

From Legacy to Digital: Ukraine's Plugged-in Economy

APRIL 2018 ANDREI KIRILENKO AND TETYANA TYSHCHUK

Introduction

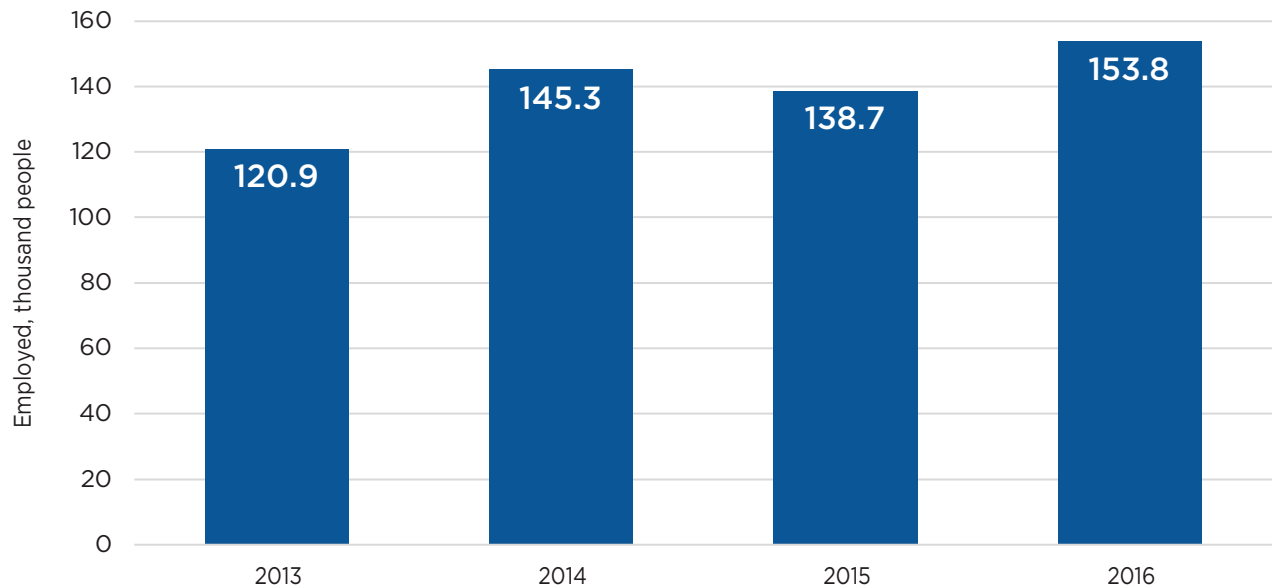
The information technology (IT) industry is a bright spot in Ukraine's patchy record of uneven progress, missed opportunities, and unfulfilled expectations. Despite the war, unfavorable investment climate, and weak institutions, Ukraine's IT industry has been experiencing double-digit growth for several years running.

In fact, it should hardly be a surprise at all as the development of digital technologies—both hardware and software—has a long and proud history in Ukraine. MESM, the first digital electronic computer in continental Europe, was completed in 1951 in Feofania on the outskirts of Kyiv. That is just two years after EDVAC, the first digital computer in the United States, and EDSAC, the first digital computer in the United Kingdom were constructed.

Advances in building computer hardware were followed by a bold proposal for the creation of OGAS,¹ a prototype Internet project developed in Ukraine in 1964. A local area network (LAN) version of OGAS was tested at a Lviv television factory in 1967, two years before the Advanced Research Projects Agency Network (ARPANET) project in the United States became operational. Among other things, the creators of OGAS developed a prototype of a digital currency as an electronic ledger of accounts.

The **Eurasia Center's** mission is to enhance transatlantic cooperation in promoting stability, democratic values and prosperity in Eurasia, from Eastern Europe and Turkey in the West to the Caucasus, Russia, and Central Asia in the East.

¹ OGAS, or the All-State Automated System in Russian, was a Soviet-era project to create a nationwide information system.

Figure 1. Number of People Employed in IT Industry, Thousands

Source: Ukrstat structural business statistics data on the number of people employed for the following types of economic activities according to the NACE2 classification: 58.2 Software publishing, 62 Computer programming, consultancy and related activities, 63.1 Data processing, hosting and related activities; web portals.

While Ukrainian computer scientists have always had plenty of great ideas and the country enjoyed a multi-generational pool of engineering talent to execute them, it was only after Ukraine's independence in 1991 that its IT industry began to acquire the necessary business skills to become globally competitive. In 2018, eighteen Ukrainian IT companies were rated among the Top-100 outsourcing companies by the International Association of Outsourcing Professionals.²

Ukraine's legacy economy and its new digital economy are built on different values. The former, which Ukraine inherited from its Soviet past, is predominantly based on rent seeking and cheap resources. The new digital economy focuses on continued integration into the global markets and on increasing productivity and competitiveness of Ukraine's human capital.

Unlike in the legacy industries, there are no Ukrainian IT oligarchs, no IT-supported political parties in the Rada, and no IT-controlled Ukrainian media channels.

² "The Global Outsourcing 100," International Association of Operating Professionals, accessed April 4, 2018, <https://www.iaop.org/GlobalOutsourcing100>.

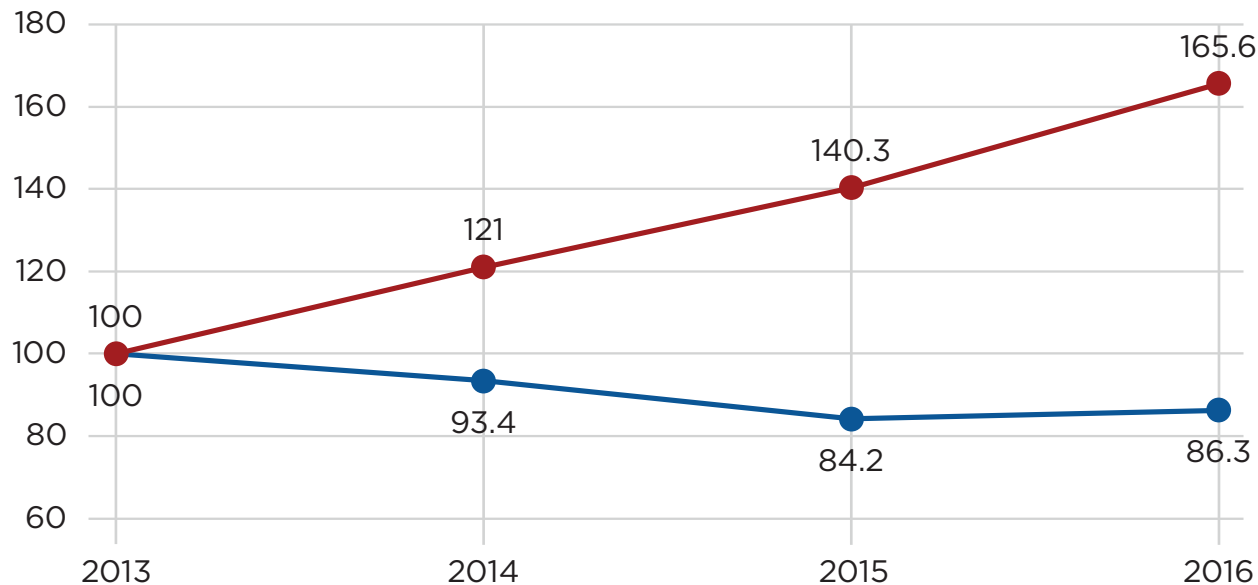
No IT company has been subsidized or bailed out with taxpayers' funds. Instead, Ukrainian IT companies pay high wages, invest in educating their labor force, and work on ever more challenging projects.

The Ukrainian IT Industry

Employment

Since 2013, the number of people employed in the Ukrainian IT industry has grown by almost 30 percent, reaching 153.8 thousand in 2016 (see figure 1). There was a period of decline in 2015, which was most likely caused by internal migration and disruption due to the war in the east of Ukraine and the occupation of Crimea. Some people moved abroad; others stayed in the occupied territories, waiting for a viable solution.

Industry leaders expect the number of people in the IT industry to double over the next five years. The growth will be achieved by attracting new university graduates and by absorbing and retraining workers from other fields. This dynamic is fueled by extremely advantageous compensations levels in Ukrainian IT, which are

Figure 2. Ukrainian GDP and Value Added of IT Industry in 2013–2016, 2013 = 100 percent, constant prices

Source: Ukrstat data on GDP and GDP deflators.

nearly six times higher than the average salary in the country—US\$1,700 vs. US\$300, respectively.

Output

Currently, IT is the most dynamically growing industry in Ukraine. While the rest of Ukraine's economy contracted from 2014 to 2015, the IT industry grew, on average, by 18 percent per year; in 2016, the value added³ created by the IT companies was higher than pre-crisis levels by 66 percent (see figure 2).

As the IT industry was growing faster than the rest of economy and was not affected by the events of 2014–2015, its contribution to the country's gross domestic product (GDP) in five years increased by 2.5 times—from 1 percent in 2012 to 2.5 percent in 2016 (see figure 3).

Average labor productivity in the IT industry is more than double that in the legacy economy. In 2016, the

average yearly labor productivity of the Ukrainian economy was calculated at US\$4,865 of value added per person employed. A person employed in the IT industry created US\$12,279 of value added.

The key factor of industry growth is a successful integration into global markets. The export geography of Ukrainian IT services has undergone some structural changes (see figure 4) and has become more diversified.

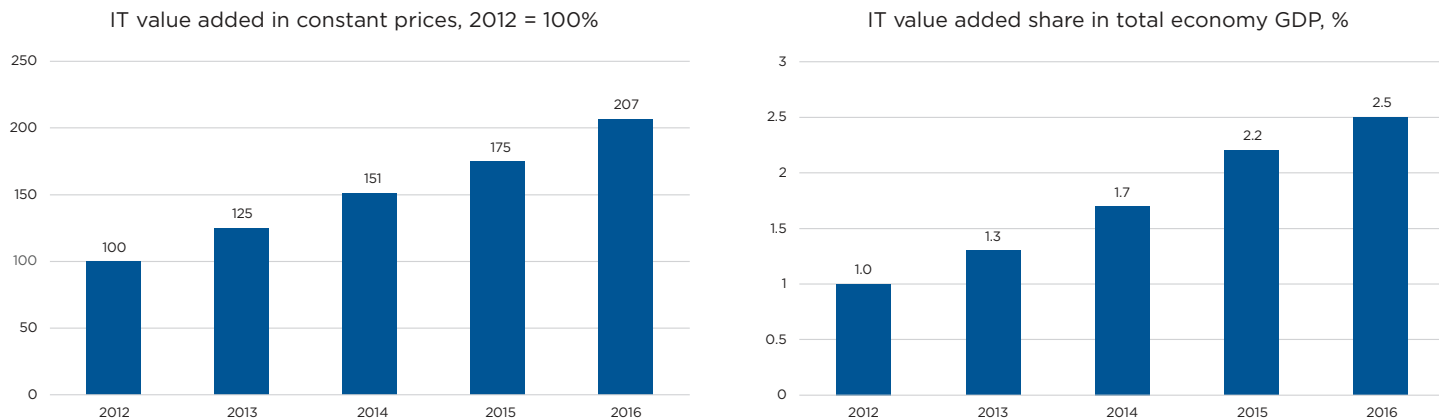
While in 2013 the top-five export destinations (United States, Russia, United Kingdom, Germany, and Switzerland) amounted to 50 percent of the total export of telecommunications, computer, and information services, in 2017, the contribution of the top-five (United States, Switzerland, United Kingdom, Russia, and Israel) was only 36 percent. Additionally, IT exports to Russia, which was Ukraine's second largest trade partner, shrunk by more than two-fold. The reduced sales to Russia were more than balanced by increased exports to other destinations.

Investments

The IT industry has been growing despite limited investment resources available in the country. According to the official statistics, during 2013–2016, IT compa-

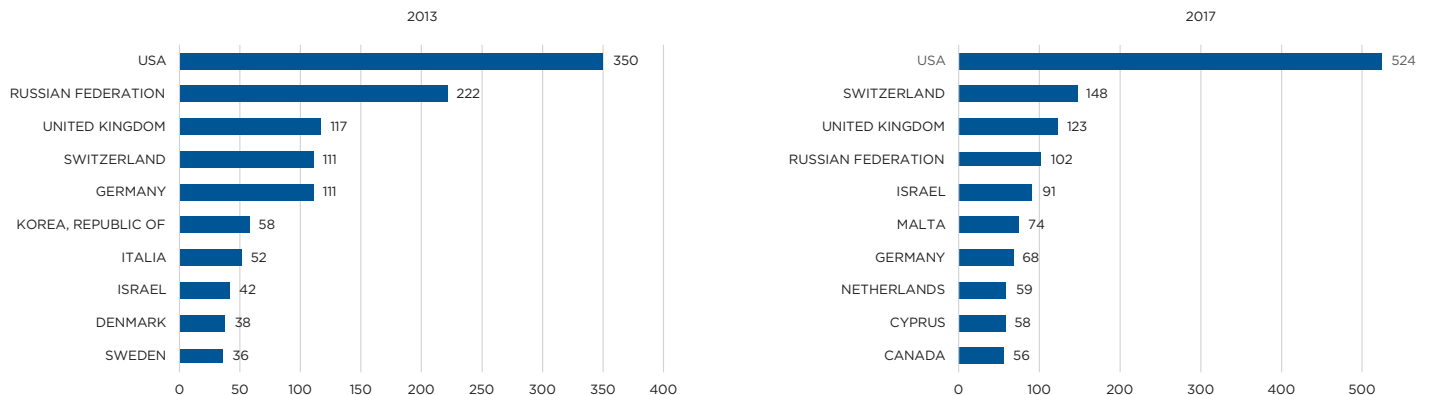
³ The *Financial Times* defines "value added" as "the worth added to a product during the production process - i.e. the difference between what the producing company paid for its inputs and the price it charges for the finished goods." See: "Definition of Value Added," *Financial Times*, accessed April 19, 2018, <http://lexicon.ft.com/Term?term=value-added>.

Figure 3. IT Industry Value Added, Percent



Source: Ukrstat data on GDP and GDP deflators.

Figure 4. Top-10 Ukrainian Export Destinations for Telecommunications, computer, and information services, US\$ million



Source: Ukrstat data.

nies invested about US\$264 million in fixed capital and intangible assets. This is less than 0.5 percent of the total capital investment in the economy.

The average amount of investment per person employed in the IT industry is almost 2.5 times smaller than in manufacturing (see figure 5).⁴ This proportion

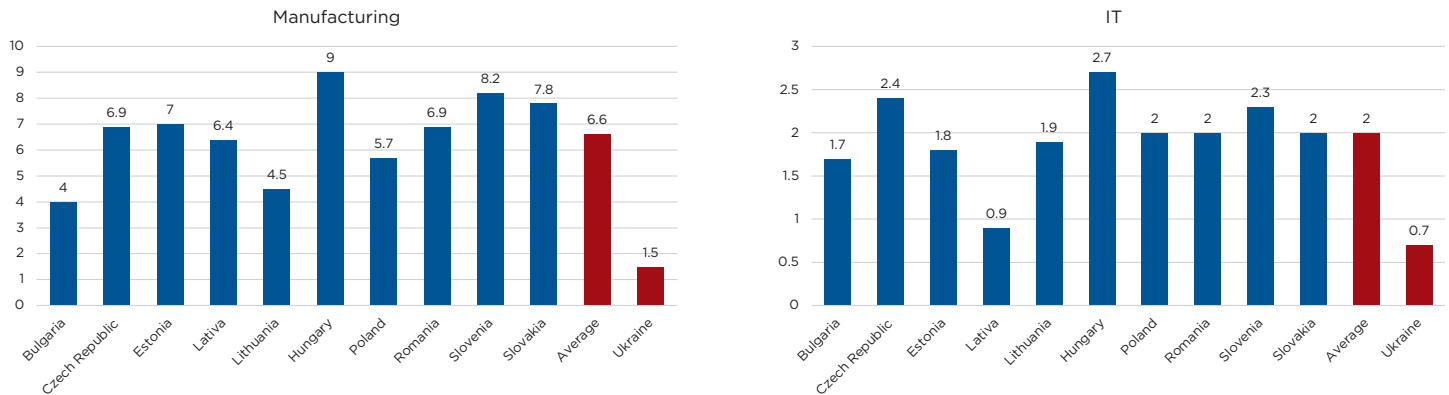
4 The sample of EU countries was chosen based on interviews with Ukrainian IT industry leaders. They mentioned these countries as the main competitors of Ukraine in Central and Eastern Europe on the global markets.

is not unique to Ukraine; similar trends exist among the European countries with which Ukraine competes on the international markets.

This investment has a significantly higher rate of return for the IT industry. One US dollar invested by a Ukrainian IT company creates about US\$33 of value added (figure 6).

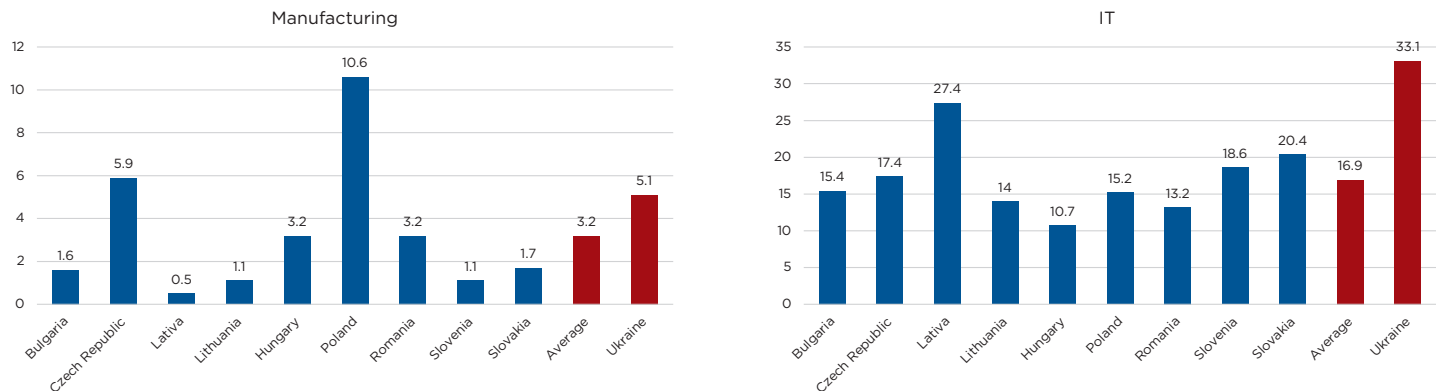
Relatively low investment requirements remove the barriers to entry for newcomers. The difficulty in getting credit and the high interest rates, which are typical barriers for

Figure 5. Investment Per Person Employed in Manufacturing and IT Industry, US\$ Per Year



Sources: Eurostat structural business statistics; Euro/US Dollar exchange rates; Capital investment and number of people employed in Ukraine: Ukrstat structural business statistics.

Figure 6. Value Added Per Investment, US\$ Per Year



Sources: Eurostat structural business statistics; Euro/US Dollar exchange rates; Ukrstat structural business statistics; and authors' estimates.

start-ups in other industries, have less of an impact in the IT industry. Individuals can start a business with a relatively low initial investment. To run a small business, they often need just a computer and a place in a co-working facility equipped with the Internet.

Structure

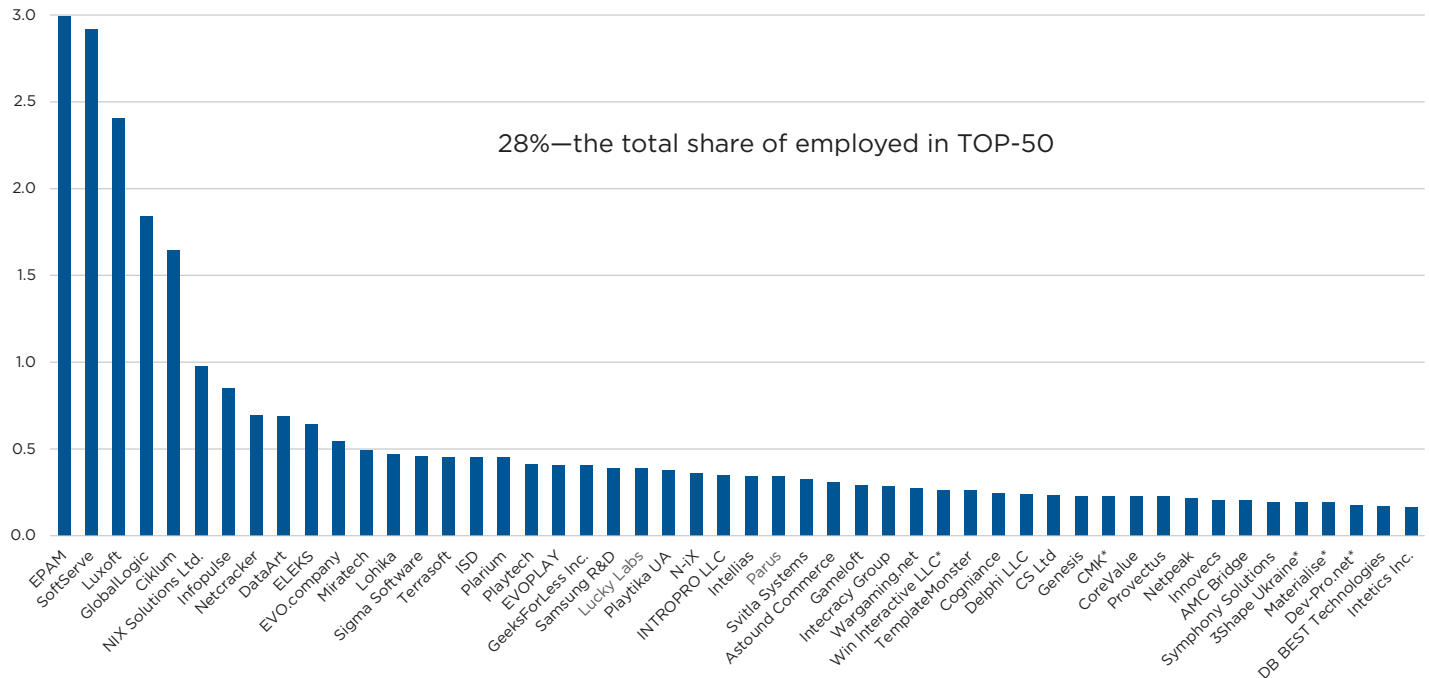
The structure of the IT industry is notable by its decentralization. In addition to Kyiv, there are large IT clusters located in Lviv, Kharkiv, Odessa, Dnipro, and

other cities, usually located near major universities that teach math, science, and technology.

The Ukrainian IT industry is also highly competitive. The biggest IT companies have less than a 3 percent share of the total labor market, and the total share of the top-fifty companies is 28 percent (figure 7).

In addition to IT companies that provide competitive services to multiple customers, a number of global companies including Samsung, Boeing, Siemens, Huawei,

Figure 7. Shares of Employed in the Companies in the IT industry in 2016, percent



Sources: DOU.ua and Ukrstat structural business statistics; web portals; and authors' estimates.

Oracle, and Ericsson have set up research and development centers in Ukraine specifically for in-house needs.⁵

Competition

Globally, Ukrainian IT firms compete, above all, with neighboring European countries including Poland, the Czech Republic, Romania, Bulgaria, Belarus, and Russia (see figure 8).

Industry leaders see Ukraine as having key competitive advantages in the large number of people with an IT or related background, the state's flexible labor market regulation, and a simplified taxation regime.

The total number of people involved in the IT industry in Ukraine is larger than in most Eastern European countries, except Poland (see figure 9).

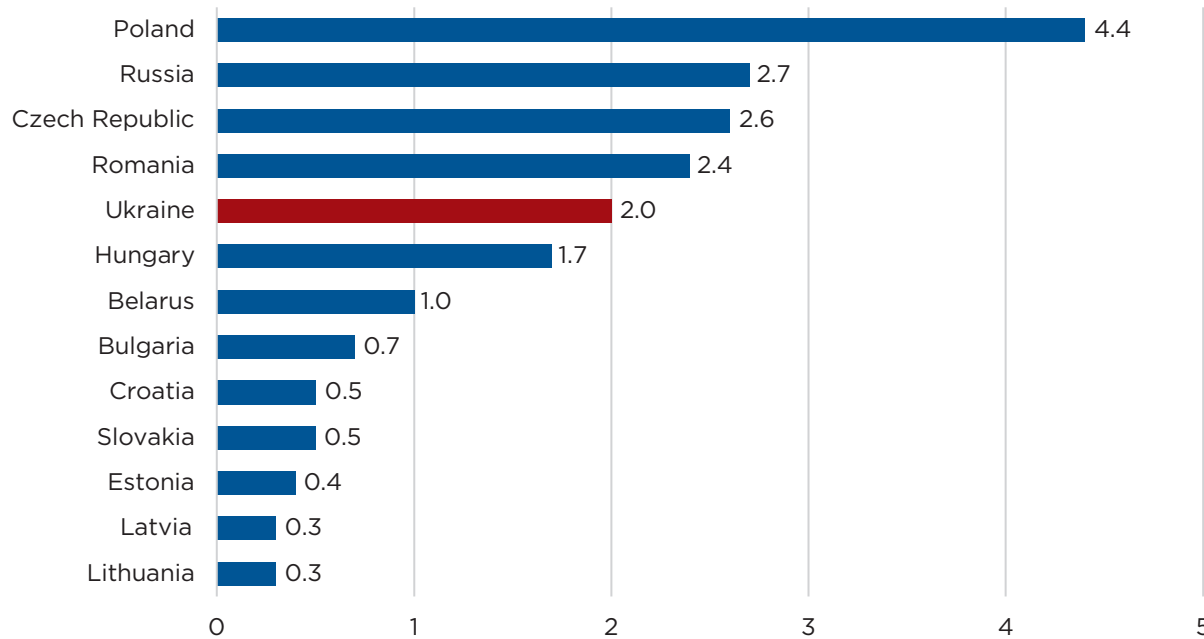
5 Ihor Samokhodsky and Oleksandr Shelest, *Green Paper on "Software Development Market Regulation,"* (Kyiv: Better Regulation Delivery Office (BRDO), 2017), accessed April 19, 2018, https://issuu.com/office_brdo/docs/software_development_market_regulat.

This is especially important for big projects, which require more manpower to staff large teams. Additionally, Ukrainian professionals are prepared to work under more severe contract terms, such as unusual shifts to support different time zones and longer hours.

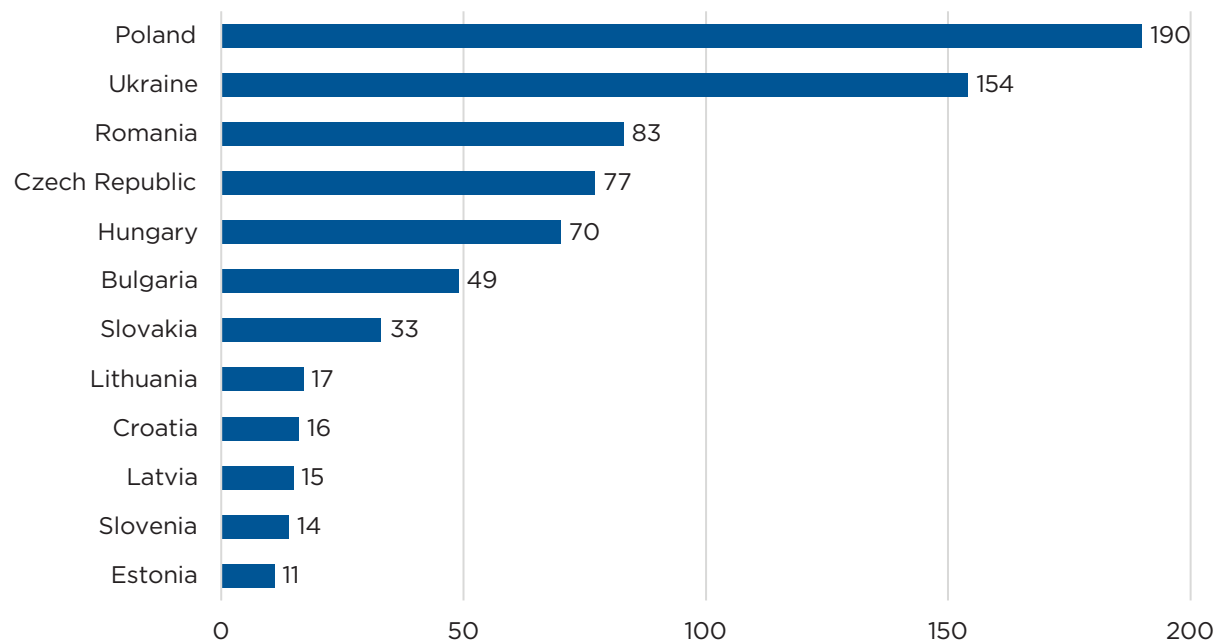
Ukrainian companies predominantly hire employees as contractors, which gives IT companies more flexibility in terms of scheduling, hiring, firing, and taxation. Only 30 percent of people employed in the IT industry in Ukraine are employees, while in Poland, the number is 66 percent; in Slovenia—73 percent, in Hungary—77 percent; and in other countries of Eastern Europe, the figure is even greater.

Ukraine's IT industry is very different from its other two post-Soviet competitors—Russia and Belarus.

Compared to Belarus, Ukraine offers a much larger, more competitive, and decentralized pool of Ukrainian IT professionals. In contrast, most IT-related activities in Belarus are concentrated in Minsk and the IT workforce in Belarus is significantly smaller. Unfortunately, the National Statistical Committee of Belarus does not provide enough data to estimate the number of people

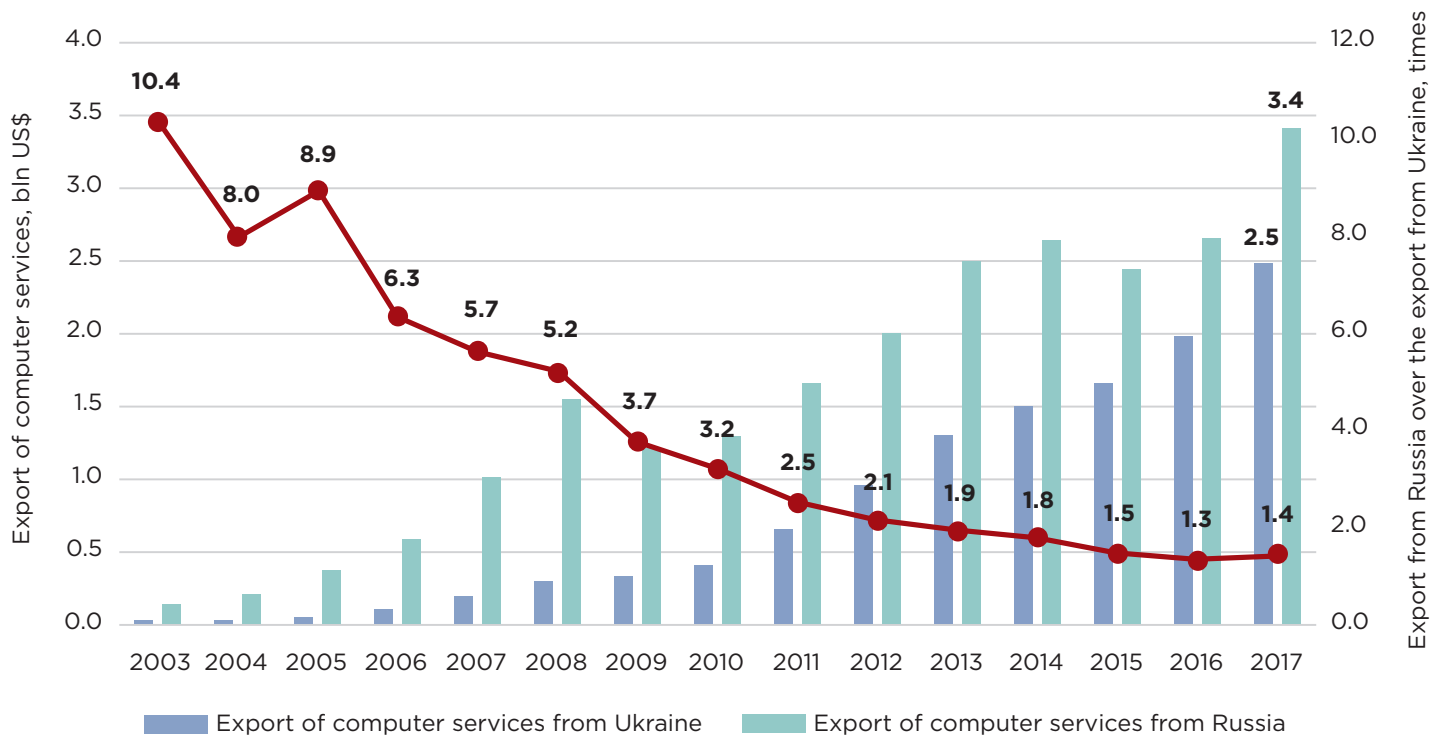
Figure 8. Export of Computer Services in 2016, US\$ billion

Source: Eurostat balance of payments statistics; Euro/US Dollar exchange rates; OECD balance of payments statistics for Russia; National Bank of Ukraine balance of payments statistics, and National Bank of the Republic of Belarus balance of payments statistics.

Figure 9. Number of People Employed in IT industry, 2016 (in thousands)

Source: Eurostat structural business statistics and Ukrstat structural business statistics.

Figure 10. Export of Computer Services from Ukraine and from Russia, US\$ billion



Sources: National Bank of Ukraine balance of payments statistics and Central Bank of the Russian Federation balance of payments statistics.

employed in the IT industry; however, some sources⁶ report the number as 85,000 (the number of employed in information and telecommunications in Ukraine in 2016 was 283,000 people). These sources also report that about 34,000 professionals are involved in the IT products and services segment.

Compared to Russia, Ukrainian IT service exports are more internationally competitive due to the country's openness. Ukraine unilaterally introduced a visa-free regime with the United States,⁷ the European Union

(EU),⁸ and Canada in July–September 2005; since 2017, Ukrainians have had a mutual visa-free regime with EU countries.

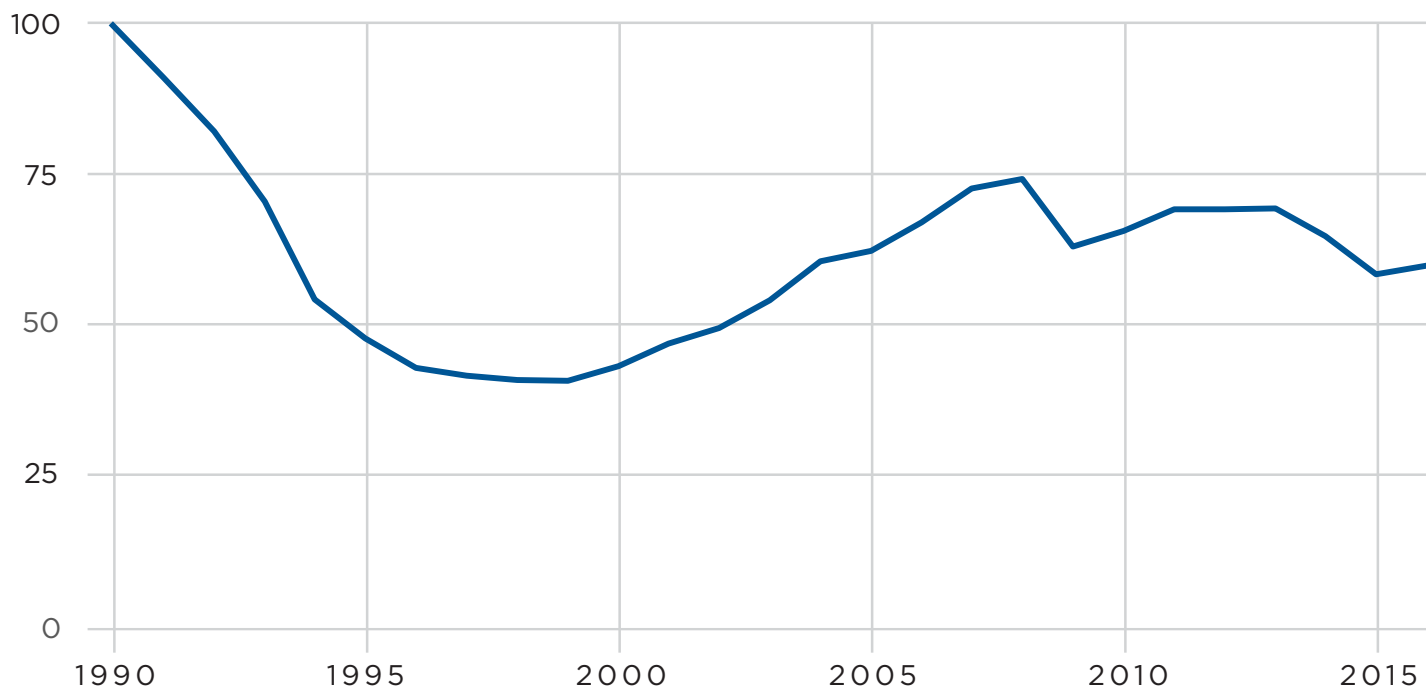
Beginning in the early 2000s, Russian IT companies have enjoyed high domestic demand, which reached US\$32.6 billion in 2014.⁹ This created significant opportunities for IT industry development in Russia. IT companies grew, but predominantly to satisfy domestic demand, Russian IT companies exported only 8-10

6 Anatoliy Voroshilov and Kiryl Domnitch, *The IT Industry In Belarus: 2017 And Beyond*, (Minsk: EY, 2017), accessed April 19, 2018, [http://www.ey.com/Publication/vwLUAssets/ey-it-industry-in-belarus-2017-and-beyond/\\$FILE/ey-it-industry-in-belarus-2017-and-beyond.pdf](http://www.ey.com/Publication/vwLUAssets/ey-it-industry-in-belarus-2017-and-beyond/$FILE/ey-it-industry-in-belarus-2017-and-beyond.pdf); "42 fakta o belorusskom IT: priority, zarplaty, prognozy iz issledovaniya EY," dev.by, accessed April 19, 2018, <https://dev.by/lenta/main/42-facts-on-belarusian-it-industry>.

7 President Victor Yushchenko, Presidential Decree N 1008/2005 (2005), "Pro vstanovlennya bezvizovoho rezhymu dlya hromadyan Spoluchenykh Shtativ Ameryky," Verkhovna Rada of Ukraine, accessed April 19, 2018, <http://zakon3.rada.gov.ua/laws/show/1008/2005>.

8 President Victor Yushchenko, Presidential Decree N 1131/2005 (2005), "Pro vstanovlennya bezvizovoho rezhymu dlya hromadyan derzhav - chleniv Yevropeys'koho Soyuzu, Shveytsars'koyi Konfederatsiyi ta Knyazivstva Likhtenshteyn," Verkhovna Rada of Ukraine, accessed April 19, 2018, <http://zakon2.rada.gov.ua/laws/show/1131/2005>.

9 Authors' estimate based on Russian input-output tables data and World Bank data on exchange rates. See: "Tablitsy resursov i ispol'zovaniya tovarov i uslug za 2015 g.," Russian Federation State Statistics Service, accessed April 19, 2018, http://www.gks.ru/free_doc/new_site/vvp/tri-2015.xlsx and "Official exchange rate (LCU per US\$, period average)," The World Bank, accessed April 19, 2018, <https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=RU>.

Figure 11. Ukrainian GDP in 1990–2016, 1990 = 100 percent, constant prices

Source: Ukrstat.

percent of their output. In 2014, in the aftermath of the Russian invasion of Ukraine, the Russian domestic market began to contract. In 2015, domestic demand had declined to US\$21.5 billion, which stimulated IT companies to attempt to compensate for domestic sales through exports. Until 2016-17, however, the increase in exports of IT services from Russia was not sufficient to offset declines in domestic market demand for IT services (see figure 10).

The Ukrainian IT industry developed and matured under much more stringent conditions characterized by weak domestic demand and limited access to global markets. In the early 2000s, the export value of computer services from Russia was ten times greater than comparable services from Ukraine. Over time, however, Ukrainian companies learned how to compete in global markets, and therefore the gap between Russian and Ukrainian exports has fallen (see figure 10).

Comparison with the legacy economy

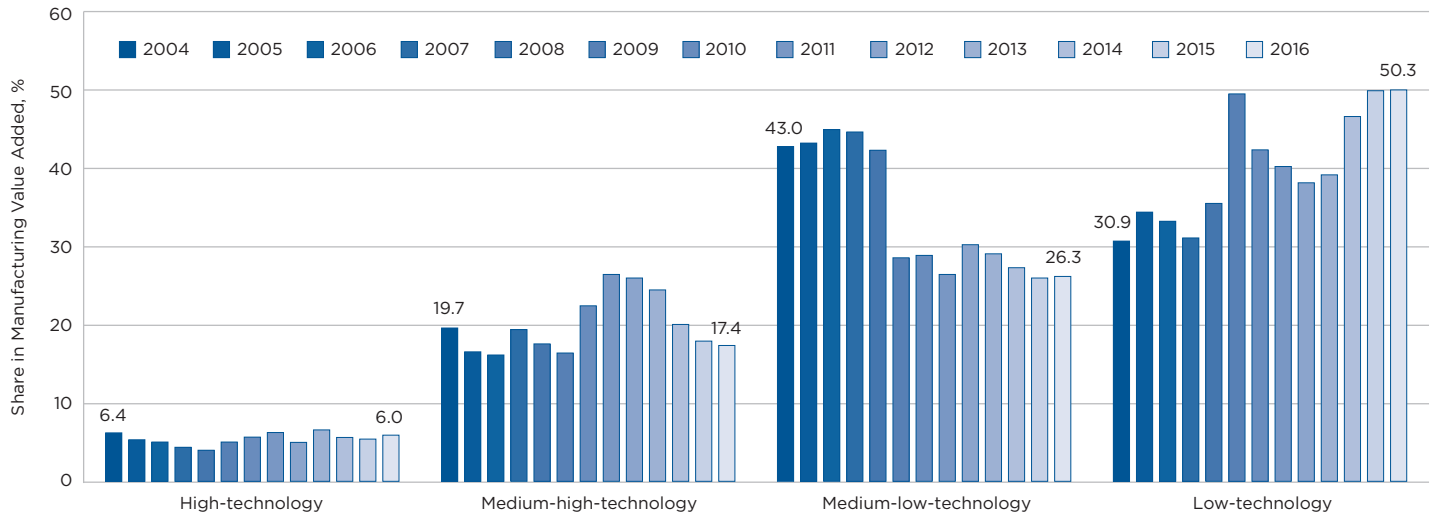
After the Soviet empire collapsed, the economy inherited by Ukraine in its wake faced the challenge of integrating

into the global business environment. Predominantly, successful competition strategies were based on cheap natural resources, labor, permissive ecological regulations, and rent seeking. This led to rapid wealth accumulation by individuals who came to be called oligarchs.¹⁰ Overall, these strategies failed to yield a medium- or long-term competitive advantage for the country. As a result, the economy lost almost 60 percent of GDP during its first years of independence and did not recover over the next twenty years (see figure 11).

Scarce investments were insufficient to modernize technologies. On average, the share of investment in GDP before the 2008-2009 global economic crisis was about 23 percent; it later fell to 17 percent. As a result, the economic complexity of exports decreased,¹¹ which reduced opportunities for emerging new industries.

¹⁰ Brian Bonner, "Forbes: World Has 2,043 Billionaires, including 6 in Ukraine," *Kyiv Post*, March 20, 2017, <https://www.kyivpost.com/ukraine-politics/forbes-world-2043-billionaires-including-6-ukraine.html>.

¹¹ "The Atlas of Economic Complexity," Center for International Development at Harvard University, accessed April 19, 2018, <http://www.atlas.cid.harvard.edu>.

Figure 12. Manufacturing Value Added Structure in 2004-2016, percent

Source: Ukrstat structural business statistics data and authors' estimates.

The manufacturing value added (MVA) was predominantly created in low- and medium-low technology¹² industries (Figure 12). Since 2004, these industries, which include food production and the manufacture of textiles, coke, rubber and plastic, and steel comprised about 75 percent of MVA. High technology industries, which include pharmaceuticals, computers, electronic equipment, and aircrafts, made up less than 7 percent of MVA. The contribution of the medium-high technology industries, including chemical companies, and the production of machinery, equipment, and instruments was about 20 percent of MVA. The major markets for Ukraine's high and medium-high technology goods were Russia and former Soviet countries.

Governance

In terms of Ukraine's political development, twenty-six years of independence were not enough to build a capable governance structure and strong institutions. Widespread corruption, inefficient government, and weak property rights have hampered economic development and disrupted the business environment.

¹² "Glossary:High-tech Classification of Manufacturing Industries," Eurostat Statistics Explained, accessed April 19, 2018, http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech_classification_of_manufacturing_industries.

In 2018, the World Economic Forum ranked Ukraine in eighty-first place among 137 countries according to the global competitiveness index.¹³

In contrast, according to the Human Capital Index, Ukraine is ranked twenty-fourth out of 130 countries.¹⁴ While human capital potential was not realized in the legacy industries, it contributed to the development of the new IT economy.

Ukraine's legacy economy and its new economy are built on different values. The first one is predominantly based on rent seeking and cheap resources; the values of the new economy focus on continuing integration into the global markets and rising productivity and competitiveness of Ukraine's human capital.

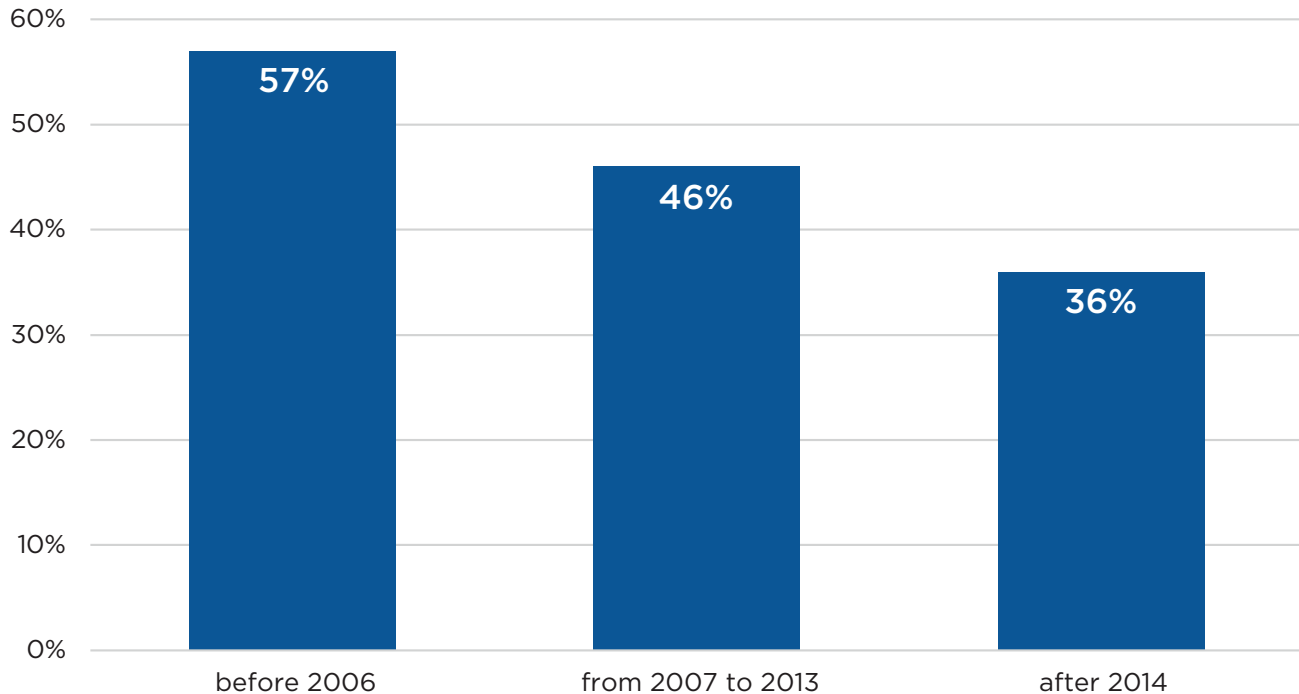
Key drivers

To identify the key drivers of Ukraine's IT industry growth we interviewed chief executive officers (CEOs)

¹³ "The Global Competitiveness Report 2017-2018," World Economic Forum, accessed April 19, 2018, <https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018>.

¹⁴ "The Global Human Capital Report 2017," World Economic Forum, accessed April 19, 2018, <https://www.weforum.org/reports/the-global-human-capital-report-2017>.

Figure 14. The Share of People from Families of IT Professionals, Mathematicians, Physicists, or Engineers Among Industry Newcomers



Source: The online survey conducted by the authors in February and March 2018 among 750 IT professionals from Kyiv and Lviv IT clusters.

These achievements in math and science come from a deep tradition. Skills accumulated by the previous generations of computer scientists played a significant role in the emergence of the modern Ukrainian IT industry. The first generation of Ukrainian computer scientists¹⁸ appeared in the late 1940s. They worked in numerous scientific centers and laboratories, which provided research and development for the military sector¹⁹ over several decades. The global scientific community did not know much about these scientists and their often brilliant achievements. Instead, computer and technology skills accumulated by generations of Ukrainian scientists was passed along through families. A number of today's professionals over the age of thirty-five got their first experience with computers in the research and development centers where their parents worked. According to a survey conducted by the authors,

¹⁸ Boris Malinovsky, "Timeline: Computing Development in Ukraine," History of Computing in Ukraine, 2012, <http://en.uacomputing.com/stories/timeline/>.

¹⁹ "Timeline: Computing Development in Ukraine."

among individuals who worked in the IT industry before 2006,²⁰ almost 60 percent came from families of IT professionals, mathematicians, physicists, or engineers (see figure 14).

The Soviet educational system strongly emphasized the fields of math, science, and IT. In the early 1990s, about sixteen thousand students graduated from these programs every year in Ukraine. Although these students had strong technical skills, they did not have experience with global markets. After Ukraine declared independence in 1991, it took nearly fifteen years to incorporate the skills necessary in a global economy and to build a modern industrial base, which is capable of successfully competing with global players.

This long tradition of accomplishment in math, technology, and computer science combined with an em-

²⁰ The authors used snowball sampling techniques and posted the questionnaire of DOU.ua portal. The sample included 742 industry representatives.

phasis on these disciplines within high school curricula have contributed to building Ukraine's talented labor pool for the IT industry. The educational foundation in math and sciences provides students the opportunity to develop the necessary competencies, even if they do not have an IT-related university education.

On average, eighteen thousand people graduate from university programs that specialize in IT and mathematics every year. Additionally, Ukrainian companies support human capital development for the IT industry. Last year, they ran a number of programs at leading universities and equipped IT laboratories to promote technology-based learning. Additionally, a big IT education industry has grown inside the educational ecosystem, including corporate universities and independent professional courses. In 2016, nearly 44 thousand people²¹ have completed courses at these centers.

Over the last several years, Ukrainian IT firms began implementing global projects²² in areas other than pure

IT—in digital innovation for the automotive, finance, retail, healthcare, energy efficiency, utilities, telecommunications, media production, and logistics industries. As a result, Ukrainian IT companies have been acquiring advanced business knowledge and global industry contacts beyond the IT field. Within a short period of time, this knowledge is likely to lead to the creation of companies and platforms that can drive the economy forward.

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21 "Rynok IT-obrazovaniya: kursy i uchebnyye tsentry podgotovili svyshe 35 tys. studentov v 2016 godu," DOU.ua, March 29, 2017, <https://dou.ua/lenta/articles/it-schools-rankings-2016/>.

22 Katerina Buyal'ska, "Naybil'shi ukrayins'ki IT-kompaniyi rozpovily pro svoji rozrobky," *Na Chasi*, October 4, 2017, <https://nachasi.com/2017/10/04/it-kompaniyi-rozrobky/>.

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