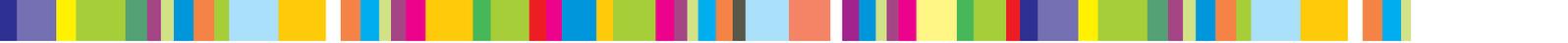


Poland: Emerging Innovation Leader of the Visegrad Group





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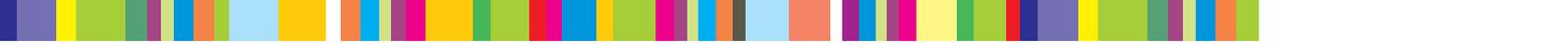
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Summary

The year 2014 marks the decade in which the successful integration took place of the Czech Republic, Hungary, Poland, and Slovakia with the European Union. Statistics such as Gross Domestic Product, Foreign Direct Investment, GDP per capita as well as people's personal stories have built a new positive narrative for Central and Eastern Europe (CEE). Thanks to the European democratic framework, access to the single market, and structural funds, the countries of Central and Eastern Europe have made a civilizational leap forward. Embracing this historic opportunity required innovation in all aspects of economy and society. It involved building new institutions, companies and communities. The transformation was radical, demanded on-the-job innovation and brought with it new entrepreneurial challenges. The next stage of development will need to focus on increasing investment in R&D, building academia-industry partnerships, providing capital to high-growth companies, and integrating innovation ecosystems. While all countries progress towards these goals, the impact of the changes is most evident in Poland, which was the only country that avoided recession and emerged as the innovation leader of the Visegrad Group.



Introduction

An attempt to explain Poland's recent past and its unprecedented achievements puts the spotlight on a generation of innovative people who have created new institutions, companies, and communities. Thanks to this entrepreneurial generation, over a period of 25 years of reforms, 20 years of membership in NATO and 10 years in the European Union, Poland is considered to have entered its new golden age and, as the World Bank claims, “the country has not been as successful as today over the last 500 years”.¹

This complex socio-economic phenomenon and the unusual historic turnaround, is anchored in 1990 when Leszek Balcerowicz, then the finance minister of Poland, launched the 'shock therapy' reforms. Practically overnight the market opened, currency was made convertible, price controls were abolished, and the systematic privatisation process of state-owned enterprises was initiated. As a result of this 'shock therapy', in the short term the GDP shrank by almost 15%.

However, this radical, transformational process of multifaceted innovation reinvented the country's institutions, economic system and its society. Only a year later, Poland embarked on an unprecedented, uninterrupted path of economic growth. In the context of its current prosperity, the pains of Poland's transformation have been justified as an unavoidable treatment. Unlike its ex-Soviet block peers, which opted for a milder transition to the free market economy, the 'shock therapy' has created sound fundamentals for continuous development.

¹ Piątkowski, M., 'Poland's New Golden Age: Shifting from Europe's Periphery to Its Center', Policy Research Working Paper 6639, The World Bank, October 2013.

The Visegrad Group countries

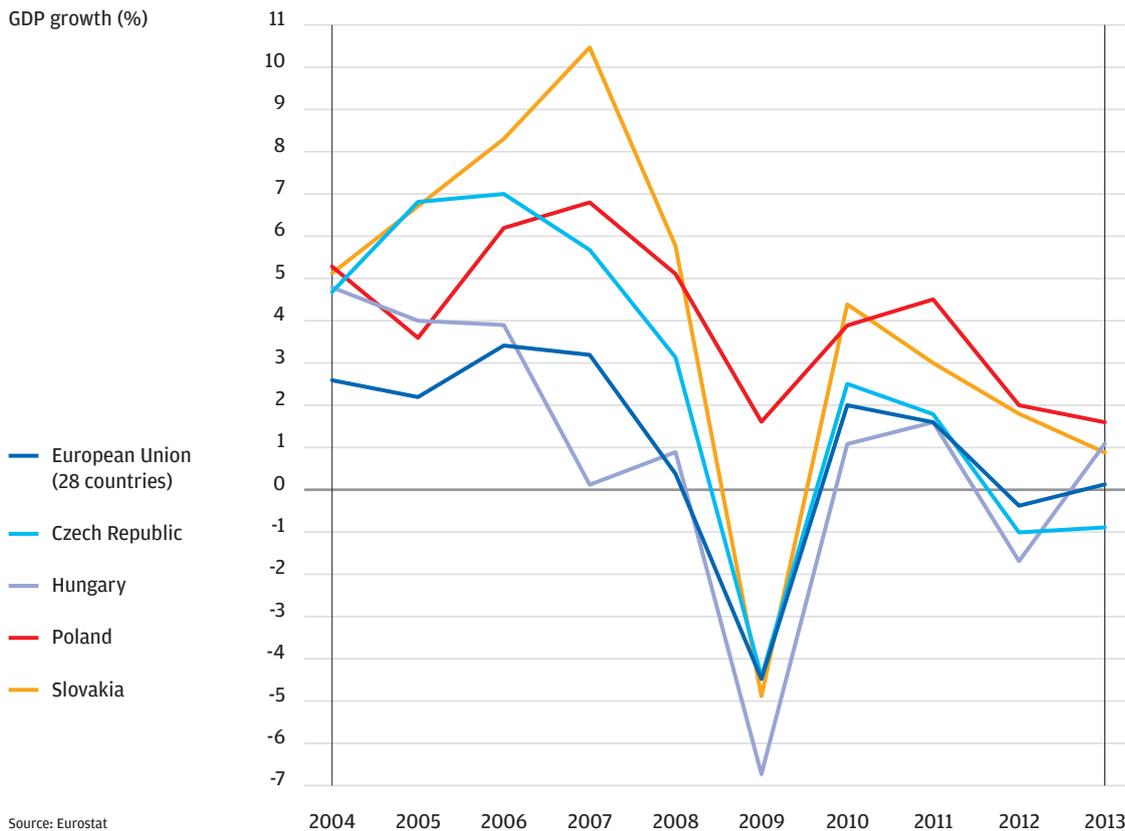
The Visegrad Group is a strategic alliance of four countries of Central and Eastern Europe: Poland, Slovakia, Hungary and the Czech Republic. Formed in 1991, on the wave of peaceful democratic transition from communism to free market democracies, the group was referred to as the Visegrad Triangle. It aided integration and collaboration between Poland, Hungary and Czechoslovakia in the area of economic, military, and energy cooperation. After the 'Velvet Revolution', which resulted in the division of Czechoslovakia into two nation states, the alliance was named the Visegrad Four, or V4.

The process of integration between the Visegrad Group countries and the most advanced knowledge economies in the world has been a major driving force for growth in the region. This positive development was shaken in 2008 by the global financial crisis, which has had a detrimental effect on Europe.

In 2014, six years after the beginning of the recession in Europe, the economies of the Visegrad Group countries largely re-established themselves.² The positive outlook for the region was demonstrated by the data presented by Eurostat and other institutions such as the World Bank, the World Economic Forum, as well as a number of reports including one by the McKinsey Global Institute 'A new dawn: reigniting growth in Central and Eastern Europe'.³

Chart 1

GDP growth (%)



Source: Eurostat

² World Bank, Strengthening Recovery in Central and Eastern Europe, EU11 Regular Economic Report, The World Bank, 89427, June 2014.

³ Schwab, K., Global Competitiveness Report 2013-2014, World Economic Forum, 2014. Labaye, E. et al. 'A new dawn: Reigniting growth in Central and Eastern Europe', McKinsey Global Institute, 2013.

Statistical data gathered in the Visegrad Group countries demonstrates an increasing level in innovation measured by the growth of clusters, patents filed, number of graduates in science and technology, and born-global innovative companies. The fifth freedom, that is, the free flow of knowledge in the European internal market with its instruments of the European Research Area and European Higher Education Area, is helping to make significant progress in this area and is becoming an increasingly important element with respect to the region's innovation capacity and output.

Championing growth throughout economic downturn

Since the beginning of the economic downturn in Europe, Poland has been the only country to avoid recession. Over the period 2008-2013, the country achieved over 20% of compound GDP growth, which peaked at 4.5% in the middle of the crisis in 2011.⁴

The reasons why Poland has been coping well with the crisis are multifold and interconnected. They reside in the fundamental health of the economic system and the synergistic relation between social, political and cultural factors including its entrepreneurial culture.

To a certain extent, the positive internal situation has been a result of the relatively low levels of public and private debt (especially in the real estate sector) and the high resilience of the entrepreneurial economy, relying on exports and on internal consumption. Surely, it was also a result of the fundamental stability of the political situation under the leadership of Donald Tusk of Civic Platform who headed the Polish government for seven years until 2014 when he was elected President of the European Council.

Certainly, maintaining positive growth dynamics was fuelled by the inflow of EU funds. Poland was very efficient in absorbing European funds. In return, the country was rewarded, and ultimately the allocation for Poland from the EU budget reached 101.5 billion EUR between 2007 and 2013, and was increased to 105.8 billion EUR in the next financial perspective of 2014-2020.⁵ The European structural and cohesion funds, however, came with strings attached. The country had to adopt new regulations, improve governance, and take transparency and anti-corruption measures seriously especially in relation to public procurement.

Therefore, when it comes to an explanation of Poland's innovativeness, this should be placed in the context of the last quarter-century, when Poland's entrepreneurial economy transformed itself by innovating in all spheres: in business, public administration and society-at-large. Although until recently, this innovation capacity has not been captured by innovation statistics, the situation has started to change. In 2014 Poland advanced in the Global Competitiveness Report from stage 2 to stage 3 of development, and moved from the group of 'modest innovators' to 'moderate innovators' in the European Innovation Scoreboard.⁶ Whatever its score, unquestionably, Poland has emerged as a European growth champion and the last quarter-century in Poland has been named 'the second Jagiellonian age'.⁷

⁴ Eurostat, 2014.

⁵ Poland's 10 years in the European Union, Ministry of Foreign Affairs, Republic of Poland, 2014.

⁶ Schwab, K., Global Competitiveness Report 2013-2014, World Economic Forum, 2014. European Innovation Scoreboard, 2014.

⁷ von Bredow, V., 'The second Jagiellonian age', *The Economist*, 26 June 2014.

Regional innovation ecosystem

Innovation is usually thought of as new products, services or processes brought to the markets and society. But innovation is more than that. It is a collective process of co-creating and scaling up solutions to generate value for shareholders and for stakeholders. In an innovation environment characteristic of a 'network society', this process is induced within local ecosystems composed of various innovation networks of large and small companies, universities and research institutions, governments and their agencies and non-profits co-located in metropolitan areas.⁸ These networks overlap, multilayer and create a critical mass of knowledge, talent and capital. The Visegrad Group countries are part of the global networked innovation ecosystem.

Innovation in emerging markets has quite different origins and drivers when compared to those in knowledge economies. Rather than being induced by science and technology and championed by industry, it strongly relies on cost innovation spearheaded by local small and medium-size companies, on social innovation driven by civil society, and institutional innovation, which creates a framework with new laws, public bodies, policies and governance models. All these types of innovation have played an instrumental role in Poland and other V4 countries during the transition process.

The innovation system in the region has been rapidly evolving over recent years, yet it remains fragmented, requires further increased investment and institutional changes. While the R&D expenditure remains much too modest, the V4 countries acquired and will continue to benefit from a significant growth impulse with the inflow of European funds as well as rising private investment. In order to further increase labour productivity and competitiveness, Poland and other V4 countries need to embrace novel innovation models, find smart growth strategies beyond the redeployment of resources, and build structural links within local ecosystems and with the most innovative ecosystems globally.

Emerging clusters

A global innovation system is a new reality when it comes to interconnected clusters, with knowledge, talent and capital flowing freely between and across them. The most vibrant places, such as Silicon Valley attract entrepreneurs, international students and researchers, venture capitalists and all sorts of innovative companies. Access to loosely-coupled global innovation nodes creates risks of a brain drain for the region. At the same time it can be mitigated with proper policies and instruments and turned into brain circulation. Stimulating exchanges create stimulus for change and growth of vibrant innovation networks, which are critical to the development of innovation ecosystems in the V4 countries.

Innovation is foremost about people. The data on employment patterns with respect to science and technology graduates in the region reveals that knowledge and talent tend to cluster in regional nodes. Knowledge workers are usually attracted to places where a significant part of the industrial value chains existed before. This is also the case with the V4 countries where the largest innovation milieus develop around Warsaw, Cracow, Wrocław and Gdańsk in Poland, Prague and the Bohemia region in the Czech Republic, and Bratislava and Budapest in Slovakia and Hungary, respectively. The largest regional innovation clusters in terms of employment of scientists and engineers are the larger metropolitan areas of Warsaw with 680 000 employees, followed by Wrocław with 386 000 and Cracow with 281 000 science, technology, engineering, mathematics (STEM) graduates.⁹

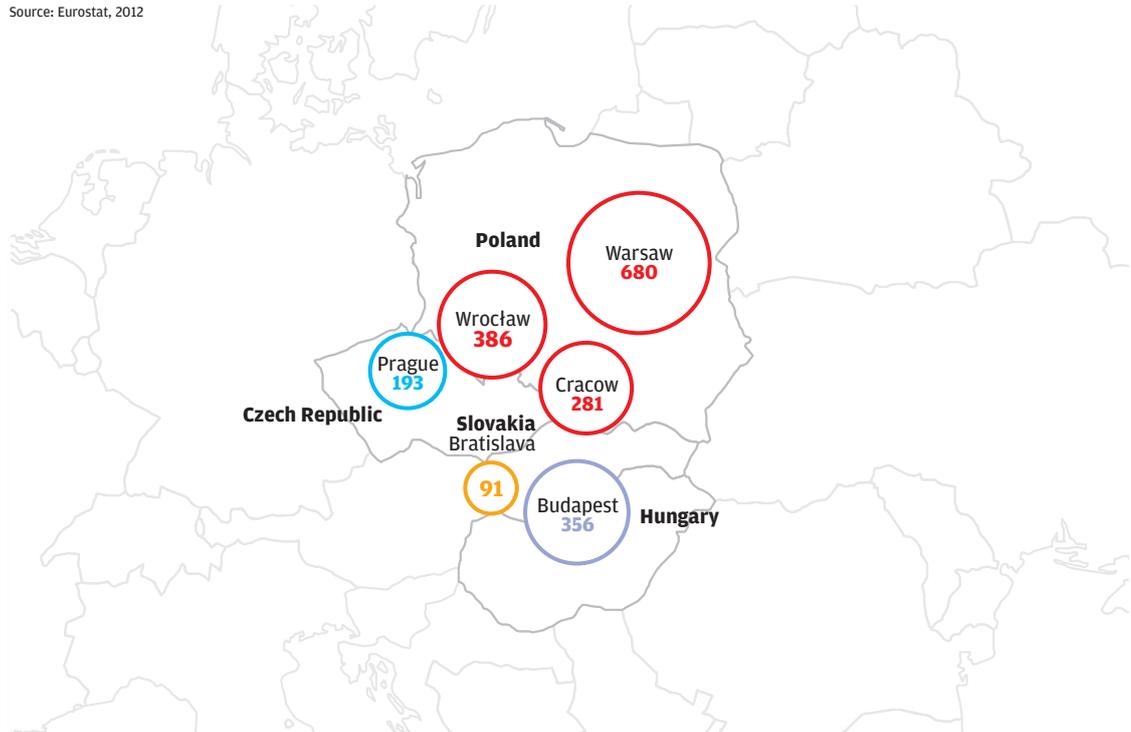
⁸ Gołębiewska-Tataj, D. 'Entrepreneurial Innovation Networks. Knowledge Triangle and Emerging Business Models', Warsaw University of Technology Publishing House, 2013.

⁹ Eurostat, 2014. Latest available data for 2012.

Map 1

Regional innovation clusters in the Visegrad Group countries in terms of employment of science and technology graduates (thousands)

Source: Eurostat, 2012



The increase in the employment of persons with tertiary education in science and technology has brought about the development or re-emergence of regional innovation clusters. Statistical evidence for the period between 2008 and 2012 demonstrates interesting dynamics and the potential for indigenous growth.¹⁰ Over this period in Poland, employment in this segment increased on average by 30% in key regions such as Mazowieckie, Małopolskie, Śląskie and Wielkopolskie, and almost doubled in Pomorskie. In the Czech Republic a similar trend has been visible with a 64% increase in employment in the Střední Čechy region around Prague, and 40% in Severovýchod, the historic region of Bohemia, once a champion of the industrial revolution in continental Europe. In Slovakia, employment of STEM diploma holders increased by 23% in Bratislavský kraj and Východné Slovensko. The same growth rate took place in the Közép-Magyarország region around Budapest, and in Dunántúl - a trans-border region on the left bank of the Danube River close to Vienna - employment has grown by 19%.

¹⁰ Eurostat, 2014.

Knowledge Triangle: bridging research, education and innovation

A critical component for stimulating the growth of innovation ecosystems is the effective collaboration between academia and business. The European Union founded a new institution - the European Institute of Innovation and Technology (EIT), a funding agency headquartered in Budapest, to stimulate these types of partnerships through a specific type of innovation network which integrates the Knowledge Triangle - that is, research, education and innovation, with entrepreneurship education and new business creation as a key focus point.¹¹

The entrepreneurship-driven Knowledge Triangle is an underlying concept of the Knowledge and Innovation Communities (KICs), launched in 2010 by the EIT. There are three such pan-European business-academia partnerships created to tackle grand societal challenges in areas related to climate change mitigation and adaptation, sustainable energy and the future information and communication society. The KICs spearhead innovation and entrepreneurship by collaborating with the best European universities such as Imperial College London, ETH Zurich, KTH Royal Institute of Technology, and ESADE, research institutes such as Fraunhofer, and companies such as Siemens, Nokia, Bayer, EDF, Deutsche Telekom, Philips, SAP, France Telecom, Ericsson, and many other academic and business partners.

Connecting to these innovation networks fosters the CEE innovation ecosystem. Joining these private-public consortia transnational collaborations, interdisciplinary teams and industry-academia partnerships will drive the growth of innovation in the V4 countries.

An example of such a partnership is a local co-location centre set up by KIC Innoenergy. It is a partnership in sustainable energy which has located one of its six European nodes in Cracow. AGH, a technical university in Cracow, and Tauron Wytwarzanie, a leader in the energy sector in Poland, collaborate locally with over two dozen partners to develop and commercialise clean coal and shale gas technologies. At the same time, being part of the KIC they are able to gain access to university and industry labs, investors, and top masters and doctoral students. This interaction and project-based collaboration brings a true learning opportunity.

The EIT+ company is a partnership between the City of Wroclaw and local universities. It is also a Regional Implementation Centre of another such community, the Climate KIC. Focused on research commercialisation, EIT+ has managed to attract funding for cutting-edge innovation projects from the structural funds. Being a node of the KIC it is connected to top research and thinking on climate and serves as a test bed for innovation emerging in labs run by other Climate KIC partners such as Imperial College London and ETH Zurich.

With the future KICs, the EIT's 2.7 billion EUR budget will seed the Knowledge Triangle networks across Europe and promote the formation of bridges between the silos of academia and business. These bridges will accelerate the emergence of entrepreneurial universities in CEE as in the case of AGH, and scale up open innovation partnerships, such as with EIT+'s project portfolio. Being part of this European innovation backbone, the CEE ecosystems will nurture the next generation of entrepreneurial people and ventures.

R&D investment and patenting activity

Vibrant innovation clusters usually grow around universities, since industry is always in need of good graduates. The quality of higher education is correlated with the quality of research conducted at universities. In order to improve the quality of education, scientific activity needs to be advanced. While funding does not always bring quality research, adequate investment in research infrastructure and human resources is indispensable. The quality of research is measured by academic output, that is, scientific papers, citations and patents.

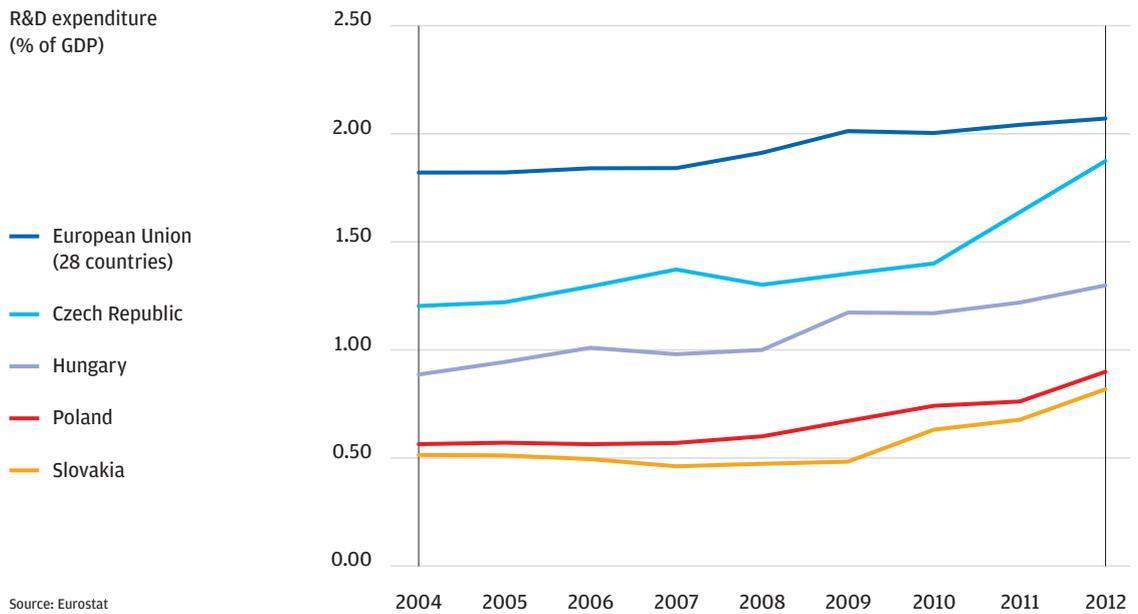
Improving the research and innovation performance of the V4 countries requires more expenditure both by public institutions as well as by private business organisations.

¹¹ Gołębiowska-Tataj, D. 'Innovation and Entrepreneurship. A Growth Model for Europe beyond the Crisis', Tataj Innovation Library, New York, 2015.

In 2000, the European Union set a target of 3% GDP to be invested in R&D activities, and this target has been maintained in the Europe 2020 strategy. In 2012, the EU-28 average R&D investment reached only 2.07% and the V4 countries lagged behind even further with 1.23% GERD on average, with the Czech Republic leading the way with 1.88%, followed by Hungary at 1.3%, Poland at 0.9% and Slovakia at 0.82%.¹² Since 2004, R&D investment in all V4 countries has been increased; although this trend had been interrupted and slowed down by the economic crises of 2008.

Chart 2

R&D expenditure
(% of GDP)



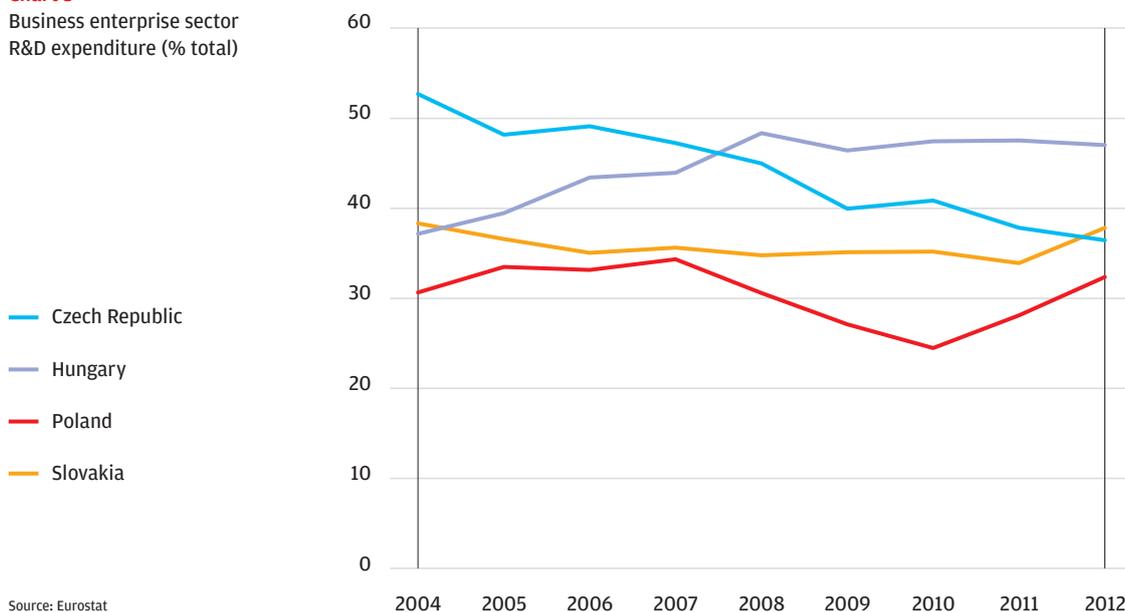
Source: Eurostat

In contrast with the EU-28, R&D investment in the V4 countries is driven mainly by public funding. In 2012, out of the total R&D expenditure, 47% in Hungary, 36% in the Czech Republic, 38% in Slovakia and 32% in Poland came from the business enterprise sector. While private investment in R&D in the EU-28 over the last decade has been steady at a level of 55% of GERD, in Hungary private sector investment increased from 37% to 47% of GERD, in the Czech Republic it decreased from 53% to 36% and it stayed at the same level in Slovakia and in Poland.

¹² GERD - Gross Expenditure on Research and Development.

Chart 3

Business enterprise sector
R&D expenditure (% total)



Source: Eurostat

While Poland came last, the situation with respect to private sector investment in R&D has started to improve. In its 2014 report, KPMG gives a positive assessment of the investment trend in Poland and notes that 57% of medium and large enterprises in Poland declare that they invest in R&D.¹³ Among them, 70% have in-house research facilities, and 30% commission research and development projects outside. In 98% of the cases, the main source for this R&D investment comes from accumulated capital. Large companies invest between 1% and 5% of their income in this activity, and 48% of firms use public grants.

However, expenditure on R&D activities increased most prominently in the public sector. Over the period between 2004 and 2012, GERD in the higher education sector amplified from 162 million EUR to 790 million EUR in the Czech Republic, from 364 million EUR to 1181 million EUR in Poland, and from 35 million EUR to 199 million EUR in Slovakia. Only Hungary stayed behind the trend, increasing this type of expenditure from 177 million to 231 million EUR only.¹⁴

The availability of more funding brings positive results. European patent filings between 2004 and 2013 measured on annual basis, tripled in Poland, doubled in the Czech Republic, and increased by 30% in Hungary and by 20% in Slovakia.¹⁵ The numbers remain modest but the trend should be accelerating since in all countries, thanks to European funds, research infrastructure has been modernised and can now count itself to be among the most advanced facilities in Europe. Notwithstanding the small patenting volume, some radical inventions have come from this region, such as an industrial production of graphene and the blue laser technology invented by Polish scientists.

¹³ 'Research and Development Activities of Enterprises in Poland. The 2020 Perspective', KPMG, 2014.

¹⁴ Eurostat, 2014. Latest data available for 2012.

¹⁵ Eurostat. European patent filings measured per country of residence of the first named applicant. In 2013, the output of Poland with respect to patents was 510, in the Czech Republic it was 291, in Hungary it was 196 and in Slovakia it was only 37.

Second wave of entrepreneurialism: innovative companies, smart capital and investment opportunities

Innovation is more than invention. Invention can be turned into innovation when entrepreneurial people within large corporations or small businesses scale it up and turn it into value for consumers and users.

Innovative businesses

The synergies between creativity, innovation and entrepreneurship have given birth to a number of new companies in the CEE region which have become global champions and radical innovators such as Estonian Skype, Hungarian Prezi, and Deep Ocean Technology from Poland.

Small and medium-size companies suffered through the crisis but at the same time they offset the economic downturns and helped to reinvent existing industries. A healthy SME sector is critical to the CEE economies and imperative to economic growth. A small, yet innovative business sector has been at the forefront of the industrial transformation from traditional industries into high technology sectors in aviation, automotive, ICT, biotechnology and food processing industries. Young firms in the region have been pioneering inroads in developing global export markets. Yet, the overall situation must improve.

Data shows that as of 2010, on average 53% of the EU-27 firms were classified as innovative enterprises.¹⁶ Only the private sector in the Czech Republic was close to this average. In Slovakia, Hungary and Poland enterprises lagged behind with 36%, 31% and only 28% of innovative companies respectively. While innovative enterprises employing over 249 people were close to or not far behind the EU-27 average of 79%, the situation in the medium segment of enterprises employing above 50 persons widened the gap with only 40% of Polish mid-size companies classified as innovative enterprises, 44% in Slovakia, 46% in Hungary versus the 65% EU-27 average, which was almost matched by the Czech Republic.

The innovation gap has been most evident in the small business sector. While almost half of small European companies implement innovation, only 23% in Poland, 26% in Hungary, and 29% in Slovakia of enterprises employing from 10 to 49 employees declare that they innovate. The Czech small business sector almost equals the EU standard with 47% of its companies being innovation-led.

Chart 4
Innovative enterprises by size of employment (2010)

Source: Eurostat.

	Total innovative enterprises	Innovative enterprises with employment above 249 employees	Innovative enterprises with employment from 50 to 249 employees	Innovative enterprises with employment from 10 to 49 employees
European Union (27 countries)	53%	79%	65%	49%
Czech Republic	52%	79%	64%	47%
Hungary	31%	70%	46%	26%
Poland	28%	68%	40%	23%
Slovakia	36%	65%	44%	29%

¹⁶ Eurostat, 2014.

Liquidity gap and entrepreneurial knowledge

The development of a flourishing innovative SME sector in the V4 faces a number of problems. One of them concerns access to finance especially by young leading innovators, or 'yollies', that is, young high-growth ventures, which need access to smart funding and entrepreneurial knowledge.¹⁷ Venture capital in the CEE represents a relatively small proportion of the total assets allocated for investment purposes by institutional investors. Venture capitalists perceive an apparent disconnect between the availability of viable investment projects and capital, while start-ups cite a shortage of funding as one of the key barriers to growth. The 'liquidity gap', that is, a shortage of funding of between half a million to 5 million EUR has been to some extent mitigated by public support as in the case of the KfK National Capital Fund of Poland, a public fund of funds, which has matched private funds in 16 seed and early stage funds.

The second major problem for the growth of 'yollies' is related to access to entrepreneurial 'know-how', especially seasoned, serial entrepreneurs who have successfully grown their businesses and are willing to coach the next generation. In many cases this lack of know-how prevents young firms from growing operations into international markets and deploying business model innovation strategies. But the situation is improving.

For example, Innovation Nest, an early stage fund seeded by the KfK, was started by Piotr Wilam, one of the investors in Onet.pl, a leading Internet portal in Poland in the early 1990s. As a business angel and investor he takes all his companies to Silicon Valley and offers them continuous support and coaching. Another example is Gabor Bojar, the founder of Graphisoft, who funded the Graphisoft University in Budapest where he himself along with Erno Rubik, the founder of Rubik Cube, and international faculty members, educate the next generation of ICT entrepreneurs from Hungary and the United States.

Born-global. Scaling up innovation and investment

Some small and medium-size companies originating in the CEE region have demonstrated great potential for radical growth. In the 2014 ranking of top technology innovators, 'Deloitte Technology Fast 50 CEE' featured 22 companies from Poland and 10 from Hungary. The winner was Szallas.hu, a Hungarian company, followed by Comperia.pl from Poland and the High Tech Engineering Center from Serbia. The growth dynamics of the 50 laureates in 2013 was 698 percent on average.

As of 2014, many 'Made in Poland' products and services have conquered global markets. They include buses produced by Solaris, trains by Pesa, software by Assecco, roof windows by Fakro as well as cosmetics manufactured by dr Irena Eris and Ingot. Furthermore, Polish capital has started to invest in global markets as in the case of the publicly quoted KGHM, a metallurgic conglomerate, and Kulczyk Investments, a Polish capital group with 2.8 billion EUR assets under management. Enterprise Partner, a Warsaw-based private equity firm with a combined capital of 2 billion EUR have invested 1.6 billion EUR in 132 companies in the region, and exited 106 investments with gross proceeds of almost 2.2 billion EUR.

¹⁷ Veuelers, R., Cincera, M. 'Europe's missing yollies', Breuegel Policy Brief, 2010/06, 2010.

Knowledge spillovers, top talent, and a vibrant young culture

Besides big cities, there are a number of interesting cases where high-tech specialised industry clusters have flourished since the beginning of the 1990s.¹⁸ Their growth has been driven by the presence of industry, which has created a market for small and mid-size companies.

Industry: leading innovation clusters

This is the case in 'aviation valley' near Rzeszow in the south of Poland, an entrepreneurial home to dozens of small and medium-size companies comprising 90% of the Polish aviation industry. In 2010 a special economic zone, SSE Euro-Park Mielec was created to attract investors with attractive corporate tax incentives. Companies settling in this special economic zone benefit from R&D facilities offered by 450 hectares of industrial zone, 60% of which is dedicated to manufacturing. The ecosystem is nurtured by Rzeszow University of Technology, Science Park AEROPOLIS and close access to an international airport. The Association of Aviation Industry Entrepreneurs "Aviation Valley" counts over. The site attracts foreign investors. Sundstrand Poland, a subsidiary of Hamilton Sundstrand Power Systems from San Diego, California, opened its production facility there in 2011.

Another example is the automotive cluster started around a 1970s factory belonging to Bratislavské Automobilové Závody in Devínska Nova Ves near Bratislava. BAZ was bought by the Volkswagen Group in early 1990. It has been producing parts for Skoda as well as for Volkswagen models such as the Passat and Golf and has become a specialised SUV platform producing parts for all SUV brands including the Audi Q7, Volkswagen Touareg, and Porsche Cayenne. The Volkswagen investment was followed in mid 2000 by PSA Peugeot Citroen, which set up its operations in Trnava, and by KIA Motors' factory in Zilina. In 2012, the production in Slovak automotive production and assembly plants increased by 44.9% versus the previous year and reached 926,555 passenger cars. Slovakia was producing 171 cars per 1000 inhabitants, which is the highest number of cars per capita in the world.¹⁹

Education for innovation

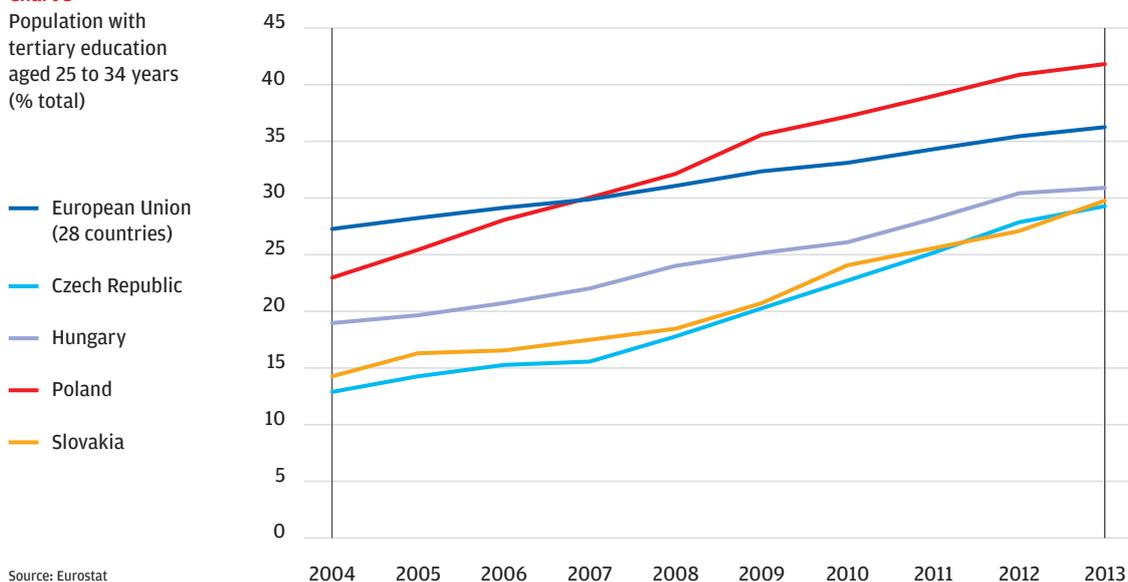
The availability of university graduates, of scientists and engineers as well as skilled technicians is one of main operational barriers to innovation growth in the business sector. Over the period between 2004 and 2013, expenditures on education doubled in Slovakia, increased by approximately 75% in the Czech Republic and Poland, and by 30% in Hungary. Eurostat data available for 2013 shows that, of adults between 25 and 34 years old, 36% were graduates in the EU-28, while the Czech Republic, Hungary, Poland and Slovakia scored 29%, 31%, 42% and 30%, respectively.

¹⁸ "Rethinking Central Europe. Business dynamics in the enlarged EU", A report from the Economist Intelligence Unit Sponsored by Ernst & Young and Oracle, 2005. http://www.eiu.com/report_dl.asp?mode=fi&fi=1169467702.PDF

¹⁹ Automotive Industry in Slovakia, Sario Slovak Investment and Trade Development Agency.

Chart 5

Population with tertiary education aged 25 to 34 years (% total)



Source: Eurostat

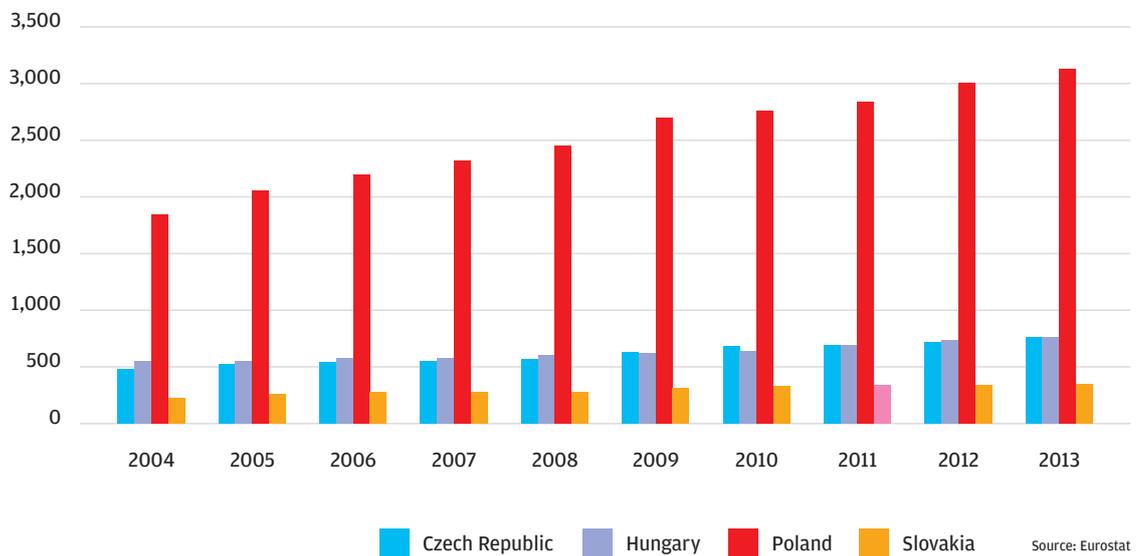
Achieving high scholarisation was the right strategy to build human resources for the economy during the 'catch up' phase. The numbers look impressive especially for Poland with over 1.7 million students and almost half a million graduates in 2012, as compared to 400,000 students and 56 thousand graduates in 1991. However, employers differentiate between degrees from public and private universities giving the former much more credit.²⁰ A program such as the Top 500 Innovators sponsored by the Polish government complements the structural reforms of the university system in Poland. It brings 500 leaders from the higher education system to Silicon Valley, Stanford University and the University of California, Berkeley, and empowers them to lead change in their home institutions.

A high percentage of university graduates is important only if they are able to find good employment opportunities. Over the last decade, the number of persons with a tertiary education employed in science and technology in the V4 countries increased by over 1.9 million. Out of this number almost 1.3 million jobs were created in Poland, 287 000 in the Czech Republic, 212 000 in Hungary and 123 000 in Slovakia. This means that over the decade of integration with the European internal market, employment in the science and technology sector in this region has increased by 70% in Poland, 60% in the Czech Republic, 55% in Slovakia, and 39% Hungary.

²⁰ 'Higher Education Institutions and their Finances in 2012', Central Statistical Office, Warsaw, 2013.

Chart 6

Employment of persons with tertiary education in science and technology (thousands)



In addition, a critical communication skill – the use of English as a second language, is very high in the V4 countries. The English Proficiency Index published in 2014, placed Poland in the group of high performers: ranking at number 8 among the 60 countries surveyed. In this ranking, other V4 countries also scored well with Hungary following Poland at number 9, Slovakia at number 18 and the Czech Republic at number 20.

Furthermore, the reform of the Polish primary and lower high school education sector has resulted in remarkable success. The Pisa Report published in 2014 by the OECD demonstrates that the performance score in mathematics, reading and science among 15-year-old Poles ranks them as the 14th best in the world and one of the top four in the European Union along with students from the Netherlands, Estonia, and Finland.²¹ The score in the Pisa ranking is an outstanding achievement taking into account that in 2000, Polish students were ranked below the OECD average. What needs to be improved, though, is their problem-solving capacity.

New Europe: Top 100 Challengers

Innovation and entrepreneurship is not only about for-profit business, it is but also about entrepreneurial people in many diverse environments. 'New Europe 100' is a project by Res Publica, International Visegrad Fund, the Financial Times, and Google, who have teamed up to identify a community of 100 challengers – entrepreneurial individuals who have confronted the status quo and changed the world around them. The list includes not only company founders but also all sorts of leaders who transform politics, the public sector and civil society.²²

²¹ PISA 2012 Results: Creative Problem Solving: Students' Skills in Tackling Real-Life Problems, Organisation for Economic Co-operation and Development (OECD), 2014.
²² 'New Europe 100', Visegrad Insight, Res Publica, October 2014.

Poland is well represented among the top 100 challengers. Among them are Internet entrepreneurs, for example, Marcin Beme, the founder of Audioteka.pl, an on-line audio book library present in 23 countries, as well as Jakub Krzych and Łukasz Kostka, co-founders of Estimote, a technology start-up with offices in San Francisco, New York, and Cracow, who have built a sensor-based analytics and engagement platform to be used by large retailers worldwide. The NE100 list includes Patryk Strzelewicz and Michał Bąk, inventors of DICE+, an electronic dice which links virtual reality with traditional board games. The list also includes Michał Kaszczuk and Łukasz Osowski, co-founders of Ivona Software, acquired in 2013 by Amazon. Their proprietary BrightVoice technology is considered the most lifelike Text-to-Speech technology in the world, and it enables developers to design solutions for mobile devices, computers, communication systems and services in 44 human-like voices in 17 languages.

The list also includes cases of the successful commercialisation of academic research, such as for example, Paweł Wyrzykowski, the CEO of Seco/Warwick, whose collaboration with Łódź University of Technology delivered a solution for the cost-effective production process of graphene, and Michał Grześ from Białystok University of Technology, the coordinator of the team designing Hyperion2, a Mars rover.

The list also features outstanding young women innovators such as Olga Malinkiewicz, a PhD student whose research on perovskite solar cells was published in *Nature*.²³ She decided to commercialise her inventions and started a new company, which gained financial investors in Poland.

Among the challengers, there are also two 17-year-old high school students: Kinga Panasewicz and Joanna Jurek. Kinga discovered a method for stimulating brain impulses between left and right brain hemispheres, which won her the second place at the Intel International Science and Engineering Fair. As part of the award a recently discovered asteroid will be named after her. Joanna's interest in nanotechnology led her towards the invention of a unique method for delivering medicine directly to cancer cells, which is useful particularly in the difficult treatment of pancreatic cancer.

This entrepreneurial drive in Poland and other Visegrad Group countries has become more and more demonstrated by culture, mentality and creativity. Over the last decade, entrepreneurs and all sorts of innovators as well as writers, film makers, artists, architects and designers, intellectuals and a new class of people in professions that did not exist not long ago such as bloggers and trend-spotters, have blended into an interesting mix making Warsaw, Prague, Bratislava and Budapest some of most interesting places in Europe. People come to these places as tourists or for business and leave inspired.

²³ Malinkiewicz, O., et al., 'Perovskite solar cells employing organic charge-transport layers', *Nature Photonics*, Volume 8, Issue 2, pp. 128-132 (2014), 02/2014. Gratzel, M. 'The light and shade of perovskite solar cells', *Nature Materials* 13, 8380843 (2014) [Nature](#), 21 August 2014.



Poland: an emerging hotspot in the global innovation network

The driver of Poland's development has been creativity, potential for implementing all sorts of innovation and the spirit of the Poles with their notable entrepreneurial achievements. These have been drivers of the economic growth throughout the last two decades.

But social cohesion is an important part of Poland's success. In its 2014 'Global Wealth Report', Credit Swiss noted that Poland was one of two countries with increasing social cohesion measured in terms of control of percentage of wealth ownership.²⁴ In 2000, 10% of Polish citizens controlled 70% of the country's wealth. By 2014, this indicator dropped to 62.8%. Social cohesion may be an important factor driving sustainable growth, creativity and innovativeness, as in the case of Scandinavian countries.

Data and case studies form a powerful new narrative for 21st century Poland. Its innovation capacity emerges as a driver for future sustainable and smart growth. 'What matters most,' writes The Economist, 'is that Poland has kept pushing ahead with reforms, in a way that Germany has not, let alone France. (...) Poland will avoid the 'middle-income trap' only if it can develop higher-tech industries and services'.

The next step for Poland then, as well as other Visegrad Group countries, which are all rich with talent, excellent education, industrial capacity and growing knowledge-intensive sectors, is the ability to integrate with global innovation ecosystems, increase innovation output and scale up businesses catering to global markets.

²⁴ 'Global Wealth Report', Credit Swiss, 2014.

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