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INFORMATION TECHNOLOGY DEVELOPMENT AND THE BRAIN DRAIN IN INTERNATIONAL MARKET OF TECHNOLOGIES

The long-range economic potential and societal impact of new technology is one of the few certainties in the decades ahead. Economies, jobs, and personal lives are becoming more digital, more connected, and increasingly, more automated. Waves of innovation build over time, powering the technology growth engine that appears to be on the cusp of another major leap forward. The global information technology industry is on pace to reach \$5 trillion in 2019, according to the research consultancy IDC. A PWC report on the future, expects the global economy to grow 3% per annum and double by 2038 to \$150 Trillion per year. If technology keeps on its exponential pace, hitting the 8% figure, then deflationary technology sectors will be doing \$12 Trillion in revenue in 2038—\$10.4 Trillion being net new revenue from today. [1]

The United States is the largest tech market in the world, representing 31% of the total, or approximately \$1.6 trillion for 2019. In the U.S., as well as in many other countries, the tech sector accounts for a significant portion of economic activity. Despite the size of the U.S. market, the majority of technology spending (69%) occurs beyond its borders [2]. pic. 1 Take, for example, one of the most famous engineering hubs - Silicon Valley. Cranking out \$128,308 per capita in the annual gross domestic product (GDP), residents in California's tech belt out-produce almost every nation on the planet. Although Silicon Valley is the undisputed epicenter of tech, if a programmer wants a great career in the software industry, he doesn't necessarily have to move to the San Francisco Bay Area.



Pic. 1 Global Information Technology Industry

A recent article in Tech Crunch states that Toronto can become one of the biggest hubs for technology start-ups in North America over the next five-ten years. Both the Canadian federal and Ontario's provincial governments offer strong support. Furthermore, The Israeli Silicon Valley (Silicon Wadi) and Startup Nation Accelerator exist in Tel Aviv, the city where such companies as Wix, Optimove, Moovit, and PetBNB are based. Israel has the highest density of startups in the world [3].

The second largest global leader in the provision of both IT services and ITES is India. Two developed countries—Canada and Ireland—have also done particularly well in the industry, as have a few developing countries, notably China, Mexico, and the Philippines. Similarly, several countries in Central and Eastern Europe (the Czech Republic, Hungary, Poland, Romania, and Russia) have also developed their capacity in IT services and ITES, though on a much smaller scale. According to a study by Brainspotting, today, more than half of IT workers of Romania live in Bucharest. The offices of such companies as Oracle, Intel, IBM, and Adobe are situated in the city. Moreover, the second-largest Romanian city of Cluj-Napoca even is compared with Silicon Valley. But this does not mean that the IT industry is developing by its native workers. The situation is otherwise due to the option of working remotely for foreign companies.

Hence, where are those best programmers and coders who develop the world IT industry from? Many would assume it's the United States. After all, the United States is the home of programming luminaries such as Bill Gates, Ken Thompson, Dennis Ritchie, and Donald Knuth. However, the realities demonstrate that such was not the case. Based on the speed and accuracy, HackerRank has ranked more than 1.5 million developers. Its recent study shows that China and Russia score as the most talented developers. For instance, Chinese programmers outscore all other countries in mathematics, functional programming, while Russians are the best hackers in the world and the world has allegedly seen their hacking skills. Since China scored the highest, Chinese developers sit at the top of the list with a score of 100. But China only won by a hair. Russia scored 99.9 out of 100, while Poland and Switzerland round out the top rankings with scores near 98. Poland programmers have won Java challenge on HackerRank ahead of all other countries. In fact, Switzerland computer programmers are the most dominant on the scoreboard of HackerRank challenges. In addition, Hungary has the best performance in tutorial challenges on HackerRank. Nevertheless, the two countries that contribute the greatest number of developers, India, and the United States don't place in the top half. India ranks 31st, with an overall score of 76 and the United States falls in at 28th, with a score of 78. [4]

Furthermore, in the next years to come the quality of coding will increase exponentially in Ukraine. Ukrainian developers are well-skilled in many now popular technologies. As a consequence, Ukraine ranks fourth in the world by the number of tech workers after the United States, India, and Russia. The biggest Ukrainian partner for IT outsourcing is the USA (80% of all IT services provided). [5]

The first five information technology waves of Defense, Integrated Circuits, the Personal Computer, the Internet and Social Media, have dramatically transformed society. And migration, in particular. As a result of research, it was learned about attractive destinations for IT professionals' moving. The most popular are the United States (13.5%) and Germany (11.4%), then Australia (9.2%), Canada (8.1%), Great Britain (7.6%) and Spain (5.4%).

Furthermore, the researchers from the National American Policy Foundation have studied 87 American startups. The results of the analysis were amazing - more than half of the startups were created by people who came to the United States. The list includes such companies as Uber, SpaceX, Palantir, which excel at job creation and brought billions of dollars into the US economy. California was the headquarters of 32 of the 44 immigrant-founded companies, followed by New York (6), Massachusetts (4) and Illinois (2). The founders are people all over the world: from India, Great Britain, South Africa, Israel, etc. [6]

Unsurprisingly, Nigeria's tech ecosystem is struggling to keep hold of its best software engineers. Lagos, the most valuable of Africa's biggest tech ecosystems is being highjacked by an excessive migration of it's highly trained or qualified Software engineers to Europe, Canada or Berlin. Since independence, Ukraine has also suffered from a shrinking population and brain drain. Thousands of young people have left the country and have built careers in technology centres such as Silicon Valley, Tel Aviv, and Toronto. They have gained valuable education and skills that are very much

needed in Ukraine. It was researched that a minimum of 5% of Palo Alto residents, the heart of Silicon Valley, are Russian-speaking - mainly immigrants from the former Soviet Union. It is hardly surprising that the problem of the brain drain from poor to rich countries has received a lot of attention in the world's press as well as from academics and researchers. [7]

However, "brain drain" is more a challenge than an obvious drawback. For example, although in the short term the reform process and Europeanization can accelerate the outflow of staff. However, the best way to return skilled workers to their homeland is to improve the political, economic and educational environment in the country. The tipping point will come when those who left return to native country to build their careers and companies, like many entrepreneurs from India and China have done after achieving success abroad.

For example, the migration of Indian programmers to the American Silicon Valley has led to significant investment in the Indian IT industry and has given a colossal impetus to the development of this segment of the national economy, turning India into one of the world's largest outsourcing centers. The 10 of the 20 largest software companies in India were formed by "American Indians," and others 4 are joint enterprises. The top managers are ex-emigrants in these 14 companies. Therefore, the return of "brain" to the homeland led to the fact that Indian IT companies now provide about 7.5% of the country's GDP and created more than 2 million jobs. In China, most of the largest internet companies have been established by ethnic Chinese, who were educated in the United States in the 1980s. The vast majority of Bulgarian IT professionals are returning annually. Considering that the country's blossoming technology market accounts for 3.6% of GDP, this is an area that the government is trying to nurture. Many expat Bulgarians are realising that there is huge competition in the IT industries abroad and are returning to find better success at home, where they are considered experts after education and experience abroad.

Consequently, working remotely is the best way to retain skilled employees. Technology has now made it possible for employees to work from almost anywhere they choose. There is project management software, cloud computing, video meetups, etc., all of which allow team members who are scattered all over the world to collaborate and get things done. As we move further into the 21st century, the changing workplace environment will only continue to unfold and evolve. Fortunately, remote work is prevalent in IT verticals. Hence, the development of IT and the ability to work remotely is an advantage rather than a disadvantage. Because it can help to revive countries that have suffered from the brain drain and chiefly reverse brain drain. Namely, with the explosion of new remote positions, talented employees can remain in their countries while working for profitable, fulfilling jobs. By working remotely, you have the potential to help boost your local economy thanks to your paycheck which is bringing new money into your place. However, in order to truly benefit your country, it's important to spend their earnings within the country.

Of course, the idea of remove work helps to reduce physical brain drain only, not a virtual one. As it is known, a lot of efforts have been made to use financial incentives to lure researchers back to the native country, but with limited success. This situation isn't unique to us, because the economic and professional factors that lead people to move away often prevent them from repatriating, even when they receive benefits from the state. However, even physical brain drain has advantages. For example, expatriates' remittances may offset or even surpass the "drain" effects.

References

1. M. Marmer, (2017, September 7). A Look At Deeper Forces Acting on The Global Startup Revolution. Retrieved from: https://medium.com/@maxmarmer/a-look-at-deeper-forces-acting-on-the-global-startup-revolution-be615e18e03e

2. (2019, January). Research Report: IT Industry Outlook 2019. Retrieved from: https://www.comptia.org/resources/it-industry-trends-analysis

3. S. Somekh, (2018, June 3). SILICON WADI: ISRAEL'S ARAB TECH BOOM Retrieved from: https://www.tabletmag.com/jewish-news-and-politics/263337/israel-arab-tech

4. R. Trikha, (2016, August 25). Which Country Would Win in the Programming Olympics? Retrieved from: https://blog.hackerrank.com/which-country-would-win-in-the-programming-olympics/

5. DAXX team, (2017, March 10). 12 Reasons to Hire Ukrainian Developers for IT Outsourcing. Retrieved from: https://www.daxx.com/blog/outsourcing-ukraine/why-ukraine-best-it-outsourcing-destination

6. S. Anderson (2016). Immigrants and Billion Dollar Startups. National Foundation for American Policy Retrieved from: https://nfap.com/wp-content/uploads/2016/03/Immigrants-and-Billion-Dollar-Startups.NFAP-Policy-Brief.March-2016.pdf

7. Y. Kazeem, (2018, December 17). Nigeria's tech ecosystem is struggling to keep hold of its best software engineers. Retrieved from: https://qz.com/africa/1491951/nigeria-tech-developers-move-to-europe-us-canada/

8. B. Kupych (2016, August 18). Building on Ukraine startup potential. Ukrainian IT industry. Retrieved from: http://bunews.com.ua/investment/item/ukrainian-it-industry-transforming-ukraines-brain-drain-into-brain-gain