

Ivano-Frankivsk Innovation System Mapping Report

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Table of Contents	
Introduction.....	3
Implications for Promprylad Project.....	4
SRI’s Pillars of Regional Innovation Systems.....	5
Talent.....	6
Education.....	6
Skills.....	7
Entrepreneurship Culture.....	9
Risk Capital.....	10
Access to Finance.....	11
1Access to Markets.....	13
Idea Generation.....	15
R&D Resources.....	15
Patents.....	16
Business Environment.....	18
Economic Sectors.....	18
Industry Focus.....	19
IT Sector.....	22
Labor Market.....	23
Networks.....	26

Introduction

This report provides analysis and overview of the innovation system in Ukraine and in the Ivano-Frankivsk region. The purpose of this report is to create a picture of the overall landscape of the national and regional innovation systems, and to identify strengths and weaknesses in those systems. SRI will use the findings from this report, as well as the innovation center case studies and interview data, to craft an overall business plan and strategy for the revitalized Promprylad facility, including recommendations for the types of customers and services it should target.

Our analyses rely on available secondary sources of data, including reports from the Ukrainian State Statistical Service, Ivano-Frankivsk State Regional Administration, European Union, World Bank, OECD, and others. However, it should be noted that data on Ukraine in general, and for the Ivano-Frankivsk region in particular, are often limited. In our analyses, we supplement these data with qualitative data collected by SRI during intensive interviews conducted in Ivano-Frankivsk and Lviv in August of 2016. Because of data limitations, this report will present analysis on both the national (Ukraine) and regional (Ivano-Frankivsk) innovation systems where possible, but there are several sections of this analysis where only national-level data were available.

Table 1: Innovation System Overview

Innovation Element	Key findings
Talent	<ul style="list-style-type: none">● Good national formal education system and literacy rates● Gaps in skills and practical training in workforce
Risk Capital	<ul style="list-style-type: none">● Risk capital investment market is growing rapidly, but investment is almost exclusively in IT sector and highly concentrated in Kyiv and in a few late-stage deals● Access to capital is a severe constraint on Ukraine's small- and medium-sized enterprises (SMEs)
Access to Markets	<ul style="list-style-type: none">● New EU comprehensive trade agreement and SME support programs represent new opportunities for Ukrainian small businesses● Ukrainian import/export processes may present major burden for small businesses when trading goods across borders
Idea Generation	<ul style="list-style-type: none">● Very low levels of academic R&D investment in Ukraine and Ivano-Frankivsk● High percentage of R&D spending and personnel in the business sector relative to most European countries
Business Environment	<ul style="list-style-type: none">● Ivano-Frankivsk economy has major concentration in agriculture sector● IT sector is a small, but rapidly growing, economic sector in Ukraine

Networks	<ul style="list-style-type: none"> ● Network formation in IF, and in Ukraine in general, is very limited ● Lack of government support for clusters and industry groups
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Implications for Promprylad Project

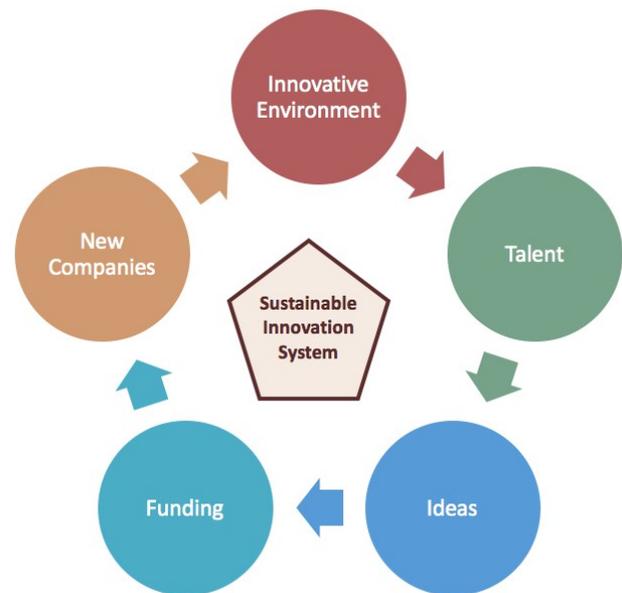
As stated in the introduction, the analyses contained in this report are intended to help SRI and Teple Misto develop a business plan and strategy for the Promprylad facility. The key findings in Table 1 have several important implications for this project going forward:

1. There is a real demand for practical training and building new skills in many different economic sectors in Ukraine and Ivano-Frankivsk. This demand represents an opportunity for the project to offer space for other organizations to conduct training courses and/or to develop and host its own practical training curricula and lectures.
2. SMEs in Ukraine face a major challenge with access to capital. The Promprylad project could help address this challenge by providing guidance and support to SMEs, helping them to find and apply to grants and loans. SRI and Teple Misto should seek out contacts and potential partnerships with grant organizations, such as representatives from regional government grant programs, the EU's SME Flagship Initiative and Invest East programme, and other international grant organizations that provide support to SMEs.
3. SMEs in Ukraine face additional challenges with finding customers in international markets and with trading across borders. The Promprylad project could offer mentorship and other support services targeted at educating businesses on how to find international customers and how to navigate customs regulations.
4. The IT sector in Ukraine is growing extremely rapidly, as are venture capital and angel investments in IT. Although the IT sector in Ivano-Frankivsk is currently very small, potential for the IT industry in the region and in the country is too large to ignore. Representatives from companies in Ivano-Frankivsk's IT industry have already expressed great interest in the Promprylad project as a venue for conferences, lectures, and practical training courses, as well as an office rental location.
5. There are large concentrations of employment in Ivano-Frankivsk in the agriculture, healthcare, and education sectors. SRI and Teple Misto should identify the types of activities and organizations that constitute those sectors in Ivano-Frankivsk to determine if there are opportunities for partnerships and/or to provide services.

SRI's Pillars of Regional Innovation Systems

This analysis is based on SRI's Regional Innovation System framework. SRI developed this framework after years of working with cities and regions to develop self-sustaining innovation systems. Through our work, SRI has identified six "pillars" of regional innovation systems:

- **Talent.** The mix of business, entrepreneurship, and technical skills, experience, and attitudes that is found among a region's workforce and students.
- **Risk Capital.** The quantity and quality of equity capital and other financing for new ventures that is available in the region, and the sector-specific expertise level of area investors.
- **Access to Markets.** The types and amount of customers that are accessible in a region to provide test beds, co-development opportunities, early revenue, supply chain partners, and a long-term customer base.
- **Idea Generation.** The volume, quality, and focus of business-relevant ideas generated within a region.
- **Business Environment.** The unique characteristics of infrastructure, expertise, geography, market demographics, and other regional characteristics that provide competitive advantages and differentiated innovation opportunities.
- **Networks.** The connectors and linkages in a region that help connect area ideas, talent, investors, and mentorship to markets and each other.



Talent

Talent refers to the mix of business, entrepreneurship, and technical skills, experience, and attitudes found among a region's workforce and students. This section is divided into three parts: education, skills, and entrepreneurship culture. Ukraine rates highly in formal education levels and literacy rates relative to its neighbors in Central and Eastern Europe and globally. However, there appear to be major gaps in practical skills in several segments of the Ukrainian workforce, including the IT sector. The data are somewhat mixed in terms of Ukraine's entrepreneurship culture – Ukrainians are somewhat risk averse when it comes to starting new businesses and ventures, but entrepreneurship does seem to be on the rise nationally.

Education

Ukraine has an adult literacy rate of 99.7 percent, among the highest in the world.¹ The country also had a 99.5 percent completion rate for secondary education completion in 2012, which again is among the highest rates in the world.² Statistics on higher education completion rates in Ukraine were not available. Looking at the quality of universities in the country, Ukraine does not have a university ranked in the global top 500 in the 2016 Academic Ranking of World Universities³ or the top 800 in the 2016 Times Higher Education World University Rankings⁴ – two of the most commonly used global university ranking publications.

Looking at the Ivano-Frankivsk region, Ivano-Frankivsk has 17 institutions of higher education, including Ivano-Frankivsk National Technical University of Oil and Gas, Subcarpathian National University, Ivano-Frankivsk National Medical University, and King Danilo University. The region has 291 students enrolled in higher education per 10,000 population – a lower rate than the national level of 393 students enrolled per 10,000 population.⁵ Social sciences (including business and law), engineering, healthcare, and education were the largest disciplines in higher education by number of students in 2014. Additionally, Ivano-Frankivsk is home to 22 professional training institutions, and has 82 students at professional

1 World Bank EdStats, Adult literacy rate, population 15+ years, both sexes (%). Accessed from <http://databank.worldbank.org/data/reports.aspx?source=Education-Statistics:-core-indicators&preview=off#->

2 World Bank EdStats. Lower secondary completion rate, both sexes (%). Accessed from <http://databank.worldbank.org/data/reports.aspx?source=Education-Statistics:-core-indicators&preview=off#->

3 Shanghai Jiao Tong University. "Academic Ranking of World Universities." Accessed from [http://www.shanghairanking.com/-](http://www.shanghairanking.com/)

4 Times Higher Education. "World University Rankings". Accessed from <https://www.timeshighereducation.com/->

training institutions per 10,000 population – a higher rate than the national level of 73 students per 10,000 population. During SRI’s interviews with stakeholders in Ivano-Frankivsk in August 2016, we heard that the overall quality of colleges and universities in the region is poor. However, King Danilo University has been receptive to working with industry to develop curricula relevant to the needs of the IT companies in Ivano-Frankivsk. Ukrainian Catholic University in Lviv also has a very good reputation as a business school and as a university that is willing to work with industry to develop curricula relevant to their needs.

Skills

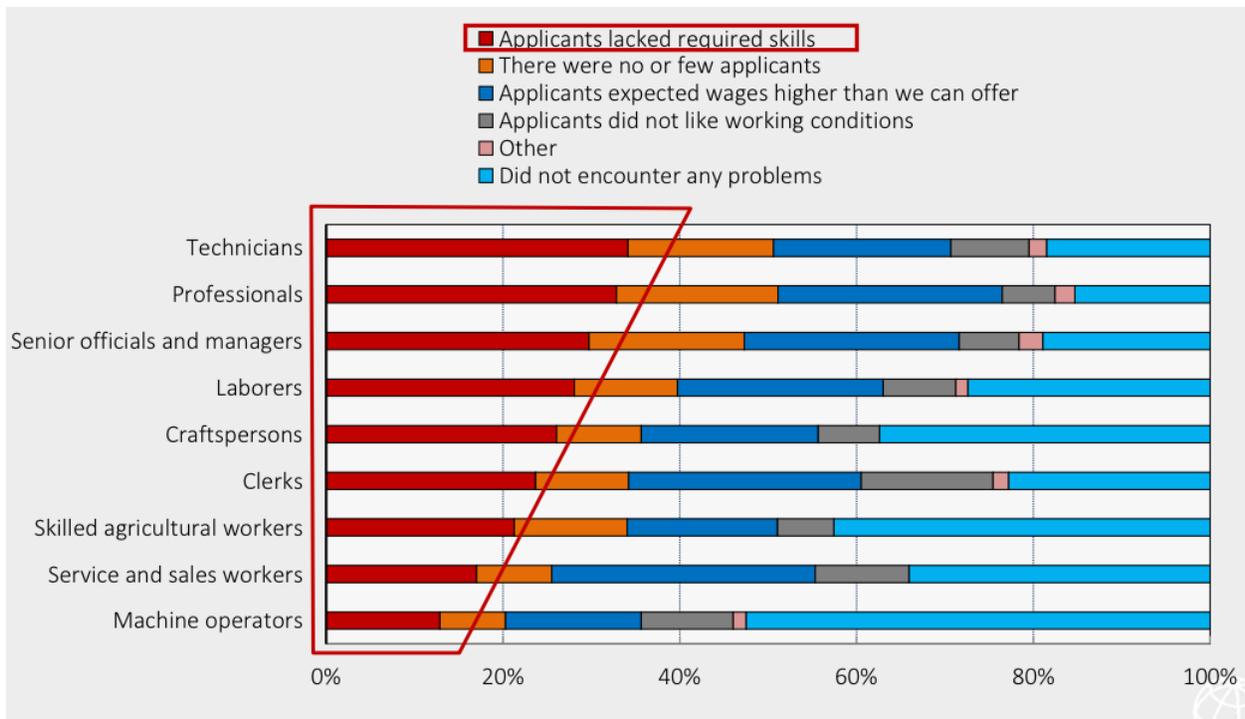
While Ukraine has high levels of literacy and formal education attainment, several recent studies have found there are gaps between the practical skills required by Ukrainian companies and the actual skills possessed by the Ukrainian workforce. The World Bank’s *Skills Towards Employment and Productivity* (STEP) survey of Ukrainian companies found that employers largely felt that Ukraine’s education and training system does not produce individuals with the skills they need – particularly practical skills. As shown in Figure 1, gaps in skills were most acute among technicians, professionals, and senior officials and managers.⁶

Figure 1. Problems encountered by employers when trying to hire staff, by occupation (%)⁷

5 State Statistics Service of Ukraine. *Regions of Ukraine 2015*. Accessed from http://ukrstat.org/en/druk/publicat/kat_e/publ2_e.htm

6 Ximena Del Carpio. *Skills for a Modern Ukraine*. World Bank Group, November 2015.

7 Ibid.



Companies reported that these skill gaps created a variety of problems, including loss of efficiency, loss of service quality, increased recruitment costs, and loss of innovation opportunities. World Bank's STEP survey also found that training beyond formal education (i.e., practical training courses, training in specific software packages or systems, etc.) was virtually non-existent in Ukraine.⁸

The OECD and World Bank's *Skills Gaps Survey* gathered information on skills used by the current workforce, skills of new hires, and skill gaps in two key sectors in Ukraine – agribusiness and energy. The survey found that a third of agribusiness companies and one-fifth of renewable energy companies experience a significant gap between their employees' skills and the skills required to meet their business objectives. This gap is particularly acute among SMEs. Surveyed companies said these skill gaps negatively impacted the efficiency and quality of their products and services, resulting in losses of sales opportunities.⁹

SRI's interviews with IT companies in Ivano-Frankivsk and Lviv reinforced the findings of these surveys. The IT managers and professionals we spoke to generally found it difficult to find employees with the skills needed for vacant positions, with few exceptions. These companies said that they often need to train new employees for a period of up to several months, depending on the position, before they could

⁸ Ibid.

⁹ OECD Eurasia Competitiveness Programme. *Identifying and Addressing Skills Gaps in Ukraine*. Working Group on Skills Development for Agribusiness December 2015.

perform adequately in their new jobs.

Entrepreneurship Culture

The Global Entrepreneurship Index (GEI), an annual report which measures the quality and dynamics of national entrepreneurship ecosystems, is one of a very few sources of cross-national data on entrepreneurial culture or attitudes toward entrepreneurship. The 2016 GEI rankings find Ukrainians to be very risk averse, as Ukraine ranked below its neighbors Poland, Russia, Slovakia, and Romania in risk acceptance (the percentage of the 18-64 aged population stating that the fear of failure would not prevent them from starting a business) and in cultural support for entrepreneurship (a measure of how a country's inhabitants view entrepreneurs in terms of status and career choice).¹⁰

However, there is anecdotal evidence that entrepreneurship is on the rise in Ukraine. High profile events like the Ukrainian Startups Roadshow in London, Kyiv Startup Week, and Lviv IT Arena have raised the profile of the Ukrainian startup scene internationally, and several successful companies have emerged from Ukraine's IT startup scene in recent years. In SRI's interviews in Ivano-Frankivsk in August 2016, several interviewees said that because of these new opportunities and success stories, many of Ukraine's IT young professionals are more willing to attempt to start their own companies.

Social entrepreneurship also appears to be on the rise in the country. Social entrepreneurship is a relatively new phenomenon in Ukraine and is largely supported by funding from international donors, rather than from Ukrainian sources.¹¹ In SRI's interviews in Ivano-Frankivsk in August 2016, several interviewees said they believed that the Euromaidan Revolution (Revolution of Dignity) spurred a large amount of activity in the social entrepreneurship sector, and those impacts are still present in 2016.

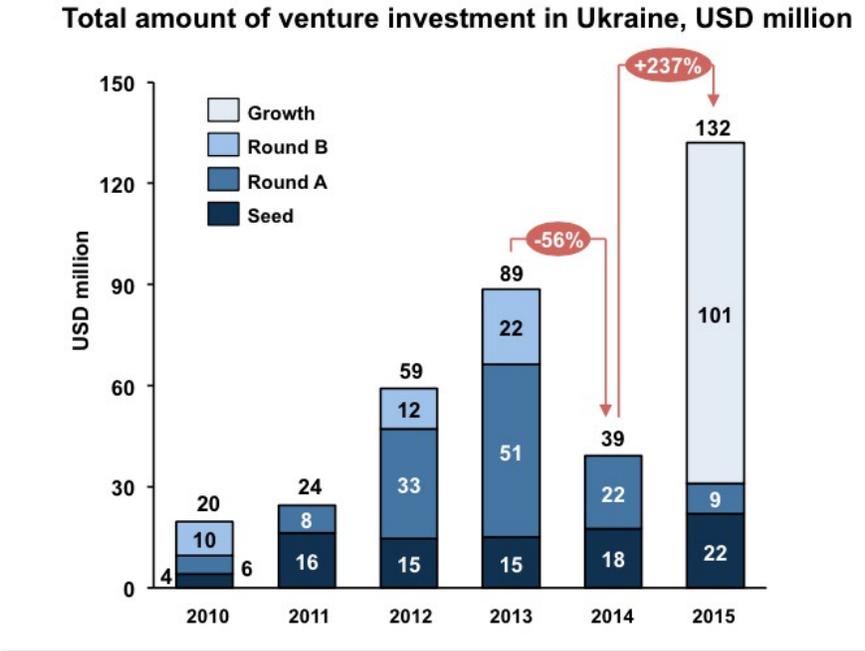
¹⁰ Zoltan Acs; Szerb, Laszlo; and Autio, Erkko. *Global Entrepreneurship Index 2016*. The Global Entrepreneurship and Development Institute.

¹¹ Innovative Social Enterprise Development Network. *Benchmarking Study on Social Entrepreneurship*. 2010.

Risk Capital

Risk capital refers to the quantity and quality of equity capital and other financing for new ventures available in the region and the sector-specific expertise level of area investors. The risk capital investment market in Ukraine, while small, has grown at a very rapid pace over the last five years. Starting from virtually no venture activity prior to 2010, there were USD \$132 million in risk capital investments in 2015, a 240 percent increase from 2014. Most of this USD \$132 million was concentrated in a few late-stage investments, though early stage seed investments also have increased – from USD \$18 million in 2014 to USD \$22 million in 2015.¹² Almost 100 percent of venture investments since 2010 were in IT companies, reflecting the importance of the IT sector in Ukraine’s innovation system. Additionally, over half of the risk capital investments in 2015, USD \$68 million, came from Ukrainian venture funds rather than from international funding sources.

Figure 2: Total venture investment in Ukraine in 2015¹³



By comparison, one report estimates the Russian venture capital investment market was approximately

12 Yuliya Sychikova; Degeler, Andrii; Yevgen, Sysoyevl and Henni, Adrien. *The Dealbook of Ukraine, 2016 Edition*. AVentures and Ukraine Digital News, 2016.

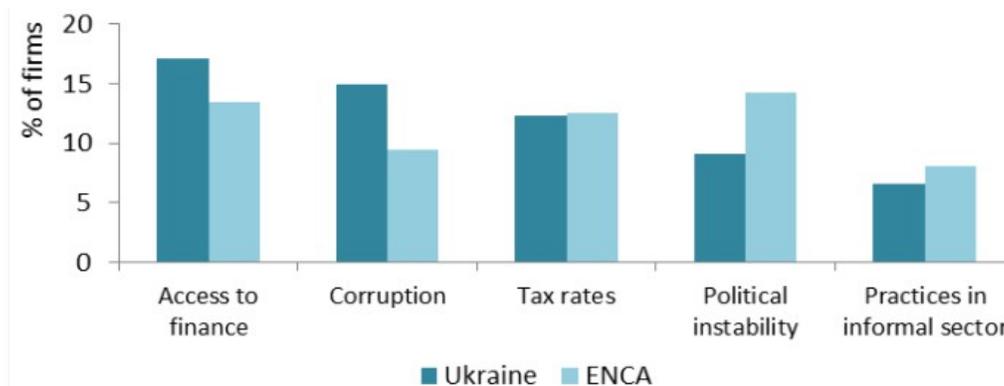
13 Ibid.

USD \$890 million in 2014¹⁴, and the Polish venture capital investment market was reported at USD \$50 million in 2016, with another USD \$50 million in investments in Polish firms that had relocated their headquarters abroad.¹⁵

Access to Finance

Risk capital is not the only form of financing available to entrepreneurs and SMEs, as loans and grants can also prove critical to the development and growth of small companies. The World Bank/EBRD *Business Environment and Enterprise Performance Survey (BEEPS)* found that almost 40 percent of Ukrainian SMEs find access to financing as a moderate, major, or very severe obstacle to business operations.¹⁶ As shown in Figure 3, access to financing was cited as the largest obstacle in Ukraine’s business environment by survey respondents. With limited access to external funding, SMEs rely heavily on internal sources of funding and retained earnings. For example, about 65 percent of investments in fixed assets and 80 percent of working capital are financed with internal resources.

Figure 3: Major Obstacles to Business Environment¹⁷



NOTE: The ENCA region refers to the countries of Armenia, Azerbaijan, Georgia, Moldova, and Ukraine

14 RMG Partners. *Russian Venture Capital Market Overview, 3rd quarter 2015*. Accessed from http://www.ewdn.com/wp-content/uploads/sites/6/2016/01/rmg_report_eng-3q2015.pdf

15 Agata Kukwa. “How Big Is the VC Market in Poland?” 150SEC.com. Accessed from <http://150sec.com/how-big-is-vc-market-in-poland/>

16 Tamar Baiashvili and Frewer, Geoff. *Ukraine Neighbourhood SME financing*. European Investment Bank, February 2016. Accessed from http://www.eib.org/attachments/efs/economic_report_neighbourhood_sme_financing_ukraine_en.pdf

17 Ibid.

The findings of the World Bank BEEPS survey are consistent with SRI's interviews in Ivano-Frankivsk and Lviv in August 2016. Interviewees said that their companies largely relied on self-financing to expand their operations, develop new products, or buy new equipment.

Governmental financial support for SMEs is also severely limited in Ukraine. Most national-level support programs are either underfunded or insufficiently implemented. While there are some regional and local level support programs, there is large variance in the quality and amount of support provided.¹⁸ Ivano-Frankivsk's *Development Strategy for the Period until 2020* includes grants for microcredits for SMEs through the Regional Fund for Entrepreneurship support, but it is unclear how large those credits are and how those grants are awarded.

One potentially promising source of funding is the EU's new SME Flagship Initiative for Ukraine, Georgia, and Moldova, which will provide approximately USD \$220 million in program funding and grants for SMEs in those countries. Grants will be aimed at helping SMEs integrate into global value chains; comply with new sanitary, environmental, technical and quality standards; find new trade opportunities; and access additional sources of finance.¹⁹

18 Ibid.

19 European Commission. "Fact Sheet: The DCFTA Facilities for SMEs." May 21, 2015. Accessed from http://europa.eu/rapid/press-release_MEMO-15-5013_en.htm

1 Access to Markets

Access to markets refers to the availability of customers accessible in a region to provide test beds, co-development opportunities, early revenue, supply chain partners, and a long-term customer base. However, because data on supply chains and the customer base in Ukraine is extremely limited, this section primarily focuses on Ukrainian companies' access to markets outside of the country.

The largest, and most financially lucrative, market for Ukraine is currently the European Union (EU). The EU is Ukraine's largest trading partner, accounting for more than 40 percent of Ukraine's foreign trade in 2015. Ukraine exports to the EU amounted to USD \$11.7 billion in 2015. The main Ukrainian exports are raw materials (iron, steel, mining products, agricultural products), chemical products, and machinery.²⁰ Germany and Poland are the EU members that Ukraine trades the most with. In January of 2016, Ukraine and the EU also provisionally agreed to a Deep and Comprehensive Free Trade Agreement (DCFTA), which will give Ukrainian companies preferential access to the European market. This should further increase trade between Ukraine and the EU. One of the key provisions of the new agreement is the DCFTE SME Flagship Initiative, which provides support for SMEs in Ukraine, Georgia and Moldova, with the aim of preparing these smaller businesses for new market opportunities in the EU and global economies.²¹ This SME initiative is discussed in more detail in the Risk Capital section of this report.

Trade with Russia, which was Ukraine's largest trading partner prior to the conflicts in Eastern Ukraine and Crimea, has dropped substantially – from 25.7 percent of exports going to Russia in 2012 to 17 percent in 2014. China, Turkey, and Egypt are also important trading partners for Ukraine.

Looking specifically at Ukraine's large IT outsourcing industry, the top international customer markets since 2000 have been the United States (US), United Kingdom (UK), and Germany.²²

It should be noted that Ukraine ranks very poorly – 109th in the world – in the World Bank's Ease of Doing Business rankings for ease of trading across borders. The World Bank's rankings note that the time and cost for obtaining documents, preparing documents, processing documents, presenting documents, and submitting documents for import and export of goods in Ukraine is extremely

20 European Commission. "Trade: Policy: Countries and Regions: Ukraine." Accessed from <http://ec.europa.eu/trade/policy/countries-and-regions/countries/ukraine/>-

21 European Commission. "Fact Sheet: The DCFTA Facilities for SMEs." May 21, 2015. Accessed from http://europa.eu/rapid/press-release_MEMO-15-5013_en.htm-

22 Ukrainian Hi-Tech Initiative. *Exploring Ukraine IT Outsourcing Industry*. 2012. Accessed from <http://hi-tech.org.ua/wp-content/uploads/2012/08/Exploring-Ukraine-IT-Outsourcing-Industry-20121.pdf>-

burdensome. While these cross-border processes do not generally affect Ukraine's IT companies, it may prove a large impediment to manufacturers and other types of businesses when trying to send their goods abroad.

Idea Generation

Idea generation refers to the volume, quality, and focus of business-relevant ideas generated within a region. There is no direct way to measure ideas, but there are several indicators that can show the amount of resources devoted to research and development (in terms of money and manpower) and show outcomes from idea generation, such as patents.

R&D Resources

Gross domestic expenditure on research and experimental development (GERD) shows R&D investments at a national level, including investments by government, academia, and the private sector. GERD as a percentage of GDP is another measure that controls for the size of a country's economy. In 2011, Ukraine spent 0.74 percent of its GDP on R&D, a decrease from 1.17 percent in 2005. There is no data on GERD for Ukraine since 2011, but it is probable that GERD as a percentage of GDP has continued to fall post-2011 as Ukraine has suffered from recession, rampant inflation, and war in the eastern part of the country in the last five years. In 2011, Ukraine ranked above its neighbors Belarus, Romania, and Slovakia but below Poland and Russia in GERD as a percentage of GDP (as shown in Table 2).²³ However, a relatively high amount of the R&D expenditure in Ukraine is conducted by business – 55.7 percent, a higher percentage than Poland, Romania, Russia, and Slovakia.²⁴ This reflects the large decreases in government spending on R&D in government labs and universities that has taken place in Ukraine in the last 10 years.

Table 2: GERD as % of GDP

	2005	2006	2007	2008	2009	2010	2011
Ukraine	1.17	0.95	0.85	0.85	0.86	0.83	0.74
Belarus	0.68	0.66	0.96	0.74	0.64	0.69	0.70
Poland	0.57	0.56	0.57	0.60	0.67	0.74	0.76
Romania	0.41	0.45	0.52	0.58	0.47	0.46	0.50
Russia	1.07	1.07	1.12	1.04	1.25	1.13	1.09
Slovakia	0.51	0.49	0.46	0.47	0.48	0.63	0.68

Looking at R&D personnel, Ukraine had 4.79 R&D workers per 1,000 people in the labor force in 2011. This represents a decrease from 5.84 R&D workers per 1,000 people in the labor force in 2006. In 2011,

23 UNESCO Institute for Statistics. GERD as a percentage of GDP. Accessed from <http://www.uis.unesco.org/DataCentre/Pages/BrowseScience.aspx>

24 UNESCO Institute for Statistics. GERD – performed by Business enterprise %. Accessed from <http://www.uis.unesco.org/DataCentre/Pages/BrowseScience.aspx>

Ukraine ranked above its neighbors Belarus, Romania, and Poland, but below Slovakia and Russia in R&D workers per 1,000 people in the labor force.²⁵ However, much like research expenditures, Ukraine has a relatively high concentration of R&D personnel working in the business sector – 46.7 percent, which is higher than Poland, Romania, and Slovakia.²⁶

While Ukraine’s overall R&D expenditures and number of R&D workers are low, even compared to their Central and Eastern European neighbors, the high concentration of R&D resources in the business sector bodes well for Ukraine’s innovation system. This is because increasing R&D resources in government and academia is a matter of policy, but it is much more difficult to stimulate investment in R&D in the private sector. Poland, for example, has struggled with chronic under-investment in R&D in its private sector since the 1990s, which has depressed innovation activity in the country.

Looking at R&D resources in Ivano-Frankivsk, the region had 0.56 R&D workers per 1,000 people in the labor force in 2014; much lower than the 2014 national average of 3.84 R&D workers per 1,000 people in the labor force.²⁷ There is no reliable data on R&D expenditures in Ivano-Frankivsk, because the Ukraine State Statistical Service appears to dramatically overstate R&D expenditures in its annual statistical report.

Patents

Patents are a commonly used metric to measure the flow of business-relevant ideas. Patents show when a person or institution feels that an invention has enough potential market value to invest in patent fees to protect the intellectual property. Looking at patent applications in the European Patent Office (EPO), Ukraine had 3 patent applications per 1 million population in 2015. In EPO applications per 1 million population, Ukraine ranked below Poland, Slovakia, and Russia, and above Romania and Belarus.

Table 3: EPO Patent Applications per 1 million population²⁸

	2015
Ukraine	3.0

25 UNESCO Institute for Statistics. Total R&D personnel per thousand total employment (FTE). Accessed from <http://www.uis.unesco.org/DataCentre/Pages/BrowseScience.aspx>

26 UNESCO Institute for Statistics. Total R&D personnel (FTE) – Business enterprise %. Accessed from <http://www.uis.unesco.org/DataCentre/Pages/BrowseScience.aspx>

27 State Statistics Service of Ukraine. *Regions of Ukraine 2015*. Accessed from http://ukrstat.org/en/druk/publicat/kat_e/publ2_e.htm

28 European Patent Office. Patents issued by country. Accessed from <https://www.epo.org/about-us/annual-reports-statistics/statistics.html>

Belarus	1.8
Poland	22.2
Romania	2.7
Russia	5.5
Slovakia	10.5

Looking at patents issued by the United States Patent and Trademark Office (USPTO), Ukraine had 3.1 issued patents per 1 million population in 2015. In USPTO patents per 1 million population, Ukraine ranked below Poland, Slovakia, Romania, and Russia, and above Belarus.

Table 4: USPTO Patents per 1 million population²⁹

	2015
Ukraine	3.1
Belarus	2.3
Poland	13.3
Romania	8.3
Russia	6.9
Slovakia	11.6

Patent data from the Ivano-Frankivsk region is extremely difficult to come by. One source of possible data is the USPTO, which has a search function that allows searches by city of applicant. A search for patents from Ivano-Frankivsk issued by the USPTO found only one patent by an inventor from the city, issued in 2015. The EPO has no search function for location, and the Ukraine State Statistical Service does not keep statistics on intellectual property.

²⁹ United States Patent and Trademark Office. Patents issued by country. Accessed from https://www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_utl.htm

Business Environment

Business environment refers to the unique characteristics of infrastructure, expertise, geography, market demographics, and other regional characteristics that provide competitive advantages and differentiated innovation opportunities.

Economic Sectors

Detailed economic data is difficult to find at both the national and regional levels in Ukraine. The Ukraine Statistical Service reports on broad economic sectors, such as “Agriculture, forestry and fisheries;” “Industry;” and “Education,” but does not break down these broad sectors into more granular and detailed segments. For example, the “Industry” sector contains every form of manufacturing, from food and metal processing to vehicle manufacturing, as well as energy production. Using only these broad industry sectors, it is very difficult to draw meaningful conclusions on the specific strengths and weaknesses of the national and Ivano-Frankivsk economies.

Ukraine’s national economy has experienced declines in real gross domestic product (GDP) since 2012, though GDP is finally expected to grow again in 2016. The country has also experienced a shrinking workforce in most economic sectors for more than a decade due to emigration. Agriculture, industry, and services are the major economic sectors by employment. Agriculture in Ukraine is mostly focused on commodities like grain, sunflowers, and corn, while the industry sector includes concentrations in steel and machine manufacturing.

The Ivano-Frankivsk region has also experienced real declines in gross regional product (GRP) and in workforce in most economic sectors since 2012. As shown in Table 5, the largest sectors by employment are Agriculture, forestry and fishing; Wholesale and retail trade; Industry; and Education.

Table 5: Ivano-Frankivsk Employment by Economic Sector 2014³⁰

Sector	Total Employment	Sector	Total Employment
Agriculture, Forestry & Fishing	155,300	Hospitality	7,900
Wholesale & Retail Trade	99,600	Professional, Scientific & Technical Work	7,700
Industry	68,700	Administrative & Support Services	7,400
Education	55,700	Arts & Entertainment	7,100
Healthcare	38,300	Finance & Insurance	4,900
Construction	25,400	Real Estate	3,800
Transportation	23,600	Information & Communications	3,600
Public Administration & Defense	22,800	Other	16,000

30 State Statistics Service of Ukraine. *Regions of Ukraine 2015*. Accessed from http://ukrstat.org/en/druk/publicat/kat_e/publ2_e.htm

Industry Focus

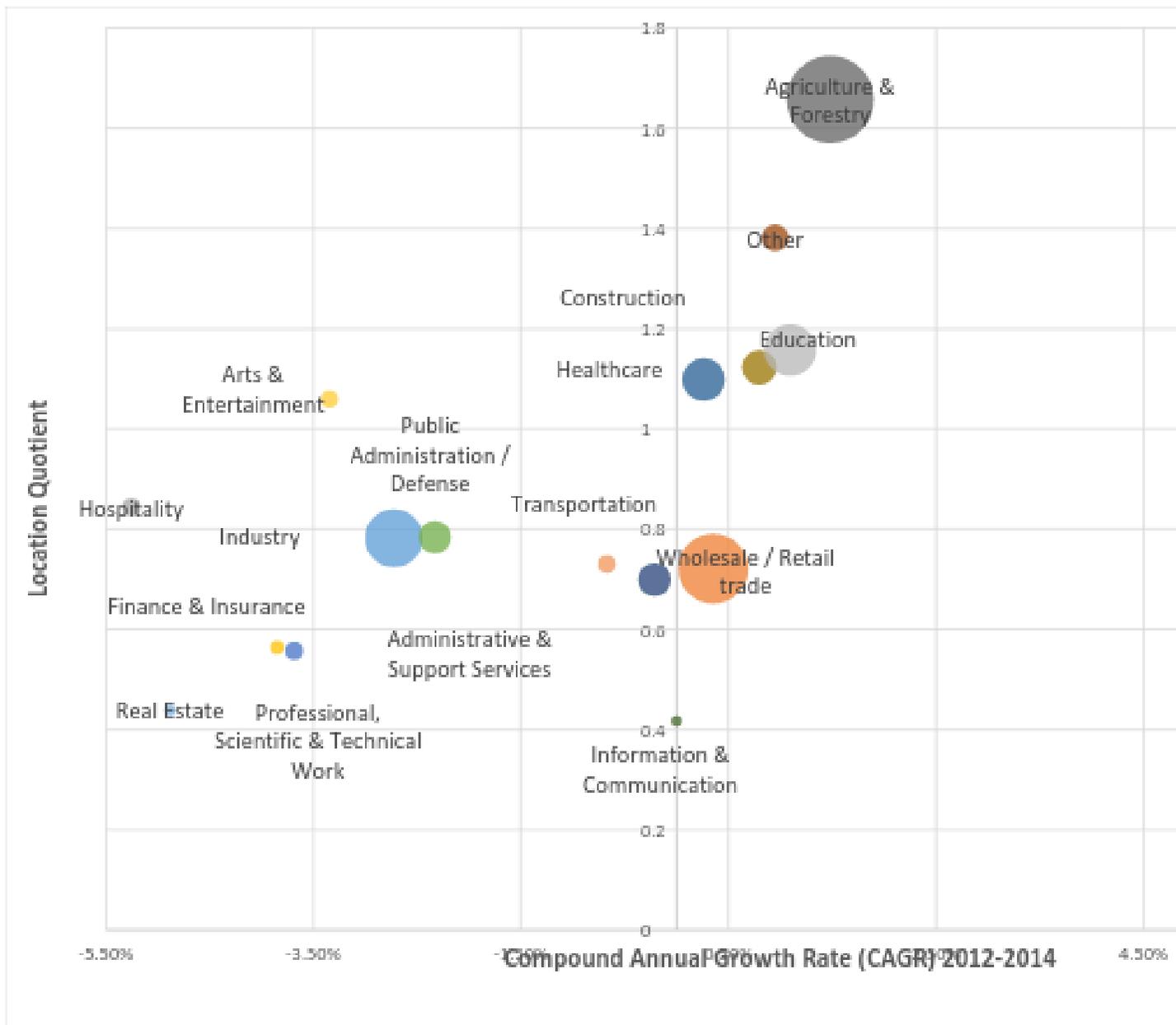
Looking at the total employment numbers in a country or region is often less instructive than looking at the areas of concentration and specialization in specific industrial sectors. One can calculate a region's degree of specialization using an indicator called the Location Quotient (LQ). LQs are used to determine the relative concentration of economic sectors in a region, relative to the country as a whole. LQs show whether the fraction of people employed in a sector is larger or smaller relative to the national average. The LQ graphic in Figure 4 (page 20) is comprised of three data points for each economic sector:

- **Total employment** is visualized by the size of the bubble – the more total employees in a given sector in the region, the larger the bubble.
- The vertical axis is the **location quotient** of each economic sector – an LQ value of 1 indicates that Ivano-Frankivsk has exactly the same degree of concentration in that industry as in Ukraine overall. A LQ value of more than 1 indicates that Ivano-Frankivsk has a higher degree of specialization in that industry compared to the national average, while a value of less than 1 indicates that Ivano-Frankivsk has a lower degree of specialization in that industry.
- The horizontal axis is the **compound annual growth rate (CAGR)** of each economic sector from 2012-2014 – the farther to the right the sector appears on the chart, the faster the sector is growing in the region. Like Ukraine overall, Ivano-Frankivsk has experienced declines in workforce in many of its economic sectors in recent years, which is reflected on the chart as negative CAGR values.

As shown in Figure 4, Ivano-Frankivsk has high concentrations of employment in Agriculture, Forestry, and Fishing; Education; Construction; Healthcare; and Arts & Entertainment, while the region has low concentrations in Information & Communication; Real Estate; Professional, Scientific & Technical Work; and Finance & Insurance. The sectors that have experienced the most growth from 2012 to 2014 are Agriculture, Forestry, and Fishing; Education; and Construction, while the sectors that have lost the most workforce are Hospitality; Real Estate; Professional, Scientific & Technical Work; and Finance & Insurance. Key findings from this analysis include:

- Agriculture is the most important economic sector in Ivano-Frankivsk in terms of both concentration of employees and in growth rate. SRI will need more detailed information about the agriculture sector in Ivano-Frankivsk to see if there are specific opportunities in agriculture for the Promprylad project.
- Education, Construction, and Health Care are also important sectors in terms of concentration of employees and growth rate. There may be opportunities for Promprylad in the Education and Health Care sectors if there are any organizations engaging in innovation activities in these sectors, rather than just public service.
- There is a high concentration of workers in Arts and Entertainment, but the sector is shrinking in size.
- Information & Communication and Professional, Scientific & Technical Work (circled in red) will most likely be target sectors for the Promprylad project. Both have very low concentrations of

workers in Ivano-Frankivsk, and the Professional, Scientific & Technical sector is shrinking in size. This does not mean that there are no opportunities in these sectors, but Teple Misto and its partners should be diligent to make sure there really is demand for services in these sectors.



IT Sector

As mentioned previously, data on specific economic sectors in Ukraine is scarce. However, there is a body of evidence, in the form of news reports, conferences, and investment activity, that shows the growing importance of the IT sector in Ukraine. AVentures Capital, an early stage venture firm focused on Ukraine and Central and Eastern Europe, estimates that the Ukrainian IT industry was worth about USD \$5 billion annually in 2015.³¹ The industry is largely driven by outsourcing, which has grown tremendously over the last decade, as shown in Figure 5. The outsourcing industry alone employs approximately 50,000 engineers in Ukraine.

Figure 5: Size of the Ukraine outsourcing market in USD million, 2003-2014³²

Total size of the IT outsourcing market, USD million



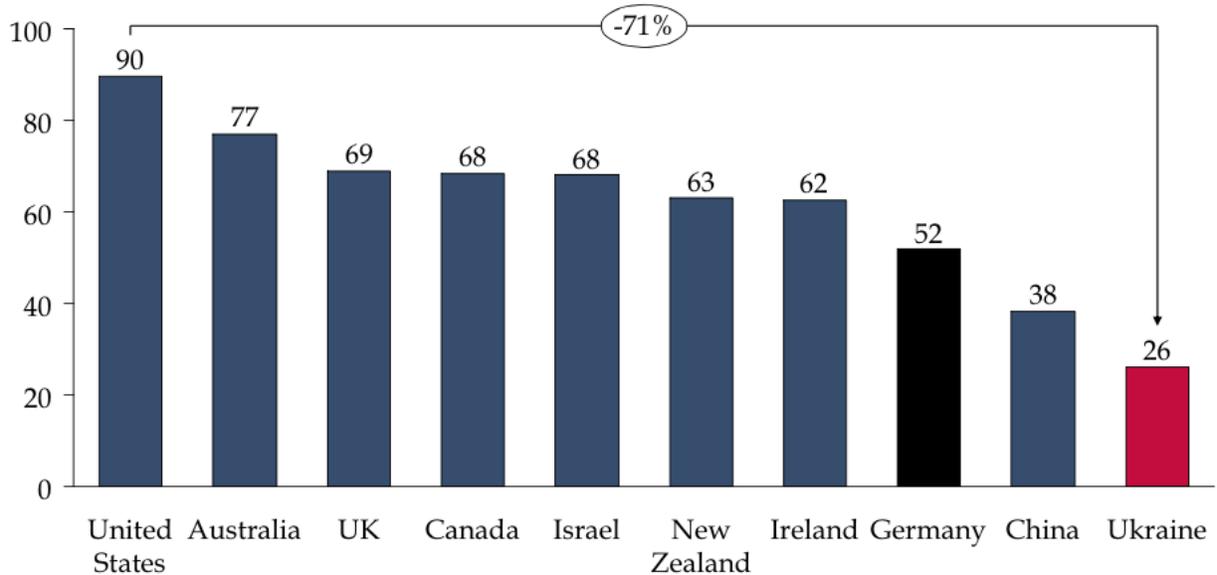
Ukraine's IT sector has benefited greatly from low labor costs, making it attractive to international companies looking for low cost, high skill programmers and software engineers. According to Stack Overflow's annual developer survey, median salaries for Ukrainian IT professionals were 71 percent lower than the median salaries for US IT professionals, 62 percent lower than UK and Israeli IT professionals, and 32 percent lower than Chinese IT professionals in 2015.³³

31 Yevgen Sysoyev. Ukrainian Venture Market presentation. AVentures, October 2014. Accessed from <http://www.slideshare.net/YevgenSysoyev/2014-developments-in-ukrainian-it-sector-yevgen-sysoyev-idcee2014->

32 Horizon Capital. "An Investor's Perspective." October 2015.

Figure 6: Average programmer salary by country in 2015, in USD thousands³⁴

Average programmer salary, comparable skills, thousand USD per annum



Labor Market

Ukraine's labor market is characterized by low wages, relatively high levels of unemployment, and relatively low levels of labor mobility. As shown in Table 6, Ukraine ranked below Russia, Poland, Slovakia, Romania, and Belarus in average monthly wages in 2013. In SRI's interviews in Ivano-Frankivsk in August 2016, we heard that Ukrainian labor costs are lower than many parts of China, giving Ukraine a major advantage when companies are considering location costs. The average monthly wage in Ivano-Frankivsk is 17 percent below the national average, making it even more attractive to businesses looking to reduce labor costs.

Table 6: Average monthly wage (USD) in 2013³⁵

Country	Average monthly wage (USD)
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33 Stack Overflow. "Developer Survey Results 2015." Accessed from <http://stackoverflow.com/research/developer-survey-2015->

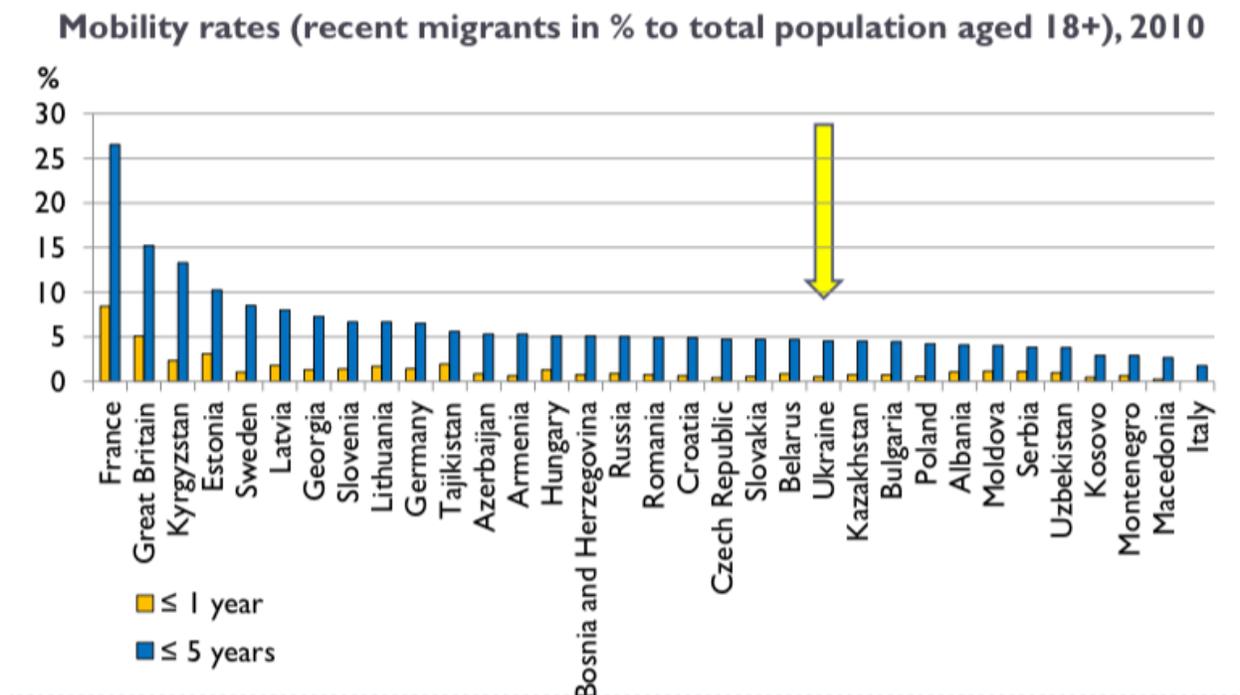
34 Horizon Capital. "An Investor's Perspective." October 2015.

35 UNECE Statistical Database. Gross Average Monthly Wages by Country and Year. Accessed from http://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT_20-ME_3-MELF/60_en_MECCWagesY_r.px/?rxid=0806c85a-23f8-4249-a4d0-10980df459d1-

Ukraine	\$409.6
Russia	\$946.7
Poland	\$1,169.4
Slovakia	\$1,1296.7
Romania	\$673.5
Belarus	\$575.4

However, Ukraine has experienced high rates of unemployment since 2009. The unemployment rate was 9.1 percent in 2015, down slightly from 2014 but still higher than the 8.2 percent unemployment rate the country had in 2010.

Figure 7: Labor mobility rates by country, 2010³⁶



Ukraine also has low rates of labor mobility compared to countries like the US, UK, and France, though mobility rates are comparable to other countries in Central and Eastern Europe, as shown in Figure 7. Labor mobility is important because it allows for more efficient use and allocation of labor across regions, leading to higher productivity and growth. In Ukraine, there are large differences in regional wages and employment levels; however, very little internal migration between regions. The World Bank cited several barriers to mobility in the country: a lack of affordable housing in high employment, high wage locations like Kyiv; lack of skills in the labor force in less developed regions; and the national

36 The World Bank. "IN SEARCH OF OPPORTUNITIES? THE BARRIERS TO MORE EFFICIENT INTERNAL LABOR MOBILITY IN UKRAINE." Presentation at the KNOMAD International Conference on Internal Migration and Urbanization held in Dhaka on April 30-May 1, 2014.

registration system (which creates administrative burdens to movement).³⁷

37 Ibid.

Networks

Networks refers to the connectors and linkages in a region that help connect area ideas, talent, investors, and mentorship to markets and to each other. Data on networks in Ukraine and the Ivano-Frankivsk region are very scarce, which is fairly common for most regions. Therefore, this section of the report relies on qualitative data collected during interviews SRI conducted in Ivano-Frankivsk and Lviv in August 2016.

During SRI's interviews, we heard that industry and trade groups and clusters are relatively uncommon in Ukraine in general. From SRI's experience working in Lithuania and Poland, there is also a lack of self-organization and coordination among companies and industries in those countries. One interviewee we spoke to in Ivano-Frankivsk said that it is possible that people in post-Soviet states developed an aversion to cooperative groups and actions after being forced into collectives during the Soviet era. Additionally, Ukraine's national government has few policies or incentives that encourage cluster development.

That said, there are IT clusters and associations in most major cities including Kyiv, Kharkiv, Odessa, and Lviv. There is also a small, relatively new IT cluster in Ivano-Frankivsk. The Ivano-Frankivsk cluster is a mix of outsourcing companies and companies that develop their own products, as well as companies based in Ivano-Frankivsk and companies headquartered elsewhere that have a satellite office in the city. The IT cluster members reported that the group has had some successes, including working with the local government on IT initiatives, organizing some practical training courses and lectures, and working with King Danilo University on its IT curriculum. However, cluster members also said that because the companies in the cluster are quite different – some do outsourcing, some do product development, some are not based in Ivano-Frankivsk – it is often hard to agree on or coordinate group activities.

There is also a small design group in Ivano-Frankivsk, which is mostly comprised of members working in web design and focused on promoting more practical training courses and co-working spaces for designers in Ivano-Frankivsk. It is possible that there are other small industry clusters or groups in the city; SRI and Teple Misto should continue to search for and engage with such organizations.

Given the prominence of the agricultural sector in Ivano-Frankivsk, SRI is extremely interested to learn whether there are any industry groups for the agricultural sector in the region, including those companies engaged in farming, transportation, food processing, feed stock production, and/or other parts of the agriculture sector. Healthcare and education are other prominent sectors where SRI would like to learn about industry groups and associations in the region. There were no available English language materials related to such industry organizations in Ivano-Frankivsk, so SRI will pursue this further during our trip to Ukraine in November 2016.