

Continuing to Lead Through Creativity and Innovation During the COVID-19 Pandemic and Beyond: Immigrant Scientists and Information Technology Workers

By Fanni Farago, MA and Michele Waslin, PhD

July 2021



Table of Contents

Introduction	2
Immigrant Workers in the Professional, Scientific, and Technical Services Industry Sector	3
Notable Immigrant Workers Pursuing Scientific Research & Development Services During the COVID-19 Pandemic	6
Immigrant Workers in the Information Industry	8
Notable Immigrant Workers from the Information Industry & their Contributions to Social Connectedness During the COVID-19 Pandemic	12
Conclusion	14
Acknowledgements	15
Endnotes	16

Introduction

Over the course of the COVID-19 pandemic, workers who specialize in scientific research have helped forge new pathways to COVID-19 vaccines and therapeutic treatments. Additionally, workers who focus on the use of technology for work and other daily life activities have innovated digital tools that have enabled millions to transition their professional and social activities to online platforms.

In a previous report, [*Leading Through Creativity and Innovation: The 2020 Nobel Laureates, MacArthur and Schmidt Science Fellows, and Immigrant Scientists in Search of a COVID-19 Vaccine*](#), the Institute of Immigration Research discussed the significant role of hundreds of thousands of highly-skilled, immigrant* workers in the Biomedical Industry. Foreign-born workers account for 19 percent of the industry's workforce and have been vital to the creation of COVID-19 vaccines through various key occupations such as virologists, immunologists, and chemists.

In the current report, we continue our discussion of highly-skilled immigrant workers' contributions, but introduce readers to two other industries that have played an important role in producing scientific knowledge or in supporting organizations' and individuals' effective use of technology during the pandemic. Specifically, we focus on highly-skilled immigrant workers in the Professional, Scientific, and Technical Services industry sector and the Information industry. There are approximately 994,600 immigrant workers in the Professional, Scientific, and Technical Services industry sector who comprise 26 percent of its workforce. Meanwhile, there are approximately 144,900 immigrant workers in the Information industry who comprise 20 percent of its labor force. By comparison, immigrants in the United States make up 13 percent of the population and 16 percent of the workforce.

This report highlights these workers' characteristics and how they compare to their native-born colleagues along various socioeconomic variables. We also present the personal stories of select immigrant workers who have made exceptional contributions to their field and to mitigating the COVID-19 pandemic. Two stories focus on pioneering immigrant scientists: a Hungarian scientific genius, Dr. Katalin Karikó, and her foundational mRNA research that led to the Pfizer-BioNTech and Moderna COVID-19 vaccines; along with Dr. Niall Lennon, an Irish immigrant, who has been instrumental in facilitating COVID-19 diagnostic testing through Clinical Research Sequencing Platform (CRSP), one of the leading COVID-19 diagnostic labs in the nation. Additionally, two other stories feature influential Information industry workers: Mike Krieger and Dr. Nasir Ahmed. Krieger is a Brazilian immigrant and cofounder of Instagram, a social media platform that fostered social connectedness for millions over the past year. Dr. Ahmed is an Indian immigrant and brilliant engineer who envisioned the Discrete Cosine Transform (DCT) algorithm in 1972. This algorithm is foundational to data and image compression technology used in most digital media, including videos, images, audio, and television. During the pandemic, DCT enabled people worldwide to safely sustain their social lives through digital entertainment, video calls, and photo-sharing with their loved ones.

The report draws on data from the American Community Survey (ACS) 2014-2018 5-year dataset. It is important to note that this analysis focuses on industries—the types of businesses—and occupations—the tasks or functions performed by individual workers within a business. The report analyzes the occupations with the highest absolute numbers of immigrant workers in each industry.

*Please note that the terms “immigrant” and “foreign-born” are used interchangeably throughout this report. Foreign-born refers to individuals who are not a U.S. citizen at birth or who were born outside the U.S., Puerto Rico or other U.S. territories and whose parents are not U.S. citizens. The foreign-born may include naturalized U.S. citizens, Legal Permanent Residents, temporary residents, refugees and asylees, and others. Native born includes those who are U.S. citizens at birth, those born in the United States, Puerto Rico, or other U.S. territories, and those born abroad to a parent who is a U.S. citizen.

Immigrant Workers in the Professional, Scientific, and Technical Services Industry Sector

The Professional, Scientific, and Technical Services industry sector is comprised of several segments including the *Scientific Research and Development Services* segment and the *Computer Systems Design and Related Services* segment.¹ In general, workers in these industry segments engage in original research and create or improve products or processes. Over the past year, workers in the *Scientific Research and Development Services* segment played a significant role in generating scientific knowledge about COVID-19. Similar to the contributions of immigrant workers in the previously profiled [Biomedical industry](#), these immigrant workers supported ongoing, original scientific efforts aimed at better understanding and treating COVID-19, including its variant strains.

Meanwhile, immigrant workers in the *Computer Systems Design and Related Services* segment, advised businesses on designing and implementing successful, automated customer support systems in the form of chatbots or digital agents that are available around the clock to address customers' service needs. This type of business and customer support has become crucial during the pandemic given that banks, grocery stores, and many other businesses had to quickly transition to providing online services, while customers needed safe and effective ways to continue using such necessary services in their everyday lives.

Table 1 shows that immigrant workers comprise 27 percent of the workforce in the *Computer Systems Design* segment and 26 percent of the sector's overall workforce, making them essential to ensuring its continued operations during the pandemic.

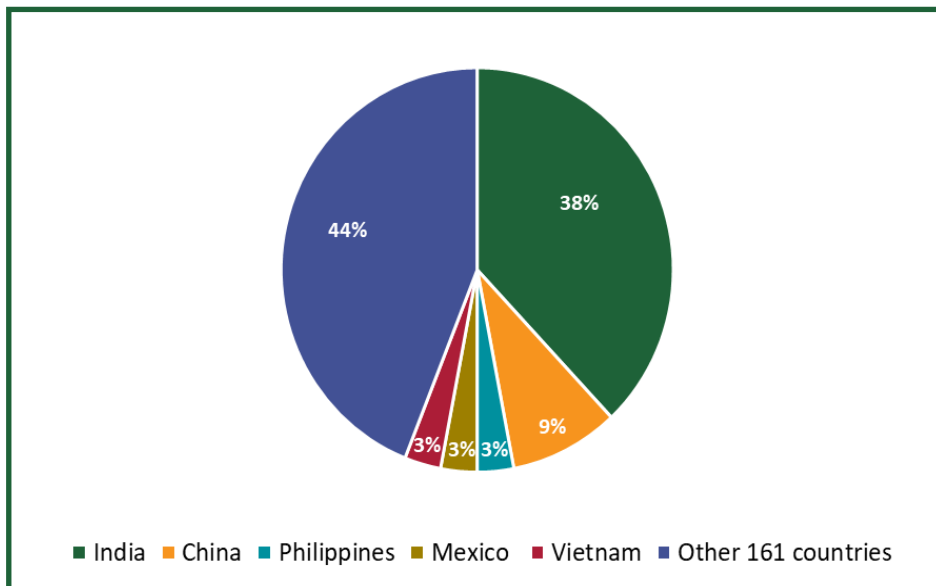
Table 1. Share of Foreign-Born Workers Across Select Segments of the Professional, Scientific, and Technical Services Industry Sector

Industry Segment	Number of Foreign-Born Workers	Share of All Workers in Industry Segment
Scientific Research and Development Services	163,747	22%
Computer Systems Design and Related Services	830,892	27%
Estimated Total	994,639	26%

Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

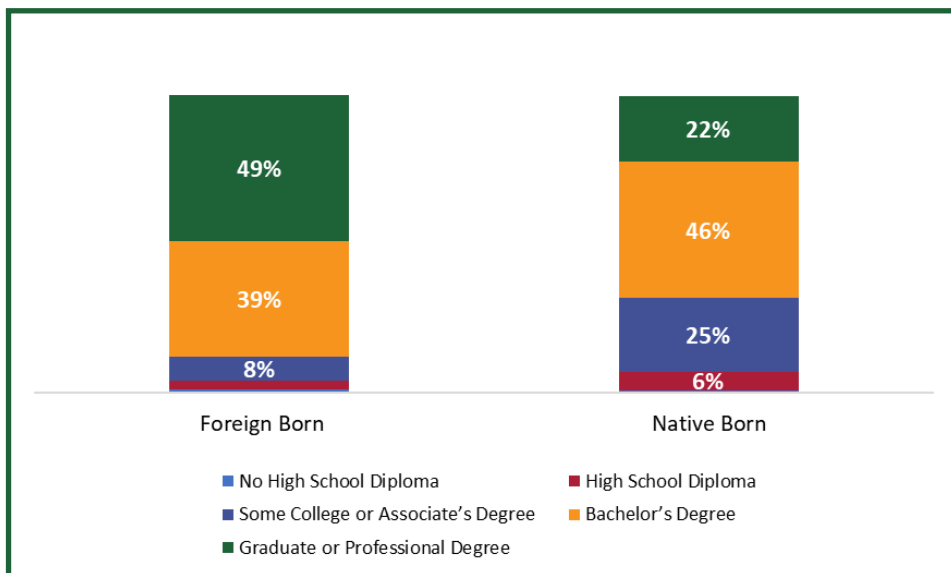
Immigrant workers in the Professional, Scientific, and Technical Services industry sector tend to be established immigrants who have lived in the United States for decades. More specifically, two-thirds (66 percent) of the sector’s immigrant workers immigrated to the United States prior to 2010 and 84 percent speak English proficiently. Furthermore, almost half (45 percent) of them are naturalized citizens. The majority of workers in the sector are male; in fact, only 30 percent of the foreign-born workers and 33 percent of native-born workers are female. Notably, more than half of the sector’s workers (53 percent) are originally from the Asian countries of India (38 percent), China (9 percent), Philippines (3 percent), and Vietnam (3 percent) (See Figure 1). Mexico is the only non-Asian country within the sector’s top five countries of origin.

Figure 1. Top Five Countries of Origin for Immigrant Workers in the Professional, Scientific, and Technical Services Industry Sector



Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

Figure 2. Educational Attainment of Workers in the Professional, Scientific, and Technical Services Industry Sector



Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

As shown in Figure 2, the vast majority of workers in the industry sector are highly educated. Immigrant workers tend to have more education than native-born workers. Overall, 88 percent of immigrant workers possess a Bachelor’s degree or higher compared to 68 percent of their native-born colleagues. Additionally, while almost half (49 percent) of immigrant workers have graduate or professional degrees, less than a quarter (22 percent) of native-born workers hold this type of credential.

Foreign-born workers' higher education levels are consistent with their occupations in this sector. Table 2 shows that within the industry sector, immigrants are much more likely than the native born to be Software Developers (27 percent to 13 percent), and the native born are slightly more likely to be managers (18 percent to 16 percent). Within the Professional, Scientific, and Technical Services industry sector, the *Computer Systems Design and Related Services* segment is estimated to be more than four times larger than the *Scientific Research and Development Services* segment (approximately 3,069,600 versus 758,400 total number of workers), so it is unsurprising that computer occupations dominate the top four occupations.

Table 2: Top Occupations of Foreign- and Native- Born Workers in the Professional, Scientific, and Technical Services Industry Sector

Foreign Born		Native Born	
Software Developers	27%	Managers	18%
Managers	16%	Software Developers	13%
Scientists	6%	Computer Support Specialists	6%
Computer Programmers	5%	All Other Computer Occupations	4%
All Other Occupations	46%	All Other Occupations	59%
Est. Total number of Foreign-Born Workers	994,639	Est. Total Number of Native-Born Workers	2,833,426

Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

However, when focusing on the *Scientific Research and Development Services* segment (Table 3), the foreign born are about twice as likely to be scientists: 36 percent of the segment's immigrant workers are scientists compared to 17 percent of the segment's native-born workers. It is important to note that native-born workers vastly outnumber their foreign-born colleagues in this industry segment (see Table 3), and, as a result, there are approximately 103,000 native-born scientists compared to approximately 58,300 foreign-born scientists.

Table 3: Top Occupations of Foreign- and Native-Born Workers in the Scientific Research and Development Services Segment

Foreign Born		Native Born	
Scientists	36%	Scientists	17%
Managers	14%	Managers	16%
Engineers	6%	Engineers	7%
All Other Occupations	44%	All Other Occupations	60%
Est. Total Number of Foreign-Born Workers	163,747	Est. Total Number of Native-Born Workers	594,683

Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

Notable Immigrant Workers Pursuing Scientific Research and Development Services During the COVID-19 Pandemic

Dr. Katalin Karikó is a Hungarian immigrant, biochemist, and one of the key scientific geniuses behind the development of the state-of-the-art Pfizer-BioNTech and the Moderna COVID-19 vaccines.² She currently serves as the Senior Vice President of BioNTech, the Germany-based biotechnology company that partnered with Pfizer to create one of the first COVID-19 vaccines.³ Karikó was born on January 17, 1955 and grew up in the rural Hungarian town of Kisujszallas. After high school, she relocated to Szeged, Hungary's third largest city, and earned her doctorate from the University of Szeged, a prestigious research university. It was during this time as a PhD Student that she began researching the mRNA molecule, the genetic material at the



Photo courtesy of BioNTech

heart of both the Pfizer-BioNTech and Moderna vaccines. After graduate school, she continued her research at the university's Biological Research Center until 1985, when she immigrated to Philadelphia with her husband and daughter to pursue a funded research opportunity at Temple University; afterwards, she continued her research as a faculty member of the University of Pennsylvania's School of Medicine. In the midst of the ongoing pandemic, Dr. Karikó has been hailed as a "pandemic crusher," "hero biochemist," and "the COVID vaccine technology pioneer," but her road to fame and due acknowledgement was tortuous and fraught with a multitude of professional and personal challenges.⁴ In Karikó's own words, "I was demoted [in 1995 after six years of professorship at the University of Pennsylvania], rejected [on countless research grant applications], terminated [in 1985 at the Biological Research Centre at the University of Szeged], and I was even subject for deportation at one point."⁵ On top of it all, Karikó was also diagnosed with cancer around the time of her demotion.⁶ In spite of it all, she has relentlessly pursued researching the therapeutic promises of the mRNA molecule.⁷ Karikó, and her long-time research partner, Dr. Drew Weissman of the University of Pennsylvania, are now credited with developing the life-saving form of the mRNA molecule that became the foundation for the leading COVID-19 vaccines, which are helping to save millions of lives worldwide.⁸ The notion that these two exceptional scientists deserve a Nobel Prize is already circulating in the scientific community.⁹

Dr. Karikó has been hailed as a "pandemic crusher," "hero biochemist," and "the COVID vaccine technology pioneer."

Dr. Niall Lennon is an Irish immigrant, innovative scientist, and a key leader at the Broad Institute of MIT and Harvard, a biomedical research institute that uses genomics to reach new frontiers in the treatment of diseases.¹⁰ He has worked at the Broad Institute since 2005 and currently serves in multiple capacities including Senior Director, Institute Scientist, and Chair of the board of managers of Clinical Research Sequencing Platform (CRSP), one of the chief COVID-19 diagnostic labs in the nation.¹¹ Dr. Lennon has been instrumental to the creation and continued supervision of CRSP and its COVID-19 clinical testing processes, the results of which have informed millions of New England area



Photo courtesy of Broad Institute

residents about their coronavirus test results.¹² Overall, CRSP processes about one in every 20 COVID-19 test in the United States.¹³ Dr. Lennon was honored by the Immigrant Learning Center during their Immigrant Heroes Award Benefit in April 2021, and the state of Massachusetts will soon be honoring him with the Immigrant Heroes Award for his exceptional leadership and contributions to mitigating the coronavirus.¹⁴ Dr. Lennon was born and raised in Ireland and obtained his B.Sc. and Ph.D. in Pharmacology from the University College Dublin, a prominent research-intensive university in Ireland and across Europe.¹⁵ He immigrated to the United States in 2001 to pursue postdoctoral research opportunities at Harvard Medical School and the Massachusetts General Hospital.¹⁶ While he and his family are happily settled in Massachusetts, they look forward to a post-pandemic world so they can resume their visits to Ireland as he explained in a recent interview, “Christmas 2019 was the last time I was home; we usually go home for Christmas and in 2020 we’d also hoped to get home for the summer. You have Facetime and Zoom, but it’s not the same.”¹⁷

Want to learn more about immigrant heroes?

In April 2021, The Immigrant Learning Center (ILC) honored the immigrant heroes of the COVID-19 pandemic at their [Immigrant Heroes Award Benefit](#). Like native-born American essential workers, many immigrant workers harvested crops, stocked grocery store shelves, delivered packages, served as healthcare workers, researched vaccines, and much more. In addition to Dr. Lennon, The ILC honored Syrian refugee Abdulkadar Hayani, who made and donated more than 2,000 masks and Canadian immigrant Monique Nguyen, co-founder of the MassUndocuFund. The IIR joins The ILC and says “thank you” to all of the immigrant heroes!



The Immigrant Learning Center

Immigrant Workers in the Information Industry

Against the backdrop of the pandemic’s socially disruptive circumstances, the Information industry has been essential to supporting an online infrastructure that could enable millions to conduct life remotely, whether for work, schooling, socializing, and/or managing other tasks of daily life.

The Information industry is made up of various industry segments, including the following three key segments examined in this report:

1. *Software Publishers,*
2. *Internet Publishing, Broadcasting, and Web Search Portals, and*
3. *Telecommunications (except wired telecommunications carriers).*

Together, these three segments and their immigrant workers provided a wide range of online services that people heavily relied on during the pandemic, including: development and publishing of online content (i.e., audio, video, textual) on internet-based sites (e.g., entertainment, news, sports, social networking); designing and installing new software to meet customers’ emerging needs (e.g., new and improved software to provide telehealth services during the pandemic); and, operating and providing access to digital infrastructure that supports satellite television, internet, and radio.

Immigrant workers are crucial for the information industry’s workforce (Table 4). The estimated 144,872 foreign-born workers in the industry comprise 20 percent of all workers. Immigrants make up a quarter of all workers in the *Internet Publishing, Broadcasting, and Web Search Portals* segment and the *Software Publishers* segment.

**Table 4. Share of Foreign-Born Workers
Across Select Segments of the Information Industry**

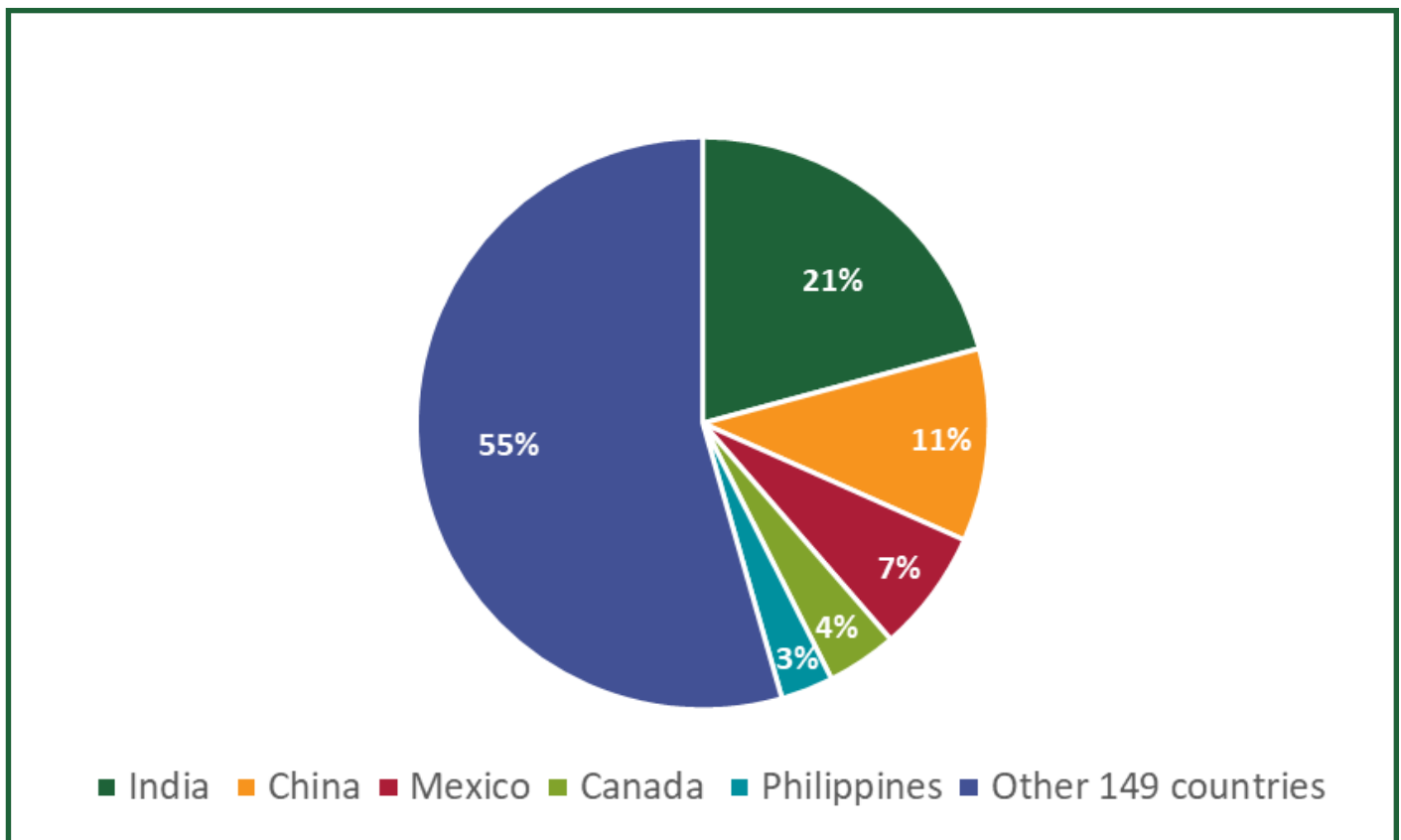
Industry Segment	Number of Foreign-Born Workers	Share of All Workers in Industry Segment
Internet Publishing, Broadcasting, and Web search portals	44,642	25%
Software Publishers	39,621	25%
Telecommunications (except wired telecommunications carriers)	60,609	16%
Estimated Total	144,872	20%

Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

Similar to immigrant workers in the Professional, Scientific, and Technical Services industry sector, the majority of foreign-born information workers (72 percent) are long-time immigrants who came to America prior to 2010. Eighty-three percent of them are proficient English-speakers and half (49 percent) of them are naturalized U.S. citizens.

As shown in Figure 3, more than a third (35 percent) of the Information industry's immigrant workforce comes from the Asian countries of India, China, and the Philippines, while only 11 percent of workers originate from the North American countries of Canada and Mexico.

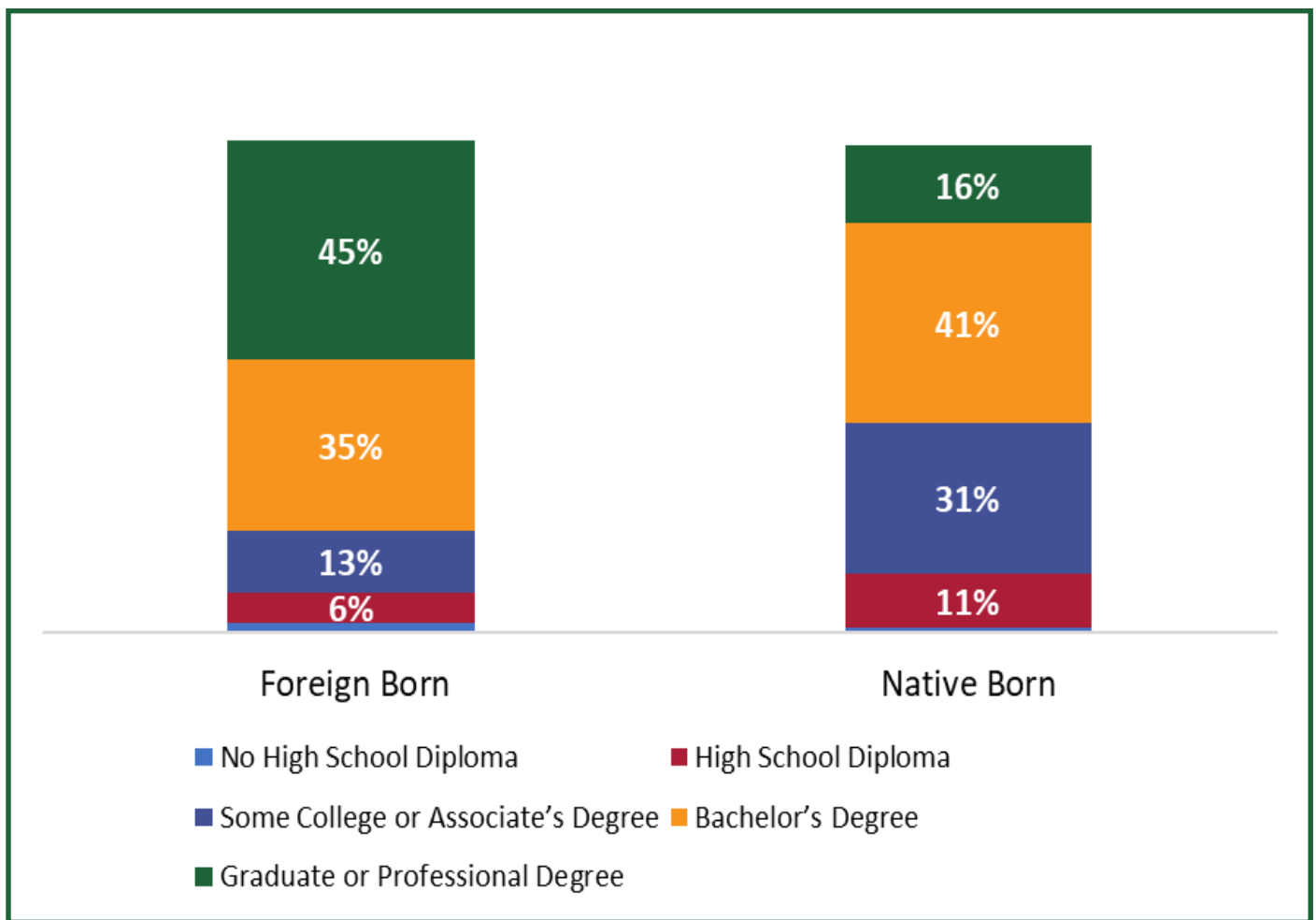
Figure 3. Top Five Countries of Origin for Immigrant Workers in the Information Industry



Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.
Numbers may not add to 100 percent because of rounding.

Patterns of educational attainment for foreign-born and native-born information workers run parallel to trends highlighted in the Professional, Scientific, and Technical Services sector (Figure 4). Here too, a considerably larger share of immigrant workers have a Bachelor’s degree or higher (80 percent) compared to their native-born colleagues (57 percent). Moreover, while almost half (45 percent) of immigrant information workers hold a graduate or professional degree, only 16 percent of native-born workers possess such a credential.

Figure 4. Educational Attainment of Foreign-Born and Native-Born Workers in the Information Industry



Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

Table 5 illustrates that, in terms of occupations, immigrants in the Information industry are much more likely to be Software Developers than the native born: 23 percent of all immigrants in the industry are Software Developers compared to seven percent of the native born. However, the foreign- and native-born are equally as likely to be Managers (16 percent). The median personal income for foreign-born workers in this industry is \$100,000 compared to \$65,000 for the native born. Immigrant workers are also more likely to earn \$75,000 or more (64 percent) compared to the native born (45 percent). Again, this disparity in personal income is likely explained by the differences in occupations and the levels of educational attainment between foreign- and native-born workers; namely that a higher percentage of foreign-born workers are Software Developers and have higher levels of education.

Table 5: Top Occupations of Foreign-Born and Native-Born Workers in the Information Industry

Foreign Born		Native Born	
Software Developers	23%	Managers	16%
Managers	16%	Sales Representatives*	9%
Sales Representatives*	5%	Customer Service Representatives	7%
First-line supervisors of non-retail sales workers	3%	Software Developers	7%
All Other Occupations	53%	All Other Occupations	61%
Estimated Total Number of Foreign-Born Workers	144,872	Est. Total Number of Native-Born Workers	570,917

*Excludes representatives for advertising, insurance, financial services, and travel
Source: IIR analysis of American Community Survey (ACS) 2013-2018 5-year survey data.

Notable Immigrant Workers from the Information Industry and their Contributions to Social Connectedness During the COVID-19 Pandemic

Dr. Nasir Ahmed is an Indian immigrant, electrical engineer, and computer science mastermind who invented the Discrete Cosine Transform (DCT) algorithm in the 1970s. DCT is the data compression technology that makes digital media, including online photo sharing and video calls, possible. In this way, Dr. Ahmed has forged the way for millions to stay socially connected with their loved ones in the midst of the COVID-19 pandemic. In the face of social isolation and distancing, DCT technology makes it possible for people to generate new social connections and to sustain old ones.²¹ Dr. Ahmed was born in 1940 in Bangalore, India and obtained his B.Sc. in electrical engineering from the University Visvesvaraya College of Engineering.²² In 1961, he



Photo courtesy of Wikipedia

immigrated to the United States to pursue his graduate education in electrical and computer engineering at the University of New Mexico. He graduated with his PhD in 1966 and worked for a few years as a Principal Research Engineer at Honeywell, prior to becoming a faculty member at Kansas State University, where he led a team of researchers to develop DCT.²³ Similar to Dr. Karikó, Dr. Ahmed faced initial setbacks with funding his novel research, “Much to my disappointment, National Science Foundation did not fund the proposal; I recall one reviewer’s comment to the effect that the whole idea seemed ‘too simple’.”²⁴ But eventually, after notable peer-reviewed publications and lots of perseverance, DCT became a prized invention. From 1983 to 2001, Dr. Ahmed worked at the University of New Mexico and is now a Professor Emeritus of Electrical and Computer Engineering.²⁵ Since retiring, he has authored two books and shared his life story, including the part about a 56 year-long love story with his wife Esther, on a recent episode of the NBC show *This is Us*.

Michel/Mike Krieger is a Brazilian immigrant, entrepreneur, and software engineer known for co-founding Instagram in 2010 with Kevin Systrom.¹⁸ On the one hand, Instagram is a social media platform that provides users with video-and-photo sharing capabilities, but on the other, it has become a meaningful and safe place for social gatherings during the pandemic. When the pandemic forced entertainment venues to shutter their doors in Spring 2020, musicians like John Legend, James Blake, and Coldplay, used Instagram to bring hope and joy to people around the world through their “quarantine concerts.”¹⁹ As social distancing and isolation became the new social norm for many in 2020, musicians, authors, and chefs also turned to Instagram Live Stories, a socially interactive, streaming feature on Instagram that allows for watchers to comment in real-time, to share their new works, host “virtual storytimes,” as well as cooking and art classes.²⁰ Born on March 4, 1986, Krieger is a native to Sao Paulo, Brazil, and like many high-achieving immigrants, he came to the United States to continue his education. From 2004 to 2008, he attended Stanford University and obtained undergraduate and graduate degrees in symbolic systems. It was also at Stanford that Krieger met Systrom, and where he developed a strong foundation of technical and entrepreneurial skills, which became key to the duo’s subsequent success as Instagram’s co-founders.



Photo courtesy of Podcast Notes

“I think as the world hopefully returns to whatever the new normal is, it is important to carry forward that spirit of creativity and adaptability on hopefully more solid ground, I think that has real potential for 2021.”

Mike Krieger

Source: Kennard, Jon. 2021. “TJ Interviews: Instagram Co-Founder Mike Krieger.” *Training Journal*.

Conclusion

Overall, the Professional, Scientific, and Technical Services and Information industries, and their considerable shares of immigrant workers, contributed to designing and implementing scientific research and technological services during the pandemic. These services and workers' efforts made life under the pandemic safer, more user-friendly with respect to everyday activities like grocery shopping and banking, and socially vibrant for millions across the United States and beyond. As more people grow familiar with current COVID-19 vaccines and become vaccinated in the United States, immigrant scientists are busy building a more robust knowledge base for the novel coronavirus and developing additional vaccines and other treatment strategies for its many variants. With the Biden administration's strong support for, and recent proposal to invest \$250 billion in U.S. scientific research and development, there is renewed hope among scientists that 2021 will yield many new and exciting possibilities for scientific innovations.²⁷ Meanwhile, President Biden's commitments to developing the nation's digital infrastructure as part of his American Jobs Plan, suggests that information workers will have many opportunities to continue creatively addressing pressing issues, such as the nation's digital divide.²⁸





Dr. James C. Witte, *Director*

Dr. Michele Waslin, *Program Coordinator*

Dr. Wenjing Wang, *Postdoctoral Research Fellow*

Katharine Rupp, *Office Manager*

Fanni Farago, MA, *Graduate Research Assistant*

Eirini Giannaraki, MA, *Graduate Research Assistant*

Kevin Nazar, MA, *Graduate Research Assistant*

Acknowledgements

The authors thank Eirini Giannaraki, Kevin Nazar, and Wenjing Wang for providing the data and fact checking, Katharine Rupp for editing and production assistance, and James Witte for providing valuable feedback and edits. Thank you to The Immigrant Learning Center and The Public Education Institute for providing biographical information about Dr. Niall Lennon.

About the Institute for Immigration Research

The Institute for Immigration Research (IIR) is a multidisciplinary research institute at George Mason University. The IIR's mission is to produce valid, reliable, and objective multidisciplinary research on immigrants and immigration to the United States and to disseminate this information through peer-reviewed academic journals, as well as in print and digital formats that make this research easily accessible to policy-makers, the media, the business community, and the general public. Our faculty affiliates, graduate students, and partners are at the forefront of research examining the economic contributions of all immigrant in the United States. The IIR produces high quality, timely research and analysis intended to promote informed action.

The IIR was founded in 2012 through the generous donation of Ms. Diane Portnoy and is a joint venture with The Immigrant Learning Center, Inc. of Malden, Massachusetts.

The IIR is located on the campus of George Mason University in Fairfax, Virginia, outside the nation's capital, Washington, DC. Its strategic location allows the IIR to draw on unparalleled academic, government, and private resources to advance its mission in research, education, and professional opportunities for current and future scholars of immigration studies. Through conferences, workshops, lectures, and other events, the IIR is able to engage in community outreach with one of the most diverse populations in the United States.

Endnotes

- ¹ According to the U.S. Census Bureau's industry codes for the American Community Survey (ACS) 2013-2018 5-year survey data, Professional, Scientific, and Technical Services is an industry sector within the Professional, Scientific, Management, and Administrative, and Waste Management Services Industry.
- ² Rose, Joel. 2020. "If COVID-19 Vaccines Bring An End To The Pandemic, America Has Immigrants To Thank." *NPR.Org*. Retrieved February 25, 2021 (<https://www.npr.org/2020/12/18/947638959/if-covid-19-vaccines-bring-an-end-to-the-pandemic-america-has-immigrants-to-than>).
- ³ Asmelash, Leah, and AJ Willingham. 2020. "Katalin Kariko's Work in mRNA Is the Basis of the Covid-19 Vaccine - CNN." Retrieved February 24, 2021 (<https://www.cnn.com/2020/12/16/us/katalin-kariko-covid-19-vaccine-scientist-trnd/index.html>).
- ⁴ Cox, David. 2020. "How mRNA Went from a Scientific Backwater to a Pandemic Crusher." *Wired UK*.; Rozsa, Matthew. 2021. "The Hero Biochemist Who Pioneered COVID Vaccine Tech Was Professionally Spurned for Years Prior." Retrieved February 25, 2021 (<https://www.salon.com/2021/01/24/the-hero-biochemist-who-pioneered-covid-vaccine-tech-was-professionally-spurned-for-years-prior/>); Kollwe, Julia. 2020. "Covid Vaccine Technology Pioneer: 'I Never Doubted It Would Work'" Retrieved February 25, 2021 (<https://www.theguardian.com/science/2020/nov/21/covid-vaccine-technology-pioneer-i-never-doubted-it-would-work>).
- ⁵ Rozsa, Matthew. 2021. "The Hero Biochemist Who Pioneered COVID Vaccine Tech Was Professionally Spurned for Years Prior." Retrieved February 25, 2021 (<https://www.salon.com/2021/01/24/the-hero-biochemist-who-pioneered-covid-vaccine-tech-was-professionally-spurned-for-years-prior/>).
- ⁶ Asmelash and Willingham 2020.
- ⁷ "Garde, Damian, and Jonathan Saltzman. 2020. "The Story of mRNA: How a Once-Dismissed Idea Became a Leading Technology in the Covid Vaccine Race." Retrieved February 24, 2021 (<https://www.statnews.com/2020/11/10/the-story-of-mrna-how-a-once-dismissed-idea-became-a-leading-technology-in-the-covid-vaccine-race/>).
- ⁸ Asmelash and Willingham 2020.
- ⁹ Asmelash and Willingham 2020; Kollwe, Julia. 2020. "Covid Vaccine Technology Pioneer: 'I Never Doubted It Would Work'" Retrieved February 25, 2021 (<https://www.theguardian.com/science/2020/nov/21/covid-vaccine-technology-pioneer-i-never-doubted-it-would-work>).
- ¹⁰ Broad Institute. 2017. "Niall Lennon." *Broad Institute*. Retrieved February 24, 2021 (<https://www.broadinstitute.org/bios/niall-lennon>).
- ¹¹ Ibid.
- ¹² Ibid.; Lennon, Niall J. n.d. "Niall J Lennon | LinkedIn." Retrieved February 24, 2021 (<https://www.linkedin.com/in/nialljennon/>); Broad Institute. 2020. "Questions and Technical Support." *Broad Institute*. Retrieved March 10, 2021 (<https://www.broadinstitute.org/covid-19-testing/questions-and-technical-support>).
- ¹³ Pender, Susan. 2021. "Tullow Man Based in the USA to Be Honoured for His Role in Covid Testing."

Carlow Nationalist. Retrieved March 5, 2021 (<https://carlow-nationalist.ie/2021/02/24/tullow-man-based-in-the-usa-to-be-honoured-for-his-role-in-covid-testing/>).

¹⁴ Ibid.

¹⁵ Lennon, Niall J. n.d. "Niall J Lennon | LinkedIn." Retrieved February 24, 2021 (<https://www.linkedin.com/in/nialljennon/>); Anon. n.d. "University College Dublin." Retrieved March 10, 2021 (<https://www.ucd.ie/>).

¹⁶ Ibid.

¹⁷ Pender 2021.

¹⁸ AAE. n.d. "Biography of Mike Krieger for Appearances, Speaking Engagements." Retrieved March 18, 2021 (<https://www.allamericanspeakers.com/celebritytalentbios/Mike+Krieger/412131>).

¹⁹ Frank, Allegra. 2020. "How 'Quarantine Concerts' Are Keeping Live Music Alive as Venues Remain Closed." *Vox*. Retrieved March 18, 2021 (<https://www.vox.com/culture/2020/4/8/21188670/coronavirus-quarantine-virtual-concerts-livestream-instagram>).

²⁰ Ibid.; Barnes, Sara. 2020. "Celebrities Are Reading Books in Free Virtual Storytime Sessions for Those Who Are Self-Quarantining." *My Modern Met*. Retrieved March 18, 2021 (<https://mymodernmet.com/virtual-storytime/>); Ngo, Hope. 2020. "How Instagram Cooking Classes Are Keeping People Together During The Pandemic." *Mashed.Com*. Retrieved March 18, 2021 (<https://www.mashed.com/196051/how-instagram-cooking-classes-are-keeping-people-together-during-the-pandemic/>); Perel, Larry. 2020. "These Instagram Art Classes Keep Kids Creative in Quarantine." *KCRW*. Retrieved March 15, 2021 (<https://www.kcrw.com/news/shows/kcrw-features/wendy-mac-instagram-coronavirus-drawing>).

²¹ Basotia, Jyotsna. 2021. "Who Is Nasir Ahmed? Real Love Story of Indian-American Engineer on 'This Is Us' Who Is Credited for .Jpg Algorithm." *Meaww*. Retrieved March 15, 2021 (<https://meaww.com/nasir-ahmed-esther-love-story-real-life-this-is-us-genius-indian-engineer-dct-jpg-file>); peoplepill.com. n.d. "About N. Ahmed: Biography, Facts, Career, Wiki, Life." *Peoplepill.Com*. Retrieved March 15, 2021 (<https://peoplepill.com/people/n-ahmed-1>).

²² Ibid.

²³ Ibid.

²⁴ Ibid.

²⁵ Ibid.

²⁶ Ibid.

²⁷ Mervis, Jeffrey. 2021. "Biden Proposes \$250 Billion Investment in Research." Retrieved May 31, 2021 (<https://www.sciencemag.org/news/2021/03/biden-proposes-250-billion-investment-research>).

²⁸ The White House. 2021. "Fact Sheet: The American Jobs Plan." Retrieved May 31, 2021 (<https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/>).



Institute for Immigration Research

Address: 4400 University Drive, MSN 1D7
Fairfax, VA 22030

Website: iir.gmu.edu

Phone: (703) 993-5833

Email: iir@gmu.edu

Facebook: facebook.com/GMUIIR

Twitter: @IIRGMU

