg and Denmark). The third chapter provides an overview of long-term scenarios of growth necessary for catching up with Austria and the EU average. These are then placed in the context of opportunities and risks brought by the megatrends and the coronavirus crisis, with the most likely consequences as presented in the literature. This is followed by an in-depth analysis of the potentials and risks associated with digital transformation, which is presented in the fourth chapter as a key to increasing well-being in Slovenia and is the main topic of this year's Productivity Report. In addition to an overview of the estimated positive and negative potential consequences, this chapter also

provides a detailed description of the state of play in this area, especially in the business sector, also based on microdata, some of which have been processed and presented in this publication for the first time. Special thanks go to Prof. Dr. Iztok Palčič from the Faculty of Mechanical Engineering, University of Maribor, with whom we prepared section 4.2.1 based on data from the European Manufacturing Survey, 2020, among other sources. The analysis of the situation is followed by an overview of the measures necessary for a successful digital transformation on the part of both the business sector and the government, along with a comparison of measures taken in advanced countries in each of the presented areas.

2 Slovenia's productivity and competitiveness

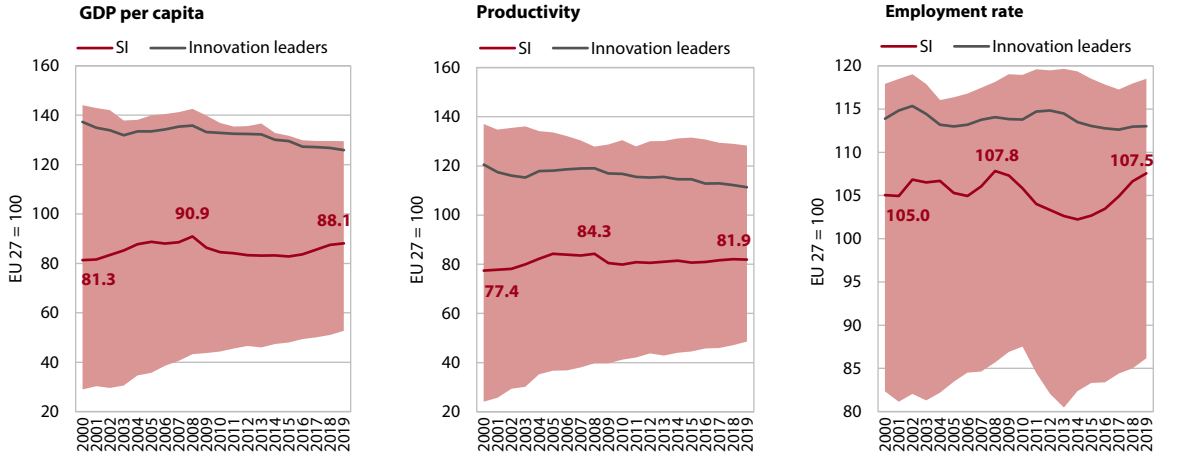
Embracing productivity is the only way to avoid a future of bleak and bitter austerity

Robert D. Atkinson, Morning Consult, 22 May 2020

2.1 The situation and trends in productivity and competitiveness

The COVID-19 crisis set in after a decade of faltering productivity growth. Average annual productivity growth eased from 3.0% in 2000–2008 to 0.6% in 2009–2019 (or 1.4% in 2014–2019, the years of buoyant economic growth).[1] With a steep fall in demand and activity due to the outbreak of the COVID-19 epidemic and the consequent extensive government policy response to preserve employment, labour productivity measured by GDP per person employed fell sharply in the first half of 2020 (by 7.6%). With the deceleration of productivity growth, the convergence with economically advanced countries also slowed in the 2009–2019 period. In 2019, Slovenia reached 88.1% of the EU average in GDP per capita. The gap is mainly due to lower productivity (81.9% of the EU average), as the employment rate[2] was above the EU average throughout the period analysed. In view of demographic trends that put constraints on (already relatively high) employment rates, the potential for a further increase in GDP per capita will be increasingly dependent on productivity growth.

Figure 1: The deceleration of productivity growth has also halted the closing of the productivity gap with the EU average



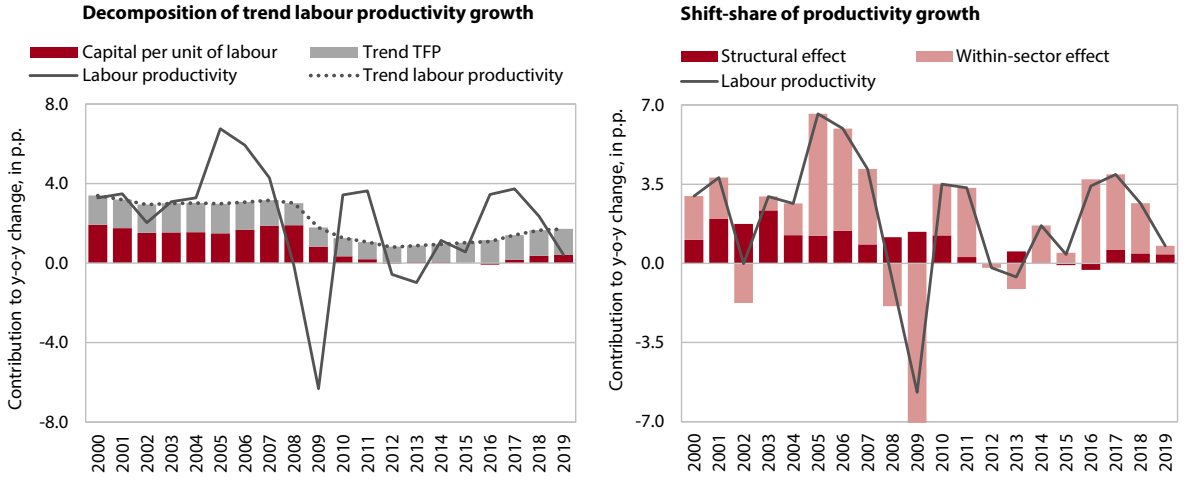
Source: Eurostat; calculations by IMAD. GDP per capita and productivity (GDP per person employed) are expressed in purchasing power standards (PPS). The shadowed field shows the range between the EU countries with the lowest and the highest indicator values, excluding Luxembourg and Ireland. For the definition of innovation leaders (SE, FI, DK, NL and LU) see Chapter 1.

[1] Average annual productivity growthmeasured as GDP *per hour worked* slowed from 3.4% in 2000–2008 to 1% in 2009–2019 (or 2% in 2014–2019). Somewhat stronger growth in productivity measured in terms of hours worked is a consequence of a declining trend in hours worked per employee. Labour productivity measured by GDP *per person employed* enables a more direct link with the GDP per capita indicator. Further on in the report, we express labour productivity by GDP or value added per hour worked.

[2] An increase in GDP per capita can be achieved by higher productivity or a higher employment rate.

A key factor in the slowdown of labour productivity growth has been modest capital deepening. Labour productivity is crucially driven by investment and technological progress[3] in the broadest sense. The latter is reflected in total factor productivity (TFP). The contribution of capital deepening to trend productivity growth fell from the pre-crisis average of 1.7 p.p. (in 2000–2008) to 0.2 p.p. in 2009–2019 and remained low also in the years of a significant improvement in the investment environment.[4] The decline was the most pronounced in investment in housing and transport infrastructure. Growth in investment in machinery and equipment was also lower than before the crisis (see Section 2.2.1), as was growth in investment in intangible assets, which, although lower in value, have significant potential for increasing TFP and thus long-term growth (see Section 2.2.2). In view of the high uncertainty caused by the outbreak of the COVID-19 epidemic, we can expect a sharper decline in investment this year, particularly of the business sector. The contribution of TFP to the growth of value added per person employed has not declined as much[5] as the contribution of capital in recent years, but the limited or not yet fully seen effect of digitalisation on TFP and thus value added per worker remains the subject of a number of studies, also in the global context.

Figure 2: A major part of the slowdown in labour productivity growth is explained by modest capital deepening and a diminishing effect of changes in the sectoral composition of the economy, although the contributions of TFP and within-sector growth also declined



Sources: Eurostat and SURS, 2020; calculations by IMAD. Notes: Trend productivity growth is growth that is adjusted for the effects of the business cycle. It is defined as potential GDP relative to potential employment expressed in hours worked. Potential GDP is calculated using the production function method, while potential employment is employment under the assumption of normal utilisation. Sectoral decomposition of productivity growth (value added per hour worked) is based on annual data of the most detailed 64-level of the Standard Classification of Activities (NACE). For more on this methodology, see IMAD, 2019a.

In the last decade, changes in the sectoral structure of the economy have had a lesser and lesser impact on productivity growth. The levels of productivity (value added per hour worked) vary significantly across sectors, which is strongly related to their different levels of capital intensity. At the turn of the millennium, Slovenia was still in the process of intense sectoral shifts. The reallocation of labour to more productive sectors and/or sectors with higher productivity growth additionally fostered aggregate productivity growth. In the last ten years, this contribution has been somewhat small, as elsewhere in the EU. The structural contribution is also weakening due to an increasing importance of service activities, which tend to be more labour (less capital) intensive and where technological progress

[3] I.e. the efficiency of the use of inputs.
[4] See also Section 2.2.1.
[5] From an average of 1.4 p.p. in 2000–2008 to an average of 1.0 p.p. in 2009–2019.

(for example robotisation) is not yet as extensive as in manufacturing. In the absence of major contributions from structural shifts, productivity growth will be all the more dependent on within-sector growth. The latter has also slowed since the onset of the crisis (to 0.7%) and was mostly lower than in the previous decade (1.7% on average in 2000–2008) also in cyclically favourable years.

Since 2008, within-sector growth has slowed despite greater positive impacts of the reallocation of labour between firms with different productivity levels within the same sector. While macrodata explain the impact on aggregate productivity as a result of changes in the sectoral composition of the economy, firm-level data enable an analysis of the impact of the remaining reallocation of production factors on within-sector growth. Since the outbreak of the financial and economic crisis and up to the rebound in economic growth in 2014, the labour reallocation between firms represented the most important or, in some cases, even the sole lever of productivity growth,[6] as in most sectors, employment share increased in more productive firms (a positive effect of covariance). Exits of less productive firms also had a greater effect on aggregate productivity than before the crisis. During the crisis increased exiting of firms is expected, but later on this may have also been due to changes to insolvency legislation[7] in mid-2013, which simplified the procedures for closing down a firm.[8] In the present crisis, the effect of the reallocation of production factors on productivity could be smaller because of the extensive government policy supports for businesses since the outbreak of the COVID-19 epidemic. Exogenous shock due to the outbreak of the epidemic and the restrictions on activity, particularly in non-essential services, justifies the temporary (bridging) measures to support businesses (see next paragraph), but over a longer period, such general supports can also have a negative effect on productivity as they hamper allocative efficiency.[9] This is in line with the OECD (2020a) recommendation that, as the recovery progresses, countries need to refocus measures in order to avoid trapping resources in non-productive firms, which would hinder aggregate productivity growth, and accelerate structural reforms that raise opportunities for displaced workers and foster the reallocation of labour and capital towards activities with the strongest growth potential.

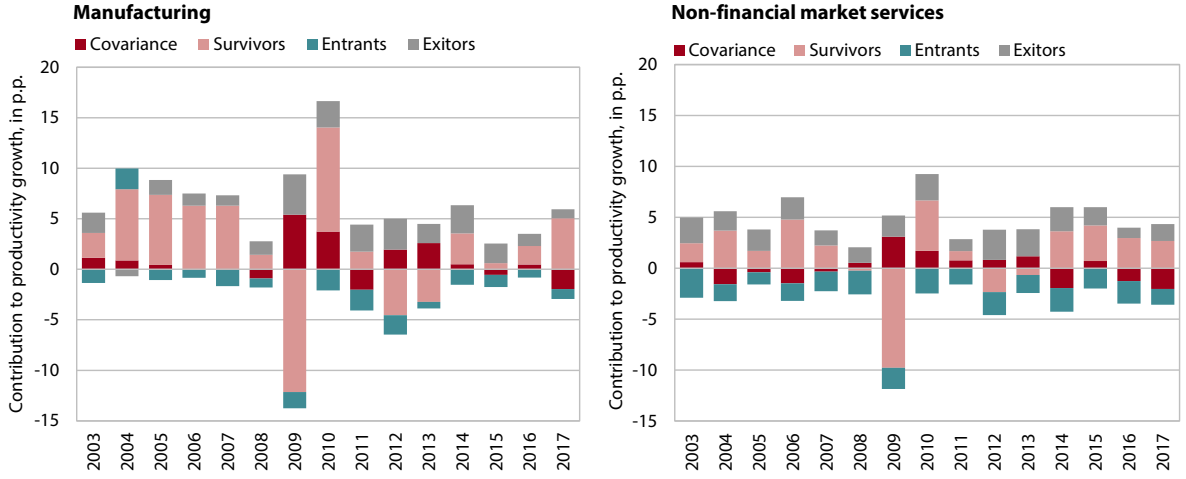
[6] Figure 3 shows the decomposition of productivity growth of the two largest business sector aggregates. The conclusions of the analysis remain robust even if based on more detailed sectoral decompositions of manufacturing, market services and the non-business sector, which was partly covered in the Productivity Report 2019 (Appendix 1, Figure 43).

[7] Act Amending the Financial Operations, Insolvency Proceedings and Compulsory Dissolution Act (ZFPPIP-E), Official Gazette of the RS, No. 47/2013.

[8] The empirical analysis of Adalet McGown et al. (2017), which also includes a change in insolvency legislation in Slovenia, shows that insolvency regimes that do not unduly raise barriers to corporate restructuring and the personal costs associated with entrepreneurial failure can spur productivity-enhancing capital reallocation.

[9] See also, for example, di Mauro and Syverson (2020) and Restuccia and Rogerson (2017).

Figure 3: The slowdown in sectoral growth since 2008 has been a consequence of modest firm-level performance (on average), while the impact of the reallocation of employment between firms with different productivity levels within the same sector has mostly been positive

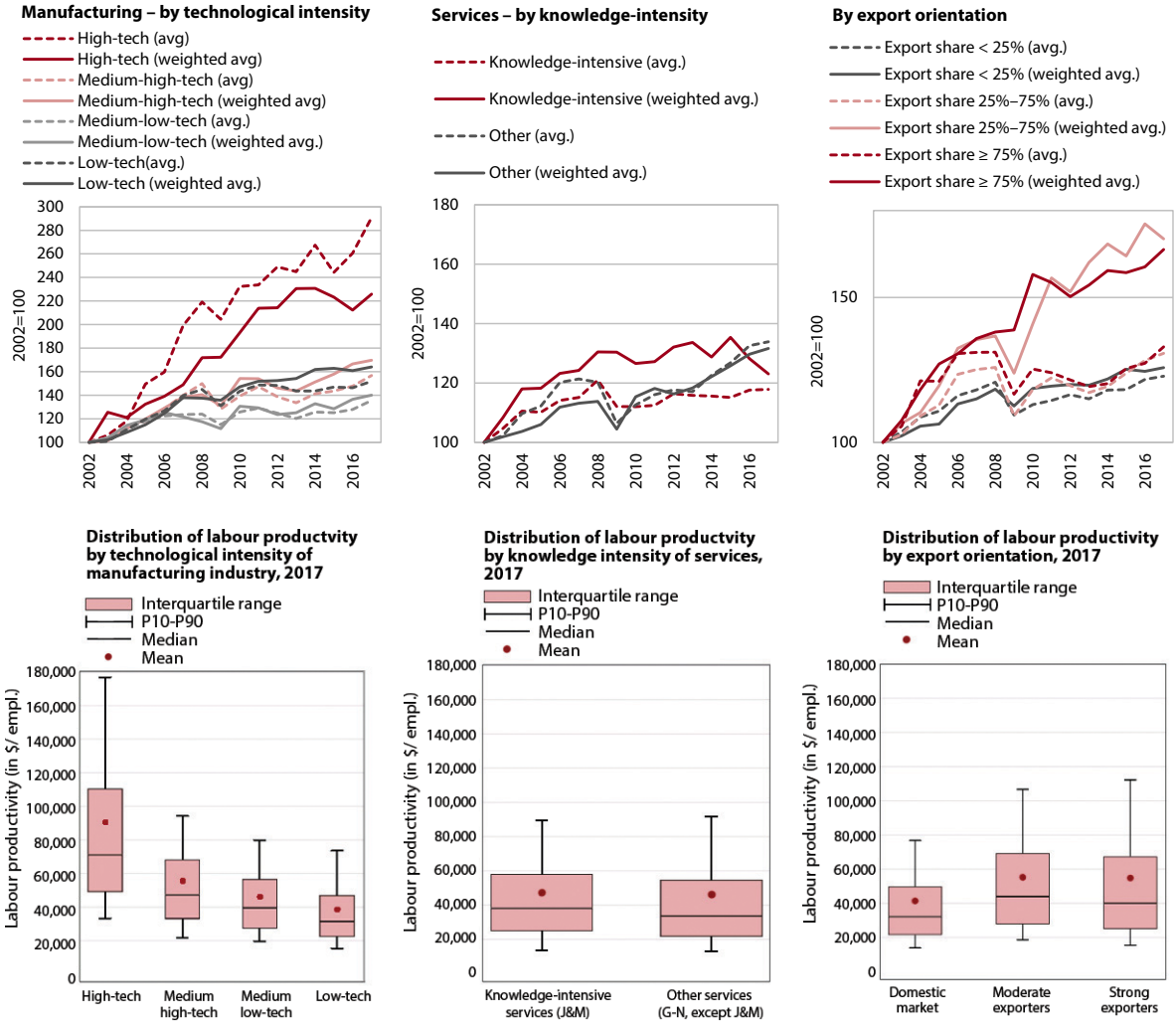


Sources: AJPES, MultiProd; calculations by IMAD. Based on dynamic decomposition of productivity with entry and exit of firms (Melitz and Polanec, 2015).

Firm-level productivity, having fallen sharply at the onset of the financial and economic crisis, started to increase gradually only in the period of the latest economic recovery. The average unweighted productivity growth of surviving firms, i.e. growth that is not affected by entries and exits of firms or the reallocation of labour between firms within the same sector, started to increase again only in 2014,[10] and did not return to pre-crisis levels until the middle of the latest economic recovery. The consequences of the financial and economic crisis have thus faded only gradually at this core firm level. This has probably been a result of modest capital deepening and intangibles lost during the crisis (such as firm-specific human capital, trust between suppliers and buyers, etc.), which is difficult to replace rapidly. At the outbreak of the COVID-19 epidemic, the government adopted a number of measures to preserve businesses and jobs, whereby it has mitigated the loss of intangible capital and thus productivity. In the absence of structural reforms, such general measures, if kept in place for too long, could, however, also have a negative impact on allocative efficiency.

[10] A pronounced decline in productivity in 2009 was otherwise followed by a temporary rebound, but several years of uninterrupted growth have only been seen since the beginning of 2014.

Figure 4: Average productivity of export-oriented and technologically intensive firms is higher and increasing faster, but there are significant differences among firms in the group



Sources: AJPES, MultiProd; calculations by IMAD. Notes: The aggregation of the manufacturing industry (NACE Rev. 2 Section C) according to technological intensity is based on Eurostat methodology. The classification of services is based on the OECD definition, according to which knowledge-intensive non-financial market services include information and communication (NACE J) and professional, scientific and technical activities (NACE M), while other non-financial market services include trade (NACE G), transportation (NACE H), accommodation and food service activities (NACE I), real estate activities (NACE L), and administrative and support service activities (NACE N). Domestic-market-oriented firms – export share < 25%; moderate exporters – export share 25%–75%; strong exporters – export share ≥ 75%.

Following the financial and economic crisis, fastest productivity growth has been recorded in high-technology manufacturing industries, while productivity growth in knowledge-intensive services has been modest. A breakdown of productivity developments by different *groups of firms* shows that in the period since the onset of the financial and economic crisis, productivity has increased the most in firms in high-technology *manufacturing*. These also have the highest labour productivity levels, on average, which is to be expected given their higher capital intensity. The average productivity level in manufacturing in general declines with the lowering of the technological intensity of the industry. This does not, however, mean that there are no highly productive companies in low-technology industries. For example, labour productivity distributions show that the most productive 10% of firms (above 90p) in industries of lower technological

Labour productivity distributions show that the most productive 10% of firms in industries of lower technological intensity have a higher labour productivity level than the median of high-technology firms.

intensity have a higher labour productivity level than 50% (the median) of high-technology firms. The labour productivity distribution of high-technology industries is, however, highly right-skewed, i.e. the most productive firms have significantly higher productivity. *Service activities*, on the other hand, have been marked by different dynamics and developments than manufacturing in the post-crisis period. The average productivity level in knowledge-intensive service activities has been comparable to that in traditional (other) services, the most productive firms stood out even somewhat less than in other services, while the average productivity growth in knowledge-intensive services has been more modest than in other market services since the outbreak of the financial and economic crisis. This has to a great extent been due to modest productivity growth in ICT services, which has also been lower than in most other EU countries, particularly innovation leaders.[11] Due to the relatively small size of this sector, ICT services do not have a major direct impact on aggregate productivity, but their potential indirect impact through the introduction and transfer of new technologies and processes to firms in other sectors can be more significant. A breakdown by *export orientation* shows that higher productivity growth and levels were achieved by export-oriented firms.

Export performance in the coming years will to a great extent depend on how quickly the balance between productivity and wages, distorted by the decline in productivity following the outbreak of the COVID-19 epidemic, is restored.

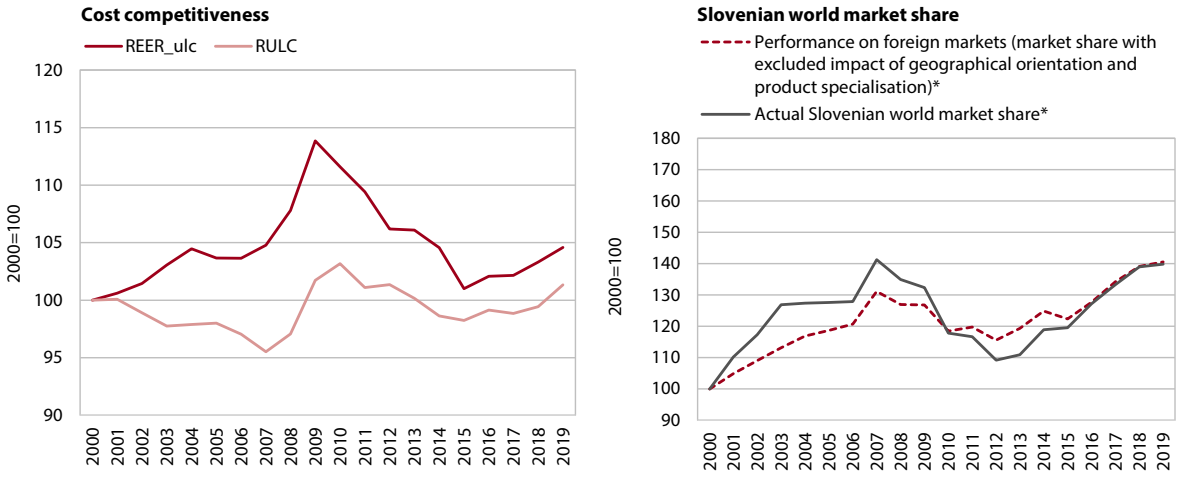
Export competitiveness and productivity are strongly interrelated. Studies show that exposure to international competition and participation in global value chains foster a more effective reallocation and use of production resources, innovations, and knowledge and technology transfer.[12] Using firm-level data for *Slovenian* manufacturing, De Loecker (2013) finds evidence of substantial productivity gains from entering export markets through "learning by exporting mechanism". On the other hand, productivity, together with wages, affects the cost and hence price competitiveness of exporters. Slovenia is a highly export-oriented economy, with around three-quarters of its goods exports destined for the EU market. Half of its total goods exports go to the euro area. A strong integration in trade flows of euro area countries means lower exposure to exchange rate fluctuations. At the same time, for countries within the euro area, competitiveness adjustments cannot be achieved through nominal exchange rates, which leaves unit labour costs as the core mechanism.[13] At the beginning of the financial crisis, Slovenia, under the impact of a decline in productivity and relatively strong wage growth (2010) given the situation at that time (amid a concurrent appreciation of the euro), significantly deteriorated its cost competitiveness and recorded one of the largest world export market share declines in the region. Its market share on the global market exceeded pre-crisis levels only at the end of the latest economic upturn (2018). Export performance in the coming years will thus to a great extent depend on how quickly the balance between productivity and wages, distorted by the decline in productivity following the outbreak of the COVID-19 epidemic, is restored.

[11] According to CompNet data, the majority of 15-EU countries in the sample recorded higher post-crisis growth in the average (unweighted) productivity of ICT services (NACE J). A more pronounced increase in productivity was recorded by firms in innovation leaders. The modest productivity growth in ICT (and knowledge-intensive) services by international comparison is also corroborated by macrodata (see Productivity Report 2019, 2019), with somewhat more favourable movements seen only in 2019.

[12] See also Section 2.2.3.

[13] I.e. the ratio between productivity and labour costs per employee.

Figure 5: Slovenian export market share dynamics have been affected by a strong deterioration in cost competitiveness during the financial crisis



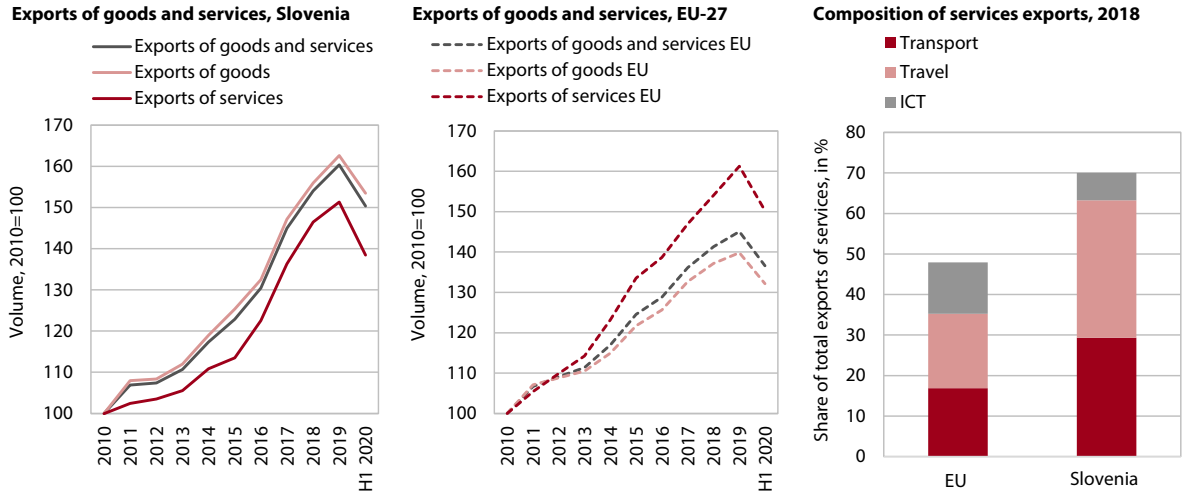
Sources: ECB, SURS, UN Comtrade; calculations by IMAD. Notes: Real unit labour costs (RULC) show the ratio between labour productivity and compensation per employee. The real effective exchange rate, deflated by unit labour costs (REER_ulc), shows changes in Slovenian NULC (nominal until labour costs) in comparison to that of 37 trading partners, adjusted for the effect of exchange rate changes and weighed by the relative importance of an individual trading partner. World export market share is the ratio of the goods exports of a country (or a group of countries) to the total goods exports of the world. *Excluding the effect of pharmaceutical exports to Switzerland, which are a proxy for strongly increased re-exports of pharmaceuticals, which have an insignificant impact on economic activity and are excluded from exports according to the national accounts.

World export market share dynamics are affected not only by export performance on individual markets, but also by geographical orientation and export specialisation. In the last decade, Slovenian product specialisation and geographical orientation of *goods exports* have not had a positive impact on Slovenian export market share growth on the global market, due to the strong attachment to markets that have mostly been growing more slowly during this period. In the initial phase of the spread of the COVID-19 pandemic worldwide, some of Slovenia's most important trading partners (e.g. Italy and France) and product groups (cars) were also among the hardest hit, which had a negative impact on Slovenia's export market share. This negative structural effect was mitigated, however, by a high export share of pharmaceuticals, with strong growth in demand during the coronavirus crisis.[14] The structure of Slovenian *trade in services*, meanwhile, is highly unfavourable from the perspective of global demand, with exports of travel and transport services accounting for over 60% of services exports. These are the segments of services trade[15] that were the most affected by the COVID-19 epidemic and the containment measures across the world and whose return to previous levels is likely to take longer. The low share of exports of ICT services – on which the containment measures might even have a potentially positive effect – stands out as well. Regardless of the composition of exports, it is very likely that the COVID-19 crisis will be reflected in less vibrant global trade (also in the long run). This demand-side shock will particularly affect economies that are strongly dependent on exports, which include Slovenia, where the current composition of exports, particularly in services, is not favourable.

[14] Detailed data on world imports and exports were not yet available when we prepared the report. According to Comext data, for example, EU import demand for medicinal and pharmaceutical products increased by 14% year on year in the first half of 2020. By comparison, total EU import demand for all goods declined by 13% in the same period. Slovenia's export market share in the EU declined by 1.6% in the first half of the year.

[15] The World Tourism Organisation (UNWTO), for example, expects between 60% and 80% fewer foreign tourist arrivals globally in 2020 (2020 Committee for the Coordination of Statistical Activities, 2020). According to the OECD (2020a), export revenues from international passenger transport were still more than 90% lower year on year in July, while the total number of world commercial flights in August was still around 40% below the pre-epidemic level.

Figure 6: Slovenian exports of services, with a high share of tourism and transport, have been particularly vulnerable since the outbreak of the COVID-19 pandemic



Source: Eurostat; calculations by IMAD.

2.2 Drivers of productivity

Labour productivity gains can be achieved by (i) greater use of capital (i.e. capital deepening[16]) and by (ii) more efficient utilisation of inputs (labour and capital), which is reflected in total factor productivity (TFP). In capital deepening, the first thing that usually comes to mind is investment in tangible capital, such as machinery, buildings and infrastructure. In addition to this, however, investment in intangible capital is increasingly gaining importance in modern times, as it explains a significant part of productivity differences between countries (Corrado et al., 2016) and is an important driver of innovation, economic growth and employment in knowledge-intensive economies.[17] While investment in intangibles directly affects productivity through capital deepening, it also has a significant indirect impact as an element of innovation processes (Jona-Ladinio and Meliciani, 2019), which are reflected in higher total factor productivity.

The scope of capital deepening and the efficiency of labour and capital utilisation depend on a number of factors; these can increase the total factor productivity of an economy through higher efficiency (productivity) at the firm level or the reallocation of labour and capital between firms, which also includes entry of new firms to the market. In this Chapter we primarily focus on factors that, in our estimation, will have a decisive impact on Slovenia's productivity and competitiveness in the coming years, given the situation in Slovenia and global megatrends. First we present the situation and trends in Slovenia in the area of capital, i.e. investment in fixed assets. Given its importance in modern economies, we then focus separately on the role of intangible capital, where we analyse the role of human capital and R&D and innovation in more detail. This is followed by an overview of productivity factors with a more indirect but also very important impact on productivity in the longer term. Among these, we address participation in global value chains, institutional factors (including the regulatory framework and business environment), and the efficiency of resource and energy consumption.

[16] An increase in capital per unit of labour.

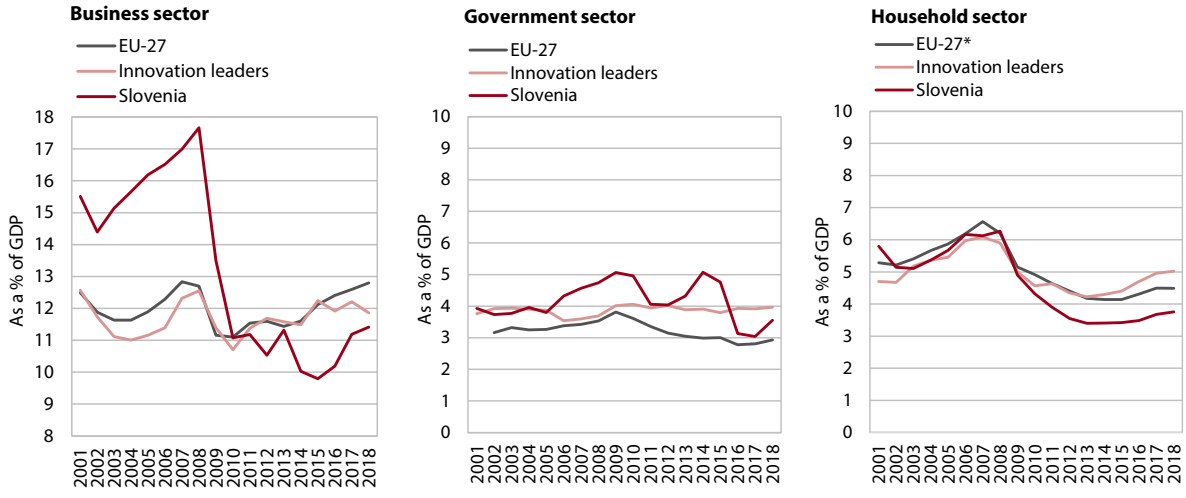
[17] It includes investment in R&D, knowledge, computer software (together with computerised databases), intellectual property (trademarks, patents, Community designs), design, and organisational capital (Corrado et al., 2016 and 2018).

2.2.1 Capital

Capital increases through investment in fixed assets,[18] thus enabling higher labour productivity. It has an impact on labour productivity mainly through capital deepening. In this way, knowledge transfer tends to accelerate as well, which is reflected in higher total factor productivity (TFP).

In the last ten years, investment activity in Slovenia has been considerably lower than before the financial and economic crisis in 2008. The smaller contribution of capital to economic growth has been the main factor in the decline in productivity and economic growth in the last decade. While until 2008 Slovenia was one of the countries with the highest investment to GDP ratios, it has been among those with the lowest in the last decade, lagging strongly behind the average of countries that are ranked among innovation leaders according to the European Innovation Index (Figure 7). The decline in investment activity after 2008 was first related to the tightened financial situation and a delay in the banking system stabilisation, while later it was also due to the increased uncertainty and doubts about Slovenia's ability to solve public finance problems on its own. The lower investment activity has also been a consequence of lower investment in infrastructure (following the completion of the most intense phase of motorway construction). After 2010, investment activity declined in the predominantly non-tradable part of the service sector, which is related to worse expectations about future demand in this sector and to some extent also to lengthy and complicated procedures in construction investment. Until 2008, the ratio of business sector investment to GDP in Slovenia was significantly higher than in innovation leaders on average. In 2008–2018, it was lower, but the gap was gradually narrowing – in 2018 it was only 0.4 p.p. The ratio of government investment to GDP, fluctuating under the impact of the dynamics of the absorption of EU funds, has been below the average of innovation leaders in recent years. Slovenia has the widest gap with innovation leaders in household investment (most of which is traditionally devoted to housing). In 2018, the gap was as much as 1.3 p.p., wider than in business and government sector investment combined.

Figure 7: Slovenia's investment activity has been low in the last ten years



Source: Eurostat; IMAD calculations. Note: The definition of innovation leaders is based on the European Innovation Index.

[18] Fixed assets is a statistical term and represents assets as an item on the active side of the balance sheet.

Slovenia has turned from an above-average to an average ICT investor in the last ten years. The decline in total investment activity has also been reflected in lower investment in information and communication technologies (ICT), which are essential for the digital transformation of the economy. Before 2008, ICT investment accounted for 1.7% of GDP, twice as much as the EU average, but in recent years, this share has declined to 0.9%, which is around the EU average and roughly the same as in innovation leaders.

In Slovenia, as an EU country with a below-average development level, the government sector traditionally invests more than in more advanced countries, but its investment fluctuates significantly depending on the absorption of EU funds. General government investment is still higher than the EU average, but in recent years Slovenia's ranking has deteriorated: at the end of the previous EU financial perspective (in 2013 and 2014), general government investment was relatively high in Slovenia compared with other EU countries, but at the beginning of the 2014–2020 financial perspective, Slovenia's relative position in general government investment deteriorated.

The coronavirus epidemic will accelerate general government investment in particular, while it will have a negative impact on the overall investment activity of the business sector. Lower expectations, low capacity utilisation and increased uncertainty due to the epidemic have a very negative impact on companies' investment decisions. The coronavirus and the related economic crisis could, however, positively affect investment in ICT equipment, as this facilitates activities in times of restrictions (for example remote working and online sales). The EU's response to the crisis in the form of a recovery instrument will mainly accelerate general government investment, but its impact will be highly dependent on its structure and the quality of execution.

2.2.2 Intangible capital

Many studies point to a significant positive impact of intangible capital (IC) on productivity. Given the slowdown in productivity growth in developed countries, various studies are increasingly examining the causes of these trends and analysing new productivity factors (focusing particularly on assessing the extent and impact of intangible capital).[19] In the global value chains of the manufacturing sector the income share of intangible capital in final production is also rising at the global level. In 2014, it stood at 31%, while the share of tangible capital was 18% (Chen et al., 2008). More efficient management of large databases and the introduction of business models based on new technologies, R&D, design and more efficient organisation of processes require new knowledge and skills and, consequently, higher investment in these types of intangible capital. In the EU, particularly intangible capital in the areas of economic competences, intellectual property and design was gaining importance in 2010–2017 (European Commission, 2020a). The estimates of the impact of intangible capital investment on productivity vary according to the methodology

[19] An expanded classification of intangible capital asset types includes software and databases; innovative property (R&D, design, other intellectual property products, etc.); and economic competences (advertising and market research, firm-specific vocational training and purchased organisational capital) (Corrado et al., 2017). Some authors use a somewhat narrower classification, which includes the basic categories of the expanded classification, such as investment in R&D, software and databases, other intellectual property products, design, organisational and business process improvements, and training/education of workers. In the national accounts, data are available only for some types of intangible capital assets (investment in R&D, computer software and databases, and other intellectual property products). The estimates for other asset types are based on databases obtained from Eurostat (Adarov and Stehrer, 2020a).

used, the period analysed and the set of counties included in the analysis, but there is a general understanding that firms and countries investing in intangible capital more in general experience higher productivity and are more innovative.

Of all capital types, intangible ICT capital and tangible ICT capital have the largest impact on productivity growth.

Of all capital types, intangible ICT capital and tangible ICT capital have the largest impact on productivity growth. An analysis for the 1998–2007 period for ten EU countries shows that an increase in intangible capital investment[20] had a statistically significant impact on productivity gains even if R&D investment is excluded. Investment in intangible capital had a larger effect in industries where ICT is more intensively used (Corrado et al.). Similar are the findings of the most recent study of productivity growth factors at the country and sectoral levels (Adarov and Stehrer, 2020a), which analyses the impact of different types of capital, particularly ICT capital.[21] According to the authors' estimates for 2000–2017 for 18 EU countries, the US and Japan, ICT capital – especially intangible ICT capital – has a statistically important impact on productivity growth. A 1 p.p. increase induces an increase in productivity growth of 0.06 p.p. at the aggregate level in the case of tangible ICT capital and of 0.09 p.p. in the case of intangible ICT capital. Intangible ICT capital is at the same time the only capital asset type that has a statistically significant impact on productivity growth at both the aggregate and sectoral levels, regardless of the specification of the model used. Analyses using data from the EIB Investment Survey (2020) at the firm level for 2016–2018 confirm a positive impact of investment in intangible assets on productivity per employee but point out that it is statistically significant only for investment in software, databases and R&D. While intangible ICT assets (software and databases) have a direct impact on productivity, the impact of R&D investment is indirect, through innovation.[22] A study on the adoption of digital technologies[23] at the industry level also corroborates their statistically significant positive effect on firms' productivity, particularly in manufacturing and routine-intensive industries.[24] The correlation between the use of digital technologies and productivity is stronger in more productive firms, as they can take advantage of complementary managerial and technical skills. In firms where these skills are lacking, the effect of the use of digital technologies on productivity tends to be smaller (Gal et al., 2019).

Slovenia did not increase the share of intangible capital investment in 2010–2016 (the most recent data) relative to 2000–2006. In terms of the share of intangible capital (IC) in the total capital stock, Slovenia, at 6.4%, ranks in the middle of EU countries (Figure 8), the majority of which have accelerated IC investment since 2010.[25] Between the periods analysed, Slovenia saw an increase in the shares of R&D and economic competences (such as advertising and market research) but a decrease in the shares of other intellectual property products (such as design) and software equipment and databases. All countries but Slovenia and three other EU countries enhanced the shares of software and databases in their capital stocks in 2000–2016, which, given accelerating digitalisation, could also affect Slovenia's

[20] ICT capital includes computing equipment, communications equipment and software; intangible capital includes R&D, design, advertising and market research, firm-specific vocational training, and organisational capital. Data are based on the new INTAN-Invest and EU KLEMS databases.

[21] ICT capital includes tangible (computer hardware and telecommunications equipment) and intangible ICT capital, also referred to as digital capital (EU KLEMS 2019).

[22] EIB Investment Report, 2019a. The analysis shows no significant statistical impact of investment in training on productivity, while the impact of organisation and business process improvements appears even to be negative.

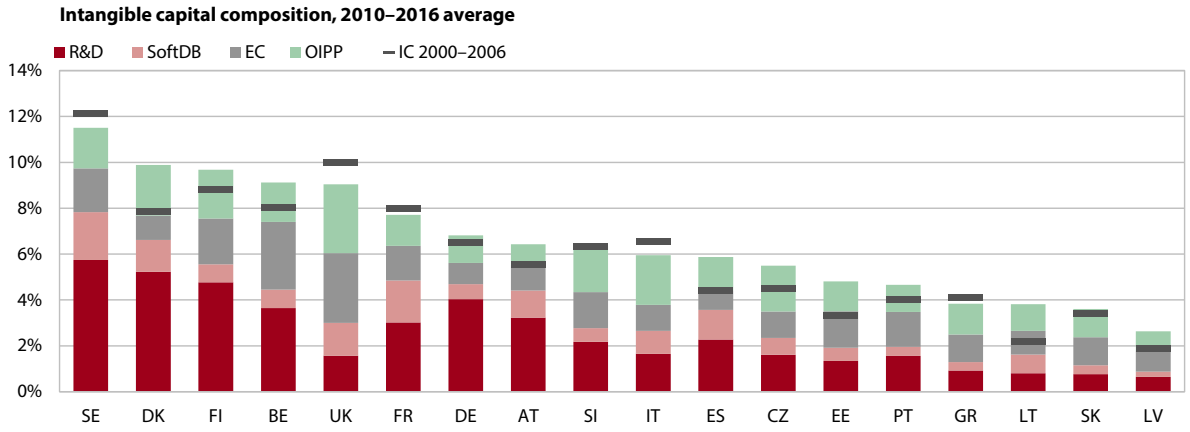
[23] High-speed broadband, simple and complex cloud computing, and CRM (customer relationship management) and EPR (enterprise resource planning) software.

[24] Data cover the use of digital technology at the industry level in 20 OECD countries (19 EU countries and Turkey) over 2010–2015.

[25] Estimates based on EU KLEMS data.

competitiveness on international markets. Considering the share of individual asset groups in the total IC stock, Slovenia ranks highest compared with other EU countries on other intellectual property products and economic competences.

Figure 8: Slovenia is lagging behind trends in intangible capital investment



Source: Adarov in Stehrer, 2020a; calculations by IMAD. Notes: R&D – research and development; SoftDB – computer software and databases; EC – economic competences, which include advertising and market research, purchased organisational capital, and firm-specific vocational training; OIPP – other intellectual property products, which refer particularly to design; IC – intangible capital.

In international comparison, Slovenian firms spend a relatively small share of total investment on intangible capital. Survey-based microdata for the business sector indicate that until 2017, the share of intangible assets in total business sector investment in Slovenia totalled 27%, compared with 37% on average in the EU and over 40% in EU innovation leaders (EIB, 2018). The most recent EIB data on firms' readiness for the digital age as measured by the EIBIS Digitalisation Index[26] in fact rank Slovenia fifth in the EU, but it has a lower share of investment in software and databases than innovation leaders and most strong innovators (EIB, 2020). This is not favourable and reduces its potential to enhance labour productivity, given that the results of the study at the macro level (Adarov and Stehrer, 2020a) show a significant and direct impact on a country's productivity growth only for intangible ICT capital (software and databases).

At the outbreak of the COVID-19 epidemic, Slovenia's lag in some areas of digitalisation additionally confirmed the urgency for greater investment in intangible ICT capital. To prevent the spread of infections at the start of the COVID-19 epidemic, a significant shift towards the digitalisation of operations, which would otherwise have happened much more slowly, was made in many public and private sector activities. However, as most firms did not sufficiently use digital business models (such as digital interconnectedness of all processes in real time) before the epidemic, they have suffered a significant decline in orders (GZS, 2020). Weak investment in ICT capital (computer hardware and telecommunications equipment, computer software and databases) and digital competences points to the need for a rapid strengthening of this investment at all levels and in all activities, including those related to mitigating the impacts of COVID-19 on the economy and society, as only in this way could ICT capital make a more significant contribution to productivity growth. At the same time, due to a fall in revenues on the domestic market and higher risks associated with integration in global value chains, firms

[26] The EIBIS Digitalisation Index consists of five components: digital intensity, digital infrastructure, investment in software and data, investments in organisational and business process improvements, and strategic monitoring system.

will be dismissing workers as the epidemic continues and may thereby lose an important portion of intangible capital (firm-specific knowledge, contacts with technologically more advanced partners and buyers, etc.) (Di Mauro and Syverson, 2020). This firm-specific capital will be difficult to restore quickly once activity is re-established and any delay may have a significant negative effect on firms' productivity and competitiveness. Moreover, a study on investment in intangible capital (OECD, 2020b) points to the existence of a financing gap, which is hindering both productivity growth in intangible-intensive sectors and aggregate productivity growth. The measures mentioned in the study include reducing limitations in bank guaranties, in access to equity finance and in the public financing of innovation to relax the financing constraints faced particularly by small and medium-sized enterprises (SMEs) and start-ups.

2.2.2.1 Human capital

Human capital is an important long-term driver of productivity growth. Productivity is associated with a high level of appropriate knowledge and skills for innovation, but also a better matching of skills to labour market needs and jobs. A study by the European Commission (Morandini et al., 2020) using data from the PIAAC survey showed that appropriate skills levels can have a positive impact on productivity.[27] Similarly, on the basis of the PISA survey,[28] Hanuschek and Woesmann (2015) found that an improvement in 15-year-olds' performance has a long-term positive impact on GDP growth.[29] An analysis for selected OECD countries also confirmed that reducing skills mismatch can have a positive impact on productivity (OECD, 2019b).[30]

The educational structure of the population is improving, but skills among adults remain low. Due to the high participation of young people in upper secondary and tertiary education and the transition of young people to older age groups (a demographic effect), the educational structure of the population has been improving for a number of years. The share of adults with at least upper secondary education is high, while the share of those with tertiary education is still lower than in innovation leaders despite a long-term increase.[31] The quality of education as measured by the PISA survey indicates that 15-year-olds' performance[32] in reading deteriorated between 2015 and 2018, while their achievements in both mathematics and science were relatively high (Figure 9). With regard to adult (reading, mathematical and digital) skills, however, Slovenia lags behind according to PIAAC data, with low skills of people with low education and older people standing out in particular.

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[27] The calculations show that an increase of 1% in literacy test scores is associated with a 10% increase in labour productivity; a 1% increase in numeracy test scores is associated with an 11.3% increase in labour productivity (Morandini et al., 2020). The link between PIAAC outcomes and productivity was also confirmed by earlier studies (Hanushek et al., 2013).

[28] For more details on the PISA survey see OECD (n.d.), PISA.

[29] Calculations for Slovenia show that, assuming an increase of 25 scores in the average performance of 15-year-olds according to the PISA survey, GDP growth is 0.48 percentage points higher in the long term.

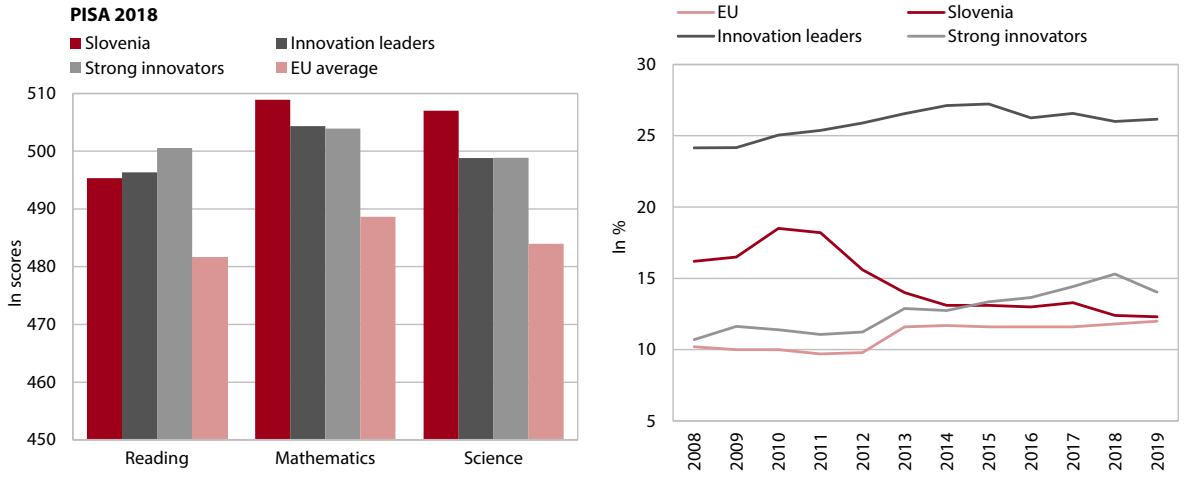
[30] The analysis focuses on the positive effects of reducing skills mismatches on allocative efficiency and, in turn, productivity. Calculations available for selected innovation leaders and strong innovators indicate that, assuming a better matching of skills, the allocative efficiency increases by from 7.7% in Ireland to 2.7% in Belgium (OECD Skills Strategy 2019: Skills to shape better future (OECD), 2019b).

[31] In 2019, the share of the adult population (25–64 years) with a tertiary education amounted to 33.3% in Slovenia (EU: 33.2%; innovation leaders: 43.5%, strong innovators: 36.8%). The definition of innovation leaders and strong innovators is based on the European Innovation Index.

[32] The PISA survey covers 15-year-olds, mainly first-year upper secondary school pupils. The remaining 10% are in basic education, adult education institutions and institutions for the education of children with special needs (Educational Research Institute, n.d.).

From the perspective of productivity, digital transformation and transition to Industry 4.0, skills mismatches of adults and employed persons, including managers, are particularly unfavourable. As regards the development of human resources that are important for innovation activity, the share of science and technology graduates has been rising and exceeds the EU-28 average and the average of innovation leaders,[33] but there is still a shortage particularly of engineers in the Slovenian economy.[34] According to the CEDEFOP index for 2020, skills imbalances on the labour market increased in Slovenia compared with 2018, but were not among the largest in international comparison.[35] Given the marked decline in activity in 2020, employers less frequently than in previous years reported difficulty in finding the right skills. Slovenia is lacking in terms of certain upper secondary vocational and technical skills[36] and in having the right skills of already employed persons (OECD, 2020c) and managerial skills,[37] which are essential to successfully manage a business. The number of new doctors of science remains unfavourable (below average).[38]

Figure 9: Satisfactory results of young people in literacy (left) and unfavourable movements in the participation of employed persons in lifelong learning (right)



Sources: OECD, PISA 2018; Eurostat Portal Page – Population and Social Conditions – Education and Training, 2020. Note: The definition of innovation leaders and strong innovators is based on the European Innovation Index.

[33] In 2018, the share of science and technology graduates totalled 27.2% (EU: 25.5%; innovation leaders: 22.7%; strong innovators: 27.0%.

[34] According to the Occupational barometer from 2019, engineers are in short supply in Slovenia (ZRSZ, 2019a).

[35] According to the Cedefop skills index 2020, Slovenia ranks 8th among EU countries in skills mismatch and achieves 60% of the ideal performance (100), compared with 62.5% of the ideal performance (100) in 2018. A higher value means a smaller mismatch. The index comprises several indicators: the share of tertiary graduates occupying jobs demanding lower skills, the share of tertiary graduates receiving low wages and mismatches in educational achievement (for a more detailed description, see 2020 European Skills Index, Technical report (Cedefop), 2020.

[36] According to the Employment Forecast 2020/I survey (ZRSZ, 2020) conducted at the beginning of June 2020, in which employers were asked about skills shortages in the past six months, almost a third of employers had difficulty finding appropriately qualified staff (in the group of large employers, the share was more that half). Employers mainly faced a shortage of candidates with appropriate skills, most frequently bricklayers, welders, drivers of HGVs and towing vehicles, and electricians (ZRSZ, 2020).

[37] According to the Global Competitiveness Index 4.0, in 2019, Slovenia ranked 16th among EU countries in terms of "reliance on professional managers" and 18th according to IMD data regarding the "availability of competent senior mangers" (IMD, World Competitiveness Online 1995–2020).

[38] In 2018, the number of new doctors of science per 1,000 inhabitants was 1.8 in Slovenia (EU: 2.1; innovation leaders: 2.3; strong innovators: 2.0). The decline in the number of new doctors of science could be attributed to the multi-year reduction in funding for the Young Researchers programme, a lower interest in enrolment in doctoral studies during the previous economic and financial crisis, and demographic change (smaller generations of students for enrolment in doctoral studies).

Adult participation[39] in lifelong learning has declined sharply in the last ten years, lagging even further behind that in innovation leaders. The low participation of low-skilled people and older people has been particularly problematic for many years.[40] The participation of employed persons has also declined (Figure 9, right). Participation in lifelong learning in the private sector has been lower than in the public sector for a number of years. Such trends are especially unfavourable in view of the above-mentioned low or inappropriate skills of adults and the employed. Also, given the challenges of digital transformation and automation, the low participation in education is particularly problematic for workers in jobs that are highly vulnerable to technological displacement, especially as their share is high in Slovenia according to OECD estimates (OECD, 2019c). Considering these and other important factors,[41] adults acquiring new knowledge and skills – and, above all, the right ones – is even more important for Slovenia than for most other EU countries (OECD, 2019d).

Slovenia is one of the countries that should significantly increase investment in education and retraining of employed persons to facilitate their re-assignment to jobs with low or medium risk of automation.

Public and private expenditure on education, particularly adult education, is relatively low. Public expenditure on formal education (expressed as a share of GDP), which is mainly allocated for the education of children and young people, has declined since 2012. In 2017, it was lower than the EU-28 average and that of innovation leaders and strong innovators. The participation of adults in education is, in addition to individuals' own investment, also enabled by the government and employers. Employers' expenditure on adult education has declined in recent years[42] and is low by international comparison (OECD, 2019d). Adults' own spending on education is also low, as education is financially inaccessible particularly for those with low and upper secondary education (OECD, 2019b). Accessibility to education is declining both as a result of low government expenditure on adult education (also compared with other countries (ibid.)) and due to a high dependence of a large proportion of providers on the (unpredictable) dynamics of absorption of resources from the European Social Fund (Beltram, 2019). The low investment level reduces the possibilities for acquiring appropriate knowledge and skills to adapt to changes in the workplace brought about by automation, robotics, digitalisation and so forth. According to OECD estimates, Slovenia is one of the countries that should significantly increase investment in education and retraining of employed persons to facilitate their re-assignment to jobs with low or medium risk of automation (OECD, 2019c). For a successful digital transformation of the economy and society, it is vital to increase both public and private funding for education and retraining of adults and improving their digital literacy skills (particularly the skills of older adults).

The coronavirus crisis may have both positive and negative impacts on human capital in the long term. The higher prevalence of remote working during the epidemic has accelerated the use of ICT technologies and increased the need for (additional) digital skills. An increase in digital skills and their wider use could boost digital transformation and contribute to higher productivity of the Slovenian economy in the long term. Given the perceived need for such workforce, especially in view of the expected accelerated digital transition, it is also vital to maintain and develop digital skills and promote enrolment in ICT studies after the epidemic. The coronavirus crisis will, however, also have negative consequences for human capital. The closure of educational institutions and distance education during the COVID-19

[39] Persons in employment, inactive and unemployed persons.

[40] For adults and older people to be successful in the digital society, it is vital to increase their participation in lifelong learning, especially in programmes for improving their digital skills. This requires increasing the offer of educational programmes, making them financially accessible and encouraging participation.

[41] Structural shifts in all sectors of the economy, population ageing, the openness of the economy, the share of employed persons facing the challenges of foreign demand, etc.

[42] According to SURS data, in 2018 average annual expenditure of employers per employed person totalled 70 euros (2008: 109 euros), which is 0.3% of labour costs.

epidemic have caused learning losses in Slovenia.[43] This can have a long-term negative impact on young generations' knowledge and, indirectly, on economic growth.[44] Distance education is also increasing inequality in learning achievements of pupils from different socio-economic backgrounds (European Commission, 2020b; OECD, 2020e), as pupils from socio-economically vulnerable families have significantly worse conditions for learning at home than their more advantaged peers (Di Pietro et al., 2020). This might have a negative impact on human capital in the long term, as an increase in social inequality is also lowering productivity. Moreover, long absences from work due to the crisis may also lead to a decline in certain skills, which can also be reflected in productivity (Di Mauro and Syverson, 2020).

2.2.2.2 Research, development and innovation

Research and innovation activities are the key long-term drivers of productivity growth. Through innovation, which is defined as a new or improved product or a new or improved business process[45] (e.g. in distribution and logistics, marketing and sales, information and communication systems, etc.), value added increases with an unchanged amount of resources used (ECB, 2017). R&D investment, together with state-of-the-art technologies and a skilled workforce, is an important basis for innovation. Skilled and creative people at various levels of operation, together with the use of modern digital technologies, also play a decisive role in transforming new ideas into commercially successful innovations, thus significantly contributing to productivity growth.

Many empirical studies find links between productivity and investment in R&D. A study by Ugur et al. (2016), for example, analyses the relationship between R&D investment and firm/industry productivity and reports that the average elasticity and rate-of-return estimates are positive. Soete et al. (2020), who investigated the impact of public and private R&D expenditure on productivity in the Netherlands, found unambiguously positive effects of additional R&D investment on total factor productivity growth and GDP. A study by Vivarelli et al. (2016) also corroborates a positive and statistically significant impact of R&D expenditure on productivity, finding that the coefficients of elasticity for the R&D of US firms are consistently higher than for comparable EU firms (the latter achieving only 35% of the former). The authors explain this by (i) a higher capacity of US firms to translate R&D investment into higher value added per employee (productivity gains) and (ii) the sectoral structure of the economy, with a significantly larger part of US firms operating in high-tech sectors, which typically have higher R&D investment. The impact of physical capital embodied in accumulated investment in various new technologies is also positive and marginally statistically significant. In this case, the elasticity coefficients for EU firms are 30% higher than for their US counterparts, which indicates that EU firms tend to achieve productivity gains by technological change rather than by accumulated knowledge, i.e. R&D investment (ibid.). These results suggest that economic policy measures should focus not only on increasing R&D expenditure but also on maximising the effectiveness of R&D investment. A Canadian study (Tang and Wang, 2019), meanwhile, shows that the relationship

[43] Learning losses in Slovenia were among the largest in OECD countries (Hanushek and Woesmann, 2020). Distance education also had a negative impact on the physical activity of children, their health and weight, and social contacts with their peers.

[44] See, for example, Hanushek and Woessmann, 2020, Di Petro et al., 2020, or OECD, 2020d. The estimate made by Hanushek and Woesmann (2020) for the G20 countries shows that learning losses have a negative impact on GDP.

[45] Definition of innovation according to the latest revised methodology of the OECD (Oslo Manual 2018, 2018).

between productivity and R&D investment should not be evaluated in isolation from the business environment where a firm operates, as business performance is determined by internal and external factors,[46] which both affect the effectiveness of R&D investment in improving productivity.

In the public sector, R&D investment declined by EUR 117 million (or by around 40%) relative to 2011; the increase in the next two years compensated for around 40% of this fall.

After several years of decline, R&D investment in Slovenia has slipped below the EU average and is significantly lower than in innovation leaders.[47] In 2012–2017, total R&D expenditure was shrinking, but in 2018 it increased to 1.95% of GDP. R&D investment declined in both sectors, in the public until 2016 and in the private in 2015–2017. The fall in R&D investment of the public sector, by EUR 117 million (or around 40%) relative to 2011, was related to the consolidation of public finances in that period. The increase in the next two years compensated for around 40% of this fall. The bulk of R&D investment[48] is accounted for by the business sector, which was a major source of R&D investment growth until 2015. The decline in business sector R&D investment was related to two sets of factors: (i) a lower volume of EU funds between 2013 and 2014[49] and late and slow absorption of EU funds since the beginning of the implementation of the 2014–2020 financial perspective;[50] (ii) after 2015, the amount of R&D tax relief claimed also started to decline.[51] The lower amount of EU funds in these periods was also reflected in lower incentives for cooperation and knowledge transfer between the research and the business sectors, as both the public and the private sector finance R&D investment mainly within their sectors. The self-financing rate of the business sector rose from 93% to 97% between 2008 and 2017, while the self-financing rate of the public sector fell from 88% to 80%. The remaining public sector funds were used to finance R&D investment in the business sector.[52]

[46] Firms can impact on internal factors (firm size, ownership structure, the skills of the workforce, investments in technologies, management practices, business strategies, etc.); to external factors (legal framework and intellectual property regimes, financial conditions, and public infrastructure, etc.) they can only successfully adapt (Tang and Wang, 2019).

[47] The definition of innovation leaders is based on the European Innovation Index. In the latest measurement, for 2019, these were Sweden, Finland, Denmark, the Netherlands and Luxembourg.

[48] In 2018, it contributed 62.6% to total R&D expenditure.

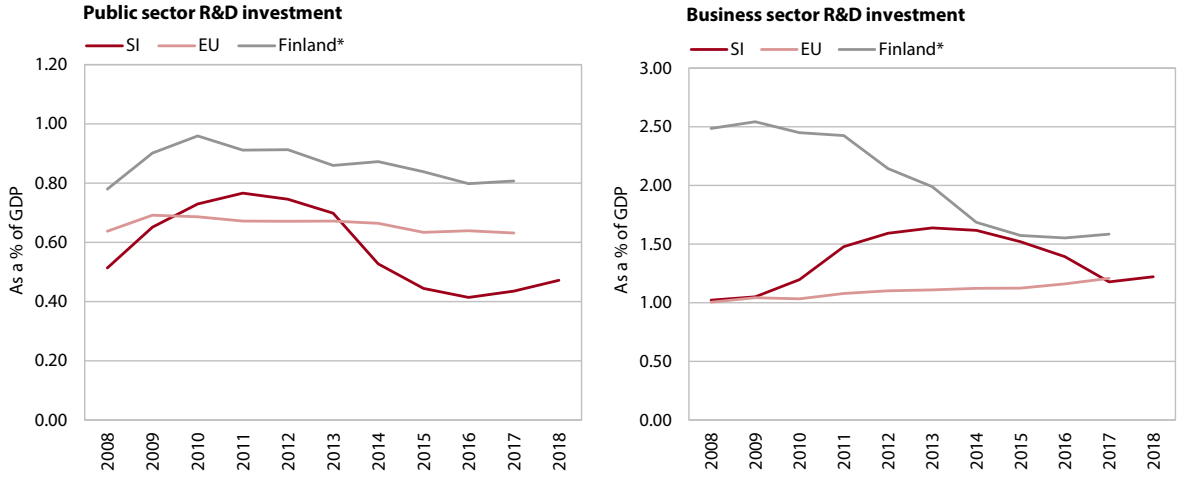
[49] The end of the co-financing of R&D projects in excellence, competence and development centres by government and EU funds, where co-funding by the business sector was also required for concrete projects.

[50] A relatively late preparation of key documents as a pre-condition for the absorption of EU funds in the area of innovation and R&D (Slovenian Smart Specialisation Strategy 2014–2020 and Operational Programme for the Implementation of EU Cohesion policy 2014–2020). The first government measures to foster innovation were implemented only in 2016 (for more see Productivity Report, 2019 and Development Report, 2020).

[51] In 2017, guidelines to ensure greater tax certainty in R&D tax reliefs were issued, as since 2016, better control over their use has been carried out (for more, see Development Report, 2019).

[52] The volume of public funds for R&D investment in the business sector declined to around EUR 49 million in 2013–2017.

Figure 10: Public sector R&D investment has declined significantly and the increase in recent years has not yet compensated for this decline



Sources: Eurostat, SURS, 2020; calculations by IMAD. Note: Finland ranks among innovation leaders according to the European Innovation Index. Since data are only available for all innovation leaders for 2017 (left figure: 0.75% of GDP; right figure: 1.51% of GDP). To ensure more up-to-date data for comparison, we show only data for Finland.

According to the most recent measurement, for 2016–2018,[53] innovation activity was only approaching the level reached before the 2010–2016 decline. Innovation activity, i.e. the share of enterprises which introduced innovation, increased from 39.8% in 2014–2016, when it was lowest, to 48.6% in 2016–2018. Before 2010, it was around one half. The strengthening after several years of decline was partly linked to the implementation of Slovenia's Smart Specialisation Strategy (S4), as in 2016–2018, 87 public tenders and programmes worth EUR 983 million were carried out, with almost half of the amount allocated for R&D and innovation programmes (Government of the Republic of Slovenia, 2019). In addition, foreign business sector funding for R&D investment carried out in Slovenia also increased considerably in 2017–2018. The decline in investment activity after 2010 also had a significant impact on the European Innovation Index (EII) value for Slovenia,[54] which fell further according to the latest measurement, for 2019, when it did not yet include the most recent data on the improvement in innovation activity.[55] Slovenia was thus placed among moderate innovators for the second consecutive year, instead of strong innovators as in previous years, when it had always ranked close to the EU average. Broken down by EII dimensions, the worst performance with regard to the EU average was recorded in "finance and support", reflecting the traditionally lowest value (also by international comparison) of venture capital. This result was also attributable to the persistent decline in public sector R&D investment between 2011 and 2017 (averaging 0.55% of GDP; EU: 0.74% of GDP; innovation leaders: 0.97% of GDP). Between 2012 and 2019, the largest decline in the EII and

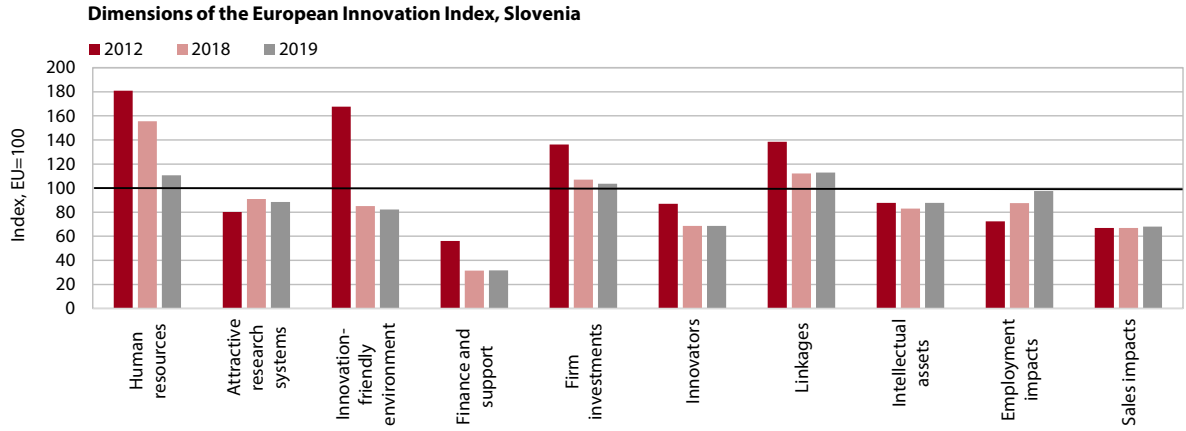
[53] In the latest survey, SURS carried out methodological changes in line with the revised OECD methodology (Oslo Manual 2018) for measuring innovation activity in enterprises. The main change refers to the new definition of the concept of innovation, which distinguishes between two types of innovation: (I) a product innovation (a new or significantly improved good and/or service) and (ii) process innovation. According to the previous methodology (Oslo Manual 2005), innovation could be (i) technological, i.e. a new or significantly improved product (good and/or service) and/or process or (ii) non-technological (a new marketing method and/or workplace organisation (Zlobec, 2020). Because of these methodological changes, a great deal of caution is required in comparing and interpreting data on innovation activity in different time periods.

[54] All indicators that come from the Community Innovation Survey for 2014–2016 (CIS 2016) deteriorated with regard to the previous survey (CIS 2014), which also had a negative impact on individual EII dimensions, which are calculated using these data (for more, see European Innovation Scoreboard 2020, European Commission, 2020c).

[55] For all EU Member States, data on innovation activity for 2014–2016 were taken into account. Eurostat is expected to publish data for 2016–2018 towards the end of 2020.

the largest increase in the lag behind the EU average were in the "innovation-friendly environment" dimension, which was mainly a consequence of a substantial decline in the motivational index[56] in recent years. A significant deterioration was also seen in "human resources", which was to a great extent related to changes in the educational system during this period.[57] Slovenia otherwise still exceeds the EU average in this dimension. An improvement with regard to the EU average was recorded for "employment impacts", mainly due to a large share of employees with tertiary education in knowledge-intensive activities.

Figure 11: The efficiency of the Slovenian R&D and innovation system as measured by the EII has been deteriorating since 2013



Source: European Innovation Scoreboard 2020, European Commission, 2020c.

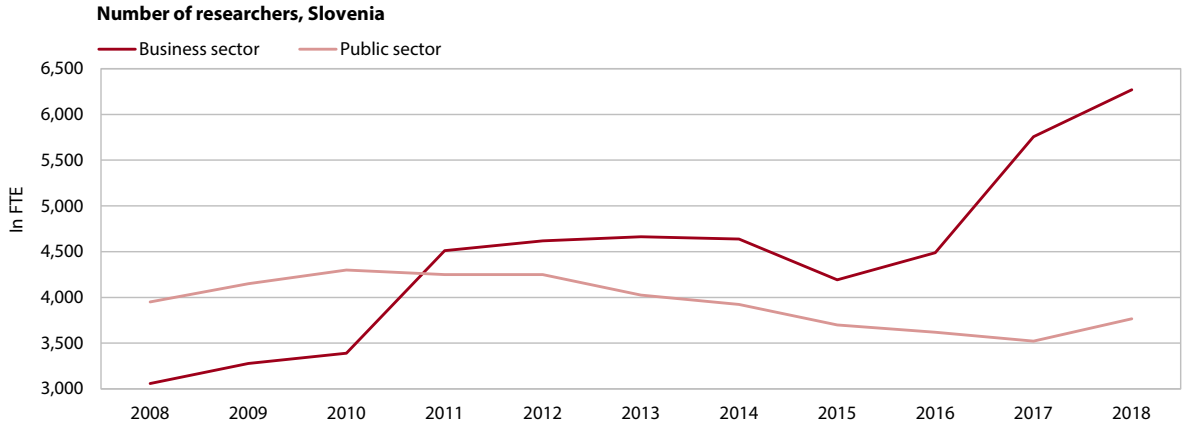
In 2008–2018 the number of researchers[58] increased only in the business sector, which in fact employs the most researchers. The share of *business sector* researchers has thus already exceeded 60% in the last two years and is above the EU average (2018: EU 52.7%), while it still lags far behind the average of innovation leaders (67.1%). This could be a good basis for a new innovation momentum in the business sector, provided that favourable conditions for R&D are also ensured in the public sector, where basic research creates the foundation for applicative business sector innovations and breakthroughs. In the *public sector*, the several-year downward trend in the number of researchers came to a halt in 2018, but the number is still 533 lower than the 2010 peak. The decline in 2012–2017 was related to the halving of funding for young researchers. This affected particularly young staff at the beginning of their careers, which is not encouraging in terms of cooperation and transfer of the newest knowledge of younger PhD researchers to the business sector. Given the unfavourable age structure of researchers (especially in the public sector, where a shortage of younger researchers is already apparent) and the outflow of researchers abroad, it will certainly be difficult to ensure a sufficient number of highly qualified researchers in the future, which will weaken the potential for successful innovation activity.

[56] According to the Global Entrepreneurship Monitor (GEM). The decline in the motivational index was due to stronger growth in the number of necessity-driven entrepreneurs (i.e. those pushed to entrepreneurship out of necessity) than in the number of opportunity-driven entrepreneurs (those pulled to entrepreneurship by opportunity and because they desire independence or to increase their income).

[57] Including the indicator of new doctors of science. In the calculation of the EII 2019, the figure for 2017 was used for this indicator, while for the comparison with the previous year, the figure for 2016 was used. However, 2016 being the last year for completing studies under the pre-Bologna study programmes, a large number of doctoral students obtained the title of Doctor of Science that year, so the comparison does not reflect the actual changes in this area. Consequently, these changes also contributed to a decline in the human resources dimension in 2019.

[58] Expressed on a full-time equivalent basis.

Figure 12: Growth in the number of researchers in the last decade only in the business sector



Source: SURS, 2020.

The impact of the COVID-19 epidemic on R&D and innovation activity is significantly dependent on the priorities that countries set in their exit strategies. With the spread of the coronavirus epidemic, R&D investment in medicines, vaccines and medical devices has risen significantly around the world, which will increase R&D spending particularly in countries that are leaders in these areas or where the production of medicines and medical devices plays a significant role in the economy. The need for changes in business operations due to the epidemic may also give an additional boost to companies' innovation activity. However, as the epidemic has significantly affected national economies and their public finances, it could, at the aggregate level, also have a significant negative effect on R&D expenditure,[59] which could be crowded out by other, in the short term even more important, expenditures. The final impact on R&D and innovation activity will therefore significantly depend on the extent to which countries support this type of (both public and private sector) investment in their exit strategies to ensure more stable and sustainable long-term economic growth.

2.2.3 Integration in global value chains

A wide range of macroeconomic analyses confirm considerable positive effects of the openness to external trade (Van Bergeijk et al., 2011), particularly the integration into global value chains (GVCs), on GDP and productivity. Empirical studies at the industry and country levels generally report a positive correlation between GVC integration and productivity.[60] Analyses using firm-level data also paint a similar picture.[61] GVC integration can boost productivity growth through multiple channels. Firms can specialise in those tasks where they are the most

[59] The literature emphasises the great uncertainty regarding the financing of R&D expenditure and innovation given the enormous scale of the current health crisis and its impact on the economy and society. In any case, both public and private resources for these purposes will be limited and under great pressure with regard to the urgency of their allocation and short-term priorities. The (private) financial sector will certainly adapt to the new circumstances, as it did during the financial crisis after 2008, with novel innovation financing mechanisms (such as sovereign wealth funds, crowdfunding, fintech solutions, etc.). Every crisis also brings opportunities and room for creative disruption, meaning that the countries most open to novelties (related to education, entrepreneurship, etc.) will adapt most easily and efficiently (The World's Most Innovative Countries, 2020).

[60] See, for example, Battiati et al., 2019; Constantinescu et al., 2019; Formai and Vergara Caffarelli, 2016; Ignatenko et al., 2019; Jona-Lasinio and Meliciani, 2019; Kordalska at al., 2016; Kummritz, 2016; Pahl and Timmer, 2019; Urata and Baek, 2019; Adarov and Stehrer, 2020a.

[61] See, for example, Ayadi at al., 2020; Agostino et al., 2016; Baldwin and Yan, 2014; Brancati et al., 2017; Ge et al., 2018; Del Prete at al., 2015; Giovannetti and Marvasi, 2018; Kilicaslan et al., 2018; Lu et al., 2016; Yu and Li, 2014.

productive. Through GVCs they can gain access to cheaper, better-quality inputs or inputs produced by more sophisticated technologies. The effects of knowledge spillovers between the world's leading and domestic firms may occur. GVCs also provide access to larger markets and thus economies of scale. On the other hand, exposure to tougher competition may also make some less productive firms leave the market (Criscuolo & Timmis, 2017). A study by Criscuolo and Timmis (2018) finds that productivity growth depends not only on the degree of GVC integration but also on a sector's or country's position in GVCs. The outcomes show that becoming more central[62] is associated with faster productivity growth in smaller and non-frontier firms and firms in smaller economies and new EU Member States. This is a message that is very relevant for Slovenia.

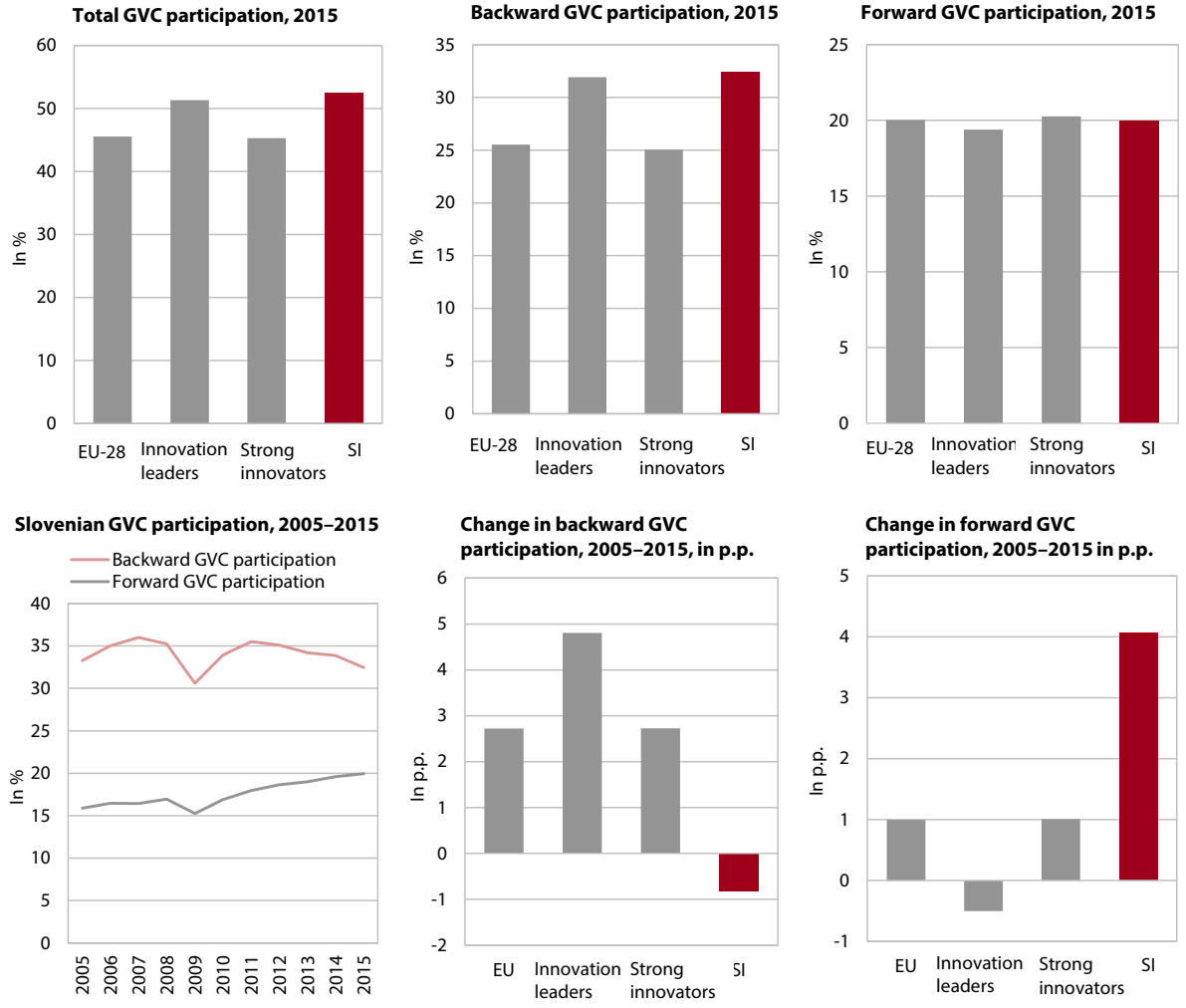
Slovenia, as a small, open economy, is relatively strongly integrated into GVCs. In comparison with the EU average, innovation leaders and strong innovators, Slovenia achieves a higher value on the total GVC participation indicator. Its ranking in backward GVC participation[63] is similar and in forward GVC participation[64] equal to the EU average. Strong innovators continue to achieve higher forward GVC participation rates, while innovation leaders lag behind Slovenia in this respect. Slovenia advanced significantly in terms of forward GVC participation in 2005–2014, while its backward participation declined somewhat, unlike in other groups of countries included in the comparison (Figure 13). From the viewpoint of Slovenia, this indicates an increase in the relative importance of exports of Slovenian value added to foreign firms and a slight decline in the role of imports of foreign intermediates.

[62] Centrality as a measure reflects the integration and the influence of sectors and countries within global value chains. Central sectors are highly connected (both directly and indirectly) and influential within global value chains. Peripheral sectors, in contrast, have weak linkages to other countries and sectors and are therefore less influential. A sector's centrality is dependent on the centrality of sectors with which it is connected and the relative importance of its linkages (Criscuolo & Timmis, 2018).

[63] The ratio between foreign value added content in domestic exports and gross exports.

[64] The ratio between domestic value added content in foreign exports and gross exports.

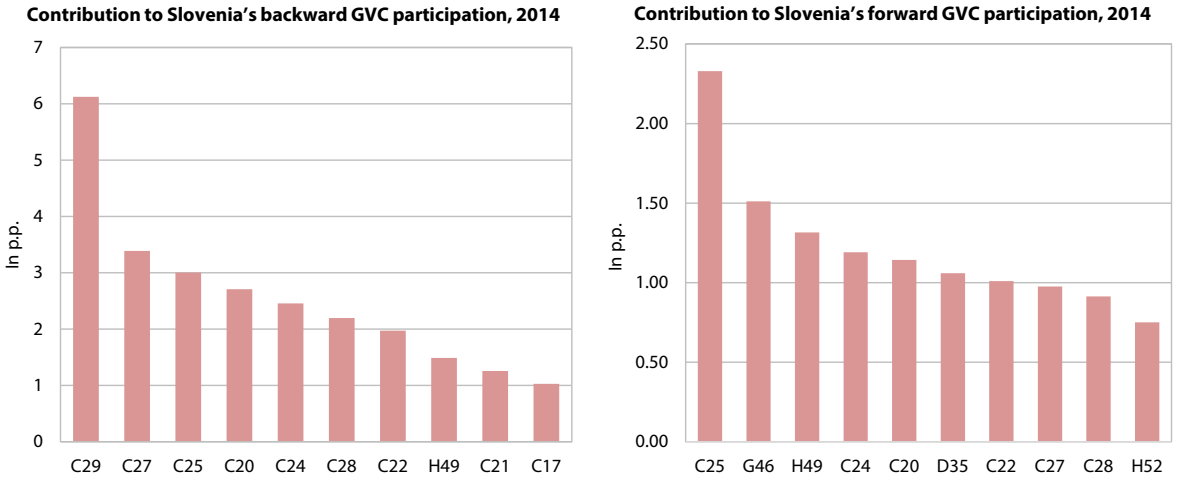
Figure 13: Slovenia's GVC participation is relatively high; in 2005–2015, forward GVC participation increased significantly



Source: OECD TiVA Indicators; calculations by IMAD. Notes: Forward GVC participation is the ratio between domestic value added embodied in foreign exports and gross exports, while backward participation is the ratio between foreign value added embodied in domestic exports and gross exports. Total GVC participation is the sum of forward and backward participation. Innovation leaders and strong innovators are defined on the basis of the European Innovation Index.

Broken down by sector, the largest contribution to Slovenia's backward GVC participation is made by the manufacture of motor vehicles and to forward GVC participation by the manufacture of metal products. These two sectors also contribute the most to Slovenia's total participation in GVCs. WIOD data for 2014 show that by far the largest contribution to Slovenia's backward participation rate, which was 35.5%, came from the manufacture of motor vehicles (C29), followed by the manufacture of electrical equipment (C27) and metal products (C25). In terms of the contribution to Slovenia's forward participation rate, the manufacture of metal products (C25) was first, followed by wholesale trade, except motor vehicles and motorcycles (G46) and land transport and transport via pipelines (H49). One of the important factors associated with GVC creation is foreign direct investment (FDI), as global value chains are for the most part shaped by transnational corporations. A study by Adarov and Stehrer (2019) empirically confirms the positive correlation between inward FDI and the backward participation of industries in GVCs. Between 2003 and 2017, the largest recipient of greenfield FDI was the automotive industry (Davies, Kogler & Crescenzi, 2020), which at least to some extent explains its leading position in backward GVC participation among sectors.

Figure 14: The largest contribution to Slovenia's backward GVC participation comes from motor vehicle manufacturing and to its forward GVC participation from the manufacture of metal products



Source: WIOD database; calculations by IMAD. Note: C29 – Manufacture of motor vehicles, trailers and semi-trailers, C27 – Manufacture of electrical equipment, C25 – Manufacture of fabricated metal products, except machinery and equipment, C20 – Manufacture of chemicals and chemical products, C24 – Manufacture of basic metals, C28 – Manufacture of machinery and equipment n.e.c., C22 – Manufacture of rubber and plastic products, H49 – Land transport and transport via pipelines, C21 – Manufacture of basic pharmaceutical products and pharmaceutical preparations, C17 – Manufacture of paper and paper products, G46 – Wholesale trade, except of motor vehicles and motorcycles, D35 – electricity, gas, steam and air-conditioning supply, H52 – Warehousing and support activities for transportation. The figures show the ten sectors that make the greatest contribution to Slovenia's backward and forward participation in GVCs.

Industries that are more integrated into GVCs are, in addition to potential benefits, also more exposed to negative shocks, such as the crisis caused by the coronavirus pandemic. The latter has caused particularly severe disruptions in production processes of companies that are heavily integrated into GVCs. Some scholars are thus already predicting that the coronavirus pandemic, coupled with uncertainties about world trade brought about by protectionist measures, will accelerate the long-term transformation of GVCs, as companies will want to protect themselves against GVC-related risks. This would lead to a regionalisation of GVCs (Javorcik, 2020; Koražija, 2020; Seric & Winkler, 2020; EIU, 2020), a process that in fact already started in the first years of the new millennium, and especially after the economic and financial crisis of 2008, and has become intertwined with the introduction of I4.0 technologies The latter has reduced dependence on low-skilled, cheap labour, which has made it possible for companies to reshore or nearshore certain production processes, thereby reducing GVC-related risks, increasing flexibility and improving the quality of products. The processes of automation and regionalisation of GVCs may thus accelerate with the coronavirus epidemic (Piatanes & Arauzo-Carod, 2019; Seric & Winkler, 2020), which could represent an opportunity for companies from Eastern and Southern Europe, including Slovenia (Javorcik, 2020; Korajžija, 2020). In this context, the readiness of firms for automatisation and digitalisation will certainly also play a significant role (see Section 4.1.1).

2.2.4 Efficiency of energy and resource consumption

The primary reason for rational use of resources and energy is to reduce the impact of economic activity on the environment, but it is also becoming a more and more important productivity factor. Higher efficiency of the use of energy and the limited primary resources, which has been excessively rising at the global level during the economic boom, is increasingly being promoted not only because of greater awareness of the urgency of environmental protection, but also because

of uncertainty about their further availability and prices (IRP, 2019). In many EU countries, resource productivity (GDP per unit of resources used), as an indicator of the efficiency of resource consumption, has thus been growing much faster than labour productivity since 2008 (Stocker et al., 2015).[65] To achieve higher productivity of the economy, the circulation of resources, i.e. their recovery and reuse and the introduction of circular business models,[66] will have to be increased even more in the future. This will have a positive impact on the environment and at the same time also further improve resource productivity amid the expected relatively lower costs of recycling (OECD, 2019f). The improvement will be particularly important for sectors that consume many resources and therefore have the greatest possibilities for their circulation. These include construction and buildings, production of electronics, batteries and vehicles, plastics, packaging materials, and textiles.

The Slovenian economy is still for the most part linear, with only around 9% of secondary materials and resources reused, which is less than the EU average.

In Slovenia, the efficiency of resource and energy consumption has been rising faster than labour productivity in the long term, but Slovenia still lags far behind the most advanced EU countries in this area. In the last two decades, *resource productivity* in Slovenia has increased by more than 70% (labour productivity has increased half less). The main reason was the completion of a multi-year cycle of intense motorway construction and thus a significant decline in the consumption of sand and gravel, which account for a major share of total resource consumption. Sand and gravel make up the largest part of the use of non-metallic minerals,[67] which has started to rise gradually again in Slovenia in recent years. As even faster growth is to be expected in the coming years given the major investments planned (the construction of the second track of the Divača–Koper railway line, the third development axis and hydroelectric power plants), it is all the more important to encourage the introduction of circular business models. The Slovenian economy is still for the most part linear, with only around 9% of secondary materials and resources reused, which is less than the EU average (see Figure 15). The growth of *energy productivity* (GDP per unit of total energy consumption) has exceeded labour productivity growth only slightly in the last two decades. In the last decade, its increase has been strongly hampered by the relatively high consumption of liquid fuels, which is also related to extensive transit traffic.[68] As in labour productivity, Slovenia lags behind the EU average in resource and energy productivity by almost one-fifth. At the same time, it is significantly more successful in terms of resource use efficiency than the other countries of the EU-13 group, where resource productivity has even declined slightly on average over a longer period, while in energy productivity it is comparable.

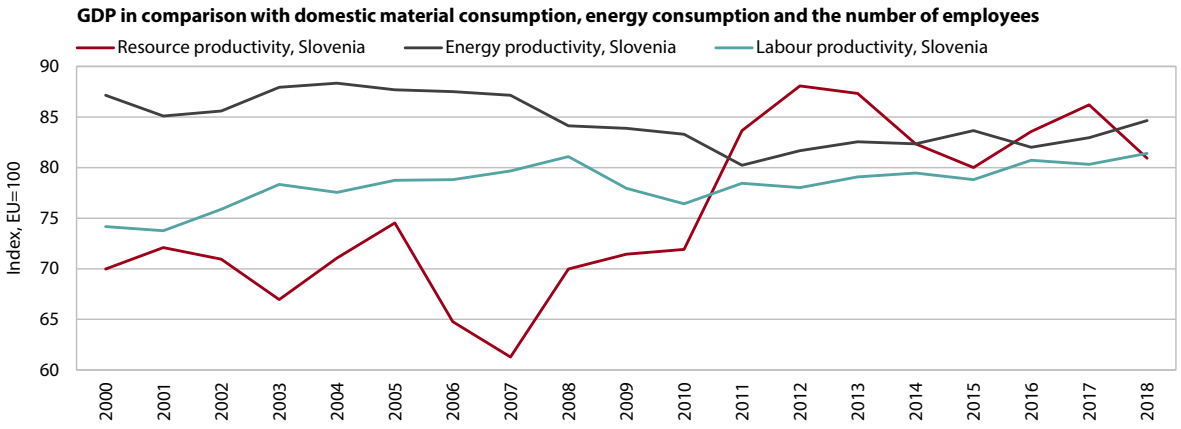
[65] Analysts attribute this mainly to high and unstable raw material and energy prices (including due to the scarcity of some materials), technological changes that allow savings in resource consumption, a structural shift towards a service economy, and the awareness of the urgency of transition to a circular economy, including, or even especially, for environmental reasons.

[66] For example product life extension, servitisation, industrial symbiosis, where wastes of one company become raw materials for another, etc.

[67] In 2007, only three EU countries had higher per capita consumption of non-metallic minerals than Slovenia (in 2018, 14 had).

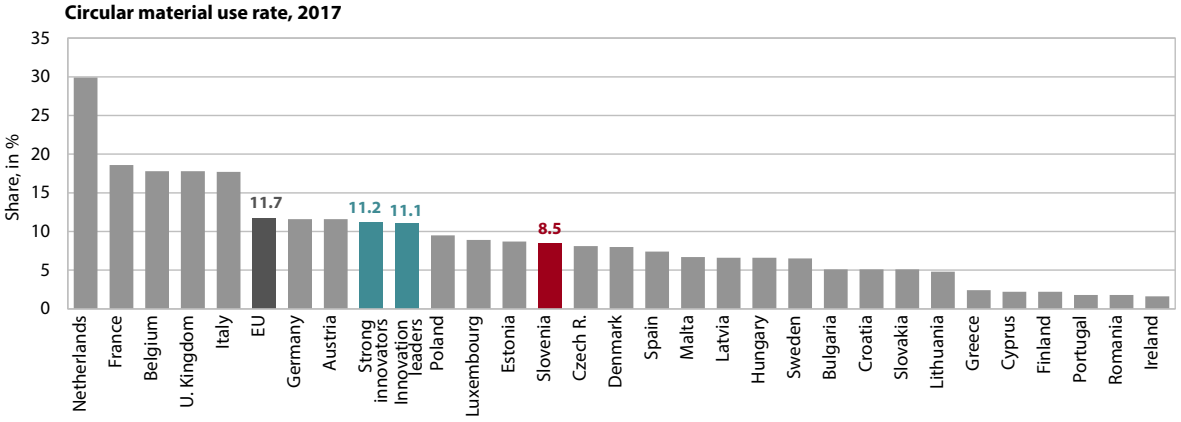
[68] Since 2008, Slovenia has been at the top of EU countries in terms of per capita energy consumption in road transport.

Figure 15: As in labour productivity, resource productivity and energy productivity in Slovenia lag behind the EU average by almost one-fifth



Sources: SI–STAT, Eurostat; calculations by IMAD. Note: Resource productivity is the ratio of GDP to domestic material consumption (PPS/kg); energy productivity is the ratio of GDP to overall energy consumption; labour productivity is the ratio of GDP to the number of employees.

Figure 16: The Slovenian economy is less circular than the EU economies on average



Source: Eurostat; calculations by IMAD. Note: The circular material use rate, also known as the circularity rate, is defined as the ratio of the circular use of materials to the overall material use. The definition of innovation leaders is based on the European Innovation Index.

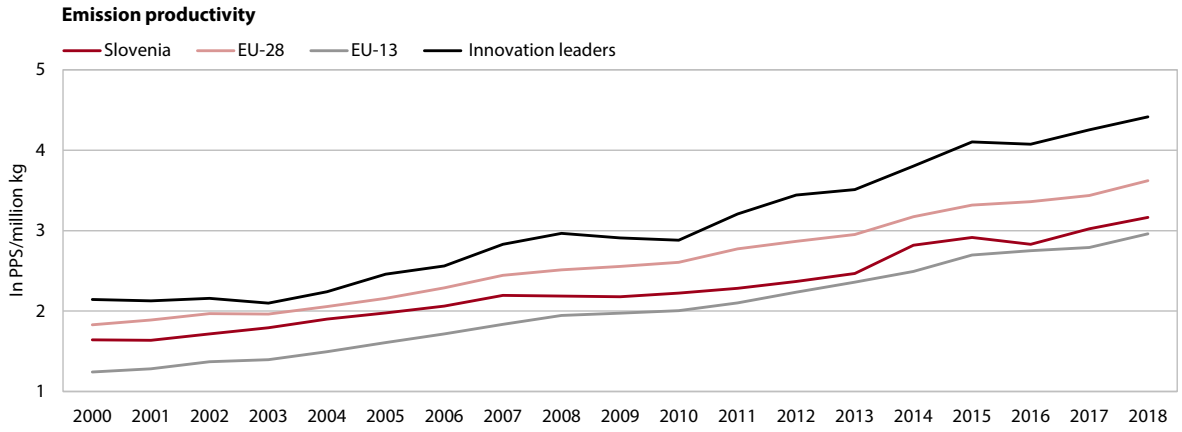
The productivity of emission-intensive sectors is increasingly dependent on compliance with the adopted guidelines for reducing indirect environmental pressures and associated costs. This is particularly true for larger industrial installations and power plants included in the greenhouse gas emissions trading scheme, which is a cornerstone of the EU's policy to combat climate change. By the monetisation of carbon emissions, these companies are encouraged to find the most cost-effective solutions to reduce emissions and invest in clean low-carbon technologies. After falling during the economic crisis, emissions have risen again slightly in Slovenia since 2014. Due to higher GDP growth, but also under the impact of one-off factors,[69] the emission productivity of the economy (GDP per unit of GHG emissions) has improved, but less so than on average in the EU-13 and in innovation leaders and strong innovators. During the COVID-19 epidemic, emissions have decreased globally,[70] due to the contraction of economic activity, but the related

[69] The reduction of emissions has been related to thermal power plants: one of the largest was closed, the other technologically upgraded.

[70] In April 2020, greenhouse gas emissions are estimated to have been 17% lower globally than in April 2019 (*The Guardian*, 2020).

longer-term level of emission productivity will to a large extent be dependent on steps taken to foster a recovery towards a greener, digital, and more resilient and competitive economy.

Figure 17: Slovenia generates less GDP per unit of GHG emissions than innovation leaders; in 2000, the gap has widened further



Source: Eurostat; calculations by IMAD. Note: The definition of innovation leaders is based on the European Innovation Index.

2.2.5 Other social and institutional factors

Social capital influences productivity by creating a favourable environment for economic performance. It is complementary to other types of capital as it does not in produce in itself but creates the conditions for sufficient quantity, intensity and quality of interpersonal interactions and cooperation and exchanges, which support development and growth. Experts offer various definitions of social capital, but it is most frequently measured by the level of cooperation, the existence of shared norms, interpersonal and institutional trust, and the density of social networks (Fedderke et al., 1999; Neira et al., 2010; Svetic, 2014). The positive impact of social capital on productivity shows particularly through informal interactions, the diffusion of information and knowledge, exchange of human and cultural capital,[71] and more inclusive, horizontal and democratic decision-making and management processes, which contribute to more effective problem-solving, better work dynamics, interaction with a broader social environment, etc. (Greve et al., 2010; Kaasa, 2016). Social capital is most often measured by the level of interpersonal and institutional trust, which is important for productivity (Jankauskas and Šeputiene, 2007; Bjørnskov and Méon, 2010). Social networks also have an important synergy effect, as they can have a positive influence on corporate innovation and, consequently, productivity (Kaasa, 2009).

In Slovenia, interpersonal trust and trust in key government institutions are fairly low compared with the EU average and the innovation leaders. The results of the European Social Survey show that interpersonal trust increased in 2002–2018 but remained relatively low[72] and below the EU average.[73] This is also corroborated

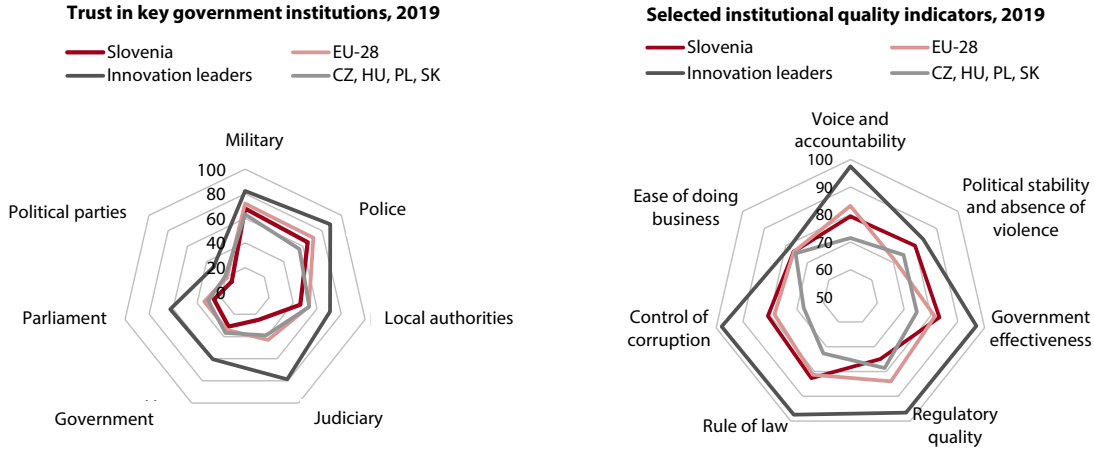
[71] In the neighbourhood, within the company, between companies.

[72] The average level of trust in other people in Slovenia was below 5 (on a scale of 0–10) in all years analysed. In 2018, 24% of respondents believed that most people can be trusted (EU 36%). This share was higher only in 2012 (25.3%).

[73] The overall average of EU countries regardless of the national sample or country size (Belgium, Germany, Denmark, Spain, Finland, France, Great Britain, Ireland, the Netherlands, Poland, Hungary, Portugal, Sweden and Slovenia).

by the results of the European Quality of Life Survey, according to which trust in people is significantly lower in Slovenia than among innovation leaders.[74] Trust in the functioning of democracy and key state institutions (parliament, government and judiciary) has also remained low, despite positive shifts in 2017–2019.[75] Particularly low is trust in politics and political parties and in the independence of courts and judges.[76] Compared with other EU countries and especially with innovation leaders, Slovenia also has a low degree of representative and participatory democracy, which are important particularly for public trust in government institutions, improve transparency and contribute to more sustainable policies (Development Report, IMAD, 2020a). All social capital aspects will also be significantly affected by the COVID-19 epidemic and the associated uncertainties and changes. The World Values Survey (WVS) examines the hypothesis that during the COVID-19 epidemic people's value orientations, attitudes and perceptions have changed more than in any other crisis in the last century,[77] moving toward more autocratic, traditional and less democratic values.[78] The long-term impact of the epidemic and the associated recession on people's trust and social networks may thus be negative for both society and productivity.[79]

Figure 18: Slovenia lags significantly behind innovation leaders according to trust in government institutions and institutional quality



Sources: WGI, Doing Business, 2019, Eurobarometer, 2019.
Notes: The definition of innovation leaders is based on the European Innovation Index. In the institutional quality indicators, countries are ranked on a scale of 0 to 100 according to their distance to the best-performing country, more being better. The averages are unweighted. Data for WGI indicators are for 2018 and data for the ease of doing business index (Doing Business) are for 2019. The WGI and Doing Business methodologies differ in the calculation of the distance to the best-performing country, as the doing business index is the average of individual sub-indices, which can underrate the range. CZ – Czech Republic, HU – Hungary, PL – Poland, SK – Slovakia.

[74] The average assessments of trust in 2016. Finland 7.4; Denmark 7.3; Sweden 6.6; the Netherlands 6.2; Luxembourg 5.8; EU 5.2; Slovenia 4.8.
[75] For more on trust in institutions, see Development Report 2020, IMAD, 2020.
[76] See Eurobarometer 92, European Commission, 2019a; Flash Eurobarometer 474, European Commission, 2019b; Flash Eurobarometer 475, European Commission, 2019c; the 2019 EU Justice Scoreboard, European Commission, 2019d).
[77] See the world survey on the impact of COVID-19 on value orientations at: https://www.worldvaluessurvey.org/WVSNewsShow.jsp?ID=416.
[78] Experiencing the Spanish flu and the associated condition of social uncertainty and mistrust had permanent consequences for individuals' value orientations and behaviour, especially regarding social distancing (Aassve et al., 2020).
[79] According to studies, the epidemic and recession may have a significant and negative impact particularly on young people in the 18–25 age group and their confidence in institutions (Aksoy, C.G., Eichengreen, B., Saka, O., 2020; Giuliano, P., Spilimbergo, A., 2013).

The quality and capacity of institutions have a significant impact on investment and business operations and are thus an important productivity factor. They involve a number of different areas related to the functioning of the state and its institutions (such as the rule of law, quality of governance, regulatory environment and control of corruption) and political stability. Improving institutional quality is closely linked to economic and technological progress, but above all it enables more sustainable economic growth (Isaksson, 2007; Bruinshoofd, 2016) and increases productivity (Ghulam, 2012; Kaufmann and Kraay, 2002). It enhances productivity mainly through a reduction in transaction costs by securing property rights and enforcing contracts, which has a beneficial effect on production and technological progress (Jankauskas and Šeputiene, 2007; Bjørnskov and Méon, 2010; Kaasa, 2016). Using data for 14 Asian countries, Ghulam finds that government effectiveness and regulatory quality are significantly positively correlated with labour productivity, while the correlation with multi-factor productivity is insignificant.[80]

In most indicators the lag behind innovation leaders is particularly significant, while Slovenia ranks higher than most Central and Eastern European countries.

Slovenia ranks in the second half of EU countries in most institutional quality indicators and lags significantly behind innovation leaders in this regard.[81] The indicators most frequently used in the literature are the World Bank's governance indicators,[82] which are based on many different data sources and indicators. Among EU countries, Slovenia ranks highest on the indicators of "political stability and absence of violence" (WGI, 2019), which ensures stability, predictability of policies for doing business and security for possible investors. On the indicators of "voice and accountability" (transparency of policies, responsibility of politicians and civil servants, government interference in company operations, etc.), Slovenia is below the EU average. The indicators of "government effectiveness" in creating a business-enabling environment and fostering development, i.e. institutional competitiveness, are even less favourable. International comparisons (IMD, WEF, WGI, Doing Business, SGI)[83] indicate that, in addition to administrative burdens and restrictive labour regulations, the main barriers to doing business in Slovenia are lengthy procedures related to public services (for example for obtaining construction permits and registration of property[84]) and contract enforcement. The efficiency of the judiciary has improved in recent years, but trust in the legal system, the rule of law and the courts nevertheless remains relatively low.[85] In most indicators the lag behind innovation leaders is particularly significant, while Slovenia ranks higher than most Central and Eastern European countries that have joined the EU since 2004. Most indicators have improved since 2013, but the gap with innovation leaders has not narrowed much. More effective strategic governance of institutions, better public policies, cutting red tape and reducing administrative burdens could have a significant positive impact on the business environment, attractiveness for foreign investment and thus productivity.

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[80] The studies also mention the problem of data availability, as time series are relatively short, while the impact of the quality of institutions on productivity is mainly long-term.

[81] The majority of institutional quality indicators are explained in more detail in the Development Report (IMAD, 2020).

[82] The worldwide governance indicators (WGI) include "voice and accountability" (political processes, rights, freedom of the media, etc.), "political stability and absence of violence" (stability and likelihood of change of government, safety), "regulatory quality", "government effectiveness" (quality, effectiveness and independence of the public administration, quality of basic health services, education and infrastructure), "rule of law" (adherence to legal norms, respect for fundamental rights, independence of the judiciary and its efficiency) and "control of corruption". The latest release of the survey was in 2019, with data for 2018.

[83] IMD World Competitiveness, 2020; WEF Global Competitiveness, 2019; World Governance Indicators 2019; Sustainable Governance Indicators 2019.

[84] The length of procedures is mainly related to the regulatory environment (complex procedures, frequent coordination between the parties involved, acquisition of permits and documentation at the local level, appeal procedures, etc.).

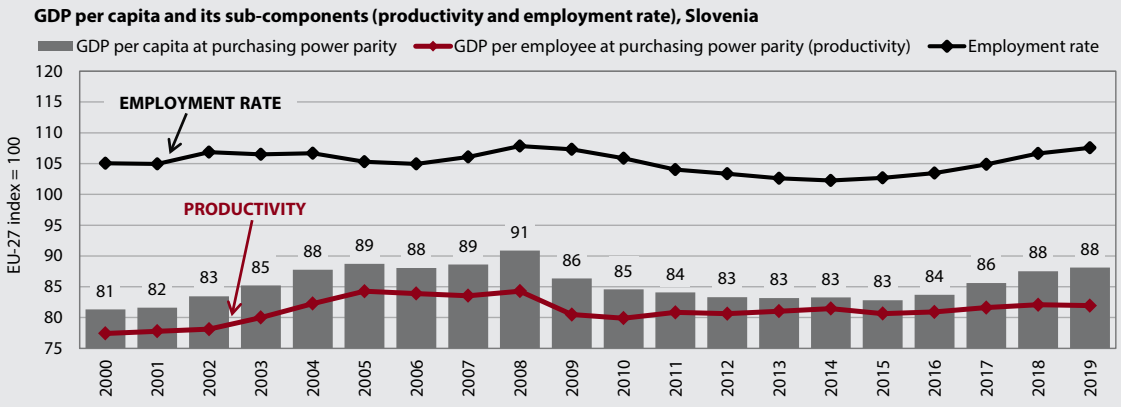
[85] See, for example, Development Report, IMAD, 2020a; WJP Rule of Law Index, 2020; World Governance Indicators, 2019.

3 The opportunities and risks of global megatrends in terms of higher productivity growth

Box 1 GDP and productivity growth rates required to catch up with more economically developed areas

To catch up with the level of development of the EU-27 as a whole or Austria, Slovenia must accelerate its economic growth. We made some simulations to estimate when Slovenia might reach the average GDP per capita at purchasing power parity in the EU-27 or Austria if its GDP growth were one or two percentage points higher than these two areas.[86] If GDP growth in *Slovenia* after 2022 were one percentage point higher every year than the EU-27 average, it would catch up with the area's GDP per capita at purchasing power parity by 2032. If it were two percentage points higher than in the EU-27, Slovenia would catch up with the area's level of development by 2027. Similar simulations for Austria[87] show that Slovenia would catch up with that country's GDP per capita at purchasing power parity by 2044 if GDP growth in Slovenia after 2022 were one percentage point higher every year than in Austria. If it were two percentage points higher, Slovenia would catch up with Austria by 2036.

Figure 19: Slovenia's development gap with the EU average is due to lower productivity



Sources: SURS and Eurostat

Between 2000 and 2008, Slovenia proved that catching up with more developed areas can be done quickly. In this period, Slovenia narrowed its gap with the EU-27 average by 10 percentage points (to 91% of the area's GDP per capita at purchasing power parity). Productivity growth amounted to an average 4.4% per year and GDP growth per capita to 5.4% per year (both at purchasing

[86] Due to this year's coronavirus crisis, the estimated achievement of economic development targets is subject to a greater degree of uncertainty and potential change. The estimates are based on IMAD's last Autumn Forecast of Economic Trends, the most recent projections of the Ageing Working Group (hereinafter: the AWG) of the European Commission, from 2018, and compatible population projections EUROPOP 2015. The impact of the coronavirus crisis was taken into account in IMAD's last GDP forecasts up to 2022. From and including 2023, the AWG forecasts were used for all areas. In the mid and short term, the forecasts or estimates are therefore subject to a higher degree of uncertainty due to the coronavirus crisis and the short period of available current forecasts and will change significantly over time.

[87] Austria was chosen as Slovenia's more developed northern neighbour, whose example the country often follows.

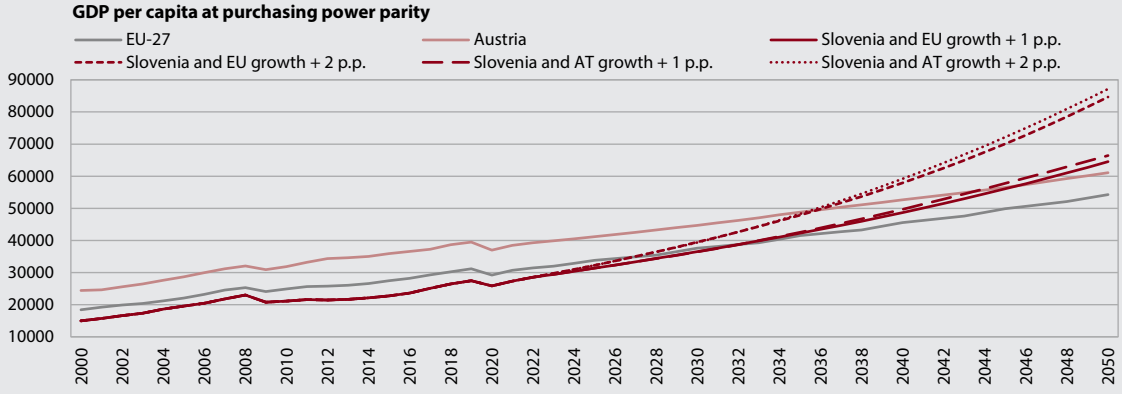
power parity). Then came the financial and economic crisis, which had a relatively greater impact on Slovenia, its gap with the EU-27 thus increasing in the 2009–2012 period (GDP per capita ending the period at 83% of the EU average at purchasing power parity). In 2014–2018, a period marked by cyclical positive trends, productivity growth halved compared to the period before the 2008 financial crisis, dropping to 2.2% (annual average)[88], while GDP growth per capita (both indicators are at purchasing power parity) decreased by less[89] due to faster employment growth.[90] In the medium term, the potential for an increase in economic growth through higher employment rates will be limited due to demographic changes resulting in the shrinking of the working-age population (Summer Forecast of Economic Trends 2020). Consequently, to catch up with the EU-27 average or Austria, sufficient GDP growth per capita at purchasing power parity will be possible to achieve almost exclusively by increasing productivity growth.

Table 1: Average annual GDP per capita and productivity growth rates at purchasing power parity

	GDP per capita growth*	Productivity growth*	GDP per capita growth*	Productivity growth*
Realisation	2000–2008		2009–2019 (2014–2018)	
	5.4%	4.4%	1.7% (4.1%)	1.6% (2.2%)

Sources: SURS and Eurostat Note: * at purchasing power parity

Figure 20: When would Slovenia achieve the average level of development of the EU or Austria under four different scenarios



Sources: SURS and Eurostat; the forecasts or estimates are based on IMAD's Autumn Forecast 2020, AWG 2018 and EUROPOP 2015.
Note: Scenario EU growth + 1 percentage point means 1 percentage point higher GDP growth in Slovenia from 2022 onwards compared to the EU-27 average; scenario EU growth + 2 percentage points means 2 percentage points higher GDP growth in Slovenia from 2022 onwards compared to the EU-27 average; scenario AT growth + 1 percentage point means 1 percentage point higher GDP growth in Slovenia from 2022 onwards compared to Austria; and scenario AT growth + 2 percentage points means 2 percentage points higher GDP growth in Slovenia from 2022 onwards compared to Austria.

[88] The reasons for decreased productivity following the financial and economic crisis are described in greater detail in the 2019 Productivity Report.

[89] In its Transition Report 2019–2020, the EBRD mentions several reasons why convergence in countries that the EBRD invests in (which include Slovenia) slowed down after the 2008/2009 crisis. Before the financial and economic crisis, this region converged mostly on account of growth in total factor productivity or efficiency gains. The latter were driven by the liberalisation of prices, the reorientation of trade patterns and integration into global value chains, which facilitated the introduction of new activities and technologies. As developing European countries were integrated into global value chains, growth became much more dependent on global economic conditions. The slowdown in global economic growth and global trade growth started to affect their economic growth. Another fact to be noted is that, when a country reaches a certain level of development, its economic growth tends to slow down. EBRD countries are also faced with the problem of management, which becomes all the more relevant at a certain level of development. This means that countries will have to improve the quality of economic institutions to ensure sustainable productivity growth.

[90] GDP growth at purchasing power parity, which is a sum of productivity and employment growth rates, decreased after the financial crisis by less than the productivity growth resulting from higher employment rates. This period was therefore marked mostly by extensive growth.

The opportunity to raise productivity means improving all productivity factors presented in Section 2, taking into account the changing conditions shaped by global megatrends that are examined in this section and the following one.

3.1 Demographic changes and fiscal sustainability

Ageing of the population is becoming a global phenomenon that is particularly prominent in Europe due to prolonged life expectancy and reduced natality rates. The share of persons over 65 is increasing while the working-age population is shrinking. According to demographic projections, these processes will continue to intensify in Slovenia. In the future, the changed age structure could therefore limit the possibilities of ensuring and increasing the population's well-being. At the same time, long-term projections of age-related public expenditure indicate that the sustainability of systems of social protection (pension, healthcare and long-term care), if existing policies continue to apply, will be put to the test due to demographic and technological changes, which could damage other economic and social relationships.

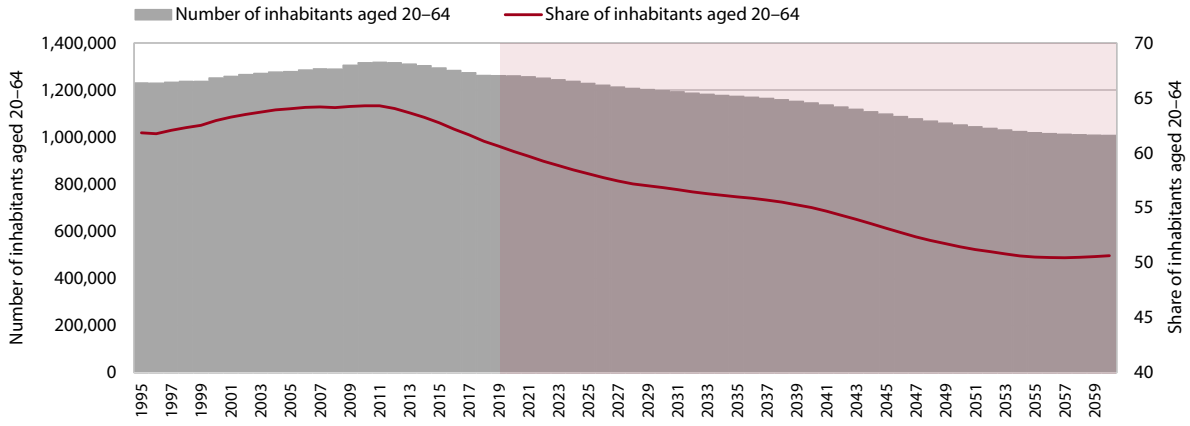
Previous IMAD analyses suggest that addressing the challenges of a long-lived society will require a comprehensive package of measures. Only a combined implementation of measures in various areas can help ensure long-term fiscal sustainability and provide a comprehensive response to the variety of challenges of a long-lived society. In particular these include: i) adapting jobs and working conditions and ensuring a sufficient supply of qualified workforce, ii) adapting social protection systems (in terms of revenues and expenditure) and iii) adapting the living environment.[91] A comprehensive framework of guidelines for the necessary adaptations to demographic changes is provided in the Long-Lived Society Strategy adopted by the Government of the Republic of Slovenia in 2017. At the same time, productivity-increasing measures can facilitate the implementation of the necessary adaptations to demographic changes, thereby creating a stable economic environment that would allow the financing of population-ageing needs and broader social development.

With the shrinking working-age population, the changed age structure poses a challenge to maintaining prosperity in the future, but it also brings new opportunities. The working-age population aged 20–64 is already shrinking, currently amounting to approximately 60%, and, according to EUROPOP 2019 projections, will come close to 50% by 2060 (similar projections have been made for the EU-27 area as a whole). This means the number of inhabitants representing the potential labour supply. One of the most important aspects of a long-lived society is its impact on productivity, as well as its innovation and adaptation possibilities. Productivity changes have an effect on changes in living standards. A changed age structure can have various effects on productivity due to several factors, for example the changing performance of certain tasks throughout the lifecycle, older people having greater knowledge and skills while finding it more difficult to adapt to changes, their potential deteriorating health and higher number of sick days, job changes, and other more subtle factors (National Research Council, 2012, p. 106).

[91] IMAD: "Demographic Changes and their Economic and Social Consequences", 2016; Long-Lived Society Strategy, 2017; Economic Challenges 2019, 2019b.

In order to ensure the greatest possible labour supply and maintain the sustainability of social protection systems, people will need to remain active for a longer period of time in the future. At the same time, the increasing share of the older population will likely bring changes to consumption patterns, resulting in the development of new business models for the so-called silver economy[92].

Figure 21 Number and share of inhabitants aged 20–64 in the 1996–2060 period



Sources: SURS and Eurostat
Note: SURS data up to 2019; EUROPOP 2019 projection for the 2020–2060 period. The projection for the 2019–2060 period is based on the assumption of average 3,863 net migration per year in the 20–64 age group.

If social protection systems are not adapted in the future, Slovenia will face a significant increase in age-related public expenditure, which can affect expenditure on other policies.

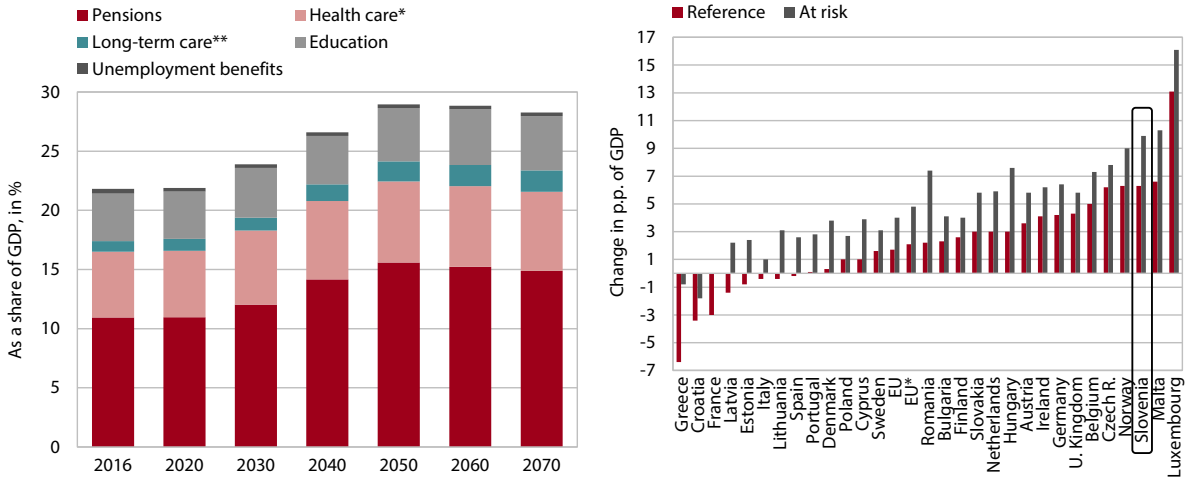
If social protection systems are not adapted in the future, Slovenia will face a significant increase in age-related public expenditure, which can affect expenditure on other policies. According to ageing indicators (the share of older people and the old-age dependency of older people), Slovenia does not yet deviate from the EU average. Age-related expenditure in 2016 (base year for the EC's latest long-term projections) was also lower than the EU average, and the most recent data for 2019 shows the same.[93] Indicator values will, however, start to increase due to the ageing of larger generations born before 1980, reaching their peak around 2050 – see Figure 23. If no policy changes are made in Slovenia, the fiscal impact of ageing (demographics) alone will be very high and much more significant than the EU average (the reference scenario). For a more vivid illustration of the consequences of the ageing population, note that an additional seven GDP percentage points – the difference between the estimated fiscal impact by 2050 and the 2016 starting point – in today's prices would represent over EUR 3 billion in additional expenditure, which would cut into other types of public expenditure, including development policies. Of this, the highest increase would arise from pension expenses based on the existing 2016 pension system. A potentially higher growth in public expenditure on health and long-term care, taking account of various non-demographic factors (considered in the risk scenario), would place long-term fiscal sustainability under even greater pressure.

[92] The part of the economy relevant to the needs and demands of persons over 50 years of age, it is the sum of all economic activity that serves the needs of the elderly, including the products and services they purchase directly and the further economic activity this spending generates (European Commission, 2018a). The EC also made recommendations to stimulate the silver economy in the light of the ageing population: i) support the technological and digital revolution of the healthcare sector, ii) support healthy ageing, iii) increase the focus on solutions for improved mobility for older people, iv) increase the active participation of older people in the labour market, and v) increase innovation of products and services targeted towards independent living of older people.

[93] According to the most recent data, for 2019, pension expenses amounted to 10% of GDP, which is lower than the EU average and the projections made in the 2018 Ageing Report.

In Slovenia, social contributions of the working population are the predominant source of funding for social protection expenditure, but even today these dedicated resources are not sufficient to cover all expenditure. This is most evident for pension expenses, the difference between these and other expenditure of the Pension and Disability Insurance Institute of Slovenia and social transfer revenues being covered by transfer payments from the state budget. The healthcare system has also seen an increase in other public healthcare sources during the cyclical decrease in social contributions, again by transfer payments from the state budget. As regards the funding of long-term care, which is not yet regulated as a uniform system in Slovenia, social contributions also represent the highest share of public sources. Due to demographic and technological changes (robotisation and automation, for example) affecting the labour market, the problem of financing social protection expenditure can be expected to worsen if social protection systems remain unchanged. Non-standard forms of employment, which represent flexible and less predictable contract-based employment relationships, often with lower contributions to social protection systems, put additional pressure on social protection systems. Certain types of work (e.g. platform-based work) are not yet common in Slovenia, but they are expected to become part of our employment structure in the future due to the spread of new technologies, global integration and the openness of our economy. It is therefore essential that these types of work be regulated in such a way that they ensure proportionately equal social protection as is afforded to standard forms of employment.[94] Given the expected trends, measures aimed at closing the gap will have to be adopted to slow the growth of social protection expenditure and restructure the sources of financing, including measures that will compensate for the loss of social security revenues, in order to ensure services for our growing needs. These possibilities are presented in greater detail in Appendix 1.

Figure 22 Projections of public expenditure related to ageing, Slovenia (left) and comparison with EU countries (right), 2016–2070



Source: The 2018 Ageing Report: Economic and budgetary projections for the EU Member States (European Commission), 2018c; Country Fiche on Pension Projections for Slovenia (MF), 2017. Notes: figure to the left: *Public expenditure on health according to SHA methodology, but excluding expenditure on long-term healthcare and including expenditure on investments according to COFOG methodology; **Total public expenditure on long-term care according to SHA methodology (excluding expenditure on disability allowances included in previous AWG projections). EU weighted average; figure to the right: EU* – arithmetic average.

[94] The current system of raising the wherewithal to fund systems of social protection is based on contributions which are paid under contracts concluded for full-time working hours for an indefinite period. The decision of employers or individuals whether to pay minimum contributions, which is often related to atypical, precarious jobs, affects the volume of funds collected and the amount of revenues that can be generated by social protections systems (Long-Lived Society Strategy, 2017, p. 33).

Productivity-increasing measures can facilitate the implementation of the necessary adaptations to demographic changes, thereby creating a stable economic environment that would allow the financing of population-ageing needs. In the future, productivity growth will be based on increasing knowledge and skills and healthy life years. A flexible, innovation-oriented economy based on new technologies, knowledge, automation, digitalisation, inclusive labour market and lifelong learning will become increasingly prominent (see Section 4). Lifelong learning will become the new reality, and workers will have to improve their knowledge and be open to retraining. As the gap between the digital literacy of older generations and younger generations, who are more adapt at performing tasks involving digital tools, may widen, attention will have to be devoted to promoting digital literacy among older persons. The labour market will have to become more inclusive and diversified to encourage the non-active population to enter the labour market by eliminating all types of discrimination, training workers in need of additional training, and fostering awareness on the importance of lifelong learning and healthy ageing. Most available analyses suggest the important contribution of healthcare investments to medium- and long-term GDP growth.[95] There is also a strong correlation between the health condition and size of the active population (fewer early and disability retirements; European Commission, 2010) and between the older population's health condition and long-term care needs. Long-term care allowing women, who tend to be the elderly's primary care-givers, to remain in the labour market and making it easier for them to balance family life and work is also an important productivity factor (Barbieri & Guibelli, 2020). At the same time, society will have to promote openness to potential higher migration levels to compensate for the lack of certain profiles and to attract talent, realising, however, that the shrinking working-age population can never be fully replaced.

3.2 Low-carbon and circular transformation

It is necessary to transition to a new paradigm of use that is environmentally friendly and socially fair but also economically flexible, which, with higher green employment rates, will have a positive impact on economic growth.

Future development will inevitably be linked with the planning of low-carbon and circular production, use and processing. The support of digital technologies will be crucial, as they will allow effective policy-making and the adoption of appropriate measures (European Commission, 2020d). They will help promote sustainable solutions in production and demand, increasing awareness about the origin of raw materials and the composition of products, including hazardous and rare materials, the impact of handling such materials, and the possibilities of circulation and recycling at the end of their lifetime. Digitalisation will thus contribute significantly to the necessary balancing of the economic and environmental dimensions of development.

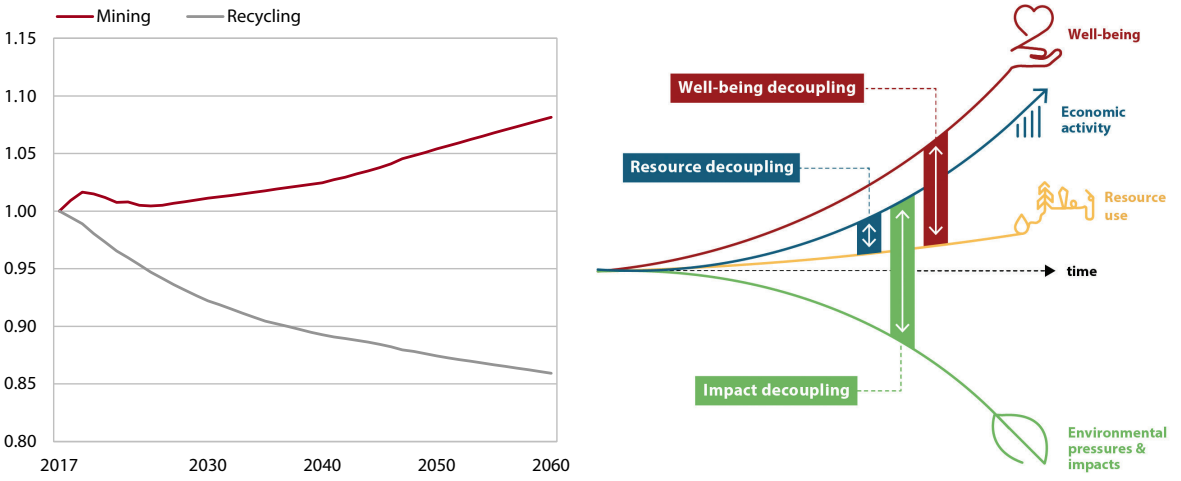
Although environmental policies have alleviated environmental problems in recent decades, profound and comprehensive systemic changes need to be made to ensure the efficient sustainable use of resources. The aim of the European Green Deal, which is a strategy for growth, is to achieve a competitive and resource-efficient economy by 2050 where there are no net emissions of greenhouse gases and where economic growth is decoupled from resource use (European Commission, 2019e). This will require a transition to a new paradigm of use that is environmentally

[95] Healthcare measures have a positive impact on the economy with both direct and indirect effects (Furceri & Zdzienicka, 2010; Barbiero & Cournede, 2013). Studies also show that health has a positive effect on the wellbeing of individuals and society as a whole, as well as on economic development, noting, however, that the correlation between health and economic activity is not one-way or linear, as higher levels of economic development also improve the health of individuals and the entire population. (Figueras et al., 2008; Suhrcke & Urban, 2010).

friendly and socially fair but also economically flexible, which, with higher green employment rates, will have a positive impact on economic growth.[96] The efficient use of energy and raw materials and decreased use of emission-intensive materials are essential to achieving this. Decarbonising energy-intensive industries (e.g. steel, chemical and cement industries and power stations) will reduce costs associated with the growing prices of greenhouse gas emissions permits (European Council, 2018). Ensuring productivity growth and strengthening competitiveness, which used to be largely related to labour costs, will rely more heavily on the promotion of new sustainable business models.

The success of the transition to a green and digital economy will depend heavily on a reliable supply with critical raw materials. The raw materials that are the most essential for the economy and whose supply is at high risk of being disrupted[97] are heavily concentrated in certain parts of the world.[98] The COVID-19 crisis has shown that disruptions in supply can escalate quickly and that economies are very vulnerable to them. On the demand side, efforts for achieving climate neutrality are expected to result in greater needs for certain rare raw materials found in nature. For example, as regards electric vehicle batteries and energy storage, the EU's consumption of lithium and cobalt by 2050 is expected to increase 60- and 15-fold respectively (European Commission, 2020e). In order to ensure steady supply and greater resilience to the availability of limited natural resources, more attention will have to be devoted to diversifying the supply with primary and secondary resources, strengthening supply chains, and reducing dependence on imports, particularly from third countries, and to circular and efficient use of resources, product sustainability, and green research and innovation.

Figure 23: As prices of limited primary raw materials found in nature will increase (left), achieving higher productivity will require increased processing and decoupling economic growth from the use of primary resources and the general impact on the environment (right).



Sources: Global Material Resources Outlook to 2060, OECD, 2019f, and Global Resources Outlook 2019, IRP, 2019.

[96] The transition to a circular economy is expected to create 700 thousand new jobs in the EU by 2030 and increase GDP by an additional 0.5% (European Green Deal, 2019).

[97] The list of critical raw materials for the EU in 2020 includes 30 items. The list grows longer every year; in 2020, for example, it included lithium, which is essential to the transition to e-mobility.

[98] For example, 98% of the EU's rare earth element needs is supplied by China, 98% of borate by Turkey and 71% of platinum-group metals by South Africa (European Commission, 2020e).

Recovery from the COVID-19 crisis is an opportunity to accelerate the realisation of the previously agreed low-carbon and circular transformation. The challenge is to find a connection between the needs for short-term solutions in the affected industries and a radical long-term restructuring that will pursue the goals of sustainable development. This will mean perfecting existing and developing new technologies, which will require more substantial investments in research and innovation. Incentives will first be needed in sectors and technologies that will speed up the green transition (OECD, 2019f). Strengthening the systemic approach to the transition to a low-carbon, circular economy and implementing innovative solutions that will turn the challenges in this area into opportunities are of the utmost importance. Support for circular start-ups and support for circular innovation in small and medium-sized enterprises will be particularly important (EIT Climate-KIC, 2020). Swift and efficient action will need to be taken, as the first and the fastest will be in the best position to exploit the advantages of transformation (Von der Leyen, 2019).

3.3 The "new normal" and COVID-19

The "new normal" will be marked by a combination of three effects: the short-term effect of reduced economic activity, the acceleration and culmination of existing megatrends, and structural change prompted by the coronavirus crisis. The cumulative effects of such extreme external shocks will be complex and consequently difficult to predict (Roland Berger, 2020a, p. 10), as their impact on countries, regions, sectors, companies and social groups will be extremely heterogeneous. The transition to the new normal will be marked by intensive market fluctuations that will reflect in an even greater heterogeneity of companies' performance results.[99] The coronavirus crisis must therefore be seen not only as a threat or a challenge but also as an opportunity. It is essential for Slovenia to understand that both negative and positive developments are subject to stakeholders' decisions and an appropriate policy package (OECD, 2020f) which can take advantage of the response to the crisis together to address opportunities, above all accelerating the digital and sustainable transformation of economies and societies to make them capable of ensuring social cohesiveness (McKinsey, 2020b; WEF, 2020; Mazzucato, 2020).

The short-term effect of reduced economic activity will be very heterogeneous, which, without appropriate intervention, could cause economic divergence and increase inequalities. The decrease in economic activity recorded thus far as a result of COVID-19-related restrictions (even if treated as a one-time, i.e. short-term, event) has already taken a heavy toll on companies' balance sheets (Spence, 2020) and consequently reduced their adaptation and investment capacities, while, according to ILO estimates (ILO, 2020), Europe would lose 44 million jobs by mid-2020, which translates to an 11.6-percent loss of available working hours in Eastern Europe. Regardless of the assumed exit strategy, it is clear that global economic power will increase only gradually, which is why *The Economist* (*The Economist*, 2020) is talking about a „90-percent economy". The impact by sector (UN, 2020), enterprise type (OECD, 2020g), region (OECD, 2020h; Boehme & Besana, 2020) and social group will be highly asymmetric, the most affected being young people, women, workers in non-standard forms of employment, and those with lower income and/or education (McKinsey, 2020c; Perez, Fana, Gonzalez-Vazquez & Fernandez-Marias, 2020; OECD,

[99] Bain (2020a) concludes that, during times of crisis, the number of stranded companies has increased by 89% while the number of rising stars has increased by 47% (ibid., p. 1).

2020i). Not only are weaker and more vulnerable individuals, companies and areas generally underprivileged due to their lower starting (financial and institutional) crisis-response capacities, they are also the groups that have been hit harder by the crisis, which can lead to the process of economic divergence and further inequalities and polarisation (OECD, 2020h; OECD, 2020i).

COVID-19 will further accelerate the already swift process of digital transformation, including structural change that occurred even before the coronavirus crisis. Accelerated business automation and digitalisation is most clearly demonstrated in a survey (Bain, 2020a) suggesting that 84% of companies intend to speed up the process of automation, the lowest share recorded in any sector being 69% (for consumer goods), with up to 90% and more when it comes to financial services or retail[100]. The impact of such acceleration could be even greater in the transformation of public services and society as a whole. McKinsey (2020a) talks about a „contactless" world, manifested particularly in the sharp rise of teleworking, e-commerce and telemedicine (Roland Berger, 2020b), which are considered structural, i.e. long-term rather than short-term, shifts (Deloitte, 2020a). The process of digital transformation is therefore expected to accelerate further (Paunov & Planes-Satorra, 2020; McKinsey, 2020d), which should be taken into account by governments when deciding on their response strategies. This, in turn, will also speed up the modification of global value chains in all aspects mentioned in Section 4.1.1.2, particularly in terms of a greater focus on resilience and increased uncertainty (Kilic & Marin, 2020), a greater focus on the transparency and traceability of supply chains (Bain, 2020a), the accelerated globalisation of advanced services (Baldwin & Forslid, 2020), and potential partial de-globalisation, i.e. a return of economic activity closer to end customers,[101] along with a greater focus on strategic industrial policies (Bergsen et al., 2020; Seric et al., 2020).

The acceleration of existing trends, particularly digitalisation, in connection with the asymmetric and heterogeneous impact of COVID-19, which will have a particular effect on vulnerable groups and areas, may lead to an intertwining of negative effects. The intertwining of various aspects of vulnerability as a result of the coronavirus crisis occurs when, for example, areas with high shares of low-educated inhabitants and high shares of non-standard forms of employment, combined with low institutional capacities and high levels of brain drain, depend greatly on finishing operations based on low labour costs or tourism.[102] Not only does this lead to significant job losses, but such jobs are often also the most vulnerable when it comes to the process of digitalisation. The correlation between potential job loss at the sectoral level due to COVID-19 or digitalisation is said to amount to 0.76, which, at the EU level, translates into 24 million or 10% of all jobs that, at the same time, are very vulnerable from both aspects (European Commission, 2020f). In addition to short-term negative economic effects, which may be accompanied by strong outbursts of social discontent (McKinsey, 2020c; Kluth, 2020), such cumulative effects must be addressed mainly because of their potential structural, long-term effects,[103] which is particularly relevant in terms of policy response (OECD, 2020i).

[100] This is also confirmed by a number of other studies, e.g. McKinsey, 2020b and 2020c, Roland Berger, 2020b, and UN, 2020.

[101] The higher likelihood of an acceleration of these processes is suggested by several authors, e.g. Bain, 2020a, EIU, 2020, Kilic & Marin, 2020, Roland Berger, 2020b, and Seric & Winkler, 2020.

[102] Illustrative examples in the context of Slovenia would be Koroška, Prekmurje or Bela Krajina.

[103] According to the OECD (2020j), a 20-percent decrease in newly-founded companies in a given year reduces the aggregate employment rate by 0.7 percent over a period of three years and as much as 0.5 percent 14 years later (ibid., p. 3).

COVID-19 also brings new structural changes, particularly an additional boost to de-globalisation and different preferences and expectations. The first obvious consequence of lockdowns and post-lockdown behaviour is the significantly reduced mobility of people, including migration, which will have an important effect on the growth potentials of various areas (Roland Berger, 2020b; OECD, 2020i). Reduced mobility is only an indirect effect of the crisis, while different preferences and expectations will very likely have a major impact on market operation in general. In addition to the abovementioned localisation of global value chains, this process will also reflect in:

(i) changed patterns of consumption which, in addition to increased e-commerce, prioritises local over global products and services, along with reduced loyalty to existing brands and greater openness to new technologies (EIU, 2020; *The Economist*, 2020).

(ii) greater role of the public sector (Rodrik, 2020; Bergsen et al., 2020; McKinsey, 2020a), with significant market interventions,[104] strengthened and expanded provision of essential public services (WEF, 2020), closer cooperation with civil society, and influence on the manner of policy coordination (Paunov & Planes-Satorra, 2020) and digitalisation of public administration (Deloitte, 2020a).

(iii) Greater company emphasis on social responsibility and accelerated transition to stakeholder capitalism (OECD, 2020i; McKinsey, 2020a).

Those countries and regions that put a comparatively greater emphasis on "digital technologies and sustainable business models by continuing to develop ... ecosystem of companies ... by expanding state-funded research and development« will prove more successful.

In connection with existing megatrends, COVID-19 is changing the basic assumptions of how markets and societies operate and consequently requires a radical (digital and sustainable) transformation of both business and public sectors.

– The business sector is in need of an even faster digital transformation, with the implementation of automation (Bain, 2020a)105 along with a strategic review of its key competences, market (re)positioning and introduction of new business models (Roland Berger, 2020b), including more agile organisation (McKinsey, 2020d). It should be noted that crises are successfully overcome by companies that are more responsive and decisive in their investment activities, specifically by investing in new, long-term business opportunities and innovations.106

– In terms of policy response, a strategic and comprehensive approach, addressing both short- and long-term aspects, is of the utmost importance (UN, 2020; Deloitte, 2020a). Those countries and regions that put a comparatively greater emphasis on "digital technologies and sustainable business models by continuing to develop ... ecosystem of companies ... by expanding state-funded research and development" will prove more successful (McKinsey, 2020b, p. 6). The coronavirus crisis is expected to significantly reduce private sector investments into research, development and innovation and restrict access to private equity capital, venture capital and the possibilities of financing the accelerated growth of new companies.[107] Given the importance of business transformation and innovation to successfully overcoming the crisis, it is clear that countries and

[104] These pertain not only to the first phase of the response to the COVID-19 crisis, but also to the growth phase (Deloitte, 2020a), e.g. by compensating for the loss of private sector investments into research and development (Roland Berger, 2020b; Rainmaking, 2020) or reduced availability of risk capital (Paunov & Planes-Satorra, 2020).

[105] For an overview of how digital technologies can help address COVID-19 challenges in business, see, for example, McKinsey (2020e).

[106] According to PwC (2019a), of the 42% of companies that have successfully overcome past crises, over 80% carried out systemic adaptations for future crises, particularly those focusing on long-term opportunities and risks. See also Rainmaking (2020) or Roland Berger (2020b).

[107] Roland Berger (2020b) estimates that investments into research and development by EU companies in 2020 and 2021 will shrink by USD 60 billion, while the Rainmaking survey (2020) shows that the share of companies that do not intend to invest in innovation this year has increased from 8% in March to 25% in mid-April. Similar negative effects on access to financing for companies were established by Kraemer-Eis et al., 2020, Paunov & Planes-Satorra, 2020, and OECD, 2020g.

regions that put greater emphasis on innovation, digitalisation, sustainable transformation (Santiago, De Fuentes & Peerally, 2020; Atkinson, 2020; McKinsey, 2020b) and the relevant retraining (McKinsey, 2020f) will be more successful,[108] managing not only to beat the competition but also take advantage of the crisis to reposition their economies and societies for the 21st century (UN, 2020). This is all the more important given the fact that, following a period of significant COVID-19-related public interventions, public funding capacities are expected to decrease considerably in the medium term (di Mauro & Syverson, 2020; Paunov & Planes-Satorra, 2020), which will pose a challenge to all stakeholders and to implementing long-term policies.

[108] For an overview, see Paunov & Planes-Satorra, 2020, OECD, 2020g, or Whiteshield Partners, 2020.

4 Digital transformation – the key to raising Slovenia's prosperity

Digitalisation is radically changing how economies, markets and societies work; hence this process is referred to as a transformation. The transformation is driven by automation (e.g. advanced robotics or additive technologies) and connectivity (e.g. the Internet of Things and smart factories) supported by digital data and digitalised relationships and relations, particularly access to the consumer, including the platform economy (Roland Berger, 2015; Eurofound, 2020). This represents a break with previous practices, as integrating, complementing and combining possibilities and solutions for these technologies[109] (WEF, 2017) enable the following (adapted from OECD, 2019a):

(i) achieving economies of scale in an extremely short period of time without any initial critical mass through zero marginal costs;
(ii) creating new sources of value through flexible specialisation, different and more complex products based on mass customisation, new business models, and dynamic and global networks of added value (Roland Berger, 2015);
(iii) digital technologies change market and economic *relations* by enabling decentralised coordination beyond key (major) institutions, change the development potentials or opportunities of different areas (e.g. rural regions) and social groups and, in particular, require an open and collaborative, i.e. ecosystem-based, approach that transcends the limits of any individual company, sector, region or country.

If *digital transformation* addresses both the economic and social dimensions, the term *Industry 4.0* (hereinafter: I4.0), or the transition to the Fourth Industrial Revolution, pertains primarily to the process of digitalisation of processing activities based on cyber and physical production systems. It comes as no surprise that, given the great importance of processing activities, Slovenia is putting greater emphasis on the implementation of I4.0; this, however, is not enough, as it is not putting sufficient emphasis on the complementary role of service activities and the need for systemic change at the level of society as a whole. The **process of digital transformation**, as presented below, **is treated**, wherever possible and reasonable, **as complementary to other megatrends**, which is particularly true of the transition to a low-carbon and circular economy.

4.1 Global trends and local consequences of digital transformation

The process of digital transformation presents a great development opportunity but also involves a number of risks – both its opportunities and its risks are presented in the first part of this section. These are followed by an overview of future forecasts that are extremely uncertain; past trends suggest, however, that the ratio between positive and negative effects will depend on the adopted decisions, which is the subject of the third part of this section.

[109] The terms generally used in the relevant literature are the convergence or confluence of technologies.

4.1.1 The potential of digital transformation

4.1.1.1 Digitalisation increases productivity and productivity growth

Digital transformation is not an end in itself, but the means to raise prosperity and allow social challenges to be addressed effectively. Particularly in the Slovenian context, the positive correlation between the deployment of digital technologies and prosperity, which is not obvious but is widely recognised in the relevant literature, is often overlooked (OECD, 2017a). Although this publication focuses on productivity, it should be noted that an estimated quarter of all benefits by 2030 could be non-monetised, i.e. with a direct positive effect on prosperity only (McKinsey Global Institute, 2019a). Specifically, this involves a potential impact on life expectancy and health, as well as greater availability of quality free time and better working conditions in terms of organisation, safety and automation of the most demanding and unpleasant jobs (UNIDO, 2019; OECD, 2017b; Bain, 2018), subject, of course, to an appropriate social agreement that prevents the realisation of risks associated with the deployment of new technologies. Their deployment can also affectively address social challenges, the most notable of them being environmental sustainability and, for example, quality education and resulting equal opportunities and trust within society. Finally, accelerated GDP growth is also reflected in higher public revenues that can, in turn, be used for social, healthcare, education, infrastructure and other prosperity-increasing programmes.

Due to the productivity premium it provides, digital transformation is an inevitable and irreversible process… Studies at the micro level show that digital transformation increases production efficiency by 10 to 20% (Bain, 2020b; McKinsey Global Institute, 2019b; Deloitte, 2020b),[110] which is directly reflected in companies' balance sheets and their capacities for further investment. McKinsey (McKinsey Digital, 2019)[111] found that companies with a comprehensive approach in this area achieve an average 4-percent higher revenues, 7-percent higher margins and up to 9-percent higher rates of return.

… with the majority of advantages resulting from digitally stimulated innovation and new, higher-quality and different products and services. Companies whose digital transformation prioritises the promotion of innovation and qualitative improvements in terms of new products and higher-quality, tailored services, including the promotion of employee engagement and satisfaction, record even better results, which is particularly true of digitally mature companies. This is confirmed by both micro- (Deloitte, 2020c) and macro-level (PwC, 2018) studies – in Southern Europe, which includes Slovenia, nearly two-thirds of economic benefits by 2030 are expected to result not from higher labour efficiency, but from the consequences on the demand side (PwC, 2018a, p. 44). The essence of digital transformation is not so much efficient and cheaper production, but its different attitude to the entire (both external and internal) company ecosystem, including the attitude to customers.

Studies confirm that digitalisation is having an increasing effect on productivity and its growth. In light of the global slowdown in productivity growth in recent decades, the correlation between productivity and digitalisation (Eurofound, 2019a) is not obvious and is the subject of widespread discussion, reflected in the

[110] This is due to the direct increase in production productivity along with, for example, lower maintenance and repair costs, smaller inventories, more efficient logistics, reduced energy consumption, and shorter time to market. For a qualitative estimate of the cost effect of each of these factors, see McKinsey Digital (2016).

[111] For other sources, see also UNIDO, 2019, Deloitte, 2020d, or Bain, 2020b.

„Solow paradox" (Solow, 1987), according to which „you can see the computer age everywhere but in the productivity statistics". While the first generation of econometric analyses, in the 1990s, produced inconclusive results (OECD, 2017a), an overview of works published in the last two decades and particularly in the last few years[112] shows that digitalisation does increase added value (Graetz & Michaels, 2018; Akerman, Gaarder & Mogstad, 2015), total factor productivity (Autor & Salomons, 2018; Bergeaud, Cette & Lecat, 2018; Gal, Nicolleti, von Ruden & Sobre, 2019) and labour productivity (Graetz & Michaels, 2018; Bertschek, Polder & Schulte, 2017; Breugel, 2017; Adarov & Stehrer, 2020b), with very few studies showing the opposite (Acemoglu et al., 2014). The established impact is not always large or larger than other previous technological shocks, but there is „growing consensus ... that the productivity gains of the ongoing second stage of the digital revolution, primarily driven by advances in AI, will eventually be realised" (ECB, 2020, p. 33), a view shared by other sources (see, for example, EIB, 2019b; UNIDO, 2019; OECD, 2019g).

4.1.1.2 The transformation of global value chains as an opportunity

Digitalisation will change the structural characteristics of (economically) dynamic and successful regions and countries, driven by the process of transformation of global value chains. Since the 1990s, globalisation and technological progress have stimulated fragmentation, i.e. mainly extending and increasing the complexity of production and global value chains (OECD, 2018b). A new wave of transformation, which the OECD characterises as „the biggest game-changer" (De Backer & Flaig, 2017), was recently set off by digitalisation, enhanced with increasing insecurities and instabilities in the international environment and the recognition of the hidden costs of globalisation (Porter & Rivkin, 2012; Kilic & Marin, 2020). Global value chains are therefore to become shorter while remaining complex, flexible and highly responsive, smart, sustainable and territorially dispersed, i.e. more localised, and closer to consumers, with a stronger focus on resilience.[113]

During the transition to I4.0, up to two-thirds of all investments would have to go into intangible capital and knowledge.

The importance of knowledge, intangible assets and services and integration in global value chains will increase further... The share of international trade based on cost arbitration has decreased significantly in the last 15 years, mostly due to high salary and cost growth in developing countries (Bain, 2019), and now accounts for only 18% (McKinsey Global Institute, 2019c). With the transition from labour- to more capital-intensive production, digitalisation will speed up this trend even further, while additionally increasing the importance of knowledge and intangible capital,[114] particularly in terms of companies' future decisions regarding location (WEF, 2018a). If most of the value in previous industrial revolutions, estimated at between 80 to 90%, was based on investments in physical capital, this share is expected to drop to only 40 to 50% in I4.0(McKinsey Digital, 2015), meaning that, during the transition to I4.0, up to two-thirds of all investments would have to go into intangible capital and knowledge (OECD, 2018b; ECB, 2020). The importance of inclusion and, particularly, the intensity of integration, i.e. the centrality of companies, regions and countries in global value chains, is expected to increase further (Criscuolo & Timmis, 2018; UNIDO, 2019; McKinsey Global Institute, 2019c).

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[112] For an overview, see, for example, ECB, 2020, or OECD, 2017a.

[113] All of these aspects, including uncertainty and the focus on the resilience of global value chains, were identified by studies even before the outbreak of the COVID-19 crisis – for more see OECD, 2015; McKinsey Global Institute, 2019c; Bain, 2019; EIU, 2017; De Backer et al., 2018; De Backer & Flaig, 2017.

[114] This trend emerged in 2000 in all sectors and chains (McKinsey Global Institute, 2019c). The share of revenues earmarked for investments into intangible assets increased globally between 2000 and 2016 by 7.5%, with dramatic increases in certain value chains, e.g. a 29-percent increase in the production of machinery and devices and a staggering 66-percent increase in pharmacy and medical devices (ibid.).

… while the relative importance of material production itself will decrease (McKinsey Digital, 2015; Eurofound, 2018; McKinsey Global Institute, 2019c). This decrease will reflect in the increased share of added value services, particularly research and development, design, ICT services, and sale and after-sale services, which will be themselves be subject to more intensive automation with service robots (Bain, 2018; Oxford Economics, 2019), and in international trade (Baldwin, 2018).

Slovenia can benefit from the modification of global value chains, including as a result of digitalisation. Despite risks associated with potential job cuts due to automation (see the following section) and comparatively more favourable structural conditions for exploiting the digitalisation potentials of the most developed countries and regions[115], the process of digital transformation offers „opportunities to ‚leapfrog' the traditional development path" (OECD, 2018b, p. 9). This is particularly true of Slovenia for the following reasons:

(i) The global trend of global value chain relocation and, particularly, near- or re-shoring (OECD, 2018b; Eurofound, 2019a), which is particularly appealing to Central and Eastern European countries (Csefalvay, 2019; Marin, Veugelers and Feliu, 2017).
(ii) due to the modification of global value chains, the growing integration, i.e. centrality of smaller companies, particularly those that are not on the technological frontier, accelerates their productivity growth. In the case of smaller countries, especially those that joined the EU after 2004, this is even true of all companies (Criscuolo & Timmis, 2018).
(iii) Compared to other similarly developed countries, Slovenia maintains relative comparative advantages[116] when it comes to knowledge and intangible capital, which, with active policymaking in this direction, can be used to boost or attract additional economic activity.

4.1.2 Risks and changes in the labour market

4.1.2.1 Potential vulnerability of existing jobs

In the OECD, 14% of jobs are at high risk of automation and another 32% could be radically transformed. The first estimates of potentially affected jobs were based on an expert assessment of the feasibility of automation of specific occupations – this very rough method produced an extremely high, 47-percent potential automation of jobs in the United States (Frey & Osborne, 2013), while, for Europe, the same method showed that between 45 and 60 plus percent of jobs in various countries could be at risk of automation (Bowles, 2014).[117] The main deficiency of this method is that individual tasks, not entire occupations, will in fact potentially become automated. The impact is therefore overestimated. Using an alternative approach based on the structure of individual PIAAC tasks, Arntz, Gregory & Zierahn (2016) reached a more conservative estimate, an average of up to 9% of jobs being at high risk of automation. This approach was later enhanced with more detailed information by Nedelkoska & Quintini (2018), who estimated that 14% of all jobs in the OECD were at high risk of automation and another 32% at significant risk of automation,[118]

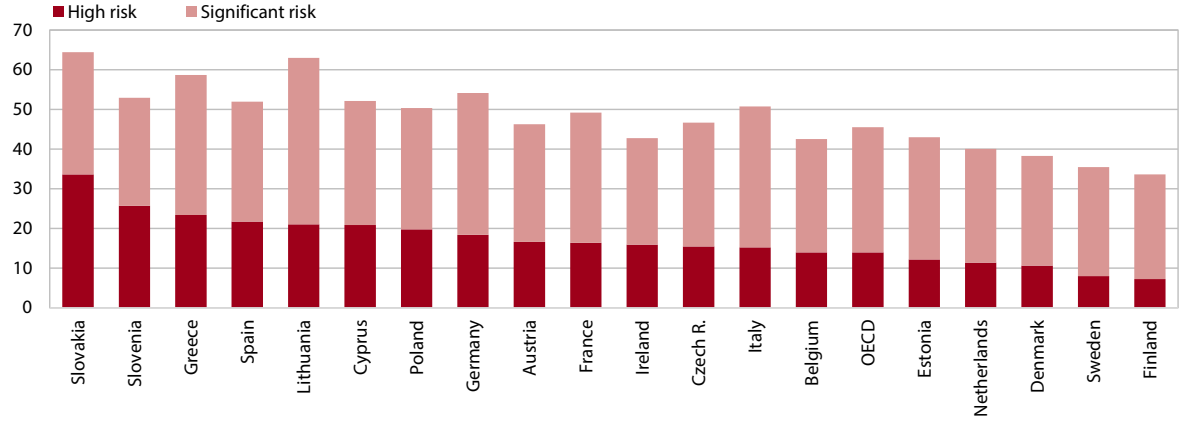
[115] See, for example, McKinsey Global Institute, 2020a; McKinsey Global Institute, 2018a; McKinsey Global Institute, 2019b; Eurofound, 2019a; Oxford Economics, 2019).
[116] It is true, however, that it is gradually losing its relative comparative advantages – see Section 2.2.2.
[117] Similar results based on the assessment of potential automation on the occupation level in Europe were reached by Lordan, 2018; for an overview by country, see Arntz, Gregory & Zierahn, 2016.
[118] A job with a high risk of automation is a job whose likelihood of automation is 70% or more and a job at

making 46% in total. These studies therefore estimate "the technical feasibility of substitution of workers by machines" (Eurofound, 2019a, p. 39), i.e. the share of tasks than can be automated, which of course does not mean that such decisions would be economically viable – for more about the preconditions, see Section 4.1.3.

With 25.7% of existing jobs with a high likelihood of automation, Slovenia is the second most vulnerable country in the OECD.

Slovenia is among the countries with the highest share of jobs at high risk of automation. According to Nedelkoska & Quintini (2018), with 25.7% of existing jobs with a high likelihood of automation, Slovenia is the second most vulnerable country in the OECD (see Figure 25). It is second only to Slovakia, with Greece and Spain in the same size class, while other Eastern European countries, such as Poland and the Czech Republic, have a significantly lower share of existing high-risk jobs (by 6 and 10 percentage points respectively). Taking into account the existing jobs with a significant likelihood of automation, the result is not as negative, but with 52.9% of jobs at (high or significant) technical risk of automation, Slovenia still ranks a relatively high number five among the EU countries that are also members of the OECD. The same was established by PwC (2018b), who predicted that, in the long run, up to the mid-2030s, Slovenia will be second only to Slovakia, with 44% of jobs at risk. In the medium term, i.e. in the late 2020s, 24% of existing jobs are expected to be at risk. The two industries at the highest technical risk of automation are the processing industry and construction, with 57 and 53% respectively (PwC, 2018b, p. 19), while McKinsey (2018) also predicts the transport, warehousing, hospitality and trade sectors to be strongly affected in the medium term and other service industries somewhat less so.

Figure 24: Estimated share of existing jobs with a high (at least 70%) or significant (50–70%) risk of automation, for 21 EU Member States and the OECD average



Source: presentation by IMAD; data taken from the OECD (2018c), based on Nedelkoska & Quintini, 2018

At the same time, hitherto estimations of the *actual* impact of digitalisation on jobs have been inconsistent; however, studies based on microdata generally indicate a positive correlation between digitalisation or robotisation and employment. An overview of 103 studies on the impact of digitalisation by the ECB (2020) shows mixed, uncertain estimates of the effect of digitalisation on the labour market to date. While studies such as Dauth et al., 2018, UNIDO, 2019, and Klenert, Fernández-Macías & Antón, 2020, show a positive impact, Acemoglu & Restrepo, 2017, Gallipoli & Makridis, 2018, and Acemoglu & Restrepo, 2020, indicate a negative impact of digitalisation on employment. At the same time, studies based on individual business data show at least a neutral impact of robotisation on the

significant risk of automation is one with a 50–70% likelihood of automation.

analysed companies' employment rates (Klenert, Fernández-Macías & Antón, 2020). Jäger, Moll & Lerch (2016) established a neutral impact on employment for six EU Member States and Switzerland, while Koch, Manuylov & Smolka (2019) and Domini et al. (2019) established a positive impact on employment for Spanish and French companies respectively. In connection with the optimistic estimates for EU Member States (Klenert, Fernández-Macías & Antón, 2020) or EU regions (Gregory, Salomons & Zierahn, 2016), these microstudies are likely the reason why the estimates and recommendations of the European Commission's Joint Research Centre (JRC, 2020) are less negative than usual. Is should also be taken into consideration that a positive impact on employment on a sample of companies does not necessarily mean a positive aggregate impact on employment, as increased employment rates of robotised companies can come at the expense of decreased employment rates of their competitors, as was illustrated in the case of France by Acemoglu, Lelarge & Restrepo (2020).

4.1.2.2 The risk of increasing territorial and social inequalities

Digital transformation could translate into a further increase in territorial disparities in development, both between countries and regions and within countries. Their varying underlying structural characteristics, combined with demanding and complex conditions for establishing a successful innovation ecosystem in the digital age, pose a risk of increasing disparities in development between developed and lagging regions and countries (UNCTAD, 2016; OECD, 2018b; McKinsey Global Institute, 2019c). The impact is said to be even more pronounced at the level of regions, which are expected to be affected to extremely varying degrees (OECD, 2018c; OECD, 2019h; OECD, 2020i), but without active policymaking, inter-regional disparities within countries could also increase. According to the McKinsey Global Institute (2020a), the share of Europeans living in regions with falling employment figures is set to increase from 22% in the 2011–2018 period to 40% in the 2018–2030 period (ibid., p. 42), as the trend of job concentration in leading cities and hubs is set to continue in the future[119]. Inter-regional differences within countries could also increase as a result (Eurofund, 2019a). According to Oxford Economics (2019), the uneven impact based on a region's development is not so much due to the regions' sectoral structures as to their structural differences reflected in the varying degrees of productivity and qualification or the tasks and functions that employees perform within the same sectors.[120]

With both of Slovenia's cohesion regions being high-risk, regional differences at this level are among the lowest compared to other countries... As shown in Figure 26, with 28% of existing jobs being at high risk of automation, Eastern Slovenia is again potentially the second most affected in the EU at the regional level. However, with 24%, Western Slovenia could potentially be significantly affected as well, as its risk level still exceeds that of the majority of most vulnerable regions in other countries, with the exception of Slovakia, Greece and Spain. In terms of the number of jobs at high risk of automation in EU Member States, Slovenia has one of the lowest rates of regional differences (see Figure 26, left axis).

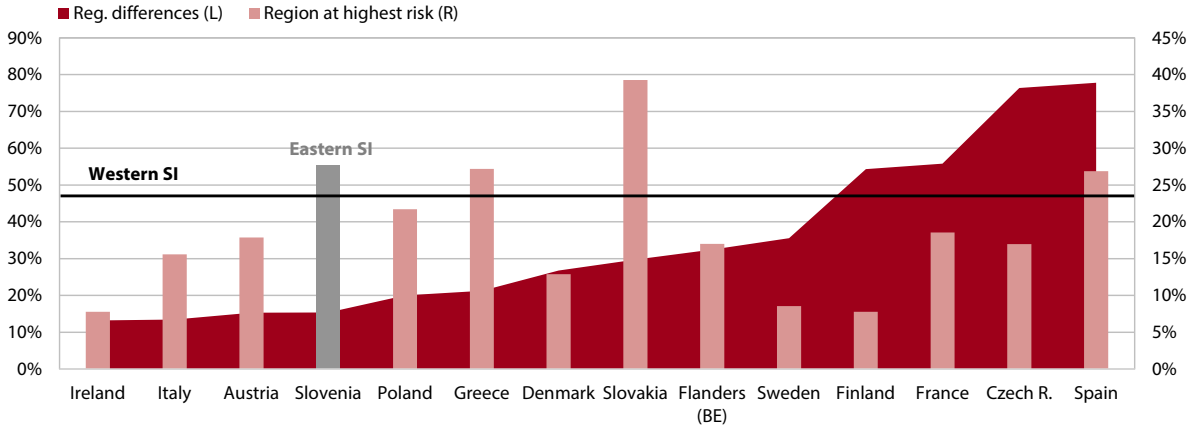
[119] The 48 leading EU regions, where 20% of the population lives and where 35% of all jobs have been created in the last decade, are estimated to be responsible for more than 50% of all new employees in the EU by 2030 (McKinsey Global Institute, 2020a, p. 25). This is based on the assumption that COVID-19 will not significantly increase the appeal of less densely populated areas for life and work.

[120] Or, as Ketels & Protsiv (2020) point out: "what you export is less important than how well you do in whatever you export" (ibid., p. 11).

Digital transformation goes hand in hand with a balanced regional development.

... but structurally weaker areas within both cohesion regions are more at risk, and their accelerated digital transformation is therefore essential to ensure a balanced regional development. Projections on a more detailed level of statistical regions show that the prospects of Central Slovenia (with Ljubljana) are much more optimistic than in other industrial and structurally weaker areas (McKinsey Global Institute, 2020a)**.** Under the basic scenario, positive growth in employment was also recorded in the Coastal–Karst region, while all other regions are supposed to be faced with decreasing employment rates. According to this projection, North-Eastern Slovenia seems to be in a particularly delicate position, being trapped in a triangle of three of the most successful regions, namely Central Slovenia and Austrian Styria on the one hand and the Zagreb area on the other. The future development and employment perspective of industrial, non-central regions will therefore depend even more greatly on the speed and ambitiousness of their digital transformation. In other words, digital transformation goes hand in hand with a balanced regional development, a point made in, for example, Oxford Economics, 2019, and OECD, 2020k**.**

Figure 25: Regional differences between the highest and the lowest risk of automation to regions' existing jobs as a result of digitalisation by country (left axis, in %), the region with the highest automation risk by country (left axis, in %), and the automation risk of the cohesion region of Western Slovenia (black line, right axis)



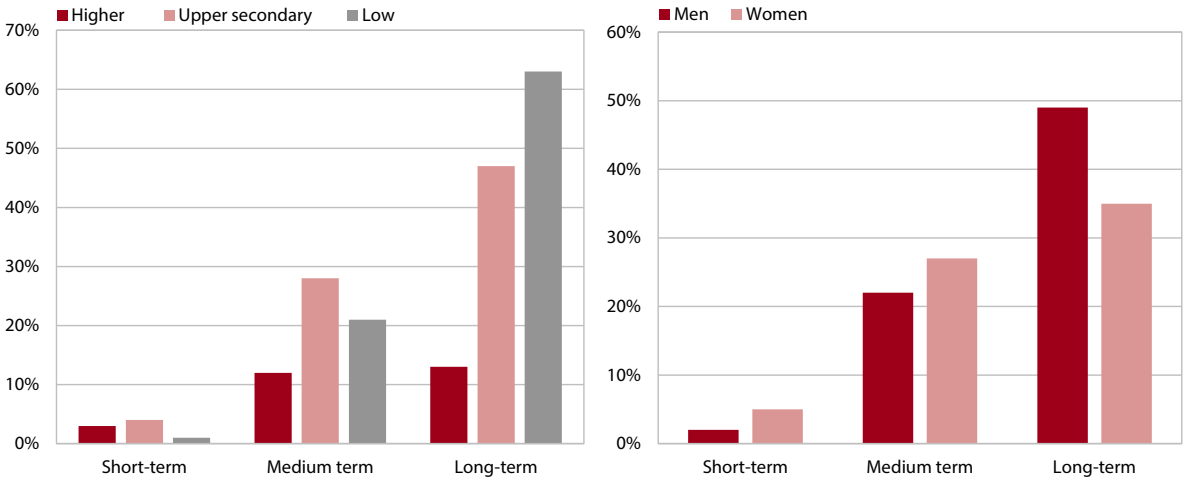
Source: presentation by IMAD; data taken from OECD (2018c), based on Nedelkoska & Quintini, 2018

Digital transformation will affect all workers, for example through salaries, but vulnerable groups will suffer the most. Lower-income workers are expected to be under the greatest pressure (OECD, 2017a), which is expected to put an additional strain on social cohesion or increase social polarisation. Lower income is associated with greater technical risk to people with low-level education, which is particularly pronounced in the long run, i.e. by the mid-2030s, when it is estimated to amount to 63%,[121] compared to 47 or 13% when it comes to people with medium- or high-level education respectively (PwC, 2018b).[122] Regarding technical risk by gender, women are expected to be more affected in the medium term, by the end of this decade, and men are expected to be more affected in the long run, faced with a 49% risk (compared to a 35% risk for women).

[121] It is important to note that low-skilled workers receive the least attention when it comes to on-the-job training (OECD, 2018d).

[122] While in the medium term, i.e. by the end of this decade, the most vulnerable group is expected to be that of people with medium-level education, facing a 28% risk, compared to a 21% risk associated with low-level and a 12% risk associated with high-level education (PwC, 2018b), which is consistent with the thesis about the polarisation of jobs (Autor, Katz & Kearney, 2006; Goose, Manning & Salomons, 2009) confirmed by recent trends (McKinsey Global Institute, 2020a); this, however, is apparently not the case in the long run.

Figure 26: Degrees of risk to jobs by education and gender in the short (early 2020s), medium (late 2020s) and long term (by the mid 2030s), in %



Source: Presentation by IMAD based on PwC (2018b)

In addition to active management, ensuring a successful transition and preventing polarisation will require a timely adaptation of the population's knowledge and skills... According to the McKinsey Global Institute (2020a), 38% or 90 million workers in Europe would have to be completely retrained within their existing occupations and another 9% or 21 million would have to leave declining occupations altogether, which is an extremely difficult process (ibid., pp. 30 & 33). Even though the digital age will put the greatest emphasis on a different way of thinking (Deloitte, 2020d), demand for basic cognitive and physical and manual skills is expected to decrease by 2030 in Europe, by 18 and 28% of working hours respectively, and in Slovenia by 16 and 17% respectively, according to McKinsey (2018). Demand for social and emotional skills, however, is expected to increase in Europe by 30% of working hours and technology skills by 39% of working hours compared to 2016 and by 22 and even 52%, respectively, in Slovenia. More important than the figures is the fact that creativity and social, business and digital knowledge and related occupations will rise in importance in the future (OECD, 2019i). At the same time, managing the transition and preventing polarisation must be treated in a positive light by strengthening human potential, including drawing in foreign talent, increasing workforce integration and diversification, and achieving higher female participation rates (McKinsey Global Institute, 2020b).

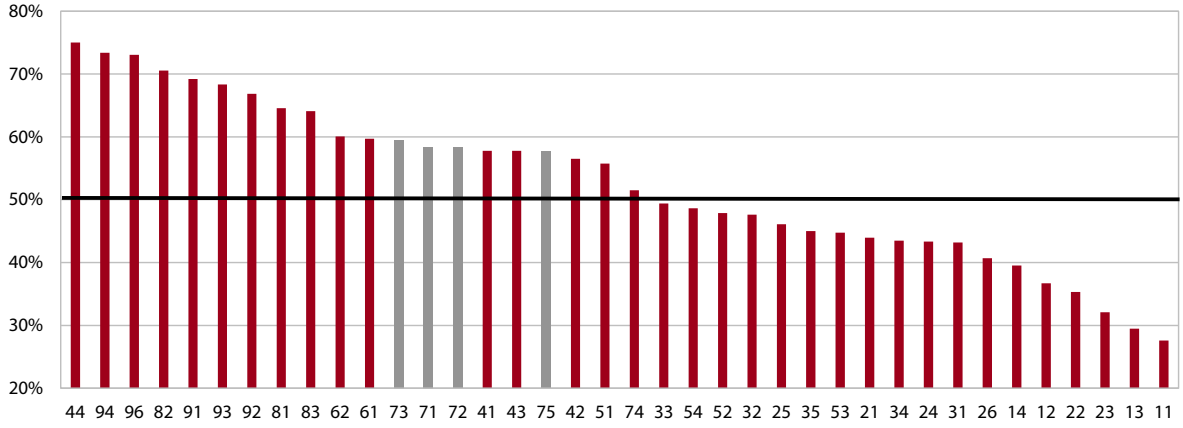
Slovenia lacks a clear picture of future HR requirements.

... for which Slovenia is not adequately prepared. For Slovenia, the OECD (2019j) expects the demand for experts to increase and the demand for basic, simple task occupations to decrease. This is further supported and specified in OECD (2018c), which presents the risk of automation by occupation according to the Standard Classification of Occupations, indicating, among other things, that Slovenia lacks a clear picture of future HR requirements. Figure 27 thus shows the level of job automation risk by occupation, highlighting shortage occupations designated as such under the scholarship policy of the Slovenian Government.[123] It shows that shortage occupations are occupations whose risk of automation is above average,

[123] For a presentation of shortage occupations see https://www.srips-rs.si/vsi-razpisi/razpis/javni-razpis-za-dodelitev-stipendij-za-deficitarne-poklice-za-solsko-leto-20202021-292-javni-r – the conversion to Standard Classification occupations was done by IMAD; due to the varying levels of classification, the shortage occupation subgroups presented here are those where more than one shortage "occupation category unit" has been identified.

although it is true that demand for such occupations grew in the past[124]. Accordingly, shortage is mainly characterised based on current or past and not future needs, which further increases the risk of "getting caught up" in existing production methods and business models. This is not surprising, as Slovenia is yet to establish a system for mid-term projections of knowledge and competence needs (IMAD, 2020a).

Figure 27: Risk of occupation automation, with highlighted shortage occupations designated as such by the Slovenian Government (grey) and total weighted average (black line)



Source: Presentation by IMAD based on OECD (2018c)
Note: the X-axis shows occupation subgroups under the Standard Classification of Occupations with classified shortage "occupation category units".

4.1.2.3 Time to move with transformation is now

As advanced I4.0 applications are still largely in the pilot phase, their broader economic and social implications have not yet been detected. According to a global expert survey, only 29% of companies in the processing industry have already deployed I4.0 technologies at scale, while a further 41% were in the pilot phase (WEF, 2018b). This has been confirmed by other sources (see, for example, OECD, 2020l), which means that, on average, leading economies are still based on proven third-generation technologies and that the impact of accelerated productivity growth due to I4.0 can be expected to manifest itself in the future (UNIDO, 2019). Based on estimates, advanced AI-related technologies are used comprehensively by only 3 to 6 percent of European companies (McKinsey Global Institute, 2019b)[125]. Possible reasons for the only gradual deployment of fourth-generation technologies are (i) long investment cycles of the existing equipment, (ii) the fact that the more complex fourth-generation technologies are still in development and therefore not fully standardised, which is associated with (iii) increased production risks, and (iv) the fact that a comprehensive transformation requires intensive investment (for more see Section 4.3.1), as a result of which the logic of transition has not yet been clear (Eurofound, 2019a; WEF, 2017).

The deployment of fourth-generation technologies will be gradual at first, but they are expected to expand fast before 2025[126]. According to PwC (2018b

[124] Whereas the total number of jobs in the 2011–2016 period decreased by nearly 17,000, the number of jobs in shortage occupations in the same period increased by nearly 7,000.
[125] For further illustration: over 25% of respondent European companies do not use any advanced AI-related technology, while over 60% use at least three of them (out of five) (McKinsey Global Institute, 2019, p. 14).
[126] The process of digital transformation is therefore often portrayed as an S-curve – see, for example, OECD (2018), McKinsey Global Institute (2018) or PwC (2018).

and 2019b), there are three waves or types of intelligence when it comes to the deployment of digital technologies: „algorithm" intelligence, which is already underway and pertains to the relatively simple process automation and data processing, followed by the „augmentation" and „autonomous" waves, the first of which is expected to involve more dynamic interaction between technology and people, while the second would generally mean a nearly full automation of work processes. For the transition to the second, intensive part of the S-curve, the WEF (2017) sets out five prerequisites for a breakthrough: (i) technologies advance to TRL 6–9[127] for the second wave, (ii) robot prices are reduced by 50 to 75%, (iii) 40% of production assets are connected, (iv) 25% of products are based on mass customisation, and (v) 25% of current capex spending is replaced with service-based spending. Data shows that the critical turning point is fast approaching, which is most clearly illustrated by robot prices relative to the price of labour, which have been falling drastically since 2008 (Kilic and Marin, 2020). Furthermore, estimates show that, since 2013, robots have been, on average, more competitive than traditional labour (Bain, 2018), taking into account that this price trend will continue along with the robots' significantly improved technological capabilities, particularly in terms of their dexterity, which is of key importance (Oxford Economics, 2019; Bain, 2018). Based on these assumptions, models from the pre-COVID-19 period, a period which is expected to accelerate the processes of digital transformation even further, predict that this turning point will happen before 2025 (PwC, 2018a), and, despite the technologies being available today, the third wave is expected to fully develop in the first half of the 2030s (PwC, 2018b).

The transition will be extremely rapid, which is why insisting on existing production methods and business models, particularly when it comes to the supplier end of the business sector, is highly risky. The supplier end of the production-oriented business sector in particular was under heavy pressure to restructure even before the coronavirus crisis. Roland Berger (2019) claims 2019 to be the turning point when a permanent decrease in the growth and profitability of car industry suppliers occurred, taking into account that the added value distribution structure is expected to change even more dramatically in the future as a result of digital transformation. Thus, according to Csefalvay (2019), 60% of the value of self-driving cars is based on software and digital equipment or content; moreover, as far as the remaining hardware is concerned, the number of parts making up an electric vehicle is expected to decrease significantly (McKinsey Global Institute, 2019c), which will put traditional suppliers under additional pricing pressure. At the same time, companies and suppliers that fail to master I4.0 solutions and the associated complete overview of the supply chain (EIU, 2017; Bain, 2020b) will be completely excluded the moment when buyers or integrators (OEMs[128]) implement or require the implementation of the 4.0 standard. According to the OECD (2020l), this is already happening[129], which, from the point of view of national economies, poses a significant risk in terms of potential job losses. The process of transformation is, of course, not just a matter of automation and robotisation in the narrow sense, but a comprehensive and in-depth digitalisation of business operations and new business models based on the most complex technologies, including artificial intelligence (Lakhani, 2020) – see Section 4.1.1.

[127] TRL stands for "technology readiness level", where level 9 refers to an actual system proven in an operational environment – see https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf.

[128] OEM stands for "original equipment manufacturer", i.e. one that integrates the parts of lower-level suppliers into the final product.

[129] One such company is BMW, which is already preparing for a complete overview of all production processes in real time with all its suppliers (OECD, 2020, p. 37).

4.1.3 The future depends on the decisions taken

4.1.3.1 Uncertain simulations of future trends

Simulations of future trends are so uncertain that we treat them as unknown. Quantitative estimates of the future impacts of digitalisation on economic growth, productivity and employment are so uncertain, both in the light of past dilemmas[130] and because of the multitude of uncertainties about future trends,[131] that leading global think tanks prefer to avoid them and simply label them as unknown (OECD, 2017c). Notwithstanding the above, there is a consensus that new technologies will „inevitably disrupt today's industries" and „redefine the terms of competitive success" (ibid., p. 15) and that digitalisation is likely to represent the biggest shock in the production structure, which some describe as seismic (De Backer & Flaig, 2017). Expectations about the future should therefore be treated with a high degree of caution (Eurofound, 2018), which is especially true of the below described review of estimates,[132] which – despite uncertainties – were prepared, as a rule, by consulting firms in the pre-coronavirus crisis period, further increasing the level of uncertainty thereof.

Simulations of consulting firms identify successful digital transformation as the most important factor of future economic growth that can significantly increase available GDP. Consulting firms identify digital transformation, with an estimated 60% contribution to potential productivity growth by 2030 (McKinsey Global Institute, 2018b), as the most important factor in future economic growth. Such estimates are based on general equilibrium models that take into account demand-side feedback in addition to supply-side effects.[133] Estimates of such models suggest that the rate of economic growth could increase globally by 1.2 percentage points (McKinsey Global Institute, 2018a) or could even double (Accenture, 2016).[134] At the EU level, economic growth is projected to increase by 1.4 percentage points per year, which by 2030 would cumulatively mean 19% higher GDP than would have been the case without the digital transformation (McKinsey Global Institute, 2019b)[135] or slightly less, for example a total of an additional 11.5% higher GDP for Southern Europe (which includes Slovenia in this study), representing an increase of annual growth by 0.84 percentage points per year (PwC, 2018a). All three studies model the impact of artificial intelligence; they are confirmed by a recent study by the European Commission (2020f), which estimates the potential for increased average GDP growth for advanced EU countries by 2030 by an additional 1.4 percentage points[136] and for medium developed ones by an additional one percentage point per year. The Oxford Economics study (2019), which focuses „only" on robotics, found that the accelerated introduction of industrial robots by 2030 could increase EU GDP by 7.5% compared to the present value.

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[130] See Section 4.1.1.1 on the Solow paradox and the mixed impact on employment in Section 4.1.2.1.

[131] For example on the technological potential of automation, the dynamics of robot prices relative to the cost of labour, their future impact on productivity, the intensity of investment in automation or what will happen to aggregate demand, which is also related to the volume of redistribution.

[132] These estimates are given only in terms of review, as, for example, in OECD, 2017b, or Szczepański, 2019.

[133] As a rule, these are also estimated based on concrete user experience, i.e. with a micro-to-macro approach.

[134] To illustrate: such an acceleration would mean at least doubling the impact of any technological transition in history, as the steam engine is estimated to have contributed about 0.3% annually to productivity growth between 1850 and 1910, the contribution of robots in the 1990s is estimated at 0.4% and the contribution of ICT in the 2000s to 0.6% (McKinsey Global Institute, 2018a), though it is true that none of the previous revolutions had such marked consequences in such a very short space of time (Bain, 2018).

[135] The estimated impact has already been reduced by the cost of implementing digital transformation and by the negative externalities caused by digital transformation – without taking into account these negative effects, the gross impact is estimated at 33.2% (McKinsey Global Institute, 2019b).

[136] Accenture (2016) also made an assessment especially for Germany and Austria (which are close to Slovenia), whose potential growth could increase from 1.4% to 3% per year, i.e. by 1.6 percentage points.

Digital pioneers are expected to achieve 6–12 percentage points higher profitability growth compared to today, while the profitability of the rest is expected to decline accordingly.

Unlike volume, it is much more certain that the impact will also depend on the speed of digital transformation. According to simulations, digital pioneers are expected to achieve 6–12 percentage points higher profitability growth compared to today, while the profitability of the rest is expected to decline accordingly, i.e. by 6 percentage points (McKinsey Digital, 2019). Even greater consequences are suggested by the McKinsey Global Institute (2018a), which predicts that businesses that will implement artificial intelligence solutions in the first wave will increase their net income by 122%, those in the second wave by 2030 by 10%, while the net income of businesses that lag behind and do not implement such solutions during this period will fall by an average of 23%. Similarly, a European Commission study (2020f) estimates that, if EU investment in technology is increased by 2023, this could be reflected in an additional, higher than 0.2 percentage points, growth increase.

Although estimates of the impact on Slovenia are even more uncertain, it is clear that Slovenia is no exception and that the impact is increasing with ambition and speed of transformation. One of the few studies that analyses the potential in Slovenia is McKinsey (2018), which is based on the assumption of closing the gap with the leading European countries in the use of existing digital technology. Such digitalisation would increase the economic growth of Central and Eastern Europe as a whole by an additional percentage point per year, while for Slovenia, given the relatively smaller lag, this contribution is estimated at 0.3 percentage points per year (IMAD calculation). No other estimates have been made specifically for Slovenia, but the estimates of the above-mentioned consulting firms for the region or countries lagging in development would imply that – under the assumption of accelerated deployment of the most advanced I4.0-related technology, including artificial intelligence – an impact, in terms of volume, of an additional percentage point of economic growth above the baseline scenario could be expected.[137] We emphasise that these are extremely uncertain estimates, which consequently cannot be considered as reference, but in any case, as in other countries, the impact is increasing with the ambition and speed of implementation of digital transformation.

The impact on the labour market is not expected to be negative in the long run, but there could be temporary shocks. As has been the case in past technological transitions, analyses anticipate that the aggregate net impact on employment in the long run should not be negative but positive (Eurofound, 2019a; UNIDO, 2019). The interim transitional period, which will be the fastest so far (Bain, 2018), is potentially problematic, however, and could result in a temporary but potentially significant increase in the unemployment rate, at least in the more affected areas. Impact estimates for the current decade range from only a slightly negative aggregate net impact on employment by 2030 (McKinsey Global Institute, 2018a) to estimates with a strong negative impact, according to which up to 25% of jobs could be temporarily lost by 2030 (Bain, 2018). One of the more in-depth studies in this field is presented by Eurofound (2019a and 2019b), which explicitly models both real investment capacity and the multiplier impacts of aggregate demand due to job loss and creation, including the possibility of government corrective measures to reduce negative social effects. According to this estimate, the number of jobs in the EU is expected to decrease by 10–16% by 2030, with the most affected being manufacturing activities that are especially important for Slovenia, within which the number of jobs is expected to decrease (net) by 20–35%. Less pessimistic, but still negative, is a recent study prepared for the European Commission (2020f), according to which the net temporary employment impact for medium developed

[137] To illustrate what an additional percentage point of economic growth would mean: by 2030 this would mean 5 percentage points or, in terms of volume, EUR 2.9 billion higher GDP than the baseline scenario.

EU countries such as Slovenia is expected to be –2.5% of all jobs by 2030, though it would exceed –4% in 2025/2026. In absolute numbers, this could mean that in Slovenia, under the assumption of an average rate of digital transformation, the number of people in employment would temporarily decrease by around 40,000 over five years.

4.1.3.2 The real impact on productivity depends on the approach to digital transformation

The intensity of digitalisation does not only increase the benefits in terms of accelerated growth… As shown in previous sections, digitalisation increases productivity and its growth, and this impact is expected to intensify and even accelerate in the future. At the same time, digitalisation, in conjunction with other global megatrends, has fostered the transformation of global value chains, potentially rewarding highly internationally integrated economies in the convergence process that will be able to transform into modern, digital, knowledge-based societies. Digitalisation, therefore, should not be seen as an imminent, inevitable and irreversible process, but should be understood as a means of increasing population well-being and strengthening public services and an effective way to address current societal challenges (Atkinson, 2020).

… but at the same time reduces the risks… Accelerated digitalisation not only accelerates growth, but is also the most effective means of reducing risks, especially those related to potential job losses and increasing social and territorial inequalities. This is supported by simulations of expected consequences of digitalisation, which show that countries with a more skilled workforce and a higher degree of robotisation of the economy on average face lower technical threats to existing jobs (PwC, 2018b; Oxford Economics, 2019; McKinsey Global Institute, 2020a). Even though these simulations may be seen as too uncertain, empirical studies of past trends also speak in favour of reduced risks. As shown in Section 4.1.2, micro-studies show that businesses that are rapidly robotising not only do not lose, but in fact even increase, employment. This may result from reduced employment by competitors, which would be in line with data on accelerated concentration of economic activities and increasing the gap between successful and unsuccessful businesses (Andrews, Criscuolo & Gal, 2019; Bajgar et al., 2019). Accelerated digitalisation may thus be subject to conflicts in terms of increased risks for unemployment, but, given Slovenia's small size and international integration, such potential negative impacts may be more reflected in other regions and countries where competitors of Slovenian businesses are located.

Slovenia can become/ remain appealing for development if there is a structural, digital transformation of the corporate sector and broader social changes based on specialised skills, suitably qualified staff and a highly developed digital-innovation ecosystem.

... which means that the ratio between positive and negative impacts will depend on the chosen approach to digital transformation and the shift towards innovation-driven economic growth... Not only potential benefits, but, indeed especially, fierce competition accompanied by the above-mentioned potential conflicts already affecting businesses, regions and countries (McKinsey Global Institute, 2018a) further reinforces the need for not only ambitious but also rapid digital transformation. Slovenia can become/remain appealing for development if there is a structural, digital transformation of the corporate sector and broader social changes based on specialised skills, suitably qualified staff and a highly developed digital-innovation ecosystem, which will require – as shown in Section 4.4 – revision of development and economic policies. According to this scenario, Slovenia could further strengthen its relative (economic) position; examples of such a process are Austria and Finland, which systematically shifted their regional processing-oriented

value chains (which also applies to Slovenia) to high value-added activities in the past (McKinsey Global Institute, 2019c). The coronavirus crisis has only increased the need for digital transformation with significantly increased uncertainties and the acceleration of current trends (Deloitte, 2020c).

… including the management of digital transition aimed at increasing wellbeing. Successful digital transformation requires enhanced social dialogue and prior social agreement on ways to maintain social cohesion, mobilise for change, strengthen mutual trust and actively address other potentially negative aspects of digitalisation (see Section 4.4.1.5). Without such agreement, it is not realistic to expect a process of positive economic and social acceleration of transformation for the benefit of everyone, which is pointed out not only by (public) organisations such as the OECD, the European Commission and their advisers (OECD, 2019k; European Commission, 2020; Eurofound, 2019b), but also by (private) consulting firms (McKinsey Global Institute, 2019a; Bain, 2018; PwC, 2018b; McKinsey, 2020g), even if this leads to increased public expenditure and taxes, to which businesses are not necessarily most inclined.

In addition to ambition and speed, the development policy must ensure the right balance between short-term and medium-term to long-term measures, i.e. measures aimed primarily at mitigating the effects of the epidemic, fostering economic growth and/or maintaining the material well-being of the population in the short term, and development-oriented measures with predominantly long-term effects on growth and prosperity (IMAD, 2020b). Different types of measures, not only of different intensity, but also with different time lags, affect the growth of the economy and productivity. Thus, for example, infrastructure-oriented measures have a strong short-term Keynesian effect on GDP, i.e. an accelerating effect through increased aggregate demand. Although the implementation of digitalisation in the corporate sector is expected to have immediate effects (Gal, Nicolleti, von Ruden & Sobre, 2019; Laczkowski, Tan & Winter, 2019), the development policy should in no way neglect the necessary complementary measures related to investment in research, development and innovation (OECD, 2020l; UNIDO, 2019) and in particular human resource development (Gal, Nicolleti, von Ruden & and Sobre, 2019) and other complementary measures (Sorbe, Gal, Nicoletti & Timiliotis, 2019), regardless of the fact that they (may) have a characteristic and strong impact on growth and productivity only in the medium term.[138]

4.2 The state of digital transformation in Slovenia

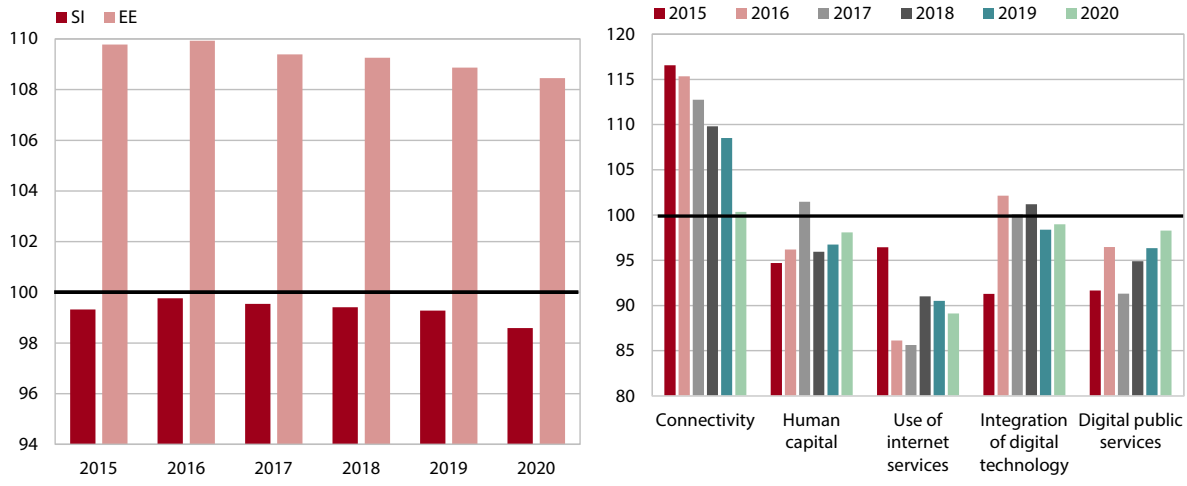
According to the Digital Economy and Society Index, Slovenia ranks slightly behind the EU average, gradually increasing its lag. In the latest report of the European Commission, Slovenia advanced by one place compared to the report from 2019, from 17th to 16th, which ranks it somewhere in the middle of EU countries in terms of the level of digital transformation. The same conclusion can be reached at the global level, as assessed by the IMD World Digital Competitiveness Ranking, where Slovenia ranks 32nd among 63 countries and has improved its ranking by seven places since 2015[139]. However, in accordance with the European DESI index, Slovenia

[138] Rodriguez-Pose and co-authors show that the period when a strong impact on growth and productivity is shown usually occurs after four or more years (Rodriguez-Pose & Fratesi, 2004; Crescenci & Rodriguez-Pose, 2008).

[139] According to data from Chakravorta and Chaturveda (2017), based on the Digital Evolution Index, which includes 108 indicators, Slovenia is expected to achieve the third lowest rate among 60 countries in the previous period of 2008–2015.

has increased its lag to the EU average in recent years. Among below-average-developed countries, Slovenia is increasing its lag, while the model country in this area, Estonia, is only seeing a decrease in its rate of advancement. The analysis by individual component shows that the relative lag is mainly due to the relative lag in connectivity, which was a comparative advantage in the past; a similar trend, but to a lesser extent, can be seen in integration of digital technologies. The use of internet services also remains problematic: despite an improvement in absolute terms, this has not been enough to reduce the relative lag behind other countries. The opposite is true as regards human capital and digital public services, where Slovenia is lagging behind but managed to reduce its lag in the last five reports.

Figure 28: The Digital Economy and Society Index (DESI) and its components between 2015 and 2020 compared to the EU average (= 100)



Source: IMAD calculation based on European Commission data available at https://digital-agenda-data.eu/datasets/desi/visualizations (25 September 2020)

4.2.1 The corporate sector[140]

The purpose of this section is to deepen the analysis from the Development Report 2020 (IMAD, 2020a), according to which the Slovenian corporate sector on the one hand shows a relatively high digital intensity of jobs, including investment in employee skills, and positive trends related to robotisation and business digitalisation, especially among large enterprises, while on the other, according to IMAD (2020a), investing too little in ICT, a lag that was found in the integration of advanced technologies and the implementation of smart factories. As much recent data is not yet available at the time of writing, the analysis below is largely based on more detailed survey studies: these provide much more granular insight but are based on samples not necessarily representative and above all not as up to date as official statistics. The above-mentioned studies include, in particular:

(i) the Slovenian and European manufacturing survey (European Manufacturing Survey – EMS2020), which was conducted in 2018 and 2019 on a sample of 127 manufacturing companies with at least 20 employees, of which 32% were small, 43% medium-sized and 25% large enterprises (Palčič, Klančnik, Lehrer & Ficko, 2020);

[140] This section was co-authored with Prof. Iztok Palčič from the Faculty of Mechanical Engineering of the University of Maribor.

(ii) a survey on the situation and needs of small and medium-sized enterprises in the field of digitalisation, conducted at the end of 2019 and in early 2020 by the Slovenian Digital Innovation Hub, which included 119 companies from all sectors (DIH, 2020);
(iii) a survey conducted for the European Commission by IPSOS and iCite on the use of artificial intelligence among EU businesses, in which 239 Slovenian businesses from all sectors and of all sizes were surveyed, though with a small share of large enterprises, i.e. 4% (European Commission, 2020h).
(iv) The EIB investment survey among 401 businesses, which includes businesses of all sizes and sectors, was conducted in 2019 (EIB, 2019b);[141]
(v) a survey of 166 small and medium-sized enterprises with more than 10 employees (of which 34% were medium-sized) from all sectors on the topic of I4.0, conducted in July and August 2018 as part of a study (Čater et al., 2019);
(vi) a survey conducted by the Slovenian–German Chamber of Commerce in 2017 among 93 predominantly manufacturing companies of all sizes on the topic of digitalisation (AHK, 2018);
(vii) a study on the state and trends of digital transformation, conducted in June and July 2017 among 213 businesses of all sizes (of which 29.5% were large enterprises) from both manufacturing and service activities, with a representative sample (Erjavec et al., 2018).

Table 2: Overview of the characteristics of used micro-studies of the corporate sector on the topic of digitalisation and I4.0

Study	Year of study	Sector	Size of business
Palčič et al. – EMS2020	2018/2019	Manufacturing	All
DIH	2019/2020	All	SME
EC	2020	All	Mostly SME
EIB	2019	All	All
Čufar et al.	2018	All	SME
AHK	2017	Manufacturing	All
Erjavec et al.	2017	All	All

4.2.1.1 Preconditions: strategic approach, investment and security

Awareness of the corporate sector about the importance of digitalisation is high, but businesses underestimate its impact when faced with significant obstacles to its implementation. According to a survey (AHK, 2018) in 2017, 91% of businesses understand digitalisation as important, with 37% seeing it as very important and 25% as decisive, which shows that the awareness of the corporate sector in Slovenia of the importance of digitalisation is generally at a high level. More problematic is the fact that businesses clearly underestimate the strength of the impact on the industry in which they operate, as, according to Erjavec et al. (2018), only 36% of businesses believe that this impact will be large, compared to 59% of businesses worldwide (ibid., p. 113).[142] In the digitalisation process, businesses face the problems of lack of staff and required skills, (un)availability of financial resources,[143] and too low priority given to digitalisation by company management (DIH, 2020; Čater et al, 2019; AHK, 2018). The last is reflected in the low (10%) share of businesses with a digital strategy for business transformation of their company's business developed and approved

[141] Data available at https://data.eib.org/eibis/download
[142] In the SURS survey (2020), 53% of businesses with at least 10 employees replied that digital transformation is not essential for their successful operation.
[143] According to SURS (2020), 41% of surveyed businesses with more than 10 employees face staff problems related to digital transformation and 40% face a lack of financial resources.

by its management (SURS, 2020). This indicates the need to strengthen the support environment, the digital and innovation ecosystem, which businesses, at least in 2017, describe as „inadequately prepared" (Erjavec et al., 2018, p. 114). Notwithstanding the above, digital transformation management in Slovenia relies on outsourcers and consultants[144] to a greater extent than abroad and less on the digital skills of existing employees (ibid.). In addition, key obstacles to accelerated digitalisation include (un)willingness to change (ibid.), a lack of knowledge of the capabilities of digital technology and an inability to experiment quickly (SURS, 2020), although businesses, at least according to Erjavec et al. (2018), are at the same time very optimistic when it comes to their capacity to adapt quickly or their agility, which is particularly strong among digitally mature organisations.

When it comes to investment in software and databases, there is a slight upward trend, but this is far from sufficient to close the gap with countries such as the Czech Republic or Austria, which invest twice as much proportionately, let alone countries such as the Netherlands, Sweden and France, which invest almost three times more than Slovenia.

Slovenia lags behind in investment in ICT equipment and in software and databases, which especially applies to manufacturing. As presented in Section 2.2.1, Slovenia has shifted from being an above-average investor in ICT equipment to being an average one. Although 0.9% of GDP is comparable to the share of innovation leaders in ICT equipment, Slovenia lags far behind convergence countries such as Estonia or the Czech Republic, which spend 1.7% and 1.5% of their GDP in this field respectively. The fact is that the share of manufacturing investment in ICT equipment is only 9%, which is significantly less than, for example, in the Czech Republic (where it is around 50%) or in Sweden or Finland (where it is around 20%) – as a result, public administration investment in ICT equipment was higher than in manufacturing in 2018. The situation is similar when it comes to investment in software and databases, where Slovenia's investment of 1.1% of GDP is below the OECD average. At least in this case there is a slight upward trend, but this is far from sufficient to close the gap with countries such as the Czech Republic or Austria, which invest twice as much proportionately, let alone countries such as the Netherlands, Sweden and France, which invest almost three times more than Slovenia. This is also confirmed by EIB data (2019b), according to which Slovenia, at 8%, lags behind the EU average by five percentage points in terms of the share of all corporate investment in software, data, networks and online activities, and even by eight percentage points behind innovation leaders; the situation is particularly critical in manufacturing, which accounts for only 4% of all investment in this field.

Survey data of businesses show a gradual increase in investment in digitalisation and computerisation, but a large portion is spent on day-to-day operations. If in 2005 businesses invested 1.5% of net income in IT, this share rose to 2.9% (Erjavec et al., 2018), with almost a third of businesses investing at least 4% of income according to the AHK (2018) survey. In view of the internationally comparable data presented above, such a rate of increasing investment in digitalisation can be described as insufficient, and the fact that only a quarter of businesses have an opportunity cost estimate of digitalisation (DIH, 2020), while after realisation most businesses do not verify return on investment (Erjavec et al., 2018) or do not measure the effects (around 45% of surveyed businesses according to the DIH (2020). According to the data of Erjavec et al. (2018), more than half of businesses allocate at least 60% of their digitalisation investments for the implementation of day-to-day operations, while the share of businesses that allocate at least 80% of such investments to development is only 10%.

Slovenian businesses are relatively sensitive to the issue of cybersecurity, and actions in this field are correspondingly intensive. Cybersecurity is considered by businesses as the third most important risk or barrier to more intensive digitalisation

[144] A total of 52.3% in Slovenia compared to 20.2% abroad (Erjavec et al., 2018).

according to AHK (2018), with the importance of security aspects increasing further in 2017. Data from Erjavec et al. (2018) show that, for the five-year period after 2017, almost 90% of businesses planned projects in this field, which is more than in any other field and significantly more than worldwide[145]. However, businesses did more than just make a plan; according to EMS2020, by 2018/2019, 43% of businesses implemented or upgraded software, hardware or organisational measures related to security. Thus 62% of businesses use special software, 46% special hardware (such as a separate internet or a subnet without internet access), and almost a third special organisational measures such as disabling radio and internet signals. A similarly high rate can be expected in the future, as 12% of businesses are planning measures in these three areas by 2021, which would mean that special hardware would be used by more than half (53%) of businesses at that time.

4.2.1.2 Industry 3.0 management

The basic level of the implementation of digitalisation in businesses is known as business operations' digitalisation,[146] where Slovenia's large enterprises are among the most successful, while its small and medium-sized enterprises lag behind but are still at the EU average. Slovenian large enterprises reach the seventh highest level of business operations' digitalisation (IMAD, 2020a), where, in addition to the use of e-invoices prescribed by law, large enterprises stand out in the use of ERP systems,[147] which are used by 91 large enterprises, making Slovenia ahead of innovation leaders by ten percentage points. On the other hand, Slovenia's large enterprises are clearly paying less attention to customer relationships, as its large enterprises rank only 15th in the EU in terms of the use of CRM software.[148] With the exception of e-invoices, the status of SME digitalisation is at the EU average and, similarly to large enterprises, SMEs lag far behind in terms of customer relationships, ranking a lowly 24th in terms of the use of CRM software. The EIB (2019b) also points out that SME business digitalisation in particular needs to be promoted.

Quality assurance and management methods show that Slovenian businesses need to significantly improve their management of existing 3.0 technologies before implementing 4.0 solutions. Mastering continuous improvement models is a prerequisite for the effective implementation of I4.0 solutions (McKinsey Global Institute, 2019c) and is therefore considered as a proxi in the assessment of the mastering of 3.0 technologies. Analysis of EMS2020 data for manufacturing shows that only half of businesses and only a good third of SMEs use quality assurance methods in manufacturing (such as Six Sigma). Certified quality-management systems (such as ISO900xx) are slightly more widespread, as more than three-quarters of businesses and 69% of SMEs are using these systems with medium or high intensity.

In robotisation of manufacturing, Slovenia has made great progress since 2016, but the latest data for 2019 show a slowdown in its implementation. According to Eurostat data, Slovenia has the seventh highest share of businesses

[145] The comparison refers to 3,700 businesses from 131 countries from 27 different industries (Erjavec et al., 2018).
[146] In line with IMAD (2020a), the following indicators were taken into account in business digitalisation analysis: the share of enterprises with e-invoices suitable for automatic sending (2018), the share of enterprises with automated business processes with suppliers and customers (2017), and the share of enterprises with ERP (2019), CRM (2019), purchasing cloud computing services (2018) and analysing big data from any source (2018).
[147] ERP is the English abbreviation for "enterprise resource planning", i.e. software systems for integrated business management.
[148] CRM is the English abbreviation for "customer relationship management", i.e. systems for the management of customer relationships.

using industrial robots, while data from the International Federation of Robotics on robot density per 10,000 employees show that in 2018 Slovenia had the 13th highest density of robots worldwide. The trend of their increase was very positive, being the fifth fastest worldwide in 2016–2018, though unfortunately it slowed significantly in 2019. According to data published at the end of September 2020, Slovenia had fallen to 17th place worldwide, as since 2016 the number of robots per 10,000 employees has increased by only 72, while in Germany it went up by 161, in South Korea by 457 and in Singapore by as much as 729. By way of illustration, if Slovenia had used Singapore's approach to robotics, given the number of people in employment, over 15,000 robots would have been put into work over three years instead of approximately 1,500. Despite its relatively good start, Slovenia must therefore maintain the high growth of robotisation from 2016–2018, as otherwise according to this indicator competitive countries will overtake us, as has been the case with Slovakia.

4.2.1.3 Integration of (4.0) technologies

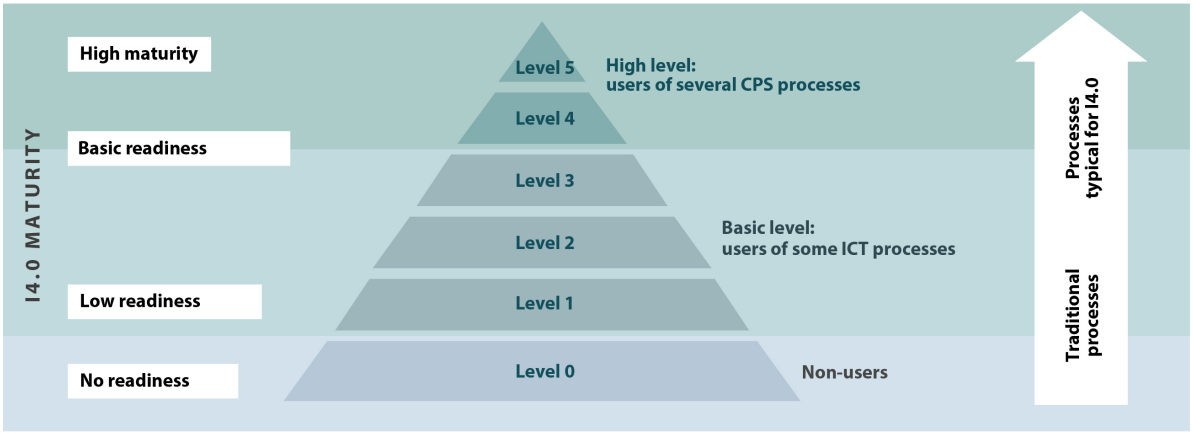
The Industry 4.0 concept requires the integration of various information and communication technologies, including the implementation of cyber-physical systems in manufacturing, which is a great challenge for businesses. As part of the EMS2020 survey, which also includes the Palčič, Klančnik, Lehrer & Ficko (2020) study, the 4.0 Industry Readiness Index was developed, based on the use of selected advanced manufacturing technologies, identifying three technological areas with related technologies:

1. digital management systems – ERP systems and product lifecycle management and systems (PLM, PDM);
2. wireless human–machine communication – mobile/wireless equipment management devices and digital visualisation;
3. cyber-physical systems (CPS) in manufacturing – digital data exchange with suppliers and customers, automated internal logistics systems, and real-time manufacturing control systems.

The first two technological areas cover processes related to information and communication technology, but these do not yet form the essence of I4.0, which requires their full integration with the technological field of cyber-physical production systems. Based on this classification, companies were classified into the following groups according to their readiness on I4.0 (see Figure 30)[149]:

[149] 1. Non-users of technologies who are not ready for I4.0 at all:
Level 0: businesses that still tend to use old, traditional technologies;
2. Basic readiness for I4.0:
Level 1 (beginners): businesses using technologies from at least one of three technological areas;
Level 2 (advanced beginners): businesses using technologies from at least two of three technological areas;
Level 3 (advanced users): businesses using technologies from all three technological areas;
3. High readiness for I4.0:
Level 4: businesses using technologies from all three technological areas and at least two technologies from cyber-physical systems in manufacturing;
Level 5: businesses using technologies from all three technological areas and all three technologies from cyber-physical systems in manufacturing.

Figure 29: Industry 4.0 Readiness Index concept



Source: Palčič, Klančnik, Lehrer & Ficko, 2020, design by IMAD

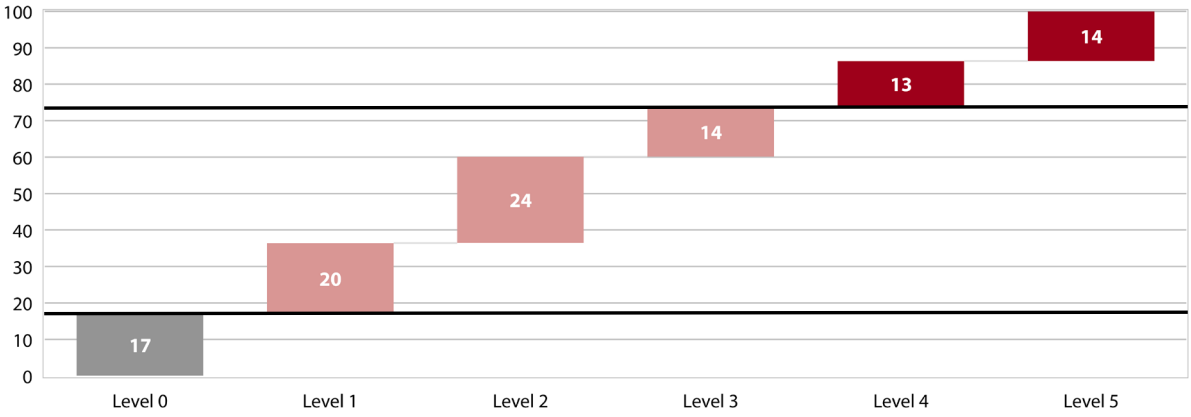
In Slovenia's manufacturing sector, there are still very many businesses that rely heavily on traditional manufacturing processes, which does not deviate from the situation in other developed countries. According to EMS2020, the share of businesses that have not yet implemented any of the above-mentioned technologies in manufacturing is 17%, while an additional 43% of businesses are in the group of beginners or advanced beginners (Figure 31). In total, approximately 60% of businesses can be described as those that do not use any or use only relatively basic ICT solutions. A comparison with Germany, France and Switzerland shows that Slovenia has a higher share of businesses at levels 0 and 1 but a smaller share of businesses at level 2. Taken together, Slovenia has a comparable share of businesses with Switzerland and a smaller share than France (71%) and Germany (67%) in relation to all three levels, i.e. the level of non-users and both groups of beginners.

Over a quarter of businesses show a high level of readiness for Industry 4.0, which is encouraging and a good basis for further accelerating the implementation of smart factories. Although even at levels 4 and 5 it cannot be assumed that the threshold for I4.0 has actually been reached, these businesses are much closer to the concept of the smart factory, meaning that there is a high degree of probability that these businesses are effectively transitioning from traditional manufacturing to manufacturing close to the integrated I4.0 concept. According to EMS2020, there are 12.7% of such businesses in Slovenia at level 4 and 13.6% at the highest level (5), where businesses use practically all key technologies from all technological areas, including cyber-physical systems in manufacturing, i.e. 26.3% in total. These are already high shares, even exceeding those in Germany, Switzerland and France, which have shares ranging from 20% to 25%. This encouraging prognosis is also supported by a EIB survey (2019b), according to which the use of the Internet of Things by Slovenian businesses is above average, and by a European Commission survey (2020h), according to which Slovenian businesses integrate the most advanced artificial intelligence technologies in all sizes of enterprises, this applying to small enterprises in particular. However, such data is somewhat compromised by the data on the use of M2M SIM cards per 100 inhabitants, which is a technology indicator that allows not only traceability but also data transfer between machines. According to this indictor, not only is Slovenia lagging far behind, but between 2017 and 2019 it fell further from 22nd to 23rd place among the EU Member States.[150] Also

[150] To illustrate the gap, compared to the EU innovation leaders, which, according to OECD data, have an average

less encouraging are EMS2020 data that show that less than 5% of businesses use the most advanced artificial intelligence technologies[151], while according to SURS (2020), a similar proportion of businesses monitor the movement or maintenance of vehicles or products and control or automate manufacturing processes. According to EIB (2019b) data, the share of Slovenian businesses with at least one digital technology implemented is above average, but at the same time Slovenia lags far behind in terms of the share of businesses that have organised their entire business operations around one or several digital technologies.[152] All of the above suggests that the implementation of smart factories and I4.0 solutions needs to be further accelerated.

Figure 30: Industry 4.0 Readiness Index for Slovenian manufacturing firms



Source: data from Palčič, Klančnik, Lehrer & Ficko, 2020, presentation by IMAD

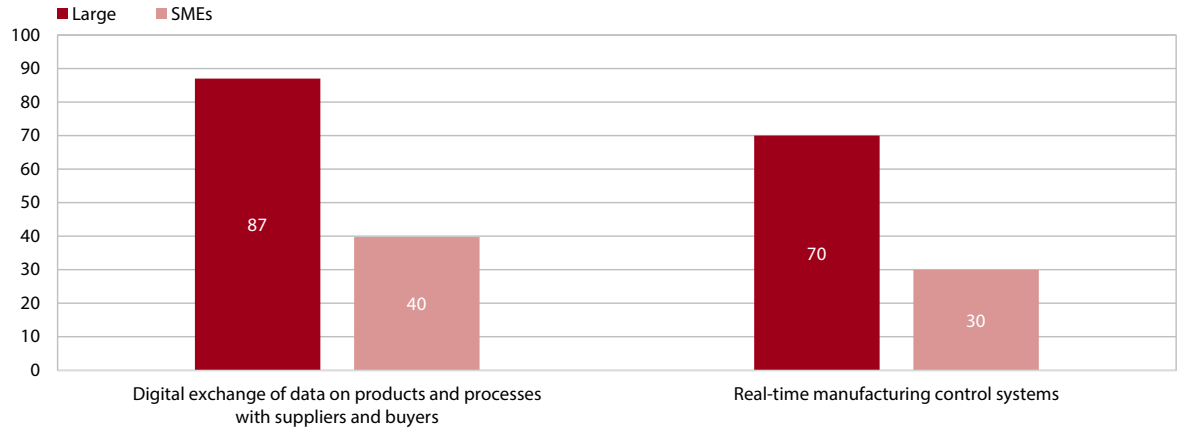
Small and medium-sized enterprises require special attention in integrating advanced 4.0 technologies. Lower use of advanced technologies among SMEs, as in other countries (EIB, 2020), is not surprising, but this does not mean that this should not be taken into account in policy design. Small and medium-sized enterprises are not only lagging behind in terms of business digitalisation, but also in the integration of advanced technologies. According to EMS2020, the share of SMEs using advanced technologies compared to large enterprises is significantly lower (Figure 32), which is also confirmed by the analysis of Čater et al. (2019). According to this analysis, only 9% of SMEs can be defined as very advanced or digital champions, the latter being defined as those using all relevant new technologies and account for only 1.3% of all SMEs. However, according to the European Commission (2020h), there is great potential in this segment, as the latest data show a significant improvement in the integration among SMEs.

of 51.1 M2M subscriptions per 100 inhabitants, Slovenia has only 3.8 subscriptions per 100 inhabitants.

[151] A more comprehensive comparison with Austria shows that Austrian businesses are leading in terms of frequent use of ERP (80% compared to a good 60% in Slovenia) and that a higher share of Austrian businesses use internal logistics automation and management systems (e.g. RFID or WMS) and systems for integrated management of product lifecycle (PLM) and processes (PDM). Slovenia is at the same level in terms of other digital technologies, however, while Slovenian businesses are in fact well ahead in terms of virtual reality and simulation solutions. This is especially evident in the use of both types of robots and additive technologies, where the share of Slovenian businesses is much higher (e.g. by 15% in industrial robots for manufacturing processes and in additive technologies for the manufacture of products, components, tools and parts).

[152] There are 4% of such businesses in Slovenia, while the EU average is 11% (EIB, 2019).

Figure 31: Use of some advanced 4.0 technologies among large enterprises and small and medium-sized enterprises (SMEs), in %



Source: EMS2020 data; calculation and presentation by IMAD

Greatly increased investment expectations in Slovenia according to the survey; Slovenian companies exceed the average rate in the EU in this regard.

The introduction of advanced technologies in manufacturing is expected to accelerate in the future. The Slovenian business sector lagged behind in terms of the intensity of implementing advanced technologies in 2017, as significantly fewer businesses than worldwide intended to implement projects relating to advanced manufacturing, artificial intelligence and virtual reality in the following year (Erjavec et al, 2018). However, data show that the implementation of new technologies accelerated in 2018 (AHK, 2018; Palčič, Klančnik, Lehrer & Ficko, 2020); before the outbreak of the epidemic, the expectations of businesses for the future were positive. According to EMS2020, a comparison of the shares of businesses planning to use individual advanced manufacturing technologies and ICT in the period up to 2021 showed greatly increased investment expectations compared to previous iterations of the survey; according to the European Commission (2020h), Slovenian companies exceeded the average rate in the EU in this regard. Nevertheless, this still means that only one in three businesses that do not yet use any of the cyber-physical systems in manufacturing will start using at least one by the end of 2021.[153]

4.2.1.4 Digital transformation

Digital transformation goes beyond the transition to I4.0 in terms of the need for a new digital mindset, the implementation of digital business models, servitisation,[154] organisation and more open business models. A closer look at the otherwise high awareness of the importance of digitalisation shows that Slovenian businesses primarily associate this with increased efficiency, this confirmed by over 60% of all businesses according to the DIH (2020) and an even higher (88%) share according to Erjavec et al. (2018). On the other hand, fewer businesses see various qualitative aspects as key, most important among these being the transformation of business processes and models, increasing of innovation,[155] development of new products and services, and identification of new customer segments and new markets.[156] In addition, similar to the implementation of 4.0 technologies, in 2017 there was a clear breakthrough in digital transformation, as, in accordance with the

[153] Calculation based on EMS2020 data.
[154] Servitisation is a business model in which services are added to products and their added value is consequently increased.
[155] Both apply to about 60% of businesses (Erjavec et al., 2018).
[156] This is confirmed by about half or a third of businesses (DIH, 2020).

AHK (2018), the share of businesses that see the added value of digital transformation in higher competitiveness increased significantly.

Until recently, Slovenian businesses lagged behind in digital transformation, but the rate of transformation has accelerated considerably in recent years, at least when it comes to simpler processes. To assess digital maturity, Erjavec et al. (2018) used a comprehensive methodology, based on which businesses were classified into three categories: those in the initial stage, those in the stage of developing digital potential and digitally mature organisations. It turns out that in Slovenia there were more businesses at the initial stage of digitalisation (38% compared to 32% worldwide) and fewer at the mature stage (18% compared to 26% worldwide). The analysis of AHK (2018), meanwhile, showed an acceleration of digital transformation, which is also confirmed by the data from the end of 2019 and 2020 based on DIH, 2020. According to said data, the process of digital transformation is already underway in almost half of businesses, while digitalisation projects in 2020 are projected by a further nearly 30% of businesses, i.e. a total of about three-quarters of businesses. All other businesses also plan to implement digital transformation over the next three years. Such a pace probably also contributed to the EIB's (2020) assessment of the relatively high use of digital technologies, infrastructure and investments by businesses, ranking Slovenia sixth among the highly digitalised economies.

Slovenian manufacturing firms are strongly focused on traditional product sales, but service-related business models are underused. An analysis of EMS2020 data shows that 49% of businesses use service-related business models, among which the most common are the provision of a comprehensive range of turnkey services and the functioning of the product at the customer or for the customer (e.g. payment per quantity produced), which are used by 24 or 23% of surveyed businesses. Adding to this the 9% of businesses that intend to implement at least one of the service business models by 2021, it can be estimated that significantly more than half of businesses will work towards servitisation. Moreover, at least 5% of income is generated from services, directly or indirectly, by only 23 or 35% of businesses, which confirms the finding of ESPON (2020) that Slovenia is still predominantly dedicated to „robotisation of traditional manufacturing".

Only 18% of businesses were those whose innovations were based (also) on the expansion of digital elements of the product.

As a result, it is necessary not only to accelerate the level of innovation, but also to deepen digital transformation, which will be reflected to a greater extent in increased income and the digitalisation of products and services. In the four years before the EMS2020 survey (i.e. from 2015), 72% of businesses launched a new product to the market which was a novelty for the business or involved major technical progress. Given the high rate in the market, the remaining 28%[157] are particularly problematic, but even businesses that have innovated and launched new products generate a relatively small share of income on their basis. Two-thirds of businesses generated less than 10% of income from new products in 2017 and only 9% of businesses more than a third. This could also be related to insufficiently strong digitalisation, as only 18% of businesses were those whose innovations were based (also) on the expansion of digital elements of the product or involved a major improvement of existing digital elements. Despite the above positive rate of digital transformation of businesses, this thus indicates the need to deepen digital transformation.

[157] The corresponding share among SMEs is 34%.

Deepening digital transformation requires an even more open approach to organisation, innovation and business, i.e. even more intensive cooperation with the support environment, the research sphere and start-ups. Businesses are more willing to cooperate internationally, especially when it comes to research and development, and less so when it comes to networking domestically. According to EMS2020, more than half of businesses cooperate with their international customers in research and development, 39% with international suppliers and 25% with other businesses abroad. The corresponding shares for cooperation with domestic entities are on average almost half lower, which is to some extent expected due to the strong international integration of manufacturing firms, but at the same time shows the potential for improvement. Businesses also connect strongly internationally as regards distribution and procurement (43% and 31% of businesses) and slightly less as regards services (24%) or manufacturing (22%), but the corresponding shares for cooperation with domestic entities are on average again more than half lower. With respect to cooperation with knowledge institutions, such as universities and research institutes, the situation is more positive, as 38% of businesses cooperate with domestic knowledge institutions (20% with foreign ones), 13% on a regular basis.[158] In particular, untapped potential is indicated by the low intensity of cooperation with start-ups, with which only 9% of surveyed businesses cooperate, the vast majority only rarely or only once.[159]

4.2.2 Enabling conditions for digitalisation

4.2.2.1 Digital knowledge and skills

The digital skills of adults and employees are gradually increasing but remain relatively low internationally and are slowing the digital transformation of society and the economy. Digital skills are one of the key factors in the expansion of digitalisation. Digitalisation and automation increase the need for basic and advanced digital skills,[160] among both residents and employees in all sectors of the economy (European Commission, 2017a; McKinsey Global Institute, 2018c; OECD, 2019e). In Slovenia, despite the progress in recent years, the digital skills of adults[161] and employees are relatively low (see Figure 32), with the unemployed, the elderly and the low-educated standing out. Although the below-average skills of employees implies higher needs of employees for education than the EU-28 average, the share of employees who were involved in training for acquiring these skills at the workplace in fact remains lower than the EU-28 average (OECD, 2019g). According to a survey of Slovenian companies, the lack of digital skills is slowing down the spread of digitalisation in companies (DIH, 2020). Given the low digital skills, the development of ICT education programmes and the encouragement and enabling of the population to participate in them are needed.

Opportunities for further development also exist in relation to the use of digital technology in education. Although primary and upper secondary schools in Slovenia are well equipped and connected digitally, they have rarely used this

[158] However, it is important to note that businesses cooperate more strongly with universities than with research institutes: according to EMS2020, more than a third of businesses cooperate with the former and less than a quarter with the latter.

[159] In this sense, the Future 4.0 initiative seems like a step in the right direction (see https://www.linkedin.com/company/future-4-0/).

[160] An example of advanced digital skills is programming.

[161] The share of the population aged 16–74 with at least basic digital skills was 55% in 2019, well behind the target set in the Skills Europe Agenda for Sustainable Competitiveness, Social Justice and Resilience (European Commission, 2020i) for 2025, which is 70%. At least basic digital skills include basic and very good digital skills.

technology in recent years (European Commission, 2019f; OECD, 2020m). Lower use is connected with less support from schools for the use of digital technologies[162] and lower expectations regarding the use of ICT for projects or lessons (MIZŠ and Pedagogical Institute, 2019). Following the outbreak of the COVID-19 epidemic, the closure of schools and the implementation of distance education has meant that the use of digital technologies in teaching has greatly increased, while distance education has accelerated the use of ICT in education. In Slovenia, the digital infrastructure and internet access are relatively well developed by international comparison (McKinsey & Company, 2018), but the implementation of distance education has shown a severe lack of adequate ICT equipment for many families,[163] which the government has tried to alleviate by taking action,[164] as have several non-governmental and humanitarian organisations.[165] A lack was also shown in the knowledge and skills of teachers needed to carry out distance education (Rupnik et al., 2020). The situation highlighted the potential of using digital technology in the classroom, though the negative effects of distance education on children in terms of physical activity, health, obesity, and less social contact with peers and thus less opportunity to develop social skills should not be ignored.

Changes in the number of ICT graduates in tertiary education have been largely unfavourable in recent years. ICT experts are key in developing the most advanced digital technologies and in research work related to digitalisation; tertiary education plays an important role in providing such staff.[166] In Slovenia, the number of ICT graduates has decreased in recent years, and their share in the total number of tertiary education graduates is also relatively low (Figure 33).[167] Such trends are particularly unfavourable given the fact that the supply of IT professionals in the labour market does not meet the needs (ManpowerGroup, 2018), while the coronavirus crisis has accelerated digitalisation and further increased the need for IT professionals (Marr, 2020). It is estimated that future trends in the number of ICT graduates will be more favourable, as there are opportunities for higher enrolment by increasing the number of available places (University of Ljubljana, "Analysis of application and enrolment for the 2018/2019 academic year", 2019) and by promoting the enrolment of women in ICT study programmes (their share is currently much lower than that of men).[168] More favourable numbers than overall in tertiary education are observed in Slovenia in terms of the share of new doctors of science in ICT, which in 2018 was higher than the average in the EU and the group of strong innovators.

[162] In Slovenia, the share of students who use a computer at school every week was lower than the EU average. School strategies that support the use of digital technologies in teaching are less widespread (European Commission, 2019f).

[163] The acquisition of ICT equipment, especially personal computers, increased between April and June 2020 (European Commission, 2020j).

[164] The MIZŠ distributed several computers and other equipment to socially disadvantaged students. The National Education Institute has prepared guidelines in which schools are called upon to pay special attention to vulnerable groups of students with learning and other difficulties. In order to ensure equal opportunities for distance education, the DIGI Šola (DIGI School) project was launched. The public broadcaster RTV carried out the educational programme. Special assistance was also provided for Roma children and their parents, immigrant pupils and students, and pupils and students with learning difficulties and special needs (MIZŠ, 2020).

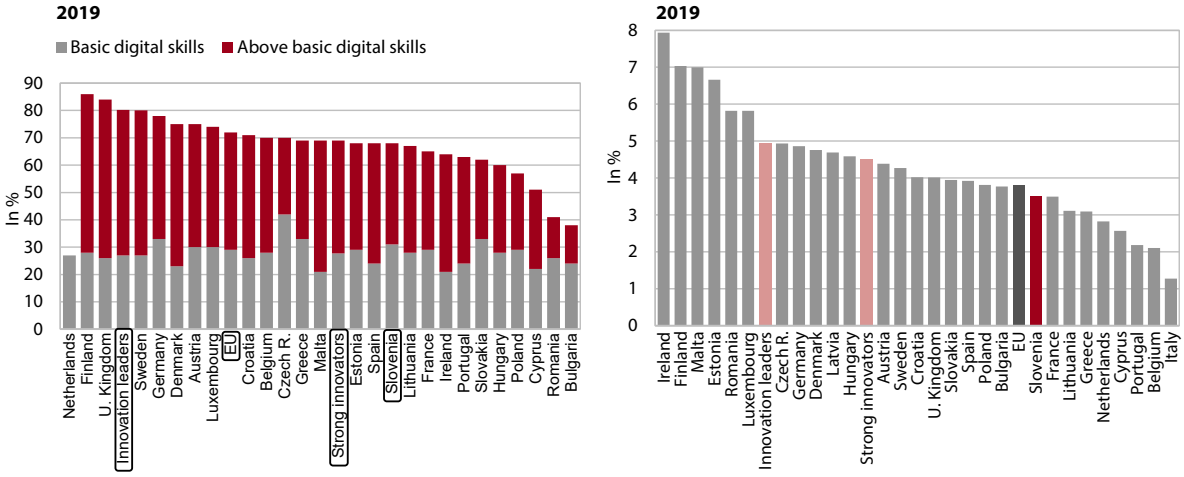
[165] See digitalna.si.

[166] See communication from the Commission to the European Parliament, the European Council, the Economic and Social Committee and the Committee of the Regions on the Digital Education Action Plan, 2018.

[167] Similarly as in engineering, manufacturing technologies and construction, the share of ICT graduates has not changed significantly in recent years, unlike in science, mathematics and statistics, where it has increased and contributed to increasing the share of graduates in science and technology.

[168] The share of women enrolled in ICT courses in the 2019/2020 academic year was 16.7%, much lower than the share of women enrolled in tertiary education overall (57.3%).

Figure 32: The low level of digital skills of persons in employment (left figure) and low share of ICT graduates in tertiary education (right figure)



Source: Eurostat – Science, technology, digital society, 2020.

4.2.2.2 Culture and attitude towards digital change

The share of individuals who positively assess the impact of technologies on society in Slovenia is the lowest among all EU countries, which could also explain the assessment of businesses that unwillingness to change is a serious obstacle to digitalisation.

Slovenians positively assess the impact of digital technologies on the economy (81%[169]; EU: 75%), but not on the quality of life of individuals and society. The share of respondents who believe that digital technologies have a positive impact on their quality of life (61%; EU: 67%) was among the lowest in the EU (only Croatia and France ranked lower than Slovenia). The share of individuals who positively assess the impact of technologies on society in Slovenia (51%; EU: 64%) is the lowest among all EU countries, which could also explain the assessment of businesses that unwillingness to change is a serious obstacle to digitalisation (Erjavec et al., 2018). They assess the attitudes of people towards digitalisation as problematic, along with trust in both science and technology and in institutions (Chakravorti and Chaturvedi, 2017), where Slovenia ranks 39th among 41 countries worldwide (ibid., p. 33).

In Slovenia, 59% of respondents have a positive view of robots and artificial intelligence, which is slightly below the EU average (61%) and much less than among innovation leaders.[170] Most Slovenians (88%; EU: 84%) agree that robots are necessary to do jobs that are too hard or too dangerous for people, but at the same time 73% (EU: 72%) of respondents believe that robots and artificial intelligence take away people's jobs. In 2017, 76% of respondents agreed that due to the use of robots and artificial intelligence, more jobs would disappear than new jobs would be created. This is slightly more than the EU average (74%) and also more than among innovation leaders, where the share of respondents who agree with this statement is the lowest among EU countries.[171]

In Slovenia, the share of people who believe that they are sufficiently skilled in the use of digital technologies is higher than the EU average. In 2019, 90% of Slovenians (EU: 80%) estimated that they were sufficiently skilled in the use of digital

[169] Source: Special Eurobarometer 460, 2017. The response "a positive impact" combines the responses "a very positive impact" and "a fairly positive impact". Among innovation leaders, Slovenia is preceded by the Netherlands (85%) and followed by Sweden (79%), Denmark and Finland (both 76%).

[170] The response "a positive attitude" combines the responses "a very positive attitude" and "a fairly positive attitude". Denmark (82%), the Netherlands (81%), Sweden (80%) and Finland (79%).

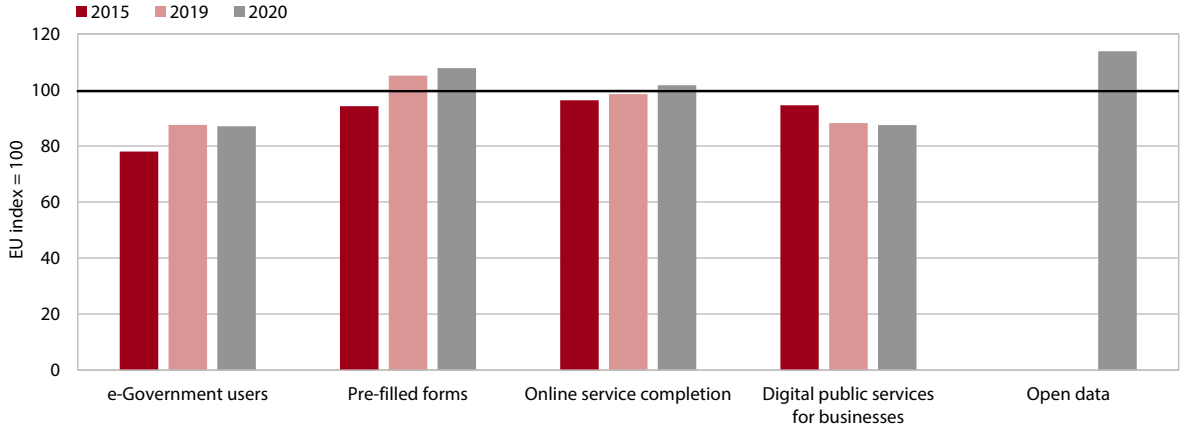
[171] Denmark (57%), the Netherlands (63%), Sweden (64%) and Finland (68%).

technologies to do their job and 72% (EU: 68%) that they were sufficiently skilled in the use of digital technologies in their daily life.[172] Both shares had increased relative to 2017. The share of respondents who agree that they are sufficiently skilled in the use of digital technologies to do their job increased slightly more (by 6 percentage points), ranking Slovenia 5th among EU Member States (after Sweden, the Netherlands, Denmark and Germany). According to Slovenians, the main barriers to improving digital skills are the lack of time (31%), the assumption that there is no need to improve one's skills (29%) and the lack of appropriate training opportunities (26%). All values are higher than the EU average.

4.2.2.3 Digitalisation of public services through digital accessibility

With regard to the digitalisation of public services, the key problem is services for businesses, in addition to problems in the use of e-government solutions. According to the 2020 Digital Economy and Society Index (DESI), Slovenia ranks 17th among EU Member States in terms of digital public services, where it is progressing on average in line with the average rate in the EU. Slovenia achieves better results in terms of the supply of e-government services, where it stands out especially according to the high availability of open data, while relatively high or above EU average are estimates of pre-filled e-government forms and the possibility of online completion of administrative services for major life events. However, Slovenia continues to lag far behind in the use of digital public services for businesses (which businesses point out as an obstacle to their digitalisation; see Erjavec et al., 2018) and the share of e-government users, as digital channels of these services are poorly known and too complicated. Most e-services rely on qualified digital certificates, which are relatively complex for the average user, while low trust and the absence of unique and secure identifiers are stated as a disadvantage in the uptake of digital public services for businesses.[173]

Figure 33: Slovenia maintains a fairly unchanged ranking among EU Member States in terms of public digital services, which indicates room for improvement



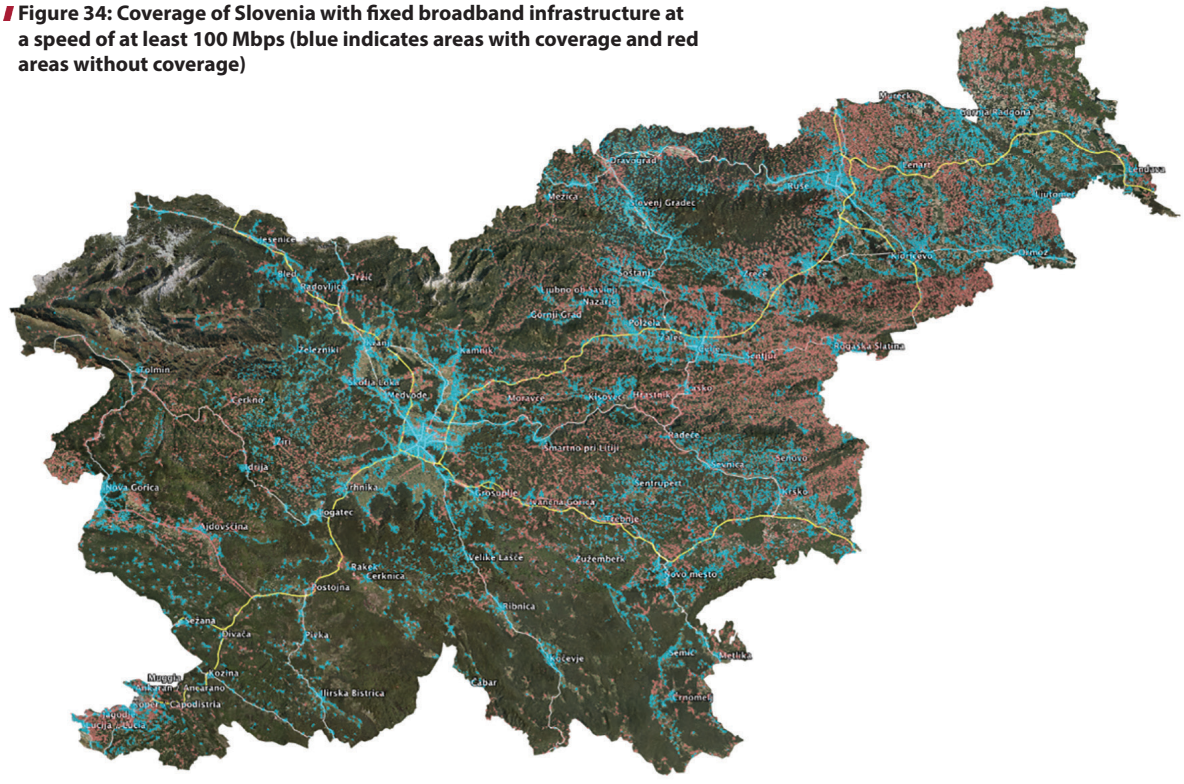
Source: Digital Economy and Society Index 2020, 2020.

[172] Special Eurobarometer 503, 2020. The response "agree" combines the responses "totally agree" and "tend to agree". A total of 36% of Slovenians (EU: 38%) totally agree with the statement that they are sufficiently skilled in the use of digital technologies to do their job, while 27% (EU: 30%) totally agree that they are sufficiently skilled in the use of digital technologies in their daily life.

[173] Digital Economy and Society Index (DESI) 2020. Slovenia. (2020). Brussels: European Commission.

In terms of connectivity, Slovenia is losing its advantage over other countries in the EU, while lagging behind in the implementation of new generation technologies and, potentially, their regional coverage. The coronavirus crisis has shown how critical digital accessibility is, not only in terms of access to broadband and fixed and mobile networks, but also in terms of access to high-capacity networks. Slovenia has no problems with basic services in both mobile and fixed networks, but it lags behind in advanced solutions. For example, it lags significantly behind in terms of the number of subscriptions per capita with access to mobile broadband and, though it exceeds the EU average in normal broadband access via the fixed network, it lags behind in access to the fixed network with at least 100 Mbps transfer rate. With regard to the latter, infrastructure coverage can also be problematic, as shown in Figure 35, although the situation in this area is expected to gradually improve,[174] without which it is difficult to imagine balanced regional development. The situation with regard to the 5G network is expected to gradually improve as the first commercial network, which is expected to provide approximately 25% coverage and even 33% coverage by the end of 2020,[175] was presented to the public in July 2020, but this will still not affect the value of the DESI 5G indicator that measures the share of allocated spectrum for 5G use – the auction of these frequencies is scheduled for the beginning of 2021.

Figure 34: Coverage of Slovenia with fixed broadband infrastructure at a speed of at least 100 Mbps (blue indicates areas with coverage and red areas without coverage)



Source: The AKOS geoportal is available at https://gis.akos-rs.si/HomePublic/OPTPogledResult/slo (both retrieved on 25 September 2020).

[174] For more information, see the RUNE project, which aims to provide access to ultra-fast broadband infrastructure in rural areas, at https://www.ruralnetwork.eu/.

[175] See https://www.rtvslo.si/gospodarstvo/tehnologija-5g-od-zdaj-na-voljo-uporabnikom-telekoma/.

4.3 Implications for the corporate sector

Digitalisation is changing the nature of innovation, which is characterised by the key role of data, servitisation and new business models, acceleration of the innovation cycle and the need for collaboration and multidisciplinarity. First, the management of data, both internal and external, is a key factor and prerequisite for digitalisation and innovation in the digital age, as they are the basis for business optimisation and flexibility and for the development of new, customer-tailored products and business models (OECD, 2020l; Eurofound, 2018). Second, another feature is partial servitisation or even "anything as a service", which further blurs the line between manufacturing and services and allows upgraded or completely new business models (e.g. the collaborative economy or digital cooperatives) .[176] Third, the innovation cycle, time to market, will be significantly accelerated by real-time data, including those related to the monitoring of market needs, digital simulations or accelerated prototyping, further increasing the importance of lean and agile business methods in conjunction with tools such as a digital twin[177] (OECD, 2019l; McKinsey Global Institute, 2019c). Finally, innovation in the digital age requires multidisciplinary and more open integration, complementarity and integration of knowledge, experiences and technologies, not only because of the greater likelihood of developing new ideas and solutions (Eurofound, 2019a; OECD, 2019l; BCG, 2019; Wostner, 2017), but also because of the need to share costs and higher risks related to increased uncertainty and unpredictability (OECD, 2020l; McKinsey Global Institute, 2019c).

84% of technology suppliers expect new competitors in their field, which indicates the need not only to respond quickly to change, but also to take a proactive approach, i.e. to stimulate shocks, based on own breakthrough innovations.

The digital economy requires even greater (flexible) specialisation, a transition from a sectoral to an ecosystem approach and a greater emphasis not only on rapid response, but also on own, disruptive innovations. With digital transformation, the functions of businesses within global value chains will be redefined (McKinsey Digital, 2015; Bain, 2017). First, given the reduced transaction costs and further increased competition (McKinsey Global Institute, 2019c), this will require even greater (flexible) specialisation from businesses (McKinsey Digital, 2015), along with different approaches, especially in manufacturing, e.g. by mass customisation (Eurofound, 2019a; McKinsey, 2019) or the integration of solutions that enable increasingly important end-to-end visibility and traceability of value chains (Bain, 2020b; EIU, 2017; BCG, 2019). Second, the boundaries of individual sectors are becoming increasingly blurred (OECD, 2019a), so a transition from sectoral to cross-sectoral and open integration, pooling and complementarity, i.e. to an ecosystem approach, is necessary (BCG, 2020). It is estimated that 83% of digital ecosystems involve stakeholders from four or more sectors and 53% even from six or more sectors (BCG, 2019, p. 14). Finally, in the digital age, virtually all market segments are increasingly subjected to shocks by new players, including small and medium-sized enterprises and start-ups, enabling rapid and global commercialisation without prior critical mass (OECD, 2019a). According to the McKinsey Digital survey (2015), 84% of technology suppliers expect new competitors in their field, which indicates the need not only to respond quickly to change, but also to take a proactive approach, i.e. to stimulate shocks, based on own breakthrough innovations (OECD, 2020n).

[176] According to the Deloitte (2020d) survey, upgrading business models is one of the key aspects of digital transformation, as 30% of businesses with more than 20% growth have already redesigned their business model. For more information, see McKinsey Digital (2015), McKinsey Global Institute (2019c), Eurofound (2019a) and OECD (2019l and 2020l).

[177] (Deloitte, 2020) identifies a digital twin as one of the six key technology trends of 2020.

4.3.1 Key orientations for the corporate sector

I. **An immediate and strategic approach to digital transformation based on clearly defined – and where appropriate niche – key competences and functions within changing global value chains.**[178] As shown in Section 4.1.2.3, the speed of transformation is crucial, as pioneers are estimated to achieve significantly better economic results than those who lag behind in the digital transformation process. Although „uncomfortably fast transformation" (Bain, 2020b, p. 8), i.e. rapid implementation despite a range of unknowns, is recommended, especially in the less aware or prepared environments, it is crucial that a strategic approach is used with strong leadership by decision-makers in businesses (Deloitte, 2019) – where such a strategically driven approach is taken, the probability of success increases threefold (Bain, 2020b). Through this process, businesses are required to clearly define their key competences and, if necessary, redefine the function or position of the enterprise in the market or in the context of changing global value chains (McKinsey, 2019; Roland Berger, 2019), with a strong emphasis on taking into account the ground-breaking changes of the coming decade, including being prepared for different scenarios (PwC, 2019b).

74% of directors consider employee training and development as their absolute priority, i.e. before all others, even technology investments.

II. **Intensive investment in (lifelong) learning of employees and the establishment of a "digital mindset and culture".** The BCG (2019) analysis shows that this is one of the key priorities and that 51% of digital champions intend to digitally train at least 20% of all employees in the next three years, while the corresponding share of businesses lagging behind is only 29%. Similarly, Deloitte (2020d) found that 74% of directors consider employee training and development as their absolute priority, i.e. before all others, even technology investments. This is not a one-off measure, but the introduction of an ongoing learning process that will be marked by a change in the culture, organisation and structure of employees at all levels (McKinsey Global Institute, 2018c). The digital culture or the transition to a „digital mindset" that encourages addressing „old problems with fresh eyes and new approaches" (Deloitte, 2019), including experimentation and risk-taking, is a particularly major challenge for more traditional environments, which is a prerequisite for effective digital transformation. Thus, it is not surprising that more mature businesses pay four times more attention to this area than digitally less mature ones (ibid., p. 11).

III. **Acceleration of investment in digital projects and upscaling of their use to the level of entire businesses.** According to BCG (2019), businesses undergoing a successful digital transformation invest significantly more in digital projects, especially in databases, technology and business growth, with an emphasis on the importance of data that have a particularly strong impact on business operations (Deloitte, 2020c). The BCG (2019) identifies as significant investments those cases where businesses allocate at least 5% of their current expenses to digital projects, of which 72 are leading businesses and only 50% are lagging behind. Furthermore, at least in the initial stages, digital transformation projects are not necessarily expensive: according to research by Laczkowski, Tan and Winter (2019), in the United States, 68% of such projects cost less than USD 250,000 in the last decade and only 16% cost more than USD 1 million. Successfully digitally transformed businesses generate 74% of estimated benefits in the first 12 months (ibid., 5). However, not all such projects are successful – according

[178] According to the survey (McKinsey & Company, 2019), 68% of surveyed businesses consider the implementation of I4.0 solutions as their first strategic priority (ibid., p. 9).

to Bain (2020a), more than half of them are in fact unsuccessful. The process of digital transformation can therefore in principle be monetised relatively quickly, but a more comprehensive and in-depth transformation requires deep investment of both time and resources, which businesses worldwide are doing more intensively (McKinsey, 2019; Deloitte, 2019). The complexity of a more comprehensive transformation is also indicated by the fact that expanding the use of pilot solutions to the level of entire businesses is one of the key dividing lines between digitally successful and less successful businesses (BCG, 2019; Bain, 2020b).

IV. **The digital economy requires a transformation of the organisation and operation of businesses with a greater emphasis on an agile, multidisciplinary, multifunctional and open, collaborative approach.** The digital transformation does not necessarily require setting up new factories, as 80% of all transformations are expected to take place within existing ones (Bain, 2020b), but it does require a thorough adaptation of business processes and organisation, which is one of the key dividing lines between successful and unsuccessful businesses. Thus 80% of leading businesses have successfully developed next-generation organisational structures that require accelerated implementation of changes based on agile management (ibid.) and a multidisciplinary, multifunctional and collaborative approach (McKinsey Global Institute, 2018c). This requires an adjustment towards the implementation of intelligent work processes[179], which is a key factor in the success of transformation, in addition to data management (Deloitte, 2020c). This requirement may explain why the digital transformation process is so demanding, as it not only involves technology but, indeed mainly, people (McKinsey, 2019), specifically the entire ecosystem in which businesses operate (OECD, 2019a and 2019l); this as a whole allows or promotes the implementation of new, digital business models.

4.4 Implications for the state

Given the complexity of the challenges that will require a stronger role of the state,[180] the state has to act strategically, i.e. in a comprehensive, coordinated manner and with a long-term perspective... Based on the interplay of the mega-trends presented, the emergence of major „turbulence and volatility" is expected in this decade (Bain, 2018), which will require governments to manage a „complex range of continually unfolding, interrelated, and often unpredictable developments" (OECD, 2019a). Apart from the need to increase the agility and institutional capacity of the public sector in order to manage complex systems (OECD, 2020l), this will require the development of comprehensive policy packages[181] also addressing less standard areas, such as inclusion and social and territorial disparities, in addition to traditionally complementary policies (e.g. research and innovation policies with human resources development). As a result, it is not surprising that the literature points to the need for enhanced coordination (Eurofound, 2019a; UNIDO, 2019), which has so far posed considerable difficulties for Slovenia (IMAD, 2020a). In this context, notwithstanding the short to medium-term challenges related to COVID-19 and the employment crisis, it is essential that governments do not neglect long-term

[179] For example, the automation of decision-making processes (linked to capacity allocation or dynamic pricing policy) or the automation of customer and/or employee relationships (Deloitte, 2020c).

[180] The role of the state is to be enhanced in order to promote and manage digital transformation (see Section 4.1.3.2) and due to the consequences of the coronavirus crisis (see Section 3.4).

[181] See, e.g., OECD, 2019a and 2020l, UNIDO, 2019, EIB, 2019b, Sorbe, Gal, Nicoletti & Timiliotis, 2019, or Tang & Wang, 2019.

structural changes in the process of policymaking and preparing policy packages, such as skilled labour force shortages (OECD, 2020l); McKinsey Global Institute, 2020a; IMAD, 2019b).[182]

... this requires an open, networked and collaborative approach with the business sector and society in general, as it allows for a responsive and tailored development policy... A networked and collaborative approach implies a more open approach to public governance, with increased reliance on the established formal networks (e.g. through the Economic and Social Council) as well as more informal networks as a way „to mobilise and engage citizens and organisations in the development, implementation and monitoring of public policy" (OECD, 2020n). Such an approach assumes a higher degree of trust on the part of society, and this is an area where Slovenia also faces significant challenges (see Section 2.2.4). In addition to greater dynamism and bridging the information asymmetry of the public sector, the collaborative approach facilitates new processes for discovering opportunities, learning and experimentation, which are of key importance to addressing the complex challenges of the digital age (Rodrik, 2004; Forey, David & Hall, 2009; OECD, 2020l and 2020n). In addition to their systemic nature, the policy packages must be highly responsive to changing situations and tailored to different areas (OECD, 2019l and 2020l) and target groups (UNIDO, 2019). In order to achieve this goal, roadmaps, prepared on the basis of a networked and collaborative approach, are often referred to as examples of good practice; these, pursuant to a „shared vision for the future" (OECD, 2019l), enable not only tailored policies but also better exploitation of synergies and risk-sharing among stakeholders themselves and between them and the state (Roland Berger, 2015).[183]

... which, however, must be both predictable and credible. The creation of conditions favourable for a digital transformation is a complex process (WEF, 2017; ECB, 2020; OECD, 2019a), which is further complicated by the fact that it is difficult to define priorities in their context, as enabling conditions complement each other and therefore need to be established in parallel for successful transformation (Wostner, 2017; UNIDO, 2019). This requires not only substantial investment, but also the development of institutions, skills and mutual trust among stakeholders (Rodríguez-Pose, 2020), which takes time (Wostner, 2017), but the ever-changing development policy makes this impossible or at least difficult. It is therefore important that it is predictable and credible in terms of known procedures about when and how changes will occur, so that the stakeholders of the non-public sector can systematically adjust their expectations and activities – and these are qualities which policy in Slovenia has not particularly manifested to date (Leon et al., 2018).

[182] An interesting example from practice of how governments help each other to successfully address such challenges is the Danish Disruption Council, chaired by the Prime Minister, who, jointly with seven ministers and 29 stakeholders, addresses the impact of automation on productivity and jobs (see https://www.regeringen.dk/media/6332/regeringen disruptionraadet_uk_web.pdf). Another example is Singapore's Future Economy Council, where the Deputy Prime Minister and the Minister of Finance, together with stakeholders, based on a systematic analysis of future trends, ensure a systemic and long-term stable approach in areas that are crucial for productivity growth, for example clustering and the development of skills and innovation (see https://www.mti.gov.sg/FutureEconomy/TheFutureEconomyCouncil).

[183] In this area, Slovenia, with its smart specialisation strategy and the preparation of action plans by the Strategic Innovation Partnerships, constituted, at least up to 2018, an example of good practice – see Smart Stories on the European S3 platform: https://s3platform.jrc.ec.europa.eu/-/intensifying-innovation-cooperation-through-slovenian-smart-specialisation-strategy.

4.4.1 Key orientations for the country

Successful digital transformation in the public sector domain is defined by the following enabling conditions (adapted after European Commission, 2018b, andOECD, 2020l):

(i) Promoting the digital transformation of the business sector.
(ii) Business environment with a digital-innovation ecosystem.
(iii) Knowledge and skills development tailored to medium-term needs.
(iv) Adequate infrastructure, cybersecurity and open data.
(v) Mobilising society for change and an inclusive transition.

4.4.1.1 Promoting digital transformation

Most countries are introducing I4.0 solutions strategically... Countries address digital transformation issues through different systemic approaches, in particular through digital strategies, platforms for the introduction of 4.0 solutions and, for more demanding technologies, artificial intelligence strategies which are already in place today in all countries, both developed and developing ones.[184] Typically, these strategies focus on promoting the use of digital technologies, including training, promoting entrepreneurship, start-ups and experimentation, developing R&D capacities, especially when it comes to the most advanced technologies, promoting cooperation, and addressing societal challenges (Planes-Satorra & Paunov, 2019), which means that they are comprehensive in nature. Also characteristic is that, as a rule, they address both the supply and the demand side in a coordinated manner.

... in this respect, Slovenia's competitors have, as a rule, more ambitious programmes, while the most advanced countries have significantly more ambitious programmes. Even without taking into account the mega-projects of large countries, where several billion-worth investments may also be made in individual projects,[185] Slovenia's competitors have a stronger financial support for their 4.0 programmes. For example, Portugal has earmarked EUR 4.5 billion for its I4.0 programme, which contains 60 measures, for the period 2017–2020, while Italy has earmarked EUR 18 billion for its Piano Industria 4.0 programme, which, in addition to the „Support to digitisation and digital transformation of enterprises" programme, exceeds the comparable amount of funds per capita and per year in Slovenia by 11 and 8 times respectively, even taking into account R&D tax deduction. Even the more modest Lithuanian Pramonė 4.0, which is estimated at EUR 80 million, still surpasses the comparable intensity of the support provided to the Slovenian programme by 75 percent. However, a direct comparison is not entirely objective due to the different width of policy measures, although precisely the extent and ambition of such measures[186] reflect the level of priority given by the various countries in this area. At the same time, the above figures do not include any additional measures deriving from the COVID-19 crisis, which will give further impetus to this area – for example, in July 2020 South Korea adopted a National Strategy for a Great Transformation,

[184] For a review, see e.g. Planes-Satorra & Paunov, 2019; European Commission, 2018f; UNIDO, 2019; or Eurofound, 2018.

[185] See the examples of Chinese artificial intelligence projects https://www.charlottestix.com/ai-policy-china or https://media.nesta.org.uk/documents/Nesta_TheAIPoweredState_2020.pdf, all of which are part of the comprehensive strategic plan "China's New Generation Artificial Intelligence Development Plan" of 2017, available at https://www.newamerica.org/cybersecurity-initiative/digichina/blog/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017/.

[186] For example, the Italian plan includes a wide range of tax measures in connection with direct financial supports of all kinds (see e.g.https://www.mise.gov.it/index.php/en/202-news-english/2036690-national-industry-4-0-plan).

pursuant to which more than 8% of their GDP would be additionally invested in digital and green transformation (Government of Korea, 2020).

Slovenia has recently developed a range of financial and substantive supports, but these need to be upgraded and, above all, strengthened. For example, the „Supporting the digitisation and digital transformation of enterprises" in conjunction with SID Bank instruments programme foresees a range of mutually reinforcing and internationally comparable measures. However, supports are not available at all times and are not predictable enough (e.g. there was a cancelled public tender for digital transformation due to the transfer of funds to other, COVID-19 crisis-related, programmes) and are not sufficient to continuously cover the whole of Slovenia or all types of businesses (for a long time, the public tender for digital transformation was available only to small and medium-sized enterprises from Eastern Slovenia), and too little attention is paid to introducing more complex technologies, for example on the basis of digital twins.[187] The importance of digital transformation has been boosted by the COVID-19 crisis and, following the example of leading countries such as South Korea, these instruments should be further strengthened – see Section 3.3. Ireland and Singapore are considered examples of good practice in promoting digital transformation: a complex range of support, both financial and substantive, is available to businesses on a continuous basis and, above all, quickly.[188]

Advanced digital technologies require increased investment, especially in research, development and innovation, and other forms of intangible and tangible capital. Slovenia needs to step up its investment in knowledge of all kinds and its investment in tangible capital, in particular ICT equipment, to enhance its economic attractiveness – see Sections 2.1 and 3.1. In this context, investment in research, development and innovation, which is also necessary to promote digital transformation, is particularly important, as available (4.0) technologies require adaptation to specific and local needs (OECD, 2018b). In this respect, it is essential not only to further support R&D projects and programmes at both higher and lower TRL[189] levels, including through the promotion of consortia approaches between the public and private sectors,[190] but also to increase the funding of the public scientific and research system (UNIDO, 2019; OECD, 2020l). The complexity of future technologies exceeds the capacities of individual enterprises, so public support is necessary (OECD, 2020l). In view of the growing importance of services and new business models, support for service innovation should also be strengthened (OECD, 2020l).[191]

The public sector needs to step up the provision of efficient digital public services to citizens and in particular to businesses, while strengthening direct support on the demand side. The quality of digital public services for businesses needs to be improved, as Slovenia is lagging behind considerably in this area, which also applies to the introduction of smart solutions that are either in the domain of or closely linked to the public sector, for example the introduction of smart and circular communities.[192] The last is also related to the implementation of innovative

[187] It identifies digital twins, e.g. (Deloitte, 2020), as one of the key technological trends of this year.

[188] For example, in Singapore, the government agency pre-identifies a set of suitable IT solutions and businesses apply for support through a single government portal and thus get access to the necessary software almost immediately.

[189] Technology readiness level.

[190] These, in line with examples of good practice such as the German SME 4.0 competence centres, the Danish MADE programme, Irish technology centres and Israeli innovation laboratories, should be expanded with demonstration, piloting and testing capacities (OECD, 2019l).

[191] Examples of good practice in this area include the "Smart and Digital Services" programme from Austria (Gönenç & Guérard, 2017) and "Service Design Vouchers" for small and medium-sized manufacturing enterprises in the Netherlands (OECD, 2020l).

[192] This is an important lever for the digitisation of both society and the corporate sector – for an example of good

public procurement, where Slovenia has virtually no successfully implemented case, and the same applies to enabling increasingly important experimentation through regulatory sandboxes (OECD, 2019l; McKinsey, 2020 g; OECD, 2020p).[193] There is also considerable room for improvement in promoting the use of public services for the population (especially through improving the user experience of services) and in the operation of the public sector, for example standardised business cases, agility of project management and the quality of coordination of digitisation-related policies, which would speed up the implementation of umbrella strategies.[194]

4.4.1.2 A business environment with digital-innovation ecosystem

The quality of the business environment continues to be a prerequisite for competitiveness also in the digital age... As pointed out in Section 2.1, short-term measures during the COVID-19 crisis aimed at keeping businesses going are reasonable and necessary, but in the medium and long term it is crucial that the business environment is as dynamic as possible (OECD, 2017a) and that it is responsive and flexible (OECD, 2018e), i.e. that it stimulates the growth and entry of new, highly productive enterprises, while the less productive exit the market (OECD, 2018b; ECB, 2020). As a prerequisite for a dynamic business environment, it is therefore first necessary to ensure clear business conditions, without unnecessary administrative procedures, while at the same time protecting the rights of stakeholders in the business process.[195] According to Calvino, Criscuolo & Menon (2016), less favourable business conditions affect the growth dynamics of new businesses more strongly than already existing ones.

... which, however, needs to be upgraded with an efficient digital-innovation ecosystem for the transition to innovation-supported growth. The most successful businesses in terms of innovation are increasingly cooperating with the external environment (BCG, 2019),[196] which can be accelerated by the state through the development of a digital-innovation ecosystem (OECD, 2019l). In addition to providing substantive advice, in particular to SMEs,[197] it promotes „effective dissemination, circulation, commercialisation, use and adaptation of new products,

practice in Slovenia, see https://www.energetika-portal.si/nc/novica/n/projekt-razogljicenja-slovenije-preko-prehoda-v-nizkoogljicno-krozno-gospodarstvo-4278/.

[193] That this is an important aspect has been shown by the research study of Erjavec et al. (2018), according to which the inability to experiment quickly was identified as the third most important obstacle to faster digitisation of businesses.

[194] According to the OECD Review of Digital Public Administration (OECD, 2020o), Slovenia has the capacity for a quick and agile digital adaptation, which, by offering digitalised public services, is an additional incentive for digital transformation.

[195] These are in particular the conditions for opening businesses and the related permits, including regulated professions and products (OECD, 2017a), dispute settlement procedures, contract enforcement, access to premises (e.g. building permits), and financing, trading and financial business conditions, i.e. insolvency and compulsory winding-up procedures for legal entities. While Slovenia has moved up from 25th to 12th place among EU countries according to the World Bank's Doing Business Index over the last ten years, business conditions remain remarkably uneven, and consequently the business operation phase should be addresses as a priority (see IMAD, 2020a); in addition, accessibility to certain financing sources remains poor, especially in the field of venture capital (European Commission, 2020c).

[196] The share of strong innovators involved with incubators was expected to grow from 59% to 75% between 2015 and 2018, the share of strong innovators participating in academic partnerships rose from 60% to 81%, and the proportion of successful innovators cooperating with other businesses in the same period increased from 65% to 83% (BCG, 2019, p. 14). These shares are well above those established for Slovenia in Section 4.2.1.4.

[197] In the digital transformation process, small and medium-sized enterprises in particular face a number of challenges which justify not only financial but also substantive support from ecosystems. In addition to the difficult integration of databases and business processes, 4.0 solutions must as a rule be integrated or individualised according to the specific needs of a specific business (OECD, 2020l), which also explains why the substantive part of the supporting environment, for example in the form of digital innovation hubs connecting providers of such services, is of such importance.

processes and services, including digital ones" (ECB, 2020). The role of intermediary institutions is performed by the start-up support environment, incubator networks, accelerators and technology parks (McKinsey, 2020g), and the literature particularly emphasises the growing importance of so-called strategic partnerships.[198] Within their context, closer inter-institutional relations between stakeholders are to be established over time, with the goal to „foster joint value creation, expand market potential and combine strengths in a way that allows closing skills or competence gaps" and which may include „sharing a range of infrastructures, investments or data" (OECD, 2019l). In recent years, Slovenia has been working in the right direction in developing a digital-innovation ecosystem, for example by establishing strategic research-innovation partnerships (IMAD, 2020a). On the other hand, the ecosystem remains extensively[199] diversified and needs to be optimised in terms of capacity-building and, above all, towards a more coordinated, systemically and long-term supported and targeted provision of ecosystem services (OECD, 2020l), which SPIRIT has already embarked on.[200]

Cutting-edge digital-innovation ecosystems are characterised by strong international involvement and an emphasis on innovative, cross-sectoral and multidisciplinary approaches. Empirically, clusters of complementary economic activities have a significant impact on both wage levels and economic growth (Ketels & Protsiv, 2020; Hollanders & Merkelbach, 2020), so going beyond sectoral approaches both in ecosystem operation and development policies is of key importance.[201] The need for openness, participation and multidisciplinarity also speaks in favour of a cross-sectoral approach, which is reflected in a greater likelihood of developing new ideas and solutions and, consequently, higher levels of innovation, especially the smarter innovation (Eurofound, 2019a, OECD, 2019l); BCG, 2019). One of the key functions of the digital innovation ecosystem is to promote internationalisation and identify new opportunities within global value chains, including the promotion of closer cooperation in research and development and the use of innovative approaches such as the European Strategic Forum for Important Projects of Common European Interest[202] and/or forms of closer international and/or interregional (development) cooperation such as the Sino-German Industrie 4.0 Cooperation (see UNIDO, 2019) or the Vanguard Initiative[203], in which Slovenia is also actively involved.[204]

[198] See, for example, OECD (2019l and 2020l); UNIDO (2019); McKinsey Digital (2015). European institutions more often mention clusters (see, e.g., https://ec.europa.eu/growth/industry/policy/cluster_en), and in the context of digital ecosystems also digital innovation hubs (see https://ec.europa.eu/digital-single-market/en/digital-innovation-hubs and, for a review of the existing ones, https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool).

[199] The positive aspect of diversification is reflected in the breadth of ecosystem services, which also address the creative part of the supporting environment (the Centre for Creativity or both networks of creative art centres), and the negative aspect in the lack of focus (certain areas are without support, as no one, for example, provides funding for concept verification, while too many institutions are involved in "everything", e.g. where there are ten digital innovation hubs), in overlapping of services offered (e.g. between incubators, accelerators and technology parks) and the consequent fragmentation of capacities, resulting in lower service quality and a territorial approach which does not provide services in all parts of Slovenia, at least not at the appropriate level of quality (e.g. when it comes to a network of learning manufacturing laboratories).

[200] Including with the help of the European Commission's technical assistance (the Structural Reform Support Service), which published a public tender for a study on how to strengthen the innovation ecosystem in Slovenia in July 2020.

[201] On this is also based the non-sectoral logic of the smart specialisation concept (Forey, David & Hall, 2009), according to which strategic development and innovation partnerships at the level of Slovenia were designed (Bučar et al., 2019).

[202] Strategic Forum for Important Projects of Common European Interest.

[203] See https://www.s3vanguardinitiative.eu/.

[204] For an overview of this kind of cooperation in the period 2016–2018, see Government of the Republic of Slovenia (2019).

4.4.1.3 Knowledge and skills development tailored to medium-term needs

The digital transformation of society and the economy influences both needs for digital skills and needs for other knowledge and skills. To successfully meet the challenges and opportunities of digital transformation, the population needs a wide range of knowledge and skills, not only digital, but also, for example, textual, mathematical, creative and communicating) – see Morandini et al. (2020). Lifelong learning systems are essential for digital transformation and must meet the following conditions (OECD, 2019c, and Morandini et al., 2020):

(i) Enhancing lifelong learning requires high-quality and accessible education, sufficient expenditure on education, and the promotion of a lifelong learning culture for all citizens.

(ii) Rapid responsiveness and the adaptation of education to work needs are essential for the development of appropriate skills to meet the opportunities and challenges of digital transformation.[205]

(iii) Monitoring and anticipating the needs for knowledge and skills play an important role in ensuring that education responds quickly to labour market needs.

Box 2

Leading and strong innovator countries in the EU, which already have highly developed digital skills on average, are investing intensively in their further improvement:

- Denmark, Germany, Flanders and Estonia have established a Technology Pact in order to bring together different stakeholders in the development of digital skills (Whiteley & Casasbuenas, 2020).
- In Denmark, the Digital Skills for All education programme is being implemented; this includes the development of new educational programmes and promotes taking up natural science and engineering education programmes (VVA & WIK consult, 2019a).
- In the context of its Technology Pact, the Netherlands brings together educational centres, scholarships, cooperation, lifelong learning, mentoring, etc. with a view to developing a structured approach to provide a well-trained workforce with a sufficient number of technical staff for the jobs of the present and the future, with particular emphasis on reducing the shortage of technical profiles. The Netherlands is also implementing its Human Capital Digital Delta Agenda, which aims to promote regional cooperation, encourage and inform students, ensure a sufficient number of ICT teachers, and promote the lifelong development of the digital society (VVA & WIK consult, 2019b).
- In a similar spirit, the School 4.0 measure is being implemented in Austria[206].
- In Norway, the Future Skills Needs Committee has been set up to provide the best possible assessments of Norway's future skills needs as a basis for national and regional planning and strategic decision-making by employers and individuals (OECD, 2020r).

[205] Such a system requires the involvement of several stakeholders, i.e. at least the education sector, the economy and the state, but in practice also other stakeholders, for example regional authorities, associations, etc., with cooperation needed at national, regional and local levels. Such an approach makes it possible to overcome the shortcomings of individual actors, promotes innovative approaches, fosters the influence of different actors and is found to be more effective. Examples of countries that have developed successful approaches to addressing businesses' needs for digital and other knowledge and skills are the Benelux countries, the Nordic countries, Germany, Denmark and Ireland (Box 2).

[206] The measure includes the dissemination of basic digital education in schools by integrating it into curricula and promoting the digitisation of teaching.

– Estonia has already set up a system for monitoring and forecasting skills needs, which includes three dimensions: (i) national demographic projections, labour market projections and labour market supply projections for 8 years, (ii) sectoral skills forecasts incorporating in-depth information on skills needs for the next 10 years, (iii) short-term forecasts of skills needs, for one year in advance.[207] It also implements a programme for the development of advanced digital skills,[208] as does Sweden.[209]
– Meanwhile, France has introduced a system of individual education accounts to provide employees with money for education. In 2018 it offered EUR 500 per person or EUR 5,000 for 10 years and EUR 800 per year for the low-skilled. The individual can spend the money with a certified education provider. Upon the setting up of the system, a database of education providers and a system to monitor the development of an individual's skills were established. France has also developed a PIX platform for digital skills, an online service to help citizens in the assessment, development and certification of their digital skills.

Slovenia has been addressing skills that are important for digital transformation with various measures for young people and adults, which have been strengthened in recent years. In the field of adult skills development, the Skills Strategy Implementation Guidance for Slovenia – Improving the Governance of Adult Learning in Slovenia was adopted in 2018.[210] Measures are being taken to improve the general skills of adults[211] and the skills related to work needs, where an example of a successful measure that could have long-term positive effects on productivity and digital transformation are competence centres for human resources development;[212] the implementation of further professional/vocational education and training programmes could have a positive impact on labour force skills; [213] and the implementation of the measure of support to companies for active ageing of the labour force could have a positive impact on the productivity of older employees.[214]

[207] Adult learning policy and provision in the member states of the EU (European Commission, 2019).
[208] Estonia has adopted its "Choose it" programme, within which a pilot model for further education and training of IT professionals will be developed (VVA & WIK consult, 2019c).
[209] Sweden has adopted a programme aimed at further training of IT professionals at universities (VVA & WIK consult, 2019d).
[210] The guidelines were developed as a result of the multi-annual Skills Strategy project, in which Slovenia and the OECD participated (see IMAD, 2019c, for more information).
[211] National Reading Month (Ministry of Culture, 2019), Reading-Friendly Municipality, National Reading Month 2020.
[212] Competence Centres for Human Resources Development bring together Slovenian businesses into human resources development partnerships and represent an important incentive for employers to use employee development as a strategic tool for achieving greater competitiveness and better business results in the global economy. The results so far show the success of the Competence Centres for Human Resources Development, within which 46 competence centres have been established so far, more than 84,000 participations in trainings have been registered and more than 1,000 enterprises have joined the project (KOC programme achievements to date – Public Scholarship, Development, Disability and Maintenance Fund of the Republic of Slovenia). In addition to this measure, other measures for improving skills are being implemented, such as a public tender for co-financing the establishment and operation of competence centres for human resources development in the period 2019–2022, a public tender for the implementation of further vocational education and training programmes in 2018–2022, and the programme of comprehensive support for businesses to encourage active ageing of the workforce (ASI), 2017.
[213] The aim of the measure is to improve employees' competencies to reduce the discrepancy between qualifications and labour market needs (a public tender for the implementation of further vocational education and training programmes 2018–2022, 2018). In 2018 there were 7,164 participants involved in these programmes and in 2019 the number of participants reached 9,014 (ACS, 2019 and 2020).
[214] The measure includes a range of activities, among them improving the skills of older people and developing and introducing innovative solutions to maintain the commitment, productivity and efficiency of older workers (comprehensive support for businesses to encourage active ageing of the workforce (ASI) (Public Scholarship, Development, Disability and Maintenance Fund of the Republic of Slovenia). For more information on the project, see https://www.srips-rs.si/sklad/o-nas

The responsiveness of education to the short-term needs of the labour market in terms of skills is facilitated by the Employment Forecast[215] and the Vocational Barometer,[216] which, however, do not address the above-mentioned needs in terms of adaptation to medium-term changes. In higher education, measures are being stepped up to address the needs of the economy (establishing a system for monitoring the employment rate of higher education graduates,[217] a cooperation measure between higher education and the economy[218]). In digital skills development, measures are being taken in the formal education of children and young people to increase the accessibility of ICT and its use in education,[219] and some additional measures have been taken following the outbreak of the coronavirus epidemic[220]. In higher education, the measure of integrating the use of information and communication technology in the higher education process is being implemented.[221] Several measures contribute to increasing the digital skills of adults (e.g. vouchers to raise the digital competences of employees in enterprises[222] and incentives for the digital transformation of small and medium-sized enterprises[223] and the acquisition of basic and professional competences, including ICT skills[224]). The Slovenian Digital Coalition – digitalna.si is expected to deal with the coordination of Slovenia's digital transformation in accordance with the adopted strategic documents.[225]

For a successful digital transformation of society and the economy, the following measures should be strengthened and/or developed in Slovenia:

(I) In the field of lifelong learning:

a) to increase the involvement of adults in lifelong learning, increase the motivation of adults to learn and promote a lifelong learning culture;
b) to develop retraining programmes and promote involvement in these programmes, in particular for employees whose jobs are at risk due to digitisation and automation or other reasons;
c) to further develop and strengthen lifelong career guidance programmes;
d) to strengthen state and business investment in education.

(II) In the field of higher education:

a) to increase the number of enrolment places in study programmes important for the digital transformation of the Slovenian economy;
b) to strengthen integration between higher education and the economy.

(III) At all levels of education:

a) to promote and facilitate greater responsiveness of education to the needs of the economy and society,

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[215] Analyses (ZRSZ), 2020.
[216] Results of Occupational Barometer 2019 (ZRSZ), 2019.
[217] Invitation to the presentation of the "Establishing a system for monitoring the employability of higher education graduates in Slovenia and the upgrade of the eVŠ" project (MIZŠ), 2019.
[218] Each academic year there are more than 150 successfully completed projects that connect students with the economic sector (Creative Path to Knowledge (PKP), Public Scholarship, Development, Disability and Maintenance Fund of the Republic of Slovenia).
[219] To this end, the ICT-supported Innovative Learning Environments project is being carried out (see https://www.inovativna-sola.si/about-us-1/), Programme for further setting up of ICT infrastructure in education – SIO-2020.
[220] Slovenia has taken measures to provide ICT technology and equipment to pupils who did not have it (see "Report on the implementation of measures in education during the COVID-19 epidemic" (MIZŠ, 2020); it also adopted the programme "COVID-19 – the provision of ICT infrastructure as the basis for distance learning" (SVRK, 2020) and a measure to subsidise the preparation of materials for the provision of digital resources to enable distance learning (MIZŠ, 2020)).
[221] The public tender "Integrating the use of information and communication technology in the higher education process". 2017.
[222] Vouchers for improving digital competences of employees in enterprises (Slovenian Enterprise Fund, 2019).
[223] The public tender "Incentives for the digital transformation of SMEs (P4D 2019–2023)". (SPIRIT, 2019).
[224] The public tender for acquiring basic and professional competences from 2018 to 2022, 2018.
[225] Digital coalition, link: https://www.digitalna.si/digitalna-koalicija

b) which calls for high-quality and up-to-date data on current and future skills needs. Accordingly, along with the already existing short-term system for monitoring these needs, it is necessary to establish as soon as possible a medium-term system for monitoring and forecasting the skills needs of the society and the economy (career platform).

(IV) In order to improve digital skills, it is crucial to:

a) facilitate and promote the involvement of young people and adults in education and training programmes aimed at improving digital skills and to develop education and training programmes for this purpose;
b) provide modern ICT infrastructure equipment, develop didactic methods and enable continuous professional training of teachers in formal education;
c) promote enrolment in the ICT field in tertiary education with the goal of providing human resources in the field of advanced digital skills;
d) increase enrolment in natural sciences and technology;
e) develop skills in the field of artificial intelligence.

4.4.1.4 Infrastructure, security and open data

In an age when digital accessibility is considered by some to be a basic human right,[226] countries will differ increasingly in terms of the quality of services provided by new generation technologies, including security, which are crucial to I4.0. For I4.0 not only access provided by optical network will be important (Čater et al., 2019), but also, for example, access to high-performance computing (HPC) and, in particular, to 5G (OECD, 2020l) networks. If Slovenia has already taken a step forward regarding the former by investing in the RIVR supercomputer centre at the University of Maribor,[227] the introduction of 5G networks, however, raises serious concerns among the public, in particular relating to their health impact. Without looking at the health aspect of this issue, which goes beyond the scope of this report, it is worth pointing out that 5G technology is crucial for the deployment of I4.0 solutions, as it opens up entirely new possibilities both in the provision of services and in the manufacturing process itself (McKinsey Global Institute, 2019c). McKinsey (2020h) thus predicts that by 2030, 5G will become the industry standard, with more than half of the sales of 5G IoT units linked to I4.0, followed by other uses related to smart cities, smart energy, connected offices and the like (ibid., p. 11). Assuming that large companies are already compelled to enter the 5G age, while for medium and small enterprises this is expected in 2023 or 2024, Slovenia will also have to look for solutions that will enable digital transformation, reservations notwithstanding, especially when it comes to the business sector. One of the potential solutions is private networks, which are also of interest to users in terms of cyber security, to which Slovenia, especially on the public side, will have to pay more attention.

Large companies are already compelled to enter the 5G age, while for medium and small enterprises this is expected in 2023 or 2024.

At the same time, the state will have to increase the responsiveness and flexibility of the regulatory framework and place even more emphasis on the availability of data and on (industrial) standardisation. In particular, the introduction of digital business models can be significantly hampered by the regulatory framework, which, in cases of insistence on traditional approaches or technologically biased requirements, in practice prevents new businesses from entering the market or creates unequal business conditions (OECD, 2018e). The

[226] See, for example, Reglitz (2019) or https://a4ai.org/covid-19-shows-why-internet-access-is-a-basic-right-we-must-get-everyone-connected/.
[227] Slovenia also hosts the head office of the High-Performance Cloud Computing Cross-Border Competence Consortium (HPC5), which also has the status of a digital innovation hub (see https://www.hpc5.eu/).

literature therefore recommends the introduction of flexible and technologically neutral standards (ibid., p. 15); by defining such standards, Slovenia would further enhance its activity at the international level, as these represent an important source of competitive advantage for leading businesses (WEF, 2017). Despite a relatively favourable picture, the integration and provision of open (public) data must remain a key priority, as their accessibility is not only important in terms of improving services for the population, but also represents an important comparative advantage for the business sector (OECD, 2020l; McKinsey, 2020g).

4.4.1.5 Mobilising society for change and an inclusive transition

An ambitious development policy based on a clearly defined strategy must create wider social and cultural conditions for change and for a successful transition and also mobilise the economy to this end. Although most countries, regions or cities already have some kind of digital transformation strategy in place, there are still considerable differences between them when it comes to their successful implementation (OECD, 2019m). In addition to the effective implementation of a series of measures, this is linked to the mobilisation of the economy and society for change (McKinsey, 2020g). Such mobilisation is a necessary condition not only for a rapid transformation or change of attitude towards digitisation, but also for creating the all-important digital mentality and culture, which is the basis for new business models, for example. Creating such an atmosphere presupposes a high level of trust and the explicit addressing of potentially negative aspects of digitisation, including, for example, the ethical dilemmas associated with the use of artificial intelligence (OECD, 2019k).

Technological developments are changing the manner and forms of work, including the necessary new skills, which calls for the adaptation of social security systems and education and training systems. Technological developments bring about major changes in the manner of work, highlighting online platforms that enable individuals to work mostly as independent contractors, with platforms enabling them to offer services and contact with consumers. Demands for ever-increasing flexibility in the labour market and the development of online platforms have led to an increase in non-standard forms of employment or forms of work. These bring greater insecurity to individuals but also make it easier to reconcile work and family life. Employees in non-standard forms of work are often exposed to greater insecurity and the risk of precariousness, which, according to the methodology of the International Labour Organisation (ILO), is identified in seven areas, including their inclusion in social security systems.[228] However, the flexibility in working time and location of work offered by digitisation and non-standard forms of work can make it easier to reconcile work and family life.

[228] These are the following areas: employment, pay, health and safety at work, social security, education and training, and representativeness and fundamental rights in the field of work. In addition to greater job insecurity, employees in non-standard forms of work are often exposed to lower pay for work, higher mental strain and thus health risks, and limited access to education and training.

Box 3 **White Paper on the Future of Work in Germany**[229]

The wide-ranging public debate on the challenges of the future of work in Germany has identified a number of challenges that we also have to address in Slovenia. In 2015–2017, the German Ministry of Labour conducted a wide-ranging discussion with experts and social partners on the necessary policy changes brought about by automation and digitisation, identifying the following challenges in this process:

(i) *ensuring a high level of employment and employability*, emphasising in particular the importance of continuing access to education and lifelong training, which can also be ensured by the transformation of unemployment insurance in the direction of a greater emphasis on assessing an individual's skills and providing appropriate training for each individual; [230]

(ii) *changes in the organisation of working time*, where, in addition to flexibility in time and location, an individual's right to sufficient rest during the week and during the weekend must also be guaranteed;

(iii) *ensuring good working conditions in service activities*, with emphasis on social protection (including appropriate wage levels) and other social services that can be provided through online platforms, including by extending the collective bargaining to these services;

(iv) *ensuring health and safety at work*, with emphasis on the adaptation of measures to increased psychological pressures and population ageing;

(v) *ensuring employee data protection*, with emphasis on the importance of protecting the personal data of employees who may be exposed to risks of data misuse in the digital economy;

(vi) *participation of all in co-decision processes*, where the importance of extending collective bargaining to the self-employed and those employed in other forms of work is particularly emphasised; and

(vii) *adaptation of social security systems* to ensure an adequate level of social security also for the self-employed and those employed in various non-standard forms of work.

In Slovenia, the social insurance system is to a certain extent already adapted to non-standard forms of work, but access to rights is still limited in some cases. In Slovenia, all four social insurance systems[231] cover all employees in employment relationship regardless of working time and duration of employment. However, the form of employment contract has a profound impact on the fulfilment of conditions and the obtaining of rights deriving from social insurance in our country (Bagari, Rataj & Strban, 2020). In the current systems, most difficulties in obtaining social insurance rights are faced by part-time employees[232] and the self-employed[233]. Social

[229] Federal Ministry of Labour and Social Affairs, 2017.

[230] An example of good practice is the Austrian model of leave for education and training, where employees have the opportunity to use 2–12 months' leave for education and training every 4 years.

[231] Pension and disability insurance, health insurance, unemployment insurance, and parental care insurance.

[232] Pension and disability insurance requires part-time employees to pay contributions to old-age pensions for proportionally longer periods of time than in the case of full-time employment.The fact that a part-time employee is granted wage compensation for temporary absence from work under health insurance only for the time when he or she is actually employed may be a problem from the point of view of providing social security if the actual workload is very small. In the case of part-time work, partial unemployment is regulated only when leaving unemployment, but not in the event of entering unemployment where an employee is employed on a part-time basis in the event of losing full-time employment.

[233] As a rule, self-employed persons are entitled to all rights under the same conditions as employees. However, they may have difficulties in the event of health problems, when they are entitled to a wage compensation for temporary absence from work only from the 31st day of absence onwards. It is also difficult for the self-employed to exercise their right to unemployment benefits, as deregistration from social insurance must be a

security systems must be adapted such that even those engaged in non-standard forms of work have adequate access to rights from social security systems. Crucial for inclusive transition is also maintaining employability and thus the opportunity to ensure an inclusive transition to the digital economy; in addition, access to appropriate training throughout the work career and lifecycle should be improved. Social partners must therefore work towards redesigning social protection systems so as to guarantee adequate social security for all workers.

Relative security enables a faster and more ambitious digital transformation than would otherwise be possible.

At the same time, technological developments and changes in the labour market call for reflection on a new social contract, including the setting up of reinforced safety nets, especially from the economic aspect. Globalisation, technological development and changes in the structure of activities and employment relationships can lead to increased labour market segmentation (Section 4.3.2), i.e. to highly paid professionals and low-paid workers working on online platforms and in service activities. With low employment security for many people working in non-standard forms of work, who are also not included in collective bargaining, this may lead to a stagnation of earnings and a change in the labour: capital distribution ratio (Bain, 2018; Eurofound, 2019b). A number of studies[234] therefore highlight the need to create a new social contract based on enhanced social dialogue, which will address the issue of ensuring social security and the right balance between the security and flexibility of work and adequate pay for work and access to lifelong learning. The motive for a thus reinforced safety net is therefore not only social, but above all economic, as people's relative security enables a faster and more ambitious digital transformation than would otherwise be possible (PwC, 2018b and 2019b; McKinsey, 2020g; Bain, 2018).

consequence of objective reasons (Bagari, Rataj & Strban, 2020).

[234] See, for example, Addeco Group (2018):Time to Act: creating a new social contract for work in the 21st century and Manyika James et al., 2020.

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Appendix 1 Detailed overview of the fiscal implications of ageing and possible responses

Projections of ageing population-related expenditure show that in the coming decades, both social protection expenditure (pensions, healthcare and long-term care) and the gap between the social expenditure and its funding sources can be expected to increase if policies remain unchanged. This is particularly true for countries where financing is based on contributions from the working population. Projections prepared by the EC Working Group on Ageing Populations and Sustainability show that, under current policies, this expenditure will increase from 21.8% of GDP in 2016 to 28.9% in 2050 (28.3% in 2070).[235] Although current expenditure does not deviate from the EU average, such an increase in the long term is one of the three highest in the EU. Below is a summary of the key drivers of expenditure growth and the possibilities for narrowing the gap with funding sources which were analysed in previous IMAD publications and in particular in the 2019 „Economic Challenges".

Slovenia stands out most in the projections of pension expenditure increase, from 10.9% of GDP in 2016 to 14.9% in 2070. Relatively late entry into the labour market and early retirement, reflected in the low employment rate of the 55–64 age group, make a significant contribution to the increase in pension expenditure.[236] At the same time, many countries already have stricter retirement conditions in terms of retirement age and plan to tighten them further by 2070, while Slovenia has plans to keep the same conditions throughout the period (we have not adopted a reform that would allow for a higher retirement age in the projections, although we believe it will increase in the future). According to the 2018 Ageing Report, current legislation provides for the same retirement age in 2016 and 2070 in only five countries, including Slovenia, while in all other countries, it is planned to be higher in 2070 than in 2016, as envisaged by the current legislation. At the same time, we are not among the 16 countries that have introduced the sustainability factor among pension parameters or some other automatic mechanism that takes into account demographic trends and/or the actual economic conditions, which could also lead to a lower share of expenditure in GDP (e.g. linking the retirement age to the increasing life expectancy).[237]

In Slovenia, social contributions of the working population are the predominant funding sources for social protection expenditure, but even today these dedicated sources are not sufficient to cover all expenditure, which is why other sources will be needed in the future. Due to demographic and technological changes (robotisation and automation) affecting the labour market, the problem of financing social protection systems can be expected to worsen in the future. An additional burden on the systems are non-standard forms of employment, often with lower contributions to social protection systems. Therefore, in addition to measures to slow the increase in social protection expenditure, measures will have to be taken in the future to compensate for the loss of revenue from social contributions in order to ensure the financing of growing needs. Even now, the gap between dedicated public sources and expenditure is most pronounced in pension

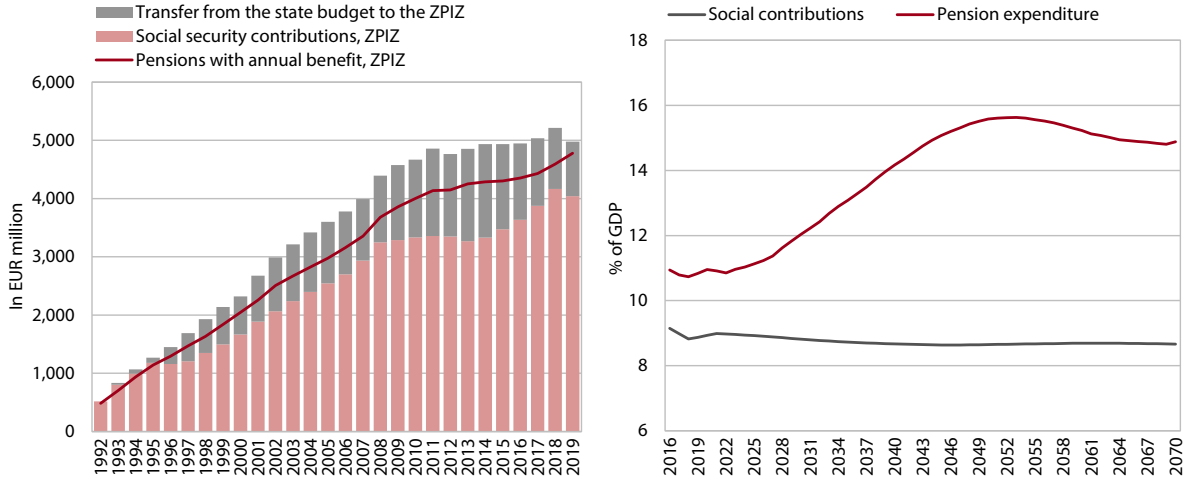
[235] The preparation of new projections, which will be published in spring 2021 in the 2021 Ageing Report, is underway.

[236] The data show the positive effects of the 2012 pension reform on slowing the growth in the number of old-age pensioners and raising the employment rate of the elderly, which still remains among the lowest in the EU (in 2019 Slovenia 48.6%; EU-28 59.1%).

[237] See also IMAD, "Short analyses: Long-term projections of pension expenditure – the method and methodology of preparation within the Working Group on Ageing Populations and Sustainability (AWG)", 2019.

expenditure, where the difference between revenue from social contributions and expenditure for pensions and other ZPIZ expenditure is covered by a transfer from the state budget. Pension expenditure in 2019 exceeded the contributions collected by 7% and the amount of transfer from the state budget reached one-fifth of pension expenditure. The contributions and/or the budget transfer cover not only pension expenditure, but also other ZPIZ expenditure, such as the payment of health insurance contributions for pensioners and certain transfers for the provision of social security (annual pensioner allowance, disability allowance, and assistance and attendance allowance).

Figure 35 Expenditure on pensions and their financing up to 2018 (left); long-term projections of pension expenditure and social contributions, % of GDP (right)



Source: MF (left); the 2018 Ageing Report, IER calculations, based on the Ageing Report assumptions (right).
Note: Pension expenditure covers expenditure on old-age pensions, disability pensions, survivors' pensions, farmers' pensions, military pensions, widow/widowers' pensions and other pensions. The sum of contributions and the budget transfer in the figure (left) is higher than the sum of pensions, as other expenditure (disability allowance, assistance and attendance allowance, and health insurance contributions for pensioners) are also covered from the ZPIZ revenue.

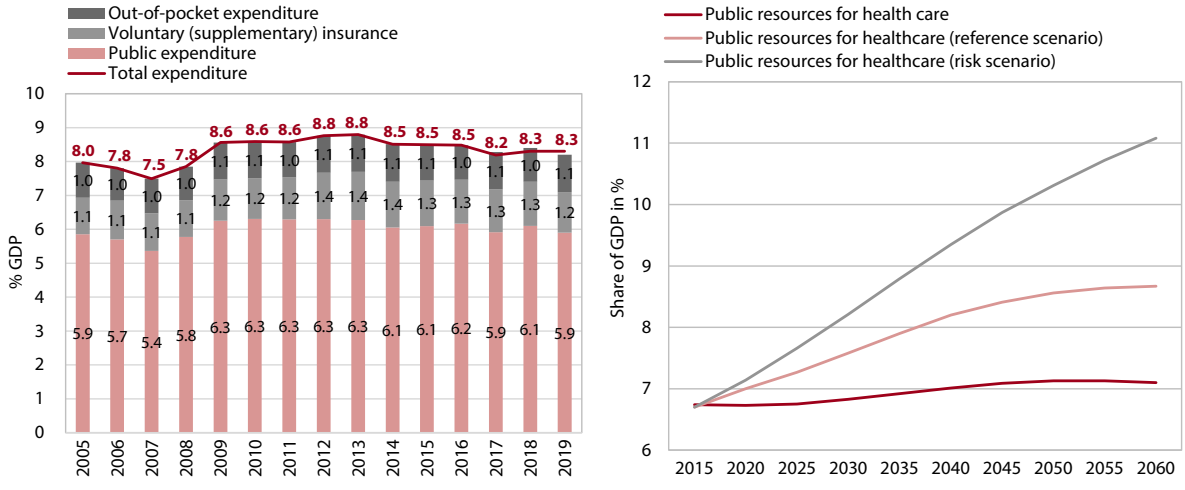
A key approach by which countries address the challenge of the financial sustainability of pay-as-you-go systems with defined benefits is to remain active as labour force for a longer time. Longer life expectancy and smaller generations entering the labour market reduce the financial sustainability of pay-as-you-go systems with defined benefits such as the Slovenian one. In half of the OECD countries, the retirement age will increase in the future, given already adopted legislative changes. However, as this is not sufficient, some countries have also introduced an automatic link between pension parameters and demographic changes (e.g. life expectancy) to mitigate the gap between resources and expenditure. Reforms to increase financial sustainability also carry a risk of worsening the financial situation of pensioners.[238] For this reason, in order to reduce pressure on public finances and maintain adequate pensions, countries are introducing supplementary pension insurance that have the same characteristics as investment schemes with defined contributions and are managed by private pension funds. In the future, the promotion of supplementary pension insurance will also be of crucial importance for Slovenia, as the country has the lowest rate of population involved in individual supplementary pension insurance in the EU.

[238] The aggregate replacement ratio in Slovenia is among the lowest in the EU (the indicator is defined as the ratio of the median individual gross pensions of the 65–74 age category relative to the median individual gross earnings of the 50–59 age category, excluding other social benefits).

At the beginning of 2020, new changes aimed at increasing pensions were introduced in the pension system. With these changes, the accrual rate for 40 years of service was equalised for both sexes (at 63.5%; for men it will increase in six years and for women it will no longer decrease and will remain at the 2019 level). This will improve the financial situation of new pensioners. The percentage of the pension received by those who remain active even after qualifying for retirement is also increasing (from 20% to 40% in the first three years), thus addressing the low work activity of the elderly and labour shortages. However, the proposal does not introduce sustainability parameters, which will exacerbate the challenge of long-term increases in pension expenditure and the long-term sustainability of the system.

The approach of different countries to reducing the gap between resources and expenditure on health is much more diverse than the approach to adjusting the pension system. The measures are not strictly health-related and require the development of cross-cutting policies. Analyses and experience of different countries have shown that a reduction in the resource and expenditure gap can be mitigated by action towards (i) improving the health of the population and/or promoting active and healthy ageing, (ii) increasing the efficiency of systems on the supply and demand side of services, and (iii) changes in the funding sources of the healthcare system. A common feature of the changes in funding sources of the healthcare system in different countries, which also indicates a range of possibilities for Slovenia, is the expansion to sources that are not tied to the income of the working population and to sources that are less dependent on cyclical fluctuations. Among the most common measures are (i) expanding the contribution base (to the inactive population and to capital income), (ii) increasing tax resources through direct financing of certain services (e.g. sickness benefit) or indirectly by increasing transfers to social security funds, (iii) increasing the resource collection efficiency and simplifying systems, and (iv) mobilising private resources (e.g. additional charges, participation payments and changes in the healthcare basket).

Figure 36: Sources of financing health expenditure in Slovenia (left) and long-term projections of public expenditure and public resources for health (right)

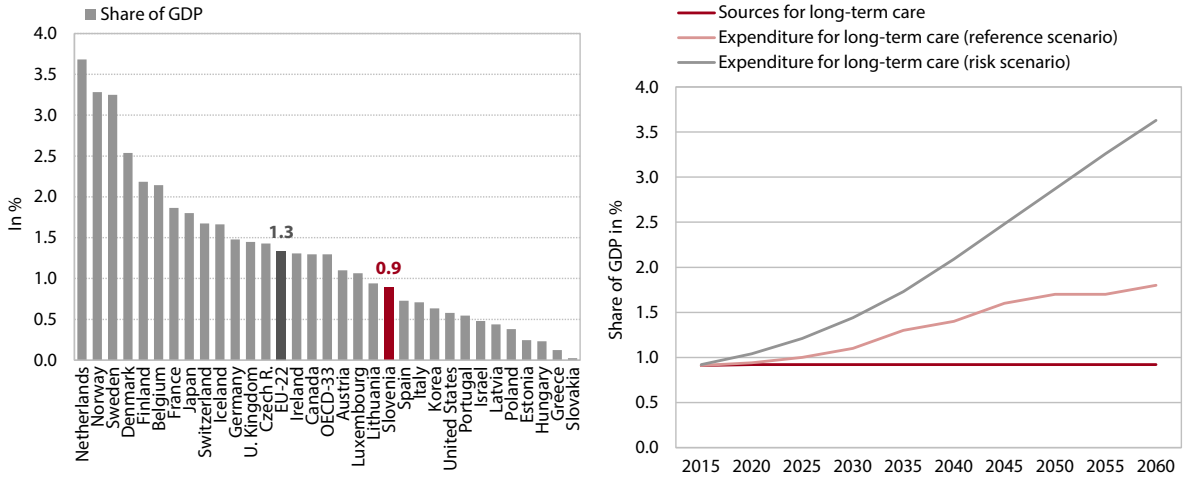


Sources: Figure to the left: SORS, Izdatki in viri financiranja zdravstvenega varstva, OECD, 2020; IMAD calculations; Figure to the right: Majcen, B. and Sambt, J., 2018, calculations based on the assumptions of the 2018 Ageing Report, ZZZS.

Note: The figure to the right shows the current public expenditure on healthcare, including the health part of long-term care (HC.3) and sickness benefits that are otherwise excluded from healthcare under the SHA, taking into account the assumptions of the AWG 2018 reference and risk scenarios. The source projection takes into account the growth of social security contributions and budgetary expenditure in line with GDP growth, while the contributions for pensioners take into consideration the IER model estimates in line with demographic projections.

The needs for long-term care are growing even faster than the healthcare needs, but given the deficient system currently in place in Slovenia, they remain largely unsatisfied even now. Public expenditure on long-term care was growing rapidly in Slovenia only in the period before the financial crisis, when many new capacities were opened in homes for the elderly. During the financial crisis, growth was modest, but still higher than in healthcare, whereas in the period from 2012 to 2017 it has fallen significantly behind the average growth in EU countries and the growth in health expenditure. In particular, the growth of expenditure on health services in homes for the elderly and in other social welfare institutions and community health nursing was very low. The situation for care recipients has also deteriorated in recent years, while private, direct expenditure on long-term care services has been increasing very rapidly. A marked increase in long-term care needs can be expected especially after 2025, when the largest generations start crossing the 80-year threshold. A key factor in the growth of this expenditure is the growing share of the elderly population that needs assistance in carrying out basic daily activities; moreover, the demand for formal care is increasing due to the greater involvement of older workers in the labour market. For this reason, it is expected that, in the future, the share of expenditure allocated to meet growing long-term care needs will be increasing despite ongoing measures to step up the efficiency of the system.

Figure 37: Public expenditure on long-term care relative to GDP in 2017 (left) and long-term projections of public expenditure and public resources for long-term care in Slovenia (right)

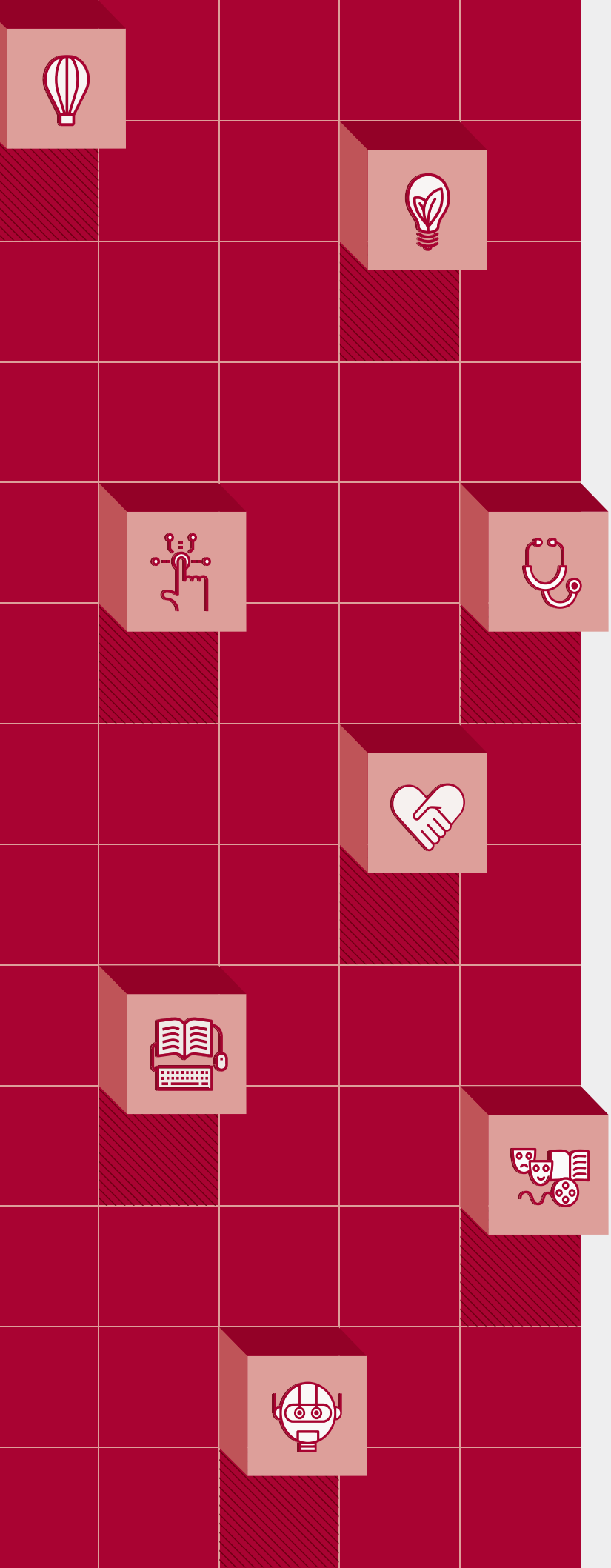


Sources: Figure left: Eurostat; Figure right: 2018 AWG projections (European Commission, 2018c), ZZZS; IER calculations, 2018.
Note: the figure on the right shows public sources and public expenditure for long-term care, including the health and social part of long-term care (HC.3 + HC.R.1). Estimates of the AWG 2018 reference and risk scenarios are taken into account in expenditure growth. The projection of public resources takes into consideration the growth of social security contributions and budgetary resources in line with GDP growth (according to the AWG 2018 assumptions). The aggregate of paid social security contributions depends on wage growth (wages are assumed to increase in line with productivity growth) and employment trends (according to the AWG 2018 assumptions).

Efforts to regulate the area of long-term care into a uniform system in Slovenia have been ongoing for more than 15 years. This is mainly related to the complexity of the system, whose regulation requires the interplay of activities under the responsibility of several ministries, and to the unresolved issue of financing the new system or the necessary additional sources.[239] In international comparisons, Slovenia lags behind in terms of public expenditure on long-term care and in the share of

[239] In August 2020, a new draft of the Long-Term Care Act, which provides for a new long-term care insurance financed from existing sources of public funds (ZZZS, ZPIZ and the state budget) and an increase in social security contributions, was submitted for public discussion.

in-home support services, which are the predominant form of care in the most developed countries. European countries have addressed the systemic regulation of this area in different ways, depending on the development stage of their current long-term care systems, economic development and the traditional role of the family. Accordingly, some countries have (i) universal coverage and budgetary funding (most of the Nordic countries) or (ii) compulsory social insurance for long-term care (Germany, Belgium, Luxembourg, Japan), and in providing sufficient resources, they also resort to less commonly established solutions such as the abolition of a free (holiday) day, the introduction of dedicated resources and the like. Similarly as in healthcare, formal long-term care services are at least partly funded from private sources in most countries.



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