2020 MAP: Invest Puerto Rico

Growing Puerto Rico's Talent for the Future

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Drake Daunter
Mike Dobmeier
Garrett White
Todd Wolverton

Executive Summary

Background

Recession in Puerto Rico, exacerbated by natural disasters in recent years, presents significant challenges as the country continues to adapt the economy, driving toward newer age industries and organizations. Among these challenges is developing workforce talent strategies to ensure economic development can be sustained and continue to grow, leveraging the depth of talent on the island. Invest Puerto Rico, an investment promotion agency founded in 2017, works hand-in-hand with other entities to advance economic development by attracting businesses within targeted growth sectors to the island. The Michigan Ross MAP team was engaged to investigate and strategize ways to improve workforce talent retention and development on the island.

Analysis

Two areas of Puerto Rico's workforce were analyzed in depth: workforce capabilities specific to the Information Technology industry and workforce migration from Puerto Rico to other regions. To gain an in-depth understanding of the targeted sectors within Puerto Rico, the IT sector was selected as a case study. Existing talent capabilities, gaps to talent requirements needed to sustain targeted growth, and potential strategies to close those gaps were identified. Upon characterizing the IT industry and types of jobs available, general growth projections of IT within the United States and Puerto Rico were analyzed. Comparatively, growth rates projected exceed 13% for the US while they are as low as 1% for Puerto Rico. Additional efforts to raise Puerto Rico's IT cluster growth to the more competitive US level could yield an estimated $119-232 million in economic benefit.

To combat the increased demand within the IT industry, many private companies have created alternative education initiatives to provide workers with the necessary skills for employment opportunities. These opportunities range from in person collaborative learning for students to online introductory coding courses for adults. While the island has made significant progress with these initiatives, there is still a large talent gap between available opportunities and skilled workers that needs to be tightened to meet demand. The primary way to close this gap is with infrastructural changes that ensure equal opportunities of education are available for all Puerto Rican youth. While those changes are underway, there is also opportunity for public and private companies to work together to ensure displaced workers have tools available to get them back into a growing industry.

In addition to further developing the workers in Puerto Rico, the team's analysis shows benefits of employing strategies to bring skilled workers originally from Puerto Rico back to the island. As many Puerto Ricans grow up and seek additional education, jobs, or improved living situations, many move off the island. This results in net outmigration, which raises the median age of Puerto Rico's remaining population. By focusing on areas with a high Puerto Rican diaspora and developing targeted campaigns to bring that talent back, Puerto Rico can grow its pool of skilled workers.

Recommendations

To attract workers back to Puerto Rico, the team developed and proposes a strategy called *Puerto Rico Recruits*. Puerto Rico Recruits is a multifaceted campaign to engage students attending US universities, develop an expat network for those living off the island, and to host a networking event in Puerto Rico connecting interested parties. Target universities within the US are highlighted and proposed for engagement at university career fairs. These events pose an opportunity to bring recent graduates home to fill the open jobs in emerging firms.

Additionally, as the network of Puerto Ricans who live in the US grows, it could be captured within an online platform leveraging the gathered user information to share updates of opportunities and developments in Puerto Rico. The Iowan Project is a benchmark platform from which parallels can be drawn and expanded to develop this network of Puerto Ricans, keeping them connected to increase the chances of bringing them back home. Taking advantage of certain times throughout the academic year when Puerto Rican students may travel back home for the holidays, a networking event should be hosted to further connect prospective employees and employers. This even could be similar to the Detroit's Homecoming annual event; however, focused on employment rather than investment. Although difficult to quantify, focused strategies to target migrated individuals to come back will pose direct and indirect benefits for the Puerto Rican workforce and overall economy.

By implementing the recommendations proposed, Puerto Rico can continue to evolve talent to meet the needs of the growing economy, in addition to bringing those back who have developed useful skills and abilities elsewhere.

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Introduction

Challenges in Puerto Rico

Historically, Puerto Rico has been a land of promise, crippled by disasters and other influences, many of which were out of its own control. As a self-governed territory of the United States, Puerto Rico has been in a recession for the past 14 years with an economy mainly supported by few dominating industries, such as manufacturing of medical devices and pharmaceuticals. In 2017, Puerto Rico's economic troubles were exacerbated by the destruction caused from Hurricanes Irma and Maria, from which parts of the island have never recovered. In addition to this, regions within Puerto Rico recently experienced earthquakes which brought down buildings, in some cases destroying whole towns, and leaving an uncertainty of potential further tectonic shifts that could further impact the island. While much of this turmoil has increased the number of people migrating away from the island, a majority of Puerto Rico has remained resilient, bouncing back from these disasters while dedicated to growing a stronger Puerto Rico for the future.

Invest Puerto Rico

Facing a pivotal point in their economic history, Puerto Rico has been taking charge of their future economic sustainability. They have begun funding new programs to support economic development and rewriting public policies to better attract new businesses to the island. These activities are centered on the goal of developing an economic backbone through new and sustainable industries and private organizations within them. One such program created to solely to support this charge is Invest Puerto Rico, an NGO created by law. Invest Puerto Rico acts as a liaison between the public and private sectors to attract and facilitate the process for organizations that want to move to the island.

Among Puerto Rico's many challenges such as damages from natural disasters, energy availability, and commercial real estate issues, Invest Puerto Rico identified workforce development as a critical topic requiring a robust strategy to attract. Simply put, as organizations investigate whether Puerto Rico would be an appropriate destination for their operations, they need to be confident there is enough high-quality talent they can leverage to achieve their firms' goals. With a history of diverse industries present on the island, Puerto Rico has no shortage of talented individuals.

MAP Project Objective/Scope

To help achieve its workforce goals, Invest Puerto engaged the University of Michigan Ross MAP team to identify and offer solutions for three main topics related to workforce development:

- Characterization of the current workforce capabilities on the island
- Workforce requirements for the targeted growth industries
- Strategies to close any existing gaps and to retain the significant amount of talent migrating away from the island each year

Our full Letter of Engagement can be found in Appendix A.

Methodology

Throughout the project, the team leveraged a variety of resources. Primary research included interviews in Puerto Rico with entities such as government organizations, private companies, universities, and individuals. See Appendix B for a list of interviews conducted. The interviews provided the team with context on the situation, and provided initial thoughts for recommendations to explore further. Secondary research included university publications, organization publications, the team's librarian resources and publications, U.S. government data, and other institutions referenced as benchmarks. These resources were instrumental in developing the migration analysis and various pieces of the IT sector case study. A Bibliography with all referenced sources can be found in Appendix C.

Report Structure

This report presents analyses and recommendations to address the workforce development objectives. To provide an appropriate depth of analysis, the first section which includes a case study was conducted for one of the targeted growth sectors, Information Technology - which was highlighted as an example for the workforce characterization and requirement topics. The analysis and resulting recommendations developed for this industry serve as a framework to perform similar analyses for parallel industries of interest. The second section on migration analysis and the recommendations that follow apply to a broader scope of sectors and are not solely IT focused.

Background

Puerto Rico History

Commonwealth of Puerto Rico
Puerto Rico has been a territory of the United States since defeating Spain in the Spanish-American War in 1898.[1] It is classified as an "unincorporated territory," meaning the island is separate from the mainland but is controlled by the U.S. government. Since 1952, Puerto Rico has been self-governed, giving its residents the ability to elect their own governor, assembly, and senate.[2] In recent years, there have been discussions and efforts made around Puerto Rico's political status: statehood, free association, and independence.

Economy
Puerto Rico's economy has faced hardship for about the past 14 years. The recession consists of a decrease in real income, consumer spending, employment, and manufacturing, among others.[3] Almost half of its residents live below the poverty line, and the unemployment rate is the highest in the U.S. Previously one of the most dynamic economies in the Caribbean, tax preferences that once led US firms to invest heavily were phased out in 2006.[4] The main industries are manufacturing and services, with manufacturing primarily comprised of pharmaceuticals and medical devices. See Appendix C for a breakdown of key industries.

Natural Disasters
Hurricane Irma and Maria both hit Puerto Rico in September of 2017 causing immense damage to the island. The hurricanes caused destruction to homes and communities, limited access to food, water, fuel, and medicine, and resulted in a complete electrical outage of the island, some lasting for significant periods of time. Hurricane Maria caused the second largest blackout in history, and is the third costliest storm in US history.[5] The damage was crippling for an island already facing many challenges.

Most recently, in January of 2020, there were two main earthquakes of level 6.4 and 5.8 magnitudes that primarily impacted the southwest area of the island. The initial earthquakes caused numerous aftershocks. However, there is potential for more tectonic activity that could bring further impact to the island.

Population/Migration
Due to the aforementioned challenges facing Puerto Rico, the island has been experiencing a continued population decline, exacerbated by Hurricane Maria. Because Puerto Rico is a U.S. territory, its citizens are U.S. citizens; those native to Puerto Rico are easily able to migrate to the continental United States. This creates low barriers to entry and ease of movement for those facing hardship or seeking perceived greater opportunity in the mainland, accelerating the migration patterns. Migration and the impacts on population are further explored later in this report.

Current State/Summary
Puerto Ricans are very passionate and have a deep appreciation for their island. The hardships faced have brought the people together with a common goal of rebuilding and bettering their

lives. Unfortunately, the outsider view of Puerto Rico, partly due to unfavorable media, does not portray the "real" life on the island. Showcasing the "real" Puerto Rico will be most valuable in attracting outside interest. Puerto Rico is in a challenging, yet opportunistic time to redesign the landscape of its economy with an eye towards the future.

Invest Puerto Rico

Invest Puerto Rico was founded by law in 2017 as an investment promotion agency (IPA) as part of governmental structural reforms.[6] IPAs are generally instituted to boost local economic development. Benefits of IPAs include:

- Common branding and messaging independent of politics
- Single point of contact for prospective investors
- Serve as link between public and private sectors

Invest Puerto Rico (InvestPR) is just getting started; 2020 will essentially be the first full year of operation, as it only had 2 employees until recently. InvestPR will leverage incentives and the attractiveness of the island along the investment promotion cycle. InvestPR helps to build the image of the island, generate leads and targets for potential investors, and facilitate action. Measuring success is important; InvestPR will measure success via a few Key Performance Indicators including awareness, sales, outcomes, organizational effectiveness, and product improvement.[7] Overall, Invest Puerto Rico's mission as a not-for-profit is to promote Puerto Rico as an attractive investment jurisdiction for new business and capital, aiding in the economic development of Puerto Rico.

Case study: Information Technology

The information technology (IT) sector represents one of the fastest growing and most dynamic industries in the world today. According to CompTIA,[8] a leading IT industry association, the global IT market is projected to be worth $5.2 trillion in 2020, with an average projected growth of 3.7% annually through 2023.

The underlying factor driving this growth is simple: the world is undergoing another industrial revolution.[9] Over the past fifteen years, innovation in technology and its associated infrastructure have changed the way businesses, institutions, and people live their lives. As reliance on tech grows, expertise is required to manage the processes, capabilities, and risks associated with it. That's where IT comes in.

To define potential workforce development strategies, our team investigated all facets of the growing IT industry to determine how Invest PR could learn from and use this industry as a model for talent growth.

IT Product Categories

In broad terms, the global IT market is broken into the following product categories[10]:

- Software: Programs and other operating systems used by a computer.
- Devices and Infrastructure: Hardware, devices, and supporting physical systems that enable information technology to run.
- IT & business services: IT processes and services that serve specific market needs in other industries. This category represents IT as a service that is deployed to assist firms in other sectors optimize their business.
- Telecomm services: Specific infrastructure category focused on network development and establishment. This category includes broadband and mobile internet, and the associated hardware needs to enable these networks – e.g. satellites, fiber optic cabling, and network access points.
- Emerging technology: Technology development in progress. These are products and services that are not currently in the market, but will be in the future. Covers a broad range of products and functions.

IT Emerging Technology Function Areas

CompTIA cites four key functional areas that are the focus of the emerging technology landscape.[11] These are: Software Development, Cybersecurity, Data, and Infrastructure.

- Software Development: Software Development deals with computer science activities dedicated to the process of creating, designing, deploying, and supporting software. Until

recently, many firms relied upon packaged software for their business operations, but with the advent of cloud computing, more and more firms are able to create software in house customized to their business needs. Innovative areas within this pillar focus on user experience, artificial intelligence, and mobile.

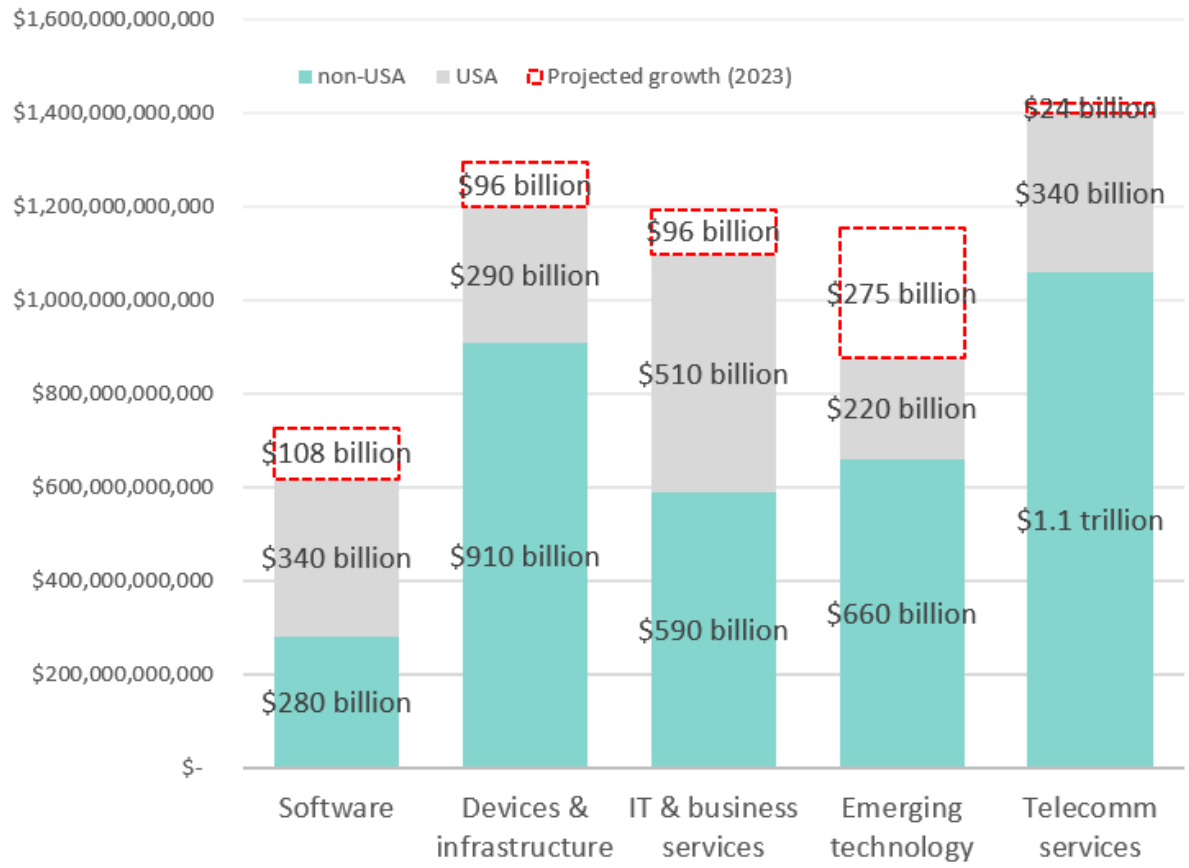
- Cybersecurity: Cybersecurity is the discipline focused on the security and protection of computer systems and networks - at the firm level or within a broader network. This complex discipline includes the development of cybersecurity defenses, the procedures to test those defenses, and the creation of internal processes that create secure operations. Innovative areas within this pillar focus on cybersecurity analytics, and privacy and risk analysis.
- Data: Data focuses on the information side of the tech-enabled world. As IT allows firms to collect more and more data about their stakeholders, the need for comprehensive policies and management of these processes is critical. Innovative areas within this pillar focus on predictive analytics, database administration, and the management of collection and reporting technologies such as distributed ledgers.
- Infrastructure: Infrastructure provides the backbone for all IT functions, and is a key driver of IT tactics and IT strategy. Depending on geography, infrastructure challenges are different, based on the stage of maturation of the region's network architecture. Cloud computing, 5G mobile networks, and fiber optics are three key areas of focus within this pillar, and will all be relied upon to drive storage, use, and function of IT in the future.

Each of these IT functional areas represents growing business opportunities and demand for skilled talent.

The U.S. IT Market and Growth

The United States leads in the production of IT around the world, making up $1.7 trillion of the projected $5.2 trillion market capitalization of the industry in 2020.[12] This is due in part to the fact that the tech revolution began in the United States, with many of the largest tech firms based there.[13] As such, the software development and IT services categories make up a larger share of the US market, and are exported to the rest of the world. Telecommunications and devices & infrastructure make up a smaller percentage of the US market. Figure 1 below shows the 2020 IT market capitalization by category and geography, including the projected growth in each category through 2023.[14]

Figure 1. IT Market Cap by geography and category through 2023 (in billions of USD)



Growth Drivers and Growth Inhibitors

Business development through new and existing customers, operational efficiencies, and positive government action are all cited by CompTIA as growth drivers for the IT industry in the coming years.[15] Lack of capital investment, unexpected shocks to the economy, and competition are cited as key threats to growth, as well as the talent shortages among the IT workforce.[16]

IT Occupations

Growing Demand

As is the case with the Information Technology market as a whole, the future is bright for those who work in IT. Figure 2 indicates the US occupations that are considered part of the Information Technology career family in this case study.[17] The occupations included represent the United States IT career cluster as classified by the O*NET OnLine,[18] plus Computer and Information Systems Managers, Computer Hardware Engineers, and Computer Operators, which

are occupations outside the IT career cluster on O*NET, but included in other IT employment assessments.[19] Many of these occupations have evolved over the past fifteen years, and are posed for continued evolution and growth as the IT sector continues to serve as a functional discipline.[20]

Figure 2. Information Technology Career Family Occupations

Career Pathway	Occupational Code	Occupation
Business Information Management	11-3021	Computer and Information Systems Managers*
Information Support and Services	15-1199.08	Business Intelligence Analysts
Information Support and Services	15-1199.00	Computer Occupations, All Other
Information Support and Services	15-1199.02	Computer Systems Engineers/Architects
Information Support and Services	15-1151.00	Computer User Support Specialists
Information Support and Services	15-1199.07	Data Warehousing Specialists
Information Support and Services	15-1199.06	Database Architects
Information Support and Services	15-1199.12	Document Management Specialists
Information Support and Services	15-1199.05	Geographic Information Systems Technicians
Information Support and Services	15-1199.04	Geospatial Information Scientists and Technologists
Information Support and Services	15-1199.09	Information Technology Project Managers
Information Support and Services	15-1199.10	Search Marketing Strategists
Information Support and Services	15-1199.01	Software Quality Assurance Engineers and Testers
Information Support and Services	15-1199.11	Video Game Designers
Information Support and Services	15-1199.03	Web Administrators
Network Systems	15-1143.00	Computer Network Architects
Network Systems	15-1152.00	Computer Network Support Specialists
Network Systems	15-1141.00	Database Administrators
Network Systems	15-1122.00	Information Security Analysts
Network Systems	15-1142.00	Network and Computer Systems Administrators
Engineering and Technology	17-2061	Computer Hardware Engineers*
Business Management & Administration	43-9011	Computer Operators*

**occupations outside of the O*NET Information Technology Career Cluster but assessed as such in this analysis*

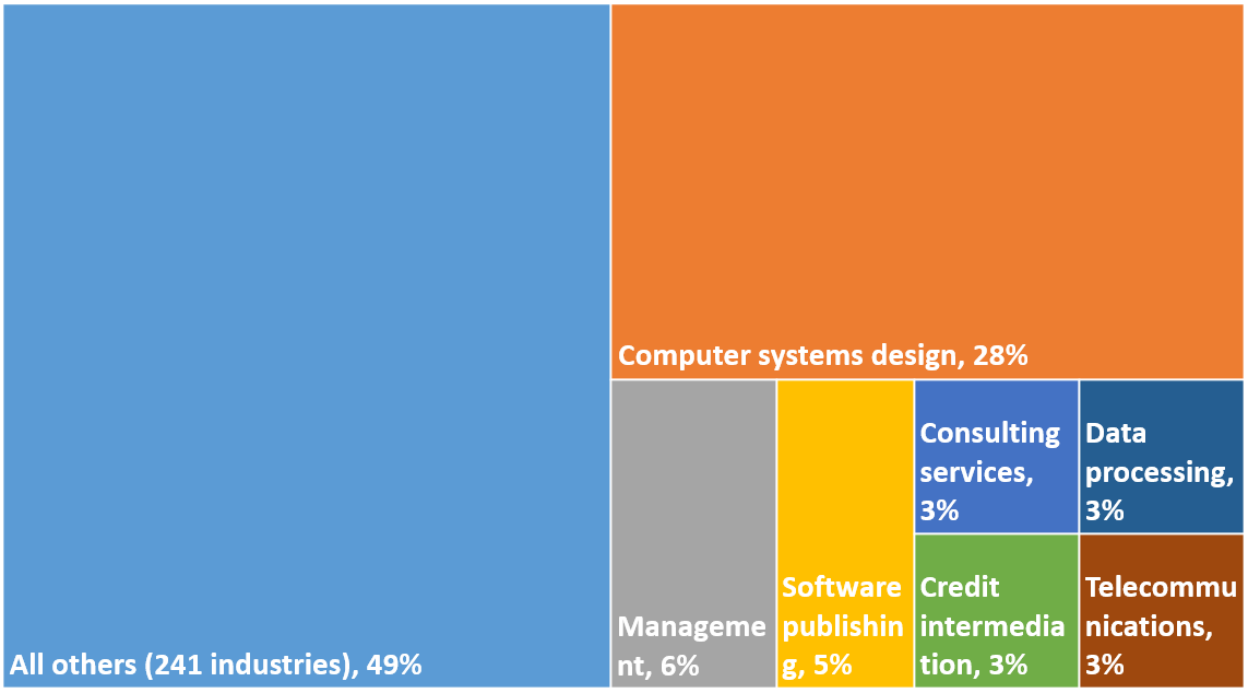
According to the US Bureau of Labor Statistics May 2019 National Occupational Employment and Wage Estimates,[21] the top five IT occupations in the US by employment are listed below, with a brief description for each based on O*NET's detailed occupation description.[22]

1. Software Developers: create the applications or systems that run on a computer or another device.
2. Computer Support Specialists: provide help and advice to computer users and organizations.
3. Computer Systems Analysts: study an organization's current computer systems and find a solution that is more efficient and effective.

4. Network and Computer Systems Administrators: are responsible for day-to-day operation of computer networks.
5. Computer and Information Managers: plan, coordinate, and direct computer-related activities in an organization.

Figure 3 indicates the breakdown of IT occupations by industry employment.[23]

Figure 3. IT Career Family Occupations, by Industry Employment



While over a quarter of IT occupations in the United States are employed in the computer systems design and service sector, information technology roles serve functionally across a diverse range of US industries, as evidenced by the fact that almost half of IT occupations are spread across 241 different industries. All told, IT occupations can be found in 248 unique industries, according to the 2018 Industry-Occupation Matrix Data, published with the 2018-2028 BLS Employment Projections.[24]

Skill Set Gaps

The skill set and training required to be a productive member of the IT workforce is high relative to other occupations. Figure 4 indicates the typical education, work experience, and on-the-job training needed for workers in the IT occupational family, as reported by the Education and Training data published with the 2018-2028 BLS Employment Projections.[25]

Figure 4. IT Career Family Education, Experience, and Training Requirements

2018 National Employment Matrix title and code		Typical education needed for entry	Work experience in a related occupation	Typical on-the-job training needed to attain competency	Experience rating*
Computer and information systems managers	11-3021	Bachelor's degree	5 years or more	None	481.8
Computer and information research scientists	15-1111	Master's degree	None	None	568
Computer systems analysts	15-1121	Bachelor's degree	None	None	480.7
Information security analysts	15-1122	Bachelor's degree	Less than 5 years	None	468
Computer programmers	15-1131	Bachelor's degree	None	None	478.9
Software developers, applications	15-1132	Bachelor's degree	None	None	511.1
Software developers, systems software	15-1133	Bachelor's degree	None	None	511.1
Web developers	15-1134	Associate's degree	None	None	459.8
Database administrators	15-1141	Bachelor's degree	None	None	475.8
Network and computer systems administrators	15-1142	Bachelor's degree	None	None	435.8
Computer network architects	15-1143	Bachelor's degree	5 years or more	None	445.6
Computer user support specialists	15-1151	Some college, no degree	None	None	415.2
Computer network support specialists	15-1152	Associate's degree	None	None	415.2
Computer occupations, all other	15-1199	Bachelor's degree	None	None	436.2
Computer hardware engineers	17-2061	Bachelor's degree	None	None	491.3
Computer operators	43-9011	High school diploma	None	Moderate on-the-job training	363.1
Average of all US occupations	00-0000	High school diploma	None	None	362.9

**Experience rating is a team-created indicator of relative experience required based on current educational distribution by degree attained among existing workforce for each occupation*

As indicated, 14 of the 16 occupations within the career family typically require a college degree, with the majority requiring at least a Bachelor's degree. The experience rating is a team-created indicator that illustrates the relative experience required based on each occupation's current educational distribution by degree attained, which is included in the same data set from the BLS. Also, all of the IT career family occupations exceed the educational experience required of the average of all American occupations.

Despite the relatively high educational attainment required to work in IT, there is a fair amount of consistency in what qualities are sought across the occupations within the career family.

Figure 5 indicates the top qualities cited in the BLS Occupational Outlook Handbook (September 2019)[26] for the top six IT occupations by 2019 employment.

Figure 5. Top Qualities Sought in Top IT Occupations, by 2019 Employment

Occupation	Communication skills	Analytical skills	Problem solving skills	Detail oriented	Creativity	Interpersonal skills
Software Developers	✓	✓	✓	✓	✓	✓
Computer Support Specialists	✓		✓			
Computer Systems Analysts	✓	✓			✓	
Network and Computer Systems Administrators	✓	✓	✓			
Computer and Information Systems Managers	✓	✓				
Computer Programmers		✓		✓		
Other	✓	✓	✓	✓		✓
Percent of jobs requiring quality	83%	75%	70%	54%	53%	37%

Communications skills, analytical skills, and the ability to problem solve are qualities sought in over 70% of IT jobs. Workers who are detail-oriented and have a knack for creativity are also sought in a majority of IT jobs. Detailed skills distributions for each IT cluster occupation can be found in Appendix D, informed by the 2016 O*NET occupational data.[27]

The demand for IT workers exceeds the supply in the United States, which has led to relative scarcity of IT occupations, and a power structure that skews toward IT workers as opposed to firms.[28] There are a number of factors driving this deficit, including the relative newness of IT positions has posed challenges for education to keep up, and rapid expansion of IT demand informed by industry expansion and technological innovation. With the emerging tech landscape continuing to grow, this deficit is expected to continue until education and training can catch up.[29] This also drives the need for alternative education programs, to supplement the workforce with older workers and career switchers. As such, the age distribution of IT workers skews younger than most other sectors.[30]

Salary Increases

The relative scarcity of talent coupled with increasing demand for workers has resulted in upward pressures on salaries. This has created a squeeze that impacts small to mid-sized firms especially, as well as secondary markets. Figures 6 and 7 indicate the spatial and wage distribution of Software Developer jobs across the US, per the US Census Bureau ACS PUMS 1-Year Estimate[31] and visualized through Data USA.[32] As indicated, the majority of positions are in major cities, with the highest-paying positions existing on the coasts in established tech hubs.

Figure 6. 2017 Spatial Concentration of Software Developers

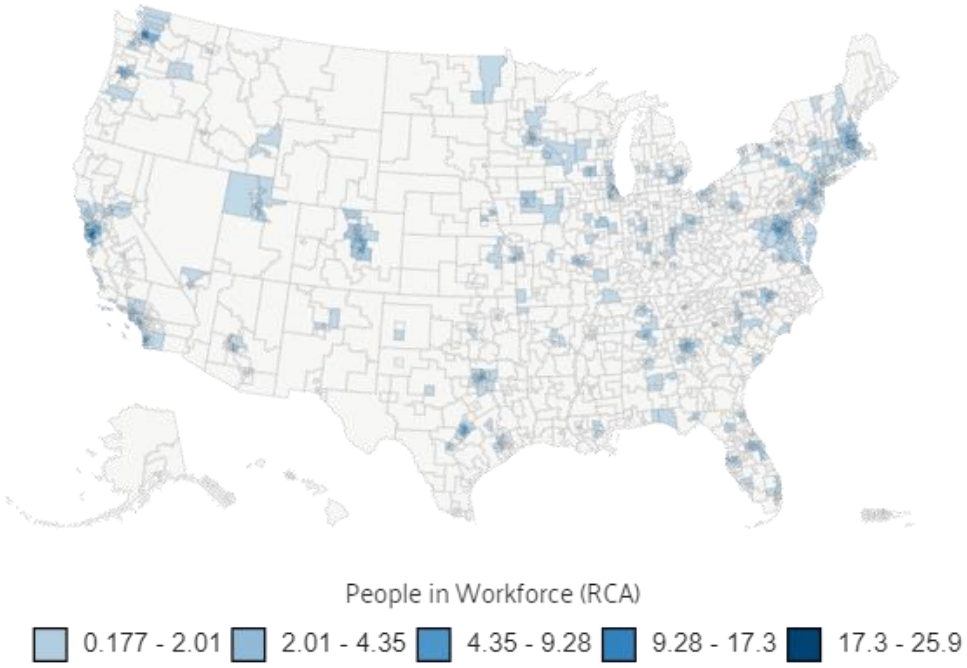
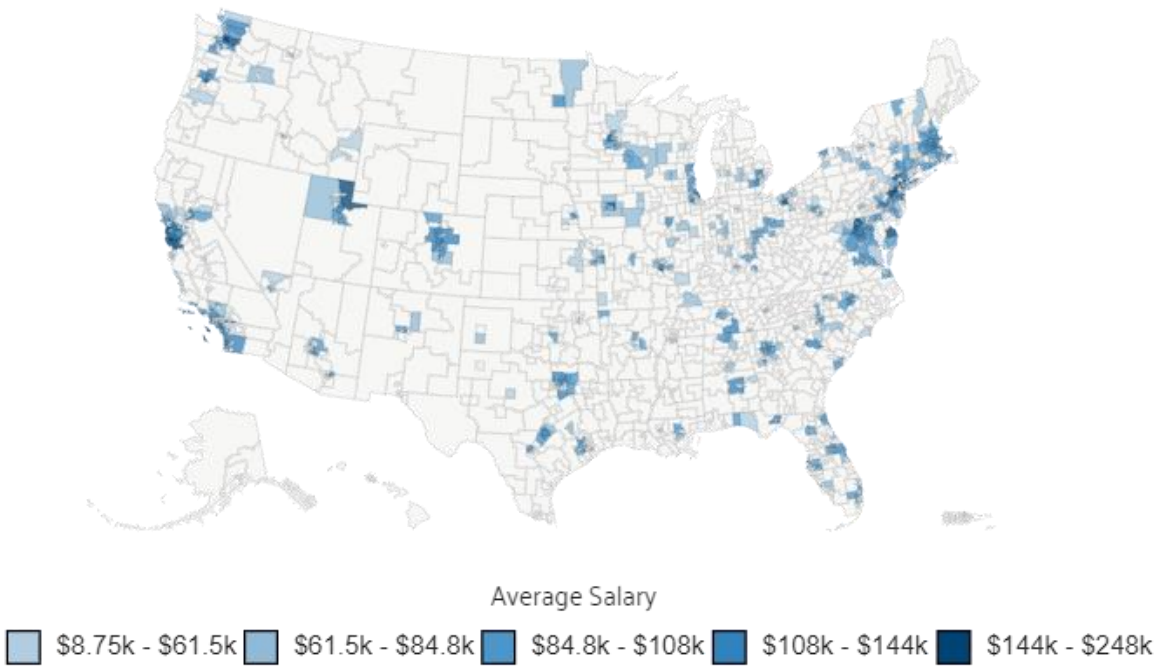


Figure 7. 2017 Wage Distribution of Software Developers



The growing type and number of occupations, skill set gaps and increasing salaries underscore the opportunities in the IT sector and warrant targeting by Invest PR.

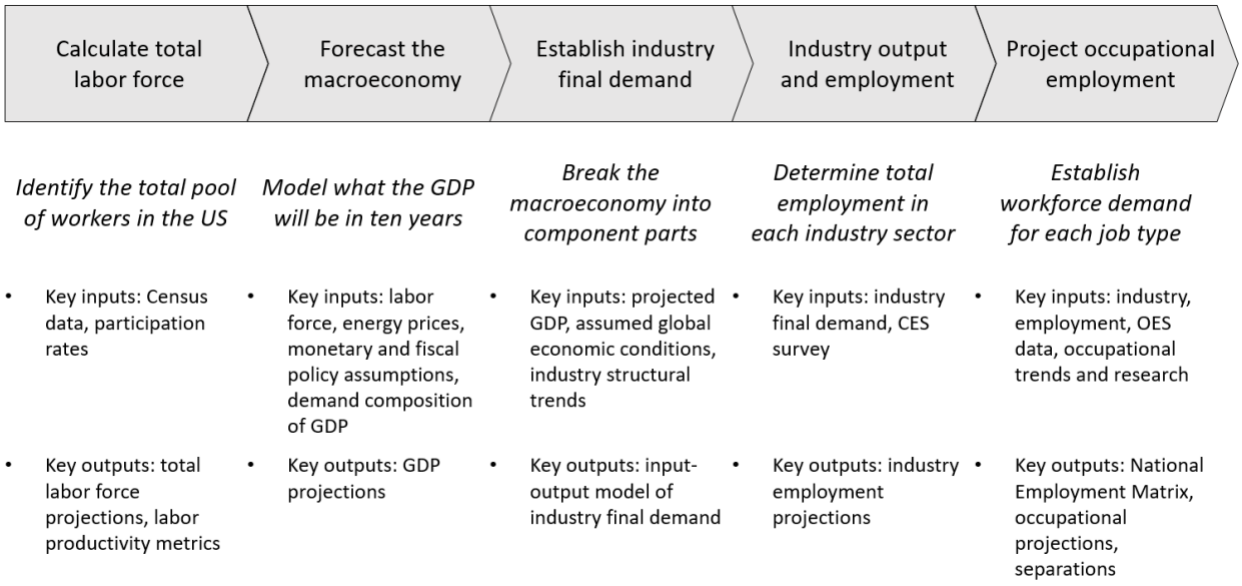
USA Workforce Projection Methodologies

To quantify the size of the opportunities in IT and other sectors, our team investigated methods used to project workforce demand projections.

Every two years, the US Bureau of Labor Statistics (BLS) creates and validates employment projections for the US workforce (September 2019).[33] The most recent long-term projections were published in 2019, and provide a snapshot of the projected workforce on a ten-year horizon, beginning in 2018 and running through 2028. To compile these projections, the BLS follows a multi-step process that examines a number of factors informing occupational employment across the US economy.[34]

Figure 8 provides a visual overview of this process as indicated by the BLS Employment Projections Methodology.[35] A more detailed breakdown of this methodology is provided in Appendix E. Key sources that inform the calculations include BLS data, Census data, Bureau of Economic Analysis (BEA) data, and other governmental and private sources.[36]

Figure 8. BLS National Employment Projections Process Overview



Why are these projections important? Well, chiefly, these projections inform human capital needs within the US, and enable an assessment of priority for education and training investment, particularly in K-12 and post-secondary education.[37] The high growth of occupations in the IT sector underscores the need for the US education system to accommodate the IT skill sets detailed earlier in this report.

USA IT Workforce Projections

Appendix F indicates the results of the long-term workforce projections for IT cluster occupations in the United States through 2028, informed by the BLS 2018-2028 Employment Projections.[38] Over the ten-year timespan from 2018 to 2028, IT occupations nationally are expected to grow by 12 percent, with over 450,000 annual openings and a total increase of 587,900 jobs by 2028. This growth rate outpaces that of most US occupations (the average ten-year growth rate across all occupations is just over 5%), corroborating the market growth forecasts for the industry at large.

Fourteen of the 16 occupations within the US IT cluster are expected to grow in the next decade. This underlies what was discussed in the earlier section regarding the IT market as a whole - functional expertise in IT is in demand, and the transition toward in-house and job-shop IT services will drive the need across the gamut of IT occupations. Software developers, computer support specialists, and computer systems analysts are projected to retain the top three positions by total workforce demand, and the need for Computer and Information System Managers will also remain high.

Another high-growth occupational category is that of Information Security Analysts, a key role in the cybersecurity sector. Figure 9 indicates the structural factors cited by the BLS as contributing to increased or decreased utilization in the IT cluster occupations over the next ten years.[39]

Figure 9. Factors Affecting IT Career Family Occupational Utilization, 2018-2028

Occupation	Factors affecting occupational utilization
Computer and information research scientists	Demand change - share increases as demand for digital devices increases.
Computer systems analysts	Demand change - share increases as companies require new technologies (chatbots, natural language, image, processing and machine learning) to support digitalization and automation of work processes.
Computer systems analysts	Sourcing change - share decreases as firms and organizations in non-IT and related industries take advantage of the economies of scale afforded by cloud computing. These firms will also increasingly contract their IT needs as a way of cutting costs.
Information security analysts	Demand change - share increases as firms increase their IT security staffs and capabilities as a response to increasing threats of cyber attacks aimed at sensitive or financial data.
Computer programmers	Sourcing change - share decreases as computer programming work continues to be offshored as a way to control costs.
Software developers, applications	Demand change - share increases as an increase in adoption of new technologies (chatbots, natural language, image, processing and machine learning) creates demand for application software development.
Software developers, applications	Demand change - share increases as more devices include software components and are connected to the internet. Application developers will be needed to design, create, and implement software to run on a wide variety of devices, from cars to household appliances to medical devices.
Network and computer systems administrators	Sourcing change - share decreases as firms and organizations in non-IT and related industries take advantage of the economies of scale afforded by cloud computing. These firms will also increasingly contract their IT needs as a way of cutting costs.
Computer network architects	Sourcing change - share decreases as firms and organizations in non-IT and related industries take advantage of the economies of scale afforded by cloud computing. These firms will also increasingly contract their IT needs as a way of cutting costs.
Computer operators	Productivity change - share decreases as the tasks of computer operators are increasingly automated allowing fewer operators to monitor more systems.

The two occupations projected to decline in number are Computer Programmers and Computer Operators. As listed, much of the decline in Computer Programming can be attributed toward offshoring that occupation as a way to control costs. The need for Computer Operators, dedicated personnel who monitor and control hardware, is decreasing as automated monitoring grows.[40] For most of these occupations, it will be critical to create and scale educational opportunities to ensure a talent pipeline is established that can meet this demand in the future.

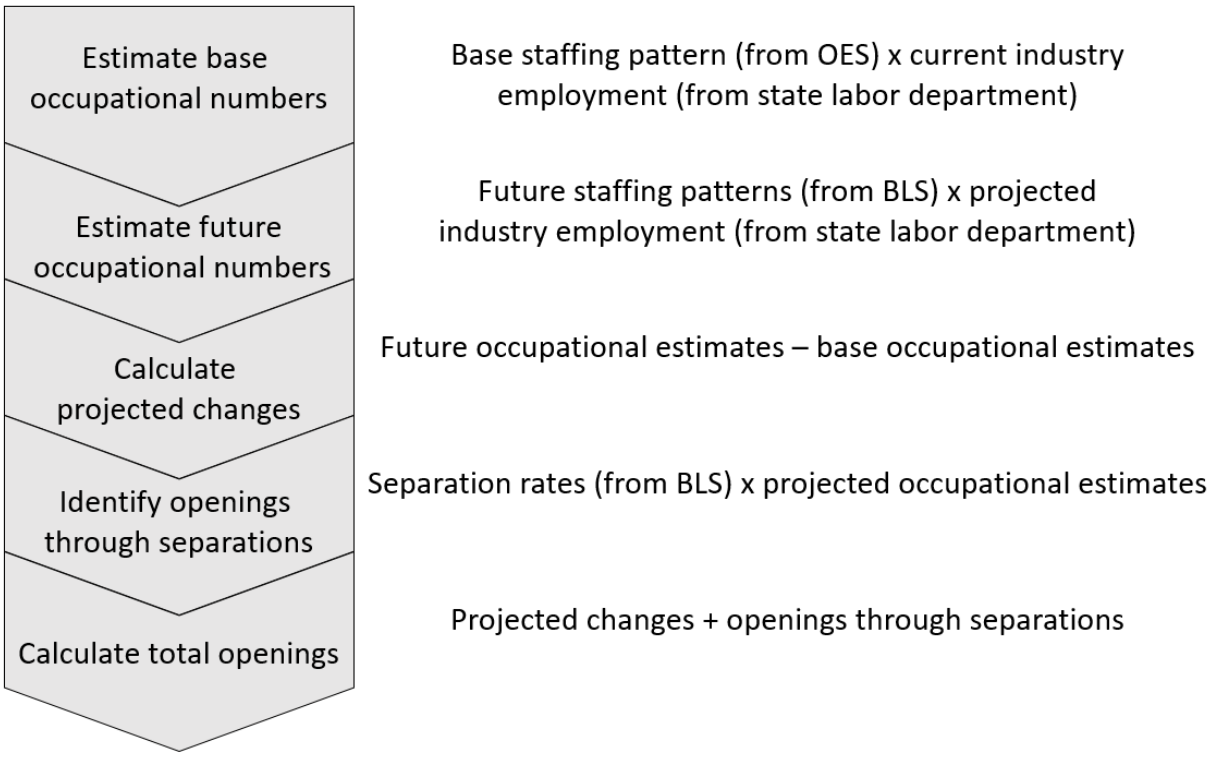
The economic impacts of the future IT workforce demand expand beyond the occupations represented in the BLS projections. Three common economic impact metrics - total employment, household earnings, and output (GDP) - were calculated by the team and are indicated in Appendix G, H, and I.[41] These calculations provide context for the country's ability to meet the workforce demand. Using industry-specific indirect employment multipliers provided by the Economic Policy Institute,[42] one can see that the total employment need, direct and indirect, driven by the IT occupational projections is north of 29 million people by 2028, representing over $1.72 trillion in earnings (in 2017 USD) and over $1.96 trillion in economic output (in chained 2012 USD).

Puerto Rico Projections Methodologies

Anthony Hayden, a Labor Market Analyst from New York State who coordinates the development of state and local workforce projections across the US provided additional insights. Per Hayden, the state and local workforce projections, including Puerto Rico, are created through a related process to the national projections. These projections are created and validated by the Projection Managing Partnership (PMP), an interstate consortium for employment projections that is funded by the US Department of Labor, Employment and Training Administration (ETA), and Bureau of Labor Statistics. The PMP provides employment projections for states and municipalities across the US, including Puerto Rico. The projections are informed by state labor analysts and finalized through the PMP to ensure consistency between the local, state, and national projections. For the purposes of this report, references to "state" methods apply to Puerto Rico.

The state methodology for occupational projections closely follows the methodology employed to develop the national projections. The differences between state and national numbers are primarily attributed to differing industry projections, differing industry composition, and different occupational distributions in those industries. A visual overview of the state employment projections process is indicated in Figure 10.

Figure 10. BLS State Employment Projections Process Overview



There are four basic inputs used to calculate the end result of the projections process, total openings by occupation. Those are:

1. State and area Occupational Employment Statistics (OES) survey data, provided by the Bureau of Labor Statistics. This data is used to calculate the percent distribution of occupations within each industry. This distribution is called a staffing pattern.
2. A future staffing pattern reflecting changes in the staffing pattern, or changes in share of each occupation within the industry, resulting from a number of factors. Future staffing patterns are calculated at the national level and applied to state and area staffing patterns.
3. Projected level of industry employment. States develop their own projections of state and area industry employment. For Puerto Rico, this process is led by Noel Zayas Moro, an economist with the Puerto Rican Bureau of Labor Statistics.
4. Estimates of occupational separations rates developed at the national level by the Bureau of Labor Statistics.

After these inputs are identified, the following calculations inform the projections:

- Base year occupational estimates are calculated by multiplying base year industry employment by base year staffing patterns.

- Projected year occupational estimates are calculated by multiplying the future staffing patterns by projected level of industry employment.
- Change in occupational estimates are the difference between base and projected year occupational estimates.
- Occupational openings due to separations are calculated by multiplying separation rates by projected occupational employment.
- Total openings are the sum of change in occupational estimates and occupational openings due to separations.

The results of these calculations are the long-term occupational projections for each state.

Puerto Rico IT Workforce Projections

Appendix J indicates the results of the long-term workforce projections for IT cluster occupations in Puerto Rico through 2026,[43] which are the most up-to-date projections available - the 2018-2028 projections will be published in July 2020 (Zaya Moro, 2020).

Over the ten-year timespan from 2016 to 2026, IT occupations within Puerto Rico are expected to grow by just 1 percent, with a total increase of 70 jobs. While this growth rate outpaces other occupations on the island - Puerto Rico is projected to have a net decrease in total workforce through 2026 - it lags the national IT occupational growth considerably.

Projections Differences

There are a few reasons for the difference in numbers between Puerto Rico and the US as a whole. First, Puerto Rico's workforce projections rely heavily on historic figures, which have been stagnant in the IT sector for the past ten years. Second, Puerto Rico's lack of an established IT sector limits the upside growth as compared to other states, where IT is a larger portion of existing industry. For example, Puerto Rico doesn't project any gains in Computer and Information Research Scientists or Web Developers, because there are none reported in the existing data. Third, infrastructure and salary challenges on the island make it difficult to compete for IT business compared to other municipalities in the continental US (Perez and Ramos, 2020). While unconfirmed by the PMP, it appears likely that some of the structural economic changes that are factored into the national data have not been applied to Puerto Rico's projections. This is supported by Puerto Rico's use of a dual-sector, Lewis model to develop its industry-occupation staffing pattern (Zayas Moro, 2020).

Perhaps the greatest difference driving Puerto Rico's relative lack of growth, however, is the occupational mix of Puerto Rico's current IT workforce. The largest occupations by share of Puerto Rico 2016 IT cluster workforce are Computer User Support Specialists, Computer Programmers, and Computer and Information Systems Managers. While Computer and

Information Systems Managers are poised for modest growth through 2026 (3%), Computer Programmers, as noted in the analysis of the national workforce projections, are projected to lose positions over the upcoming decade, and Computer User Support Specialists are projected to gain only 40 jobs, about 1% of the 2016 volume of positions in that category. In short, the base workforce mix in Puerto Rico limits the effect that occupations poised for rapid growth - like Software Developers and Information Security Analysts - has on the projected 2026 workforce.

Recommendations to Improve IT Cluster Employment

A big-picture viewpoint is increasingly necessary to shift toward a workforce that is digital-ready.[44] Economic development agencies and other public organizations play a critical role in enabling this change as governments shift toward a model of effective strategic centers.[45] To affect meaningful change for its jurisdiction, economic development agencies must define its jurisdiction's value proposition, become a source of knowledge to its institutions, and act as a communication platform for its constituents.[46] They must also promote innovation among its firms, which is one of the critical agents of positive change.[47]

As such, we believe that by focusing on three key goals and by executing through specific strategies and tactics, Invest Puerto Rico can improve Puerto Rico's standing as it relates to IT.

The following goals should drive Invest Puerto Rico's strategy with regard to developing the island's IT industry:

1. Promote high growth occupations in emerging technologies to achieve improved mix of workers in line with national growth rates.
2. Develop existing IT workforce to limit impacts in occupations that are projected to decline.
3. Maximize opportunities for impact by incentivizing innovation among Puerto Rican IT firms.

The following strategies translate the above goals to specific actions:

1. Become a conduit between firms, institutions, and the government - assist with identifying firm-specific workforce needs and communicate those with educational systems, the government, and other organizations who are in a position to help.
2. Study trends in IT and become a source for government action in the sector - this will optimize investment monies and improve structural factors reflected in the long-term Puerto Rican workforce projections, which influences federal and Puerto Rican investment and education development in the sector.

3. Define and Promote Puerto Rico's value proposition in the IT space by developing talking points that can be shared with potential businesses, and promoters on and off the island.
4. Identify, advocate for, and support blue-sky initiatives in IT - high risk, high reward ideas that have the potential to positively disrupt industry on the island.

We believe that Invest PR can execute on the above strategies by acting in the following roles:

- Invest PR as researcher. In this role, Invest is responsible for defining Puerto Rico's value proposition in the IT sector, and in charge of identifying trends and practices within the sector that are best fit for the island.
- Invest PR as partner. In this role, Invest acts as an arbiter of the zoomed-out vision between firms, educational institutions, the government, and the workforce. Invest establishes a consortium of these groups and acts as a resource to assist partners with overcoming challenges in the IT sector.
- Invest PR as sponsor. In this role, Invest incentivizes actions among its partners by providing its stamp of approval on sponsored events, grants, and competitions. These events are informed by the research Invest has done on proven actions that will improve the industry. This might include an annual innovation competition, or an IT-focused speaker series, or funding for workforce training.
- Invest PR as communicator. In this role, Invest is the mouthpiece for the state of IT in Puerto Rico. It advocates with the government, it educates firms and workers, and it shouts Puerto Rico's IT story to the world, integrating the outcomes of the prior three roles into a consistent and compelling message.
- Invest PR as measurer. In this role, Invest tracks Puerto Rico's progress in the IT sector. It develops a scorecard to measure firms' and institutions' success. That scorecard is tied to desired outcomes in the sector, and provides incentive for action that might otherwise be ignored.

Quantitative Economic Impacts of Tech Sector Investment

By implementing the above recommendations, we believe it is feasible for Puerto Rico to beat the current 2026 IT workforce projections, achieving a growth or an occupational mix that matches that for the rest of the US. A 15% growth in Puerto Rican IT occupations represents just over one thousand jobs, which is a drop in the bucket compared to an occupational cluster that will employ 5.5 million people nationally by 2028.

The impacts of beating the projections would have meaningful consequences to the Puerto Rican economy. Appendices K, L, and M indicate the economic impact indicators for Puerto Rico in the same manner that was calculated for the national projections, and Appendices N, O, and P compare the effects that three hypothetical scenarios would have on projected 2026 total employment, household earnings, and output, respectively, in the Puerto Rican economy.[48]

In Scenario 1, the direct employment in Puerto Rican IT occupations matches the national growth rate, creating 660 more direct jobs and 2,687 indirect jobs on the island using the same indirect industry multipliers as was done in the national analysis. Applying the 2017 Puerto Rican mean wage for each IT occupation to each category of direct employment, (and utilizing the 2017 mean wage for all Puerto Rican occupations for indirect employment) yields over $110 million (in 2017 dollars) worth of added earnings in year 2026. The added output of scenario 1 is projected to be worth over $107 million (in 2012 chained dollars) based on output per direct employment position, adjusted to Puerto Rican wages.

In Scenario 2, a revised mix of IT cluster employment that tracks with that of the national mix is applied, without adding more total employees than are currently projected through 2026. The results indicate that 1,275 indirect jobs would be added, over $104 million in added 2017 earnings, and a whopping $232 million in added 2012 chained dollar output would be achieved. The results of this scenario emphasize the opportunity available to Puerto Rico if it is successfully able to develop talent in high-impact IT occupations. Occupations like Software Developers, Computer Network Support Specialists, and Computer Network Architects all have high indirect employment multipliers, improved wages, and high output potential. Focusing on building out those occupations will generate positive effects economically on the island.

Scenario 3 represents the likeliest future that we believe can be achieved with concerted effort described above by Invest Puerto Rico and its partners. In this scenario, particular emphasis is placed on growing the Software Developer and Computer Support Specialist occupations, which leverages Puerto Rico's existing occupational strengths in the Computer Support Specialist role and tracks with high growth potential in the Software Developer role. The development of IT Managers is also an area of focus. For the most part, the remaining occupations track with retaining existing growth rates on the island. The results indicate that 3,977 total jobs would be added, over $131 million in added 2017 earnings, and $145 million in added 2012 chained dollar output would be achieved above and beyond the current BLS 2026 projections.

Qualitative Economic Impacts of Tech Sector Investment

In addition to the quantitative impacts that adding tech sector jobs has on an economy, there are other less-measurable benefits that could result from investment in the information technology sector.

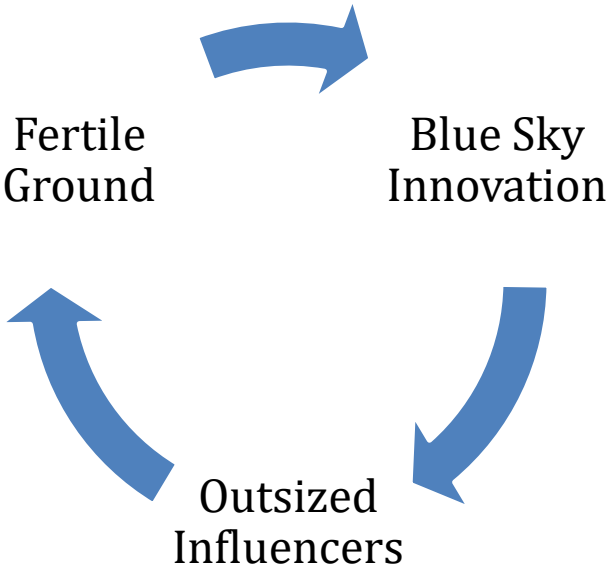
To illustrate these potential effects, consider Puerto Rico's music industry. Puerto Rico has become a colossal force in music, despite its relative population disadvantage compared to other entertainment markets. The Puerto Rican music industry did not gain dominance overnight, but it did gain traction through its unique history, intersection of cultures, and inherent artistry.[48] In short, Puerto Rican music was poised for success because it had fertile ground - an environment ripe for innovation and one that attracted interest from industry players.

In the 1990s, Raggaeton exploded from this fertile ground. Raggaeton represents a blue sky innovation in the music industry - an idea that pushed the industry forward in an exponential

way. As a result, Puerto Rican music was lifted to new heights, to the point where Raggaeton artists are known globally, now a part of the cultural lexicon and performing on the world's biggest stages. Daddy Yankee and Luis Fonsi are examples of artists that became outsized influencers as a result, and their influence has enabled more fertile ground to be laid, and other innovations to occur.

Figure 11 illustrates this cycle. It has been manifested in other industries too - like the automotive industry in Detroit,[49] and the startup scene in Israel.[50] The information technology industry has the potential for exponential results, and investment in fertile ground that leverages Puerto Rico's strengths could lead to exceedingly positive consequences.

Figure 11. Qualitative Innovation Cycle



(Source: Team Analysis)

As with Puerto Rican music, success begets success. Puerto Rico is as unique a destination and positioning the island as a low-cost tech destination with a relaxed lifestyle and room to experiment is a value proposition that will attract investment. In tech, successful investment can produce network effects – impacts that amplify and grow exponentially. While these effects cannot yet be quantified, they have the potential to influence meaningful change on the island.

Conceptual Budget

Appendix Q provides a conceptual budget of our team's recommendations, broken out by category, action, labor, and other costs. In addition, we have indicated a number of risks associated with the implementation of these recommendations, and associated mitigation strategies.

Current Development Strategy

With the most recent industrial revolution underway, Puerto Rico has come up with some creative ways to ensure that necessary development opportunities are in place to meet the industry demand. While the public education system has been slow to adjust to the increased need for IT specific roles, extracurricular STEM programs have tried to pick up the slack. Programs like Engine-4 teach kids the necessary skills to understand entry-level coding and gain an interest in the STEM areas. As the largest co-working space in Puerto Rico, Engine-4 offers membership plans with a collaborative learning environment to any young individual interested in coding with a valid student ID (Carolo, February 2020).

At the collegiate level, Puerto Rico has a strong system of government owned universities with 11 campuses and ~50,000 students.[51] For undergraduate programs, students accepted enroll within the major that they chose prior to beginning courses. While this system works well for job placement, some more technological campuses are struggling to adapt to demand. For example, UPR Mayaguez has historically been renowned as a top engineering school in the United States, and the best in Puerto Rico. With the current bidding system in place for undergraduate specializations, UPR Mayaguez has been graduating the same number of engineers in software, manufacturing, mechanical and industrial areas (Torres, February 2020). With the current job market shifting towards IT, the demand has significantly increased for Software engineers, and many UPR graduates do not have the skill set to match the current demand.

Puerto Rico has come up with methods of alternative education to combat labor displacement. Initiatives outside of the UPR system are stepping up to the plate. The Holberton School, a product of Code Puerto Rico LLC, recently launched a location in Puerto Rico to develop Software engineers. The school currently has 10 locations that bring in curriculums developed by top experts from Silicon Valley who offer a high quality software education regardless of socioeconomic background. This is done by the school allowing students to pay for their education once they graduate and begin their career as software developers.[52] Allowing any displaced worker/student to gain a high-quality education in software development helps Puerto Rico effectively close the gap between demand of growing tech companies and lack of programmers located on the island.

Recommendations for IT Development

While the Island of Puerto Rico has taken some significant steps in workforce development, there are still many opportunities to grow and adjust to the current state of economic demand. From a developmental perspective, there are two areas to focus on while examining the current state of the Puerto Rican workforce.

Institutional Changes

While the University of Puerto Rico Mayaguez has some of the best engineering resources in the United States, there is no current strategy to engage and inform Puerto Rican youth of these opportunities. The UPR system has the ability to partner with local high schools and offer training and events to engage youth by introducing them to the STEM field. A great benchmark for this would be the University of Michigan's Youth Hub. The Youth Hub is an online platform that showcases all events that the university of Michigan offers to local K-12 students. These events are founded by PhD students and put on by student organizations. A typical event is a 1-3 week camp for students to learn new skills, like entry level coding or engineering principals.[53] This would be a great opportunity to introduce young Puerto Ricans to the opportunities they have ahead of them in Software Development and other IT fields.

Displaced Worker Support

Second, there are some short term actions which can be taken to help displaced workers. Providing displaced workers with tools to help them acquire the proper education and training for available jobs will have an immediate impact on the economy. While the Holberton School is an excellent start, there needs to be more opportunities for development.

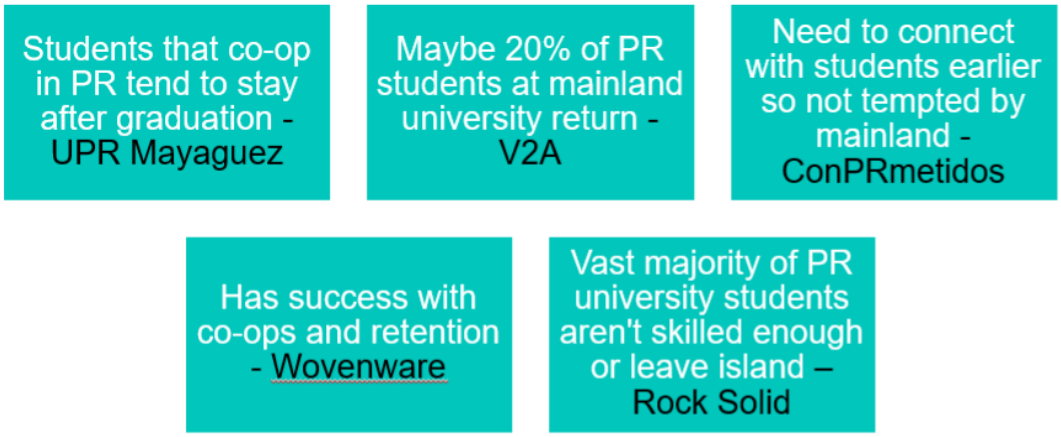
The WIOA State Plan for The Commonwealth of Puerto Rico is working to allocate funding to the proper training required for IT demand.[54] This is an opportunity for Puerto Rico to work with current employers to locate displaced workers and provide them with a “one stop shop” database for all of the training and education required to transition into their new career. Invest Puerto Rico can work with current tech employers to develop a curriculum based on their industry needs and create online training platforms like “Engine-4” for adults. Developing a common database will make it easy for workers to transition from unemployed and underemployed into a career with a more stable future.

Expand Co-ops/Internships

Another challenge facing Puerto Rico is local university students leaving for jobs in the mainland following graduation. Although there is no hard data, according to UPR Mayaguez's career office, roughly one third of students leave for jobs in the mainland.

A key way to combat that is by developing an extensive co-op/internship program. UPR Mayaguez's career office stated that students that have a co-op/internship in Puerto Rico tend to stay rather than leave for the mainland. The goal here is to create more opportunities for students to become grounded on the island and less likely to leave for opportunities in the mainland US. More anecdotal evidence from team conducted interviews in Puerto Rico is included in Figure 24:

Figure 12. Anecdotal Evidence Supporting Co-op/Internships



(Source: Team Interviews 2020

Part of the process of developing these programs will be gaining companies' buy in to the idea and participate. There are numerous benefits to companies participating in co-op/internship programs:[55]

- Recruiting Top Talent - These programs are designed to interact with top talent. This method can eliminate the need to go the typical experienced hire recruiting route which can be quite expensive. The time the student spends at the company is a trial period where fit can be determined. This can also serve as free advertising as students will share their experiences with others.
- Improve Retention - Provided the student had a good experience with the company, it is likely that they will return for a full-time job. Students that return are more likely to stay for longer compared to their counterparts that are hired in traditionally. This will also save on additional recruiting costs of filling positions.

- Improved Work Performance - Due to the fact that the student has already been exposed to the company and learned their way of doing things, they will hit the ground running better than someone completely new to the company.
- Lower Labor Costs - Co-ops/Internships do not require the typical pay of a full-time employee.

To ensure companies find success with co-ops/internships, InvestPR should ensure they are aware of best practices:[56]

- Provide clear job descriptions and expectations - This is likely the students' first exposure to real world work. It is important to clearly communicate what they will be doing and what will be expected of them.
- Provide a supporting mentor - Students will want to receive guidance and feedback on how they are doing. A designated mentor to provide that guidance and feedback is imperative.
- Give meaningful and developmental work - Students want to find success and be impactful with their first experience. They also want to learn and grow from the projects the company gives to them.
- Showcase company culture - This is the company's time to give a good impression, and give reason to the student to want to continue to work there following the student's graduation.
- Present opportunities for progression - Following the time with the company, the student will want to know if there is an opportunity to continue with the company following graduation. It is important the company communicates what opportunities there are for the student if they were to return.
- Provide overall great experience to gain interest in return - This is the opportunity for the employer to make a good impression on the student and attract them back following completion of college.

Other Recommended Retainment Strategies

Other retainment strategies should also be implemented to keep talent on the island. These include typical corporate retention strategies, retention strategies unique to Puerto Rico, and a bit more out of the box potential strategies.

Typical retention strategies should be included so Puerto Rico firms can maintain competitiveness with mainland corporations and other corporate competitors.[57,58]

- Compensation - To the best of Puerto Rican firms' ability, they should aim to be as competitive as possible. This is a challenge due to business environments, but Puerto Rico also has a lower cost of living. This should be communicated when discussing compensation.

- Alignment on position - Between the firm and employee, there should be clear alignment on the role of the position and expectations of the employee. This will set the foundation for employee success, which leads to employee satisfaction, and therefore greater retention.
- Training and Development - Employees are more inclined to leave if not provided opportunity to learn or enhance skills. This comes through work within the firm, as well as outside opportunities.
- Socialization and Engagement - Socialization within the firm is essential to building a team environment. Employees are more likely to leave if they feel isolated and alone. Being part of a supportive team creates positive contagion within the firm, and is key to a high performing team. This aids in employees being engaged at work and overall firm success.
- Tuition Reimbursement - Not as common, but becoming more common, is firm tuition reimbursement. If an employee wishes to return to school for classes, degree, etc., the firm helps to pay up to a specified amount. Firms typically require approval beforehand, and there are regulations to follow regarding tax law.

In order to stand out from competitors, Puerto Rican firms must communicate what differentiates them and working in Puerto Rico. This value proposition includes:[59]

- Culture - Puerto Rico as a very rich and robust history. Puerto Ricans are passionate and likely do not want to leave the island. Potential employees likely still have family or strong connections to the island. These can be leveraged to keep talent on the island.
- Climate - Puerto Rico has tropical weather along with beautiful beaches and many attractions including El Yunque Rainforest and Old San Juan. This environment is limited on the mainland U.S.
- Cost of Living - The cost of living in Puerto Rico is much lower compared to the mainland U.S. Employees may be tempted by higher compensation numbers in the mainland, but does not tell the whole story of standard of living.
- Intimate Firm Experience - Firms in Puerto Rico are typically smaller than what is found in the mainland. This provided opportunity for employees to make a greater impact within their firm and allows for a more intimate and family like working environment.

Puerto Rico could also leverage more outside the box retention strategies. Ideas include:[60]

- Government Intervention - The government could push and fund educational initiatives to develop and retain talent. The government could subsidize target degrees that are needed in the Puerto Rican economy. In return, students that partake in the initiative must stay and work in Puerto Rico for a predetermined amount of time. For example, the government could subsidize half the cost of the target degree, and in return, the student must stay to work in Puerto Rico for five years following graduation. Taking the example further for illustrative purposes only, if a 4-year computer science degree cost $20,000 and the government pays half making their share $10,000, the government could partially

fund 100 students educations for $1 million dollars. The money helps to supply a need in the labor force, and in return the economy gains 100 young motivated workers for at least 5 years each.

- Company Assistance - Companies could do something similar on a narrower scale. Students typically partake in a co-op/internship between their junior and senior year of college. If a company has a successful experience with a student, and the company wants to bring that student back, they could help to pay for tuition. The company could offer to pay for the students remaining tuition - senior year- in return for the student's commitment to work for the firm for 3 years following graduation. Again, for illustrative purposes only, if the company pays for a quarter of a $20,000 education, so $5,000, the graduate would return for at least 3 years.

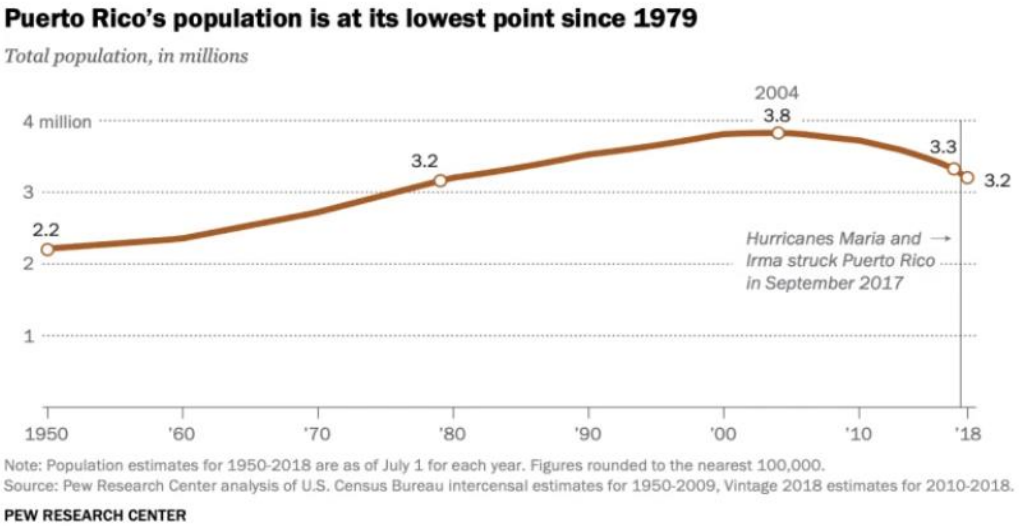
Although the examples only show students committing to 3-5 years of working in Puerto Rico, it also increases the likeliness of the student to stay for longer. Within those 3-5 years, the student might buy a house, find a significant other, or have a kid. These examples ground the student to Puerto Rico, and therefore would involve greater effort and sacrifice to move elsewhere.

Migration Analysis

General Migration Outlook

Puerto Rico's population peaked in 2004 at about 3.8M people, but has been gradually declining ever since, as shown in Figure 25. The mid 2000s financial debt crisis, and more recently the governmental turmoil and natural disasters have accelerated the outmigration of Puerto Ricans.

Figure 13. Puerto Rico Population Statistics



(Source: Pew Research Center, 2019)[61]

Coinciding with the outmigration, recession, and natural disaster impacts, the number of births have decreased by almost half over the past decade. As a result of the outmigration and change in fertility rates, Puerto Rico's median age has increased from 36 in 2008 to 43 in 2018.[62]

The latest population estimate by the US Census Bureau in July 2019 came in at just under 3.2M people. Additionally, early Census estimates show that Puerto Rico's population increased in the 2019 calendar year by 340.[63] So, the population remained essentially flat, but is a tremendous improvement from the past few years. The flat population growth is presumably from a return of those who left the island following the destruction of Hurricane Maria. So, it is unknown what to make of this. Could the flat migration growth show signs of stabilization? Is it a temporary improvement due to an influx of Puerto Ricans returning?

On one hand, the island's economy has grown due to the reconstruction process. Typically, migration slows down as the economy grows. This has also aided in the increase in the employment rate. However, population projections do not paint a favorable outlook in the coming years (Appendices R and S). Economic development and opportunity is imperative to ease further outmigration from the island of Puerto Rico.

Key Drivers

Prior to Hurricane Maria, Puerto Ricans migrated to the mainland US primarily for two key reasons: jobs and families. PEW Research Center, using data from the 2014 American Community Survey, found that 40% of migration was job-related and 39% was family or household related.[64] The remaining 21% was comprised of housing related, retirement, or other.

Following Hurricane Maria, the destruction was a clear catalyst for Puerto Ricans moving to the mainland. The Washington Post conducted a survey of Puerto Rican residents that gave insight into the struggles about a year following the hurricane. The survey cites many reasons for leaving:[65]

- Not able to repair home
- Lack of electricity
- Job/income loss
- Lack of infrastructure
- Lack of medical support
- Emotional trauma
- Denied disaster relief

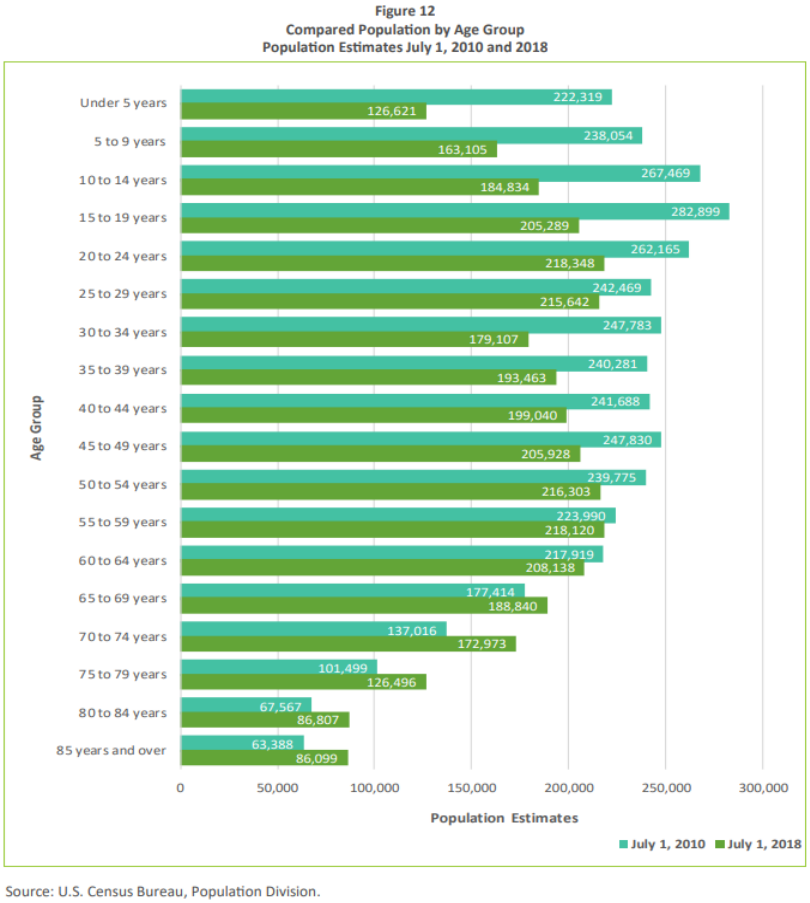
The survey paints a bleak outlook as it pertains to outmigration. Of those surveyed, 68% had close family or friends move to the mainland, and of those that moved, 75% did not have plans to return to Puerto Rico.[66]

Another reason some Puerto Ricans leave, potentially key among young adults, is the notion that the *grass is always* greener (Perez, February 2020). Some may feel obligated to go experience "the good life" in the mainland. The higher salaries may pique the interest of those looking for more. However, the cost of living is also greater in the United States along with the requirement of paying federal taxes. So, the *grass is always greener* mentality may be deceiving.

Demographics and Talent Analysis

The population has been in decline, and it is important to take a look into the demographics of those that are leaving the island. Over the past few decades, the age group of 16-30 has been a significant proportion of the outmigration.[67] That trend has continued the past decade, but in addition ages 0-15 have faced serious outmigration.

Figure 14. Puerto Rico Population Statistics by Age Group



(Source: Government of Puerto Rico Economic Report 2019)[68]

Although the younger age groups made up a majority of those that left, ages 15 -29 remain a good part of the population and are instrumental in developing the workforce.

According to the Federal Reserve Bank of New York, using government provided data, in the year 2012, roughly 80% of those who left the island had at least a high school education. In addition, roughly 20% had at least a college degree (Appendix T).

In recent years, the U.S. has been experiencing low unemployment rates, and so companies have been looking far and wide for workers. Companies have been reaching out to those in Puerto Rico in industries such as education, police departments, medical, landscaping, and hospitality. "As long as we keep losing our human capital, it's going to hurt the possibility of a sustainable economic recovery," said Gustavo Velez, the president and CEO of Inteligencia Economia.[69] "Puerto Rico is losing educated workers in their most productive ages," said former Governor Acevido Vila.[70] Keeping them is essential to the long term outlook of the island.

Target Personas

In addition to reversing the trend of migrating from the island, Invest Puerto Rico and companies can recruit on the mainland to bring workers back to the island. Obviously, there must be interest from the workers side as well. Those that are now well established in the mainland are less likely to have interest in returning to Puerto Rico. This includes those who have houses, families, and those that have been disconnected from the island for an extended period of time.

So, Puerto Ricans who have most recently left are more likely to be connected to the island and less tied down in the mainland. Some may have left due to lack of opportunities on the island, but if opportunities arise and are presented to them, it may be the key for them to return to Puerto Rico.

2017 data from Pew research suggests that 30% of those born in Puerto Rico and now live in the United States have lived here for 10 years or less.[71] This data comes before Hurricane Maria, so that percentage is likely larger since there has been more recent migration. This presents an opportunity to attract workers back to the island.

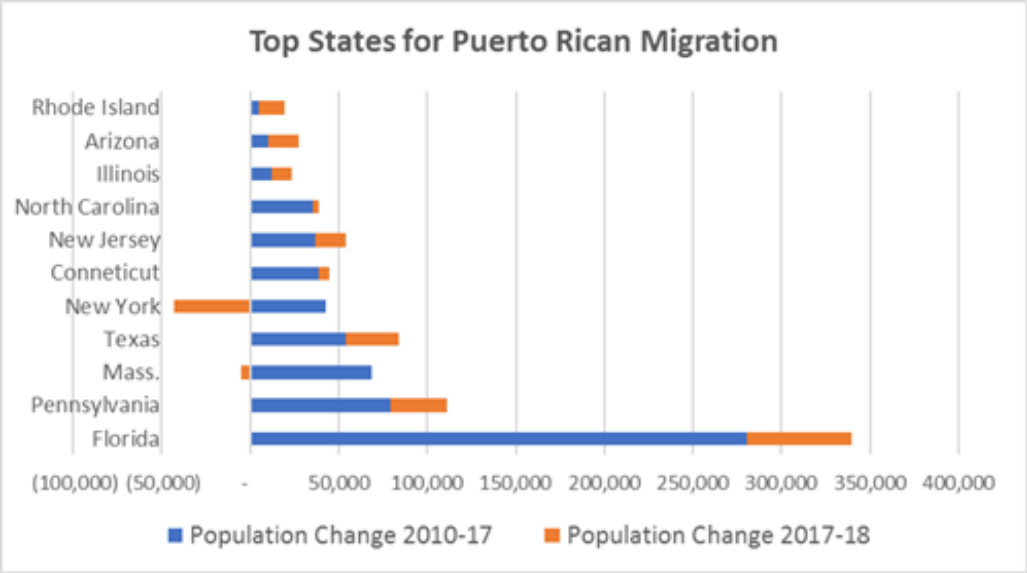
Hotspots

Where can we find those that have recently moved to the mainland?

Analyzing Puerto Ricans who migrated post Maria may lead to more success in recruiting workers back to Puerto Rico. The following chart, using data from The Center for Puerto Rican

Studies at Hunter College in New York, gives the top 10 state destinations for migration in the past decade.

Figure 15. Top US States for Puerto Rican Migration



(Source: Center for Puerto Rican Studies at Hunter College 2019)[72]

Note: See Appendix U for a heatmap of migration based on FEMA data.

Recommended Strategies: Puerto Rico Recruits

Puerto Rico Recruits is designed to be a holistic approach to attracting talent back to the island. Diaspora can be recruited back to the island via attending mainland university career fairs, holding local networking and recruiting events during holidays while diaspora are home, and by developing a diaspora network. If performed well, each part of the proposal below will build on the others to bring more islanders into the network. Together these strategies will yield an increased number of Puerto Ricans within that network who find opportunities and move back to Puerto Rico once the platform matures.

Recruit at Mainland Universities

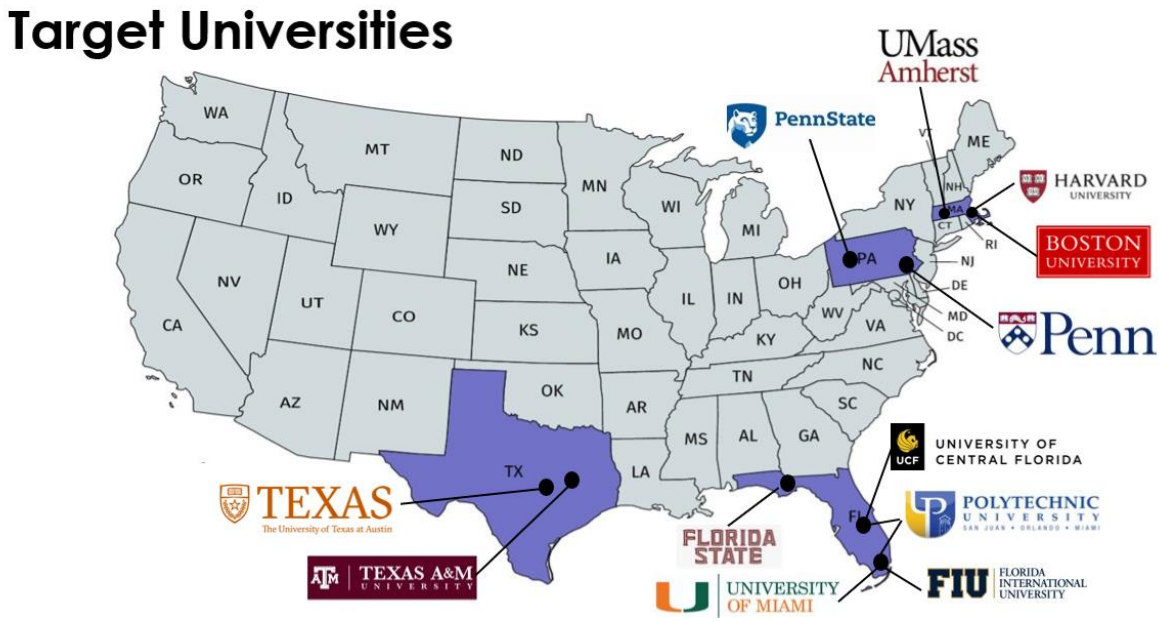
During the team's visit to Puerto Rico, we received a few anecdotal stories regarding graduating high school students opting to migrate to the mainland to attend college. A strategy is needed to attract those students gaining a college education back to the island to bolster the available workforce.

The first piece of developing this strategy is to determine which universities Puerto Rico should target. The goal here is to find universities with Puerto Rico student populations that may be interested in returning to the island. Universities with large Puerto Rican student populations in areas with recent migration should have the highest chance of successfully recruiting talent back to the island.

Taking from the earlier migration study, the data showed the top four states for Puerto Rican migration are Florida, Pennsylvania, Texas, and Massachusetts. We can use these states to narrow the scope of where to recruit. From here, the process to find target universities includes finding hotspots of Puerto Rican populations within these states, finding the largest universities within these states, and finding universities with Puerto Rican student clubs.

Leveraging migration data from Hunter College and analyzing student demographic and club data from university sites, the following universities should be considered target universities (See Appendix V for further breakdown and sources):

Figure 16. Target US Universities for On Campus Recruiting



Note: Regarding student demographics, Puerto Rican students are categorized as Hispanic/Latino students. So, the team targeted universities with high Hispanic Student populations in known Puerto Rican hotspots.

Per the V2A white paper model,[73] leveraging a team approach will likely lead to greater success. The team could include companies such as V2A and other top employers, NGOs such as Invest

Puerto Rico and ConPRmetidos, and university-based organizations such as the student clubs. The team approach will provide strength in numbers to recruit students back to Puerto Rico. More participating members means more employment opportunities and will increase student interest and engagement. The team approach will also allow the opportunity to share costs. All participating members must be committed and share intense enthusiasm in attracting talent back to the island.

Career fairs are typically held during the fall and late winter timeframe. Seniors will be looking for jobs as they will soon enter the working world, and juniors may attend as well to get a head start on networking. Connecting with students early on in the process will be essential, before the big mainland corporations can "woo" students with their attractive offers. Therefore, the team should plan to attend the fall career fairs as students are less likely to have jobs lined up yet or have even received job offers. Developing a relationship with student clubs will be key. Let the clubs know Puerto Rico firms will be coming to recruit. The clubs may also be able to provide some insights into what students are looking for when it comes to job opportunities.

Costs associated with recruiting at mainland universities are highly dependent on the number of universities, locations, number of representatives that travel, number of partners, and fees associated with career fairs, among others. These will be helpful to keep in mind when developing a strategy around recruiting at mainland universities and choosing entities to partner with.

Executing before and at the career fair can make or break the success of the effort. See Appendix W for best practices to have a successful effort.

Additional Note: Although this was not considered in the process of finding target universities, the following schools could also be considered. Florida is a hotspot for those escaping the devastation of Hurricane Maria. Florida schools, through the Murphy Initiative,[74] received federal funds to aid in taking on displaced students from Puerto Rico.Thirteen colleges and universities received about $6.5M to date. These institutions include University of Central Florida,Valencia College, Seminole State College, Broward College, College of Central Florida, Daytona State College, Eastern Florida State College, Florida Atlantic University, Florida International University, Indian River State College, Santa Fe College, St. Thomas University, and University of South Florida.

Develop Online Puerto Rico Expat Network

As the mainland university recruiting strategy develops, it is important that those who are engaged, along with other Puerto Ricans of interest in the US, have a platform to stay connected to Puerto Rico and the latest information regarding the ongoing development efforts on the

island. During the visit to Puerto Rico, the team was able to meet with ConPRmetidos, an NGO with a similar focus of finding a way to connect to those Puerto Ricans that have left the island.

With some additional horsepower and a stronger focus behind this charge, an online Puerto Rican community could be developed which would be a critical asset to the workforce development goals of attracting talented Puerto Ricans back to the island. Not only would this be a way for those Puerto Ricans to stay connected, it would be a valuable tool for Puerto Rico to maintain updated data on those who have left. Information such as location, email addresses, job title and company, could all be aggregated within this tool to give recruiting companies a platform to target their efforts to specific areas and people within the community.

To implement the proposed online community, many parallels can be taken from "The Iowan Project", an online platform with a goal very similar to that proposed for Puerto Rico. The project is an initiative of The Technology Association of Iowa to recruit tech skilled Iowa expats back to the state, in partnership with Iowa Economic Development and the local economic development authorities in the more populated cities/areas (Cedar Valley, Ames, Des Moines). Their focus is simple:

> *Find and connect with fellow Iowans across the globe. Stay connected to your roots and learn about the great job opportunities awaiting you in Iowa. Iowan Project users will receive news and updates about happenings in the state, as well as information about Iowa tech meetups in your area.*[75]

The Iowan Project website has a simple interface in which users can create a login and become members, at which point they will enter the vital personal information that can be used later on, as mentioned above. Once the members have joined the website, they can begin to utilize a few key features of the site:

- Find Iowans: An interactive map showing the current location of all the other users (Iowans) throughout the United States. It shows the population density of Iowans as users zoom in on areas of interest along with basic information for each used such as location, hometown, school (university), and where they currently work.

Figure 17. Iowan Project Interactive Map Feature

(Source: The Iowan Project, 2020)[76]

- Meetups: Upon collecting information on where large populations of Iowans now live, The Iowan Project selects certain locations and hosts meetups in those locations to provide an opportunity for current Iowans and Iowa expats to meet, connect and learn about great technology career opportunities available in Iowa.

- About: General information about The Iowan Project and the state of Iowa.

- Featured Employers and Communities: An area where individuals can connect with the partnered economic development authorities for information about industries within a specific region. Additionally, job opportunities and employer contact information can be posted here to highlight the immediate opportunities that are available.

In an age where online user engagement and constant availability of information is critical, The Iowan Project can serve as an outstanding benchmark to develop an online community platform to take engagement to the Puerto Rican diaspora to a new level. For additional information regarding The Iowan Project, contact Mollie Ross (mollie@technologyiowa.org).

Utilize Holiday Recruiting

In addition to mainland university recruiting and a new online community connecting those who have left the island, a further recommendation is to increase engagement of prospective talent to firms in Puerto Rico. Focusing on students attending university in the mainland US, there are a

few times throughout the school year in which an increased number of them travel home for an extended holiday (Thanksgiving weekend, Winter break between the Fall and Winter terms, Easter Holiday weekend, etc.). By taking advantage of one of these select times, a networking event could be hosted in Puerto Rico, in partnership with interested firms, to engage students that are home for the holidays with those organizations that are eager to find high quality talent.

The event could be hosted in one evening, starting with a keynote speaker who would highlight many of the developments that have been ongoing on the island; things such as new companies that have launched or moved to the island, companies and employees that are experiencing growing success, companies and people that are making a lasting impact in any way. The key point here is to show off the emerging industry that will continue to flood the island and shed Puerto Rico in a new light for those who left, thinking there is not enough good opportunity to stay.

Following this portion of the evening, the prospective workers should be reminded of all the unique benefits that exist in Puerto Rico such as the island lifestyle difficult to find anywhere else in the US, culture and traditions they would most likely be missing, and workforce incentives for those willing to work in Puerto Rico. Additionally, things such as the salary vs. cost of living differences should be addressed in such a light to show how competitive life in Puerto Rico really is. Following the reception, the rest of the evening would be structured toward engagement and networking between the attendees. This could look like a combination of a large happy hour reception and an informal career fair with their main focus centered around getting workers personally engaged with specific companies and opportunities for which they are looking to hire.

For the most impact, it would be beneficial to host this event early in the students' university recruiting process which most likely happens in the late Fall through early Winter terms. If companies are eager enough, it should be encouraged to schedule interviews with and look to hire those they connect with shortly following the event. Otherwise, formal connections should be made such that both parties can continue to follow up with each other regarding any developments in opportunities as they become available.

The city of Detroit has an event called Detroit Homecoming, which has been taking place for the last five years since the economic resurgence of the city. While Detroit Homecoming is more focused on bringing Detroit expats back to the city in order to influence the community through funding new projects, new ventures, real estate connections, etc.[77] the fundamental structure of the event can provide parallels to the holiday recruiting event proposed. The main parallels being a social platform in order to show off great things happening within the industry and the impacts they are creating to make the area, where each person so proudly grew up in, better than it has

even been. While one is focused on bringing in funding and investment, the other could be focused on bringing in the investment of talent and workforce.

Recommendations Summary

Within the Information Technology Sector in Puerto Rico, recommendations were made to continue to develop the existing development platforms. Although it will be difficult and time consuming to make a major shift, institutional changes should be made to allow prospective students access to information regarding career possibilities within IT while they still have time to make a shift. Additionally, companies on the island should be encouraged to increase Co-op and internship opportunities as the anecdotal evidence has proven this greatly increases the chances Puerto Ricans will remain on the island after graduation. Once students are retained for full time positions, firms should be encouraged to structure retention programs aimed to keep graduating students and recent hires working for the companies on the island.

Shifting focus to the goal of bringing Puerto Ricans back to the island, it is expected that positive results from the recommended strategies can be achieved individually (University Career Fairs, Puerto Rico Expat Network, Holiday Recruiting opportunities). However, if appropriately executed together, they will generate one overall development strategy in which each portion will build upon the success of the others. Along with finding potential employees for PR firms, University career fairs provide an opportunity to reach individuals targeted for the Puerto Rico Expat Network. Once the Puerto Rico Expat Network is strong in user numbers, it can be regularly maintained to appropriately reach the users with information about opportunities. As these opportunities remain relevant to those in the network, participation at events such as Holiday Recruiting will be much stronger. As execution becomes stronger and more aligned each year, it is expected that firms will find direct success in hiring workers that were discovered through this strategy.

For university recruiting, a key for success will require marketing to firms seeking employees to raise awareness of the importance of attending events off the island and utilizing career fair best practices. It will be up to the firms to sign up and attend the career fairs. As this initiative is about bringing opportunities to Puerto Ricans off the island, the more firms that attend, the more results this will provide. However, it is important to keep in mind the risks associated with this strategy in that there will always be firms willing to pay more and offer a different lifestyle in the US versus Puerto Rico. The firms that can appropriately target students interested in high quality opportunities in Puerto Rico and leverage the unique selling propositions of the island will find the most success.

The Puerto Rico Expat Network will be the most difficult recommendation to implement however, although difficult to quantity, has the potential to yield the largest results. The platform

will require time and investment to initiate along with regular maintenance to provide benefit. Once the site has launched, a campaign will be required to develop a user base. This should be done through existing social media platforms (Facebook, LinkedIn, Twitter, Instagram) as well as increasing awareness through events such as career fairs and word of mouth. It is important to remember that without users, the site is worthless. Similarly, it will not work if users exist and the platform fails to leverage their information to connect them to opportunities. As the Iowan Project was developed by the Technology Association of Iowa, it is recommended Invest Puerto Rico or a similar function partner with local technology associations to leverage the expertise of developing such a platform and increase firm interaction with the platform.

While these ideas will require partnerships and funding outside of Invest Puerto Rico, the team believes Invest Puerto Rico can serve as a catalyst to take the lead aligning with organizations to put these ideas in motion.

Conclusion

While Puerto Rico is taking many great strides toward a strong future economy, additional focus can and should be placed on further developing the skills of those in Puerto Rico, as well as attracting workforce back to Puerto Rico to fill the surplus of opportunities.

Creating a talent pool that supports the IT cluster and parallel sectors, will further support opportunities providing direct economic benefits seen in the overall GDP and individual income statistics in addition to the cascading indirect benefits an economy built upon these sectors can provide. As many of the proposals to develop talent on the island target earlier education, it will take some time before the paradigm shifts toward impactful support of the new economy; similarly, it will take time to continue to develop these targeted sectors within the economy. This being said, it is critical to start as soon as possible and ensure the private and public sectors continue to work together to assure the talents of individuals and requirements of the firms are progressing in parallel.

Additionally, shorter term measures can and should be taken to bring back the already existing talent that is leaving or has left the island to go elsewhere. Increasing US University recruiting is a great first step - if local organizations and firms correctly target the universities with high Puerto Rican populations and keep in mind best practices of recruiting, including selling the benefits of working in Puerto Rico, this could make an immediate impact in obtaining even a small piece of that population. To take things to the next level, a formal network should be developed to develop a platform to recruit all year round.

Developments are going to continue to increase on the island; it is important that those who have left are aware of the great things going on as their potential dream lifestyle in Puerto Rico begins to become a reality. It will be a challenge to create and maintain a network such as The Iowan Project; however, if implemented, it can be a powerful tool to multiply the magnitude of Puerto Ricans being drawn home. Finally, it is important to keep the community connected to the firms; ideas such as a holiday recruiting event are a great opportunity to do it.

Upon completion of an example case study and migration analysis regarding workforce capabilities and development opportunities, the team has completed the work requested by Invest Puerto Rico. This work should serve as a framework to continue to build upon for other sectors as well as provide implementation opportunities to start increasing the quantity and quality of talent in Puerto Rico.

As the economy transforms into the vision Puerto Rico has set forth to realize and Puerto Rico can continue to provide opportunities to develop their people, more people will begin to come home and more people will begin to stay, hopefully for generations to come.

Appendix

Appendix A. Letter of Engagement - January 2020

Dear Ms. Nolan and Mr. Bozek:

Thank you for providing our 2020 Ross School of Business MAP team the opportunity to assist Invest Puerto Rico in comprehensively analyzing Puerto Rico's workforce and creating a strategic framework for workforce development in the future. Our team will conduct the project with input from Professor Brian Talbot, Communication Coach Lisa Pawlik, and research support from Corey Seeman. This letter of engagement confirms our mutual understanding of the project motivation and objectives, scope, approach and timing, deliverables, and resource requirements.

Project Motivation and Objectives

A well-developed workforce that meets the needs of a region's industry sectors is among the most critical components that informs where businesses decide to put down roots and one that has been a challenge for Puerto Rico given recent natural disasters and economic factors. With a mission to attract businesses to Puerto Rico, Invest Puerto Rico aims to gain a deeper understanding of the workforce resources on the island, including the competencies of the available workforce (Puerto Rican denizens plus a subset of the Puerto Rican diaspora) and the human capital needs of prospective companies in target sectors. The MAP team will lead this analysis and recommend how Invest Puerto Rico can better convey its value proposition to these firms and bridge the gaps between resources and requirements.

Project Scope

The MAP team's work will encompass the following:

- Perform comprehensive talent analysis
    - Map migration patterns of Puerto Ricans including destinations, motivations, and demographics
    - Identify talent and competency distribution within overall potential talent pool
    - Aggregate existing talent development capabilities, opportunities, and best practices including development mechanisms (e.g. universities, vocational programs, sponsored training, etc.)
    - Identify talent profiles and workforce skillsets required by target knowledge service industries (focus on aerospace, artificial intelligence, electronic, pharmaceutical, biotechnology device, software development, call center, and insurance subsectors)
    - Gap analysis between existing and necessary talent distribution for target sectors
- Recommend strategy to develop workforce
    - Identify areas of focus for training
    - Identify prioritization of training
    - Recommend best way to track/promote training and development opportunities
    - Recommend engagement opportunities with Puerto Rican diaspora

Project Plan

Phase 1: Project Charter (January 10 - January 25, 2 weeks)

- Conduct kickoff meetings with project sponsor
- Discuss and confirm scope of the project
- Finalize letter of engagement
- Define project milestones including the expected timeline to complete each milestone
- Define data required to complete deliverables
- Kick-off knowledge services industries research through Ross library and other databases
- Co-develop site visit itinerary with Invest Puerto Rico

Phase 2: Research and Data Collection (January 26 - February 16, 3 weeks)

- Continue conducting secondary research
- Aggregate data already available from Invest PR and identify gaps
- Develop detailed research plan with interviewee and data resource targets, interview guides and primary data collection approaches
- Conduct site visits with Department of Economic Development, University of Puerto Rico (Mayaguez and Río Piedras), company visits (Cooper Vision, Abvi, Primex), private colleges

Phase 3: Data Analysis and Synthesis (February 17 – March 6, 3 weeks)

- Aggregate training/educational resources available to address talent gaps
- Synthesize comprehensive overview of talent demographic research and sector requirements
- Present findings to sponsor in Mid-Term Review

Phase 4: Solution and Recommendation Development (March 7 - March 27, 3 weeks)

- Define talent profiles for targeted sectors and options to close gaps between required talent vs available talent
- Evaluate outgoing migration patterns and potential opportunities
- Prepare outline and begin drafting final deliverables

Phase 5: Project Wrap Up (March 28 - April 18, 3 weeks)

- Prepare final presentation reviewing the team findings
- Prepare final report
- Deliver final presentation
- Provide recommendations for next projects/implementation

Deliverables

The MAP team will deliver a thorough final report and presentation including:

- Talent profile distribution of overall talent pool – this includes the workforce currently living in Puerto Rico and an appropriate subset of diaspora in continental US and elsewhere
- Migration pattern analysis of Puerto Rican diaspora
- Required talent profiles of targeted sectors within knowledge services industry
- Analysis and aggregation of education and training opportunities available to Puerto Rican workforce
- Gap analysis of education and training opportunities of Puerto Rico and required talent profiles or targeted industries
- Recommendations and prioritization of competencies to focus on developing and analysis of training options to do so
- Recommendations on target segments within the Puerto Rican diaspora to engage with
- Recommendation on best way to track/promote training and development opportunities (e.g. a website, database, etc.)

Support Resources Required

To deliver the highest quality end deliverables, the MAP team would benefit from the following resources from the Invest Puerto Rico team:

- Access to Invest Puerto Rico personnel for guidance and technological capabilities relating to data collection and analysis
- Support in bringing the MAP team to a general understanding of Invest Puerto Rico's mission and its role in aiding Puerto Rico's economy
- A designated company liaison available at all working times during the project
- Access to the necessary resources during our visit to Puerto Rico (working space, setting up meetings with companies, people, etc.)
- Active feedback and engagement during weekly progress calls, Mid-Term Review, and Final Review

We are very excited to be working with Invest Puerto Rico and look forward to delivering meaningful recommendations that will have a lasting impact on the organization.

Appendix B. List of Team Interviews

Puerto Rico Department of Economic Development and Commerce	Noberto Perez O'Neill
Engine 4	Luis Torres
University of Puerto Rico Mayaguez	Margarita Carolo
Rock Solid	Angel Perez Professor Arnaldo Torres
Wovenware	Christian Gonzalez
V2A	Manuel Calderon
ConPRmetidos	Clay Garnett
MIT	Professor Michael Piorre

Appendix C. Puerto Rico Key Industry Breakdown[78]

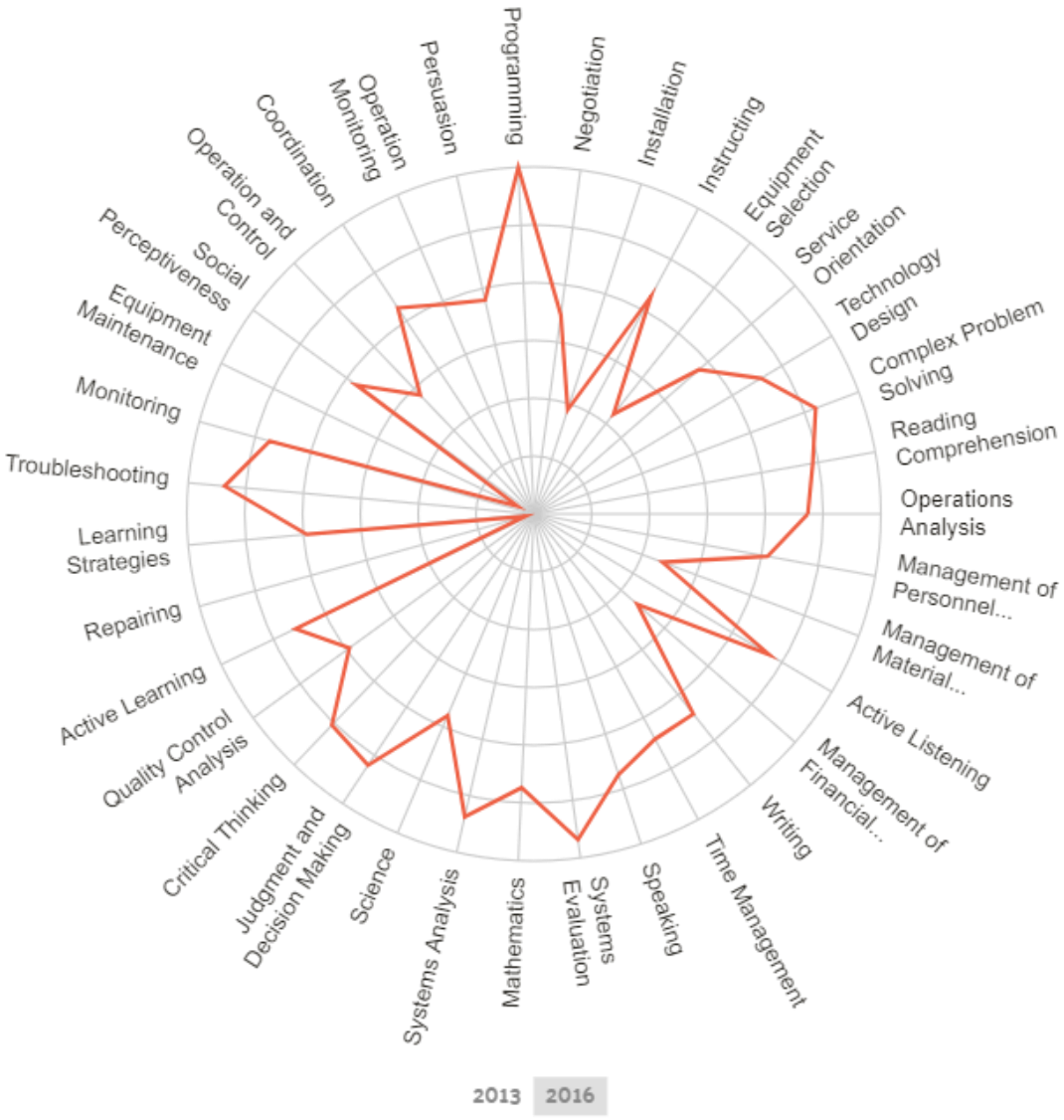
Gross Domestic Product by Major Industrial Sector - Current Prices
(millions dollars - fiscal years)

Transportation and Warehousing	Fiscal Years				Difference	Percent Change
	2017r	Percent	2018p	Percent		
Gross Domestic Product	**104,250.2**	**/**	**101,130.9**	**/**	**-3119.3**	**-3.0**
Agriculture	**847.3**	**0.8**	**792.1**	**0.8**	**-55.2**	**-6.5**
Mining	**25.8**	**0.0**	**25.7**	**0.0**	**-0.1**	**-0.4**
Utilities	**2,158.1**	**2.1**	**1,981.2**	**2.0**	**-176.9**	**-8.2**
Construction	**805.6**	**0.8**	**863.1**	**0.9**	**57.5**	**7.1**
Manufacturing	**50,423.7**	**48.4**	**47,834.8**	**47.3**	**-2588.9**	**-5.1**
Service (except Government)	**43,317.9**	**41.6**	**43,674.0**	**43.2**	**356.1**	**0.8**
Wholesalers Trade	2,766.6	2.7	2,750.5	2.7	-16.1	-0.6
Retail Trade	5,229.9	5.0	5,259.6	5.2	29.7	0.6
Transportation and Warehousing	1,116.7	1.1	1,095.3	1.1	-21.4	-1.9
Information	2,843.1	2.7	2,757.8	2.7	-85.3	-3.0
Finance and Insurance	4,174.1	4.0	4,522.7	4.5	348.6	8.4
Real Estate and Rental	15,912.9	15.3	16,055.3	15.9	142.4	0.9
Professional, Scientific, and Technical Services	2,152.0	2.1	2,272.6	2.2	120.6	5.6
Management of Companies and Enterprises	83.9	0.1	92.0	0.1	8.1	9.7
Administrative Services and Support	1,799.9	1.7	1,927.7	1.9	127.8	7.1
Educational Service	609.5	0.6	578.1	0.6	-31.4	-5.2
Health Care and Social Services	3,902.6	3.7	3,763.0	3.7	-139.6	-3.6
Art, Entertainment and Recreation	158.7	0.2	140.1	0.1	-18.6	-11.7
Accomodation and Food Services	2,137.4	2.1	2,052.3	2.0	-85.1	-4.0
Other Services	430.6	0.4	407.0	0.4	-23.6	-5.5
Government	**7,145.2**	**6.9**	**6,438.6**	**6.4**	**-706.6**	**-9.9**
Statistical discrepancy	-473.0	-0.5	-478.3	-0.5	-5.3	1.1

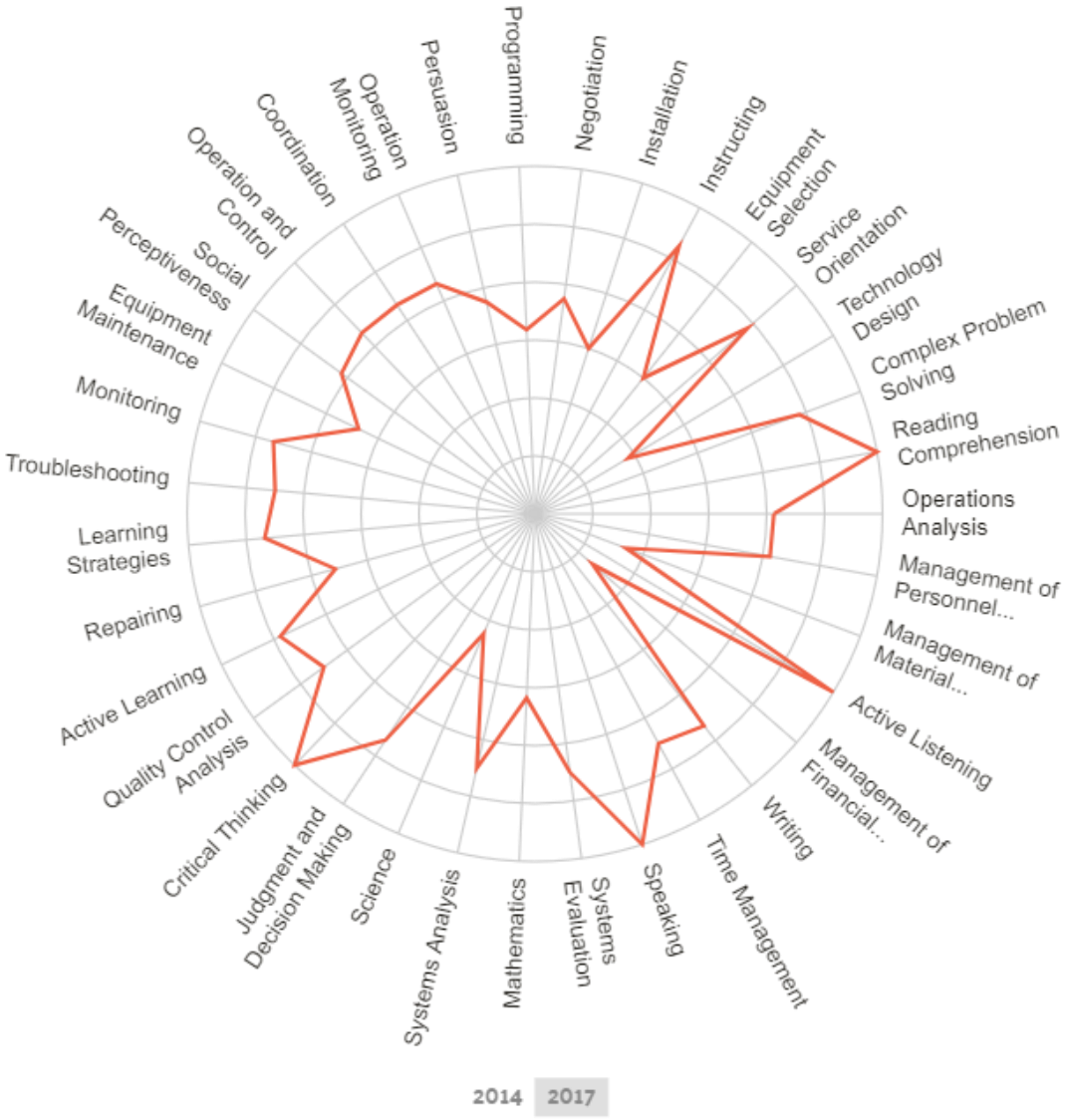
r-revised figures
P-preliminary figures
Source: Puerto Rico Planning Board

Appendix D. Skills Distributions for Top IT Occupations, by employment

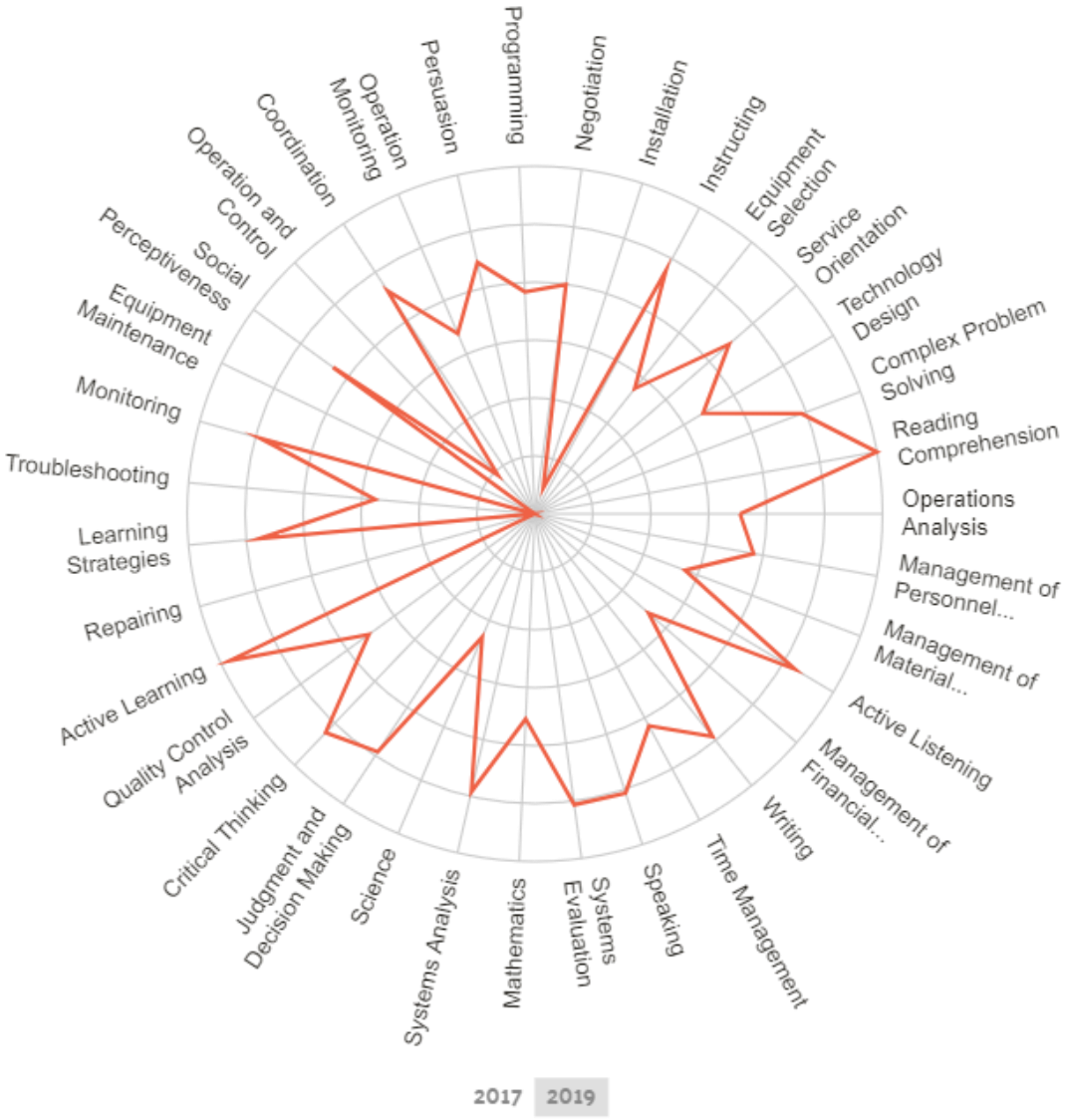
Software Developers



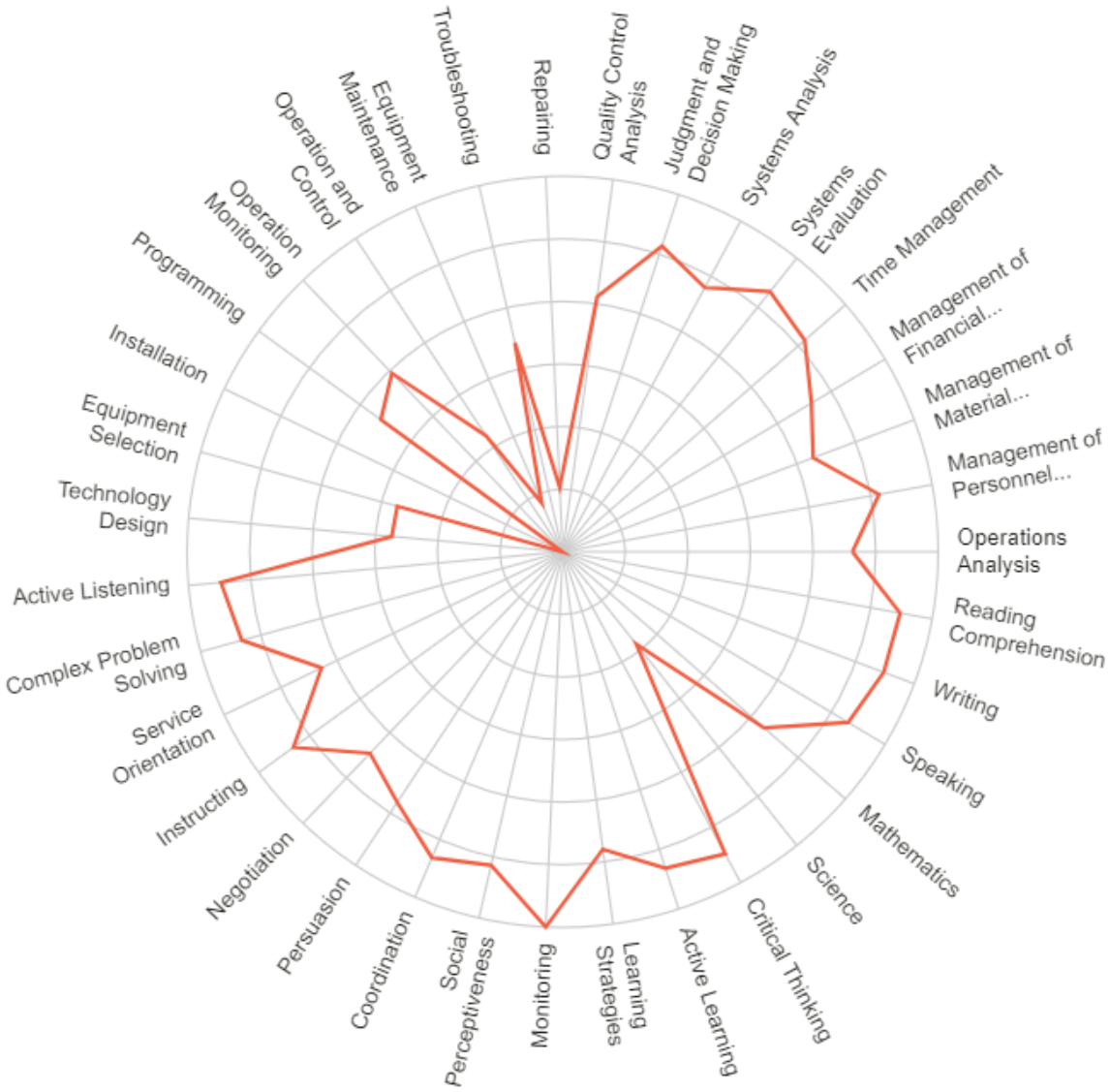
Computer Support Specialists



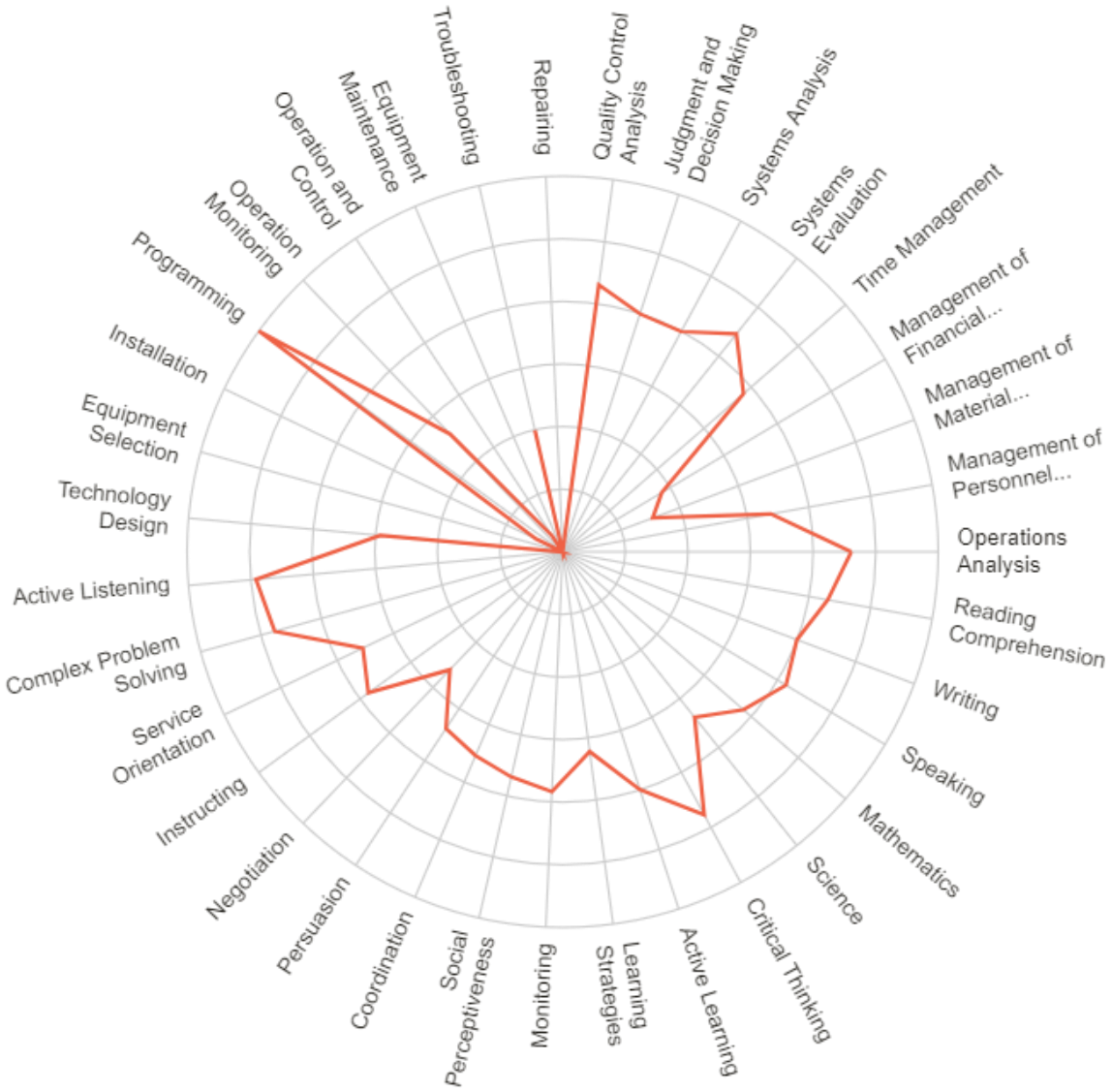
Computer Systems Analysts



Computer and Information Systems Managers



Computer Programmers



Appendix E. Bureau of Labor Statistics National Employment Projections Detailed Methodologies

The following paragraphs outline each step in the BLS National Employment Projection process in detail, as informed by the BLS Employment Projections Methodology.

1) Labor Force: Labor force projections provide the base level input for the workforce projections, and represent the total pool of US workers who supply the workforce needs across all industries. In this step, resident population projections from the US census are converted into the civilian noninstitutional population, which represents the number of people in the US that are eligible to work. From there, BLS-maintained labor participation rates are applied against the noninstitutional population using demographic information and historical data to determine the projected labor force. Modifications are made to these projections based on trends researched and validated by the BLS.

2) Aggregate Economy: The next step in the process is developing a projection of the aggregate US economy. The outputs of this step are a number of metrics that provide a snapshot of the US macro economy. Chief among them is projected gross domestic product. To accurately project GDP, a half dozen or so key assumptions are made that drive inputs to the IHS Markit model. These include the labor force numbers from Step 1, as well as assumed energy prices, fiscal and monetary policy, demand composition of real GDP, and labor productivity. The consumption analysis is based on a life-cycle model, and the investment analysis in this step is based on a neoclassical model. In addition to GDP, key outputs of this step include personal consumption expenditures, private investment, and labor supply and productivity factors, including unemployment.

3) Industry Final Demand: Once the aggregate economy projections are established, the next step the BLS takes on is to deaggregate the GDP into its component parts. This is perhaps the most involved step in the projections process, and the result is a detailed input-output matrix that sectors the economy by category and commodities demanded in each. The Houtakker-Taylor model is used for consumption expenditures, and a bridge table is employed based on historical relationships between input-output accounts to distribute demand category impacts on various commodities. As a final step, the data is converted from purchaser value to producer value in order to determine margins that inform wholesale, transport, and retail projections. Key inputs for this step are the aggregate economy projections from Step 2, as well as a number of assumptions regarding trade outlook, world economic conditions, and trends in spending and policy. The output is a “sliced and diced” view of the economy by industry segments.

4) Industry Output and Employment: After projecting the macroeconomy and breaking it into component parts, the BLS translates industry output to industry employment. This

step is informed by two employment surveys - the Current Employment Statistics survey (CES), which provides a snapshot of non-agricultural wage and salary employment, and the Current Population Survey (CPS), which details farm, self-employed, and private house workers. The CES is the principal source of employment data, and the CPS operates as a supplement for non-traditional positions. The calculations that produce industry-specific employment statistics relate labor demand to industry output, wages relative to output prices, and makes use of trend variables to capture structural changes within specific industries. Separate calculations account for variances in weekly hours worked in each industry to yield industry job projections expressed in gross number of jobs as well as total hours worked for 200+ industries.

5) Occupational Employment: The final step in the process is to convert the industry employment into specific occupational projections. The Occupation Employment Statistics program (OES), a database of occupations maintained by the US Department of Labor, is used in conjunction with the sources from the prior step to develop a detailed National Employment Matrix (NEM) that illustrates specific occupational projections within industries and worker classes. These projections rely on qualitative and quantitative inputs, and BLS economists review articles, new stories, and expert interviews in each industry to represent structural changes in the projections. Occupational demand can be affected by a number of factors, including tech innovation, changes in production methods, replacement of products and services, and organizational restructuring. Occupational separations - the number of people exiting the workforce - are also included in the occupational employment projections. The result of this step in the process is a detailed forecast of individual occupations in the US labor market.

Appendix F. BLS US Employment Projections 2018-2028, for IT Career Family Occupations

Occupation Code	Occupation Name	2018 Direct Employment	2028 Projected Direct Employment	Change 2018-2028	Change Rate 2018-2028	2028 Employment Mix Percentage	Average Annual Openings
11-3021	Computer and Information Systems Managers	414,400	461,100	46,700	11%	8%	38,800
15-1111	Computer and Information Research Scientists	31,700	37,000	5,300	17%	1%	3,200
15-1121	Computer Systems Analysts	633,900	689,900	56,000	9%	12%	53,400
15-1122	Information Security Analysts	112,300	147,700	35,400	32%	3%	12,800
15-1131	Computer Programmers	250,300	232,300	(18,000)	-7%	4%	15,100
15-1132	Software Developers, Applications	944,200	1,185,700	241,500	26%	21%	99,200
15-1133	Software Developers, Systems Software	421,300	463,900	42,600	10%	8%	35,400
15-1134	Web Developers	160,500	181,400	20,900	13%	3%	15,100
15-1141	Database Administrators	116,900	127,400	10,500	9%	2%	9,700
15-1142	Network and Computer Systems Administrators	383,900	402,100	18,200	5%	7%	29,300
15-1143	Computer Network Architects	159,300	167,700	8,400	5%	3%	12,200
15-1151	Computer User Support Specialists	671,800	742,700	70,900	11%	13%	65,100
15-1152	Computer Network Support Specialists	191,300	203,400	12,100	6%	4%	17,400
15-1199	Computer Occupations, All Other	412,800	455,000	42,200	10%	8%	35,700
17-2061	Computer Hardware Engineers	64,400	68,400	4,000	6%	1%	5,200
43-9011	Computer Operators	36,800	28,000	(8,800)	-24%	1%	3,100
	Total, IT Career Family	**5,005,800**	**5,593,700**	**587,900**	**12%**	**100%**	**450,700**

Appendix G. US IT Employment Calculations, 2018-2028

Occupation Code	Occupation Name	Indirect Employment Multiplier	2018 Direct Employment	2018 Indirect Employment	2018 Total Employment	2028 Projected Direct Employment	2028 Projected Indirect Direct Employment	2028 Projected Total Employment	2018-2028 Change in Total Employment	Total Employment Change Rate 2018-2028
11-3021	Computer and Information Systems Managers	4.296	414,400	1,780,351	2,194,751	461,100	1,980,984	2,442,084	247,333	11%
15-1111	Computer and Information Research Scientists	4.081	31,700	129,358	161,058	37,000	150,985	187,985	26,928	17%
15-1121	Computer Systems Analysts	4.080	633,900	2,586,073	3,219,973	689,900	2,814,532	3,504,432	284,459	9%
15-1122	Information Security Analysts	4.072	112,300	457,321	569,621	147,700	601,481	749,181	179,560	32%
15-1131	Computer Programmers	4.360	250,300	1,091,417	1,341,717	232,300	1,012,930	1,245,230	(96,488)	-7%
15-1132	Software Developers, Applications	4.423	944,200	4,176,088	5,120,288	1,185,700	5,244,215	6,429,915	1,309,627	26%
15-1133	Software Developers, Systems Software	4.535	421,300	1,910,422	2,331,722	463,900	2,103,596	2,567,496	235,773	10%
15-1134	Web Developers	4.227	160,500	678,368	838,868	181,400	766,703	948,103	109,236	13%
15-1141	Database Administrators	4.010	116,900	468,766	585,666	127,400	510,870	638,270	52,605	9%
15-1142	Network and Computer Systems Administrators	3.924	383,900	1,506,527	1,890,427	402,100	1,577,948	1,980,048	89,622	5%
15-1143	Computer Network Architects	4.313	159,300	687,019	846,319	167,700	723,246	890,946	44,627	5%
15-1151	Computer User Support Specialists	3.788	671,800	2,544,799	3,216,599	742,700	2,813,370	3,556,070	339,471	11%
15-1152	Computer Network Support Specialists	4.207	191,300	804,745	996,045	203,400	855,646	1,059,046	63,001	6%
15-1199	Computer Occupations, All Other	4.274	412,800	1,764,187	2,176,987	455,000	1,944,537	2,399,537	222,550	10%
17-2061	Computer Hardware Engineers	4.363	64,400	281,007	345,407	68,400	298,461	366,861	21,454	6%
43-9011	Computer Operators	3.917	36,800	144,139	180,939	28,000	109,671	137,671	(43,268)	-24%
	Total, IT Career Family		5,005,800	21,010,586	**26,016,386**	5,593,700	23,509,176	**29,102,876**	3,086,490	12%
		calculated based on BLS industry multipliers	from BLS projections	calculated by multiplying indirect employment multiplier by direct employment for each occupation	sum of direct and indirect employment	from BLS projections	calculated by multiplying indirect employment multiplier by direct employment for each occupation	sum of direct and indirect employment		

Appendix H. US IT Household Earnings Calculations, 2018-2028

Occupation Code	Occupation Name	2017 Mean Annual Wage	Direct Earnings	Indirect Earnings	Total Earnings	Direct Earnings	Indirect Earnings	Total Earnings	2018-2028 Change in Total Earnings	Total Earnings Change Rate 2018-2028
11-3021	Computer and Information Systems Managers	$ 149,730	$ 62,048,112,000	$ 90,121,349,609	$ 152,169,461,609	$ 69,040,503,000	$ 100,277,399,384	$ 169,317,902,384	$ 17,148,440,775	11%
15-1111	Computer and Information Research Scientists	$ 119,570	$ 3,790,369,000	$ 6,548,094,048	$ 10,338,463,048	$ 4,424,090,000	$ 7,642,885,797	$ 12,066,975,797	$ 1,728,512,749	17%
15-1121	Computer Systems Analysts	$ 92,740	$ 58,787,886,000	$ 130,907,033,343	$ 189,694,919,343	$ 63,981,326,000	$ 142,471,623,763	$ 206,452,949,763	$ 16,758,030,420	9%
15-1122	Information Security Analysts	$ 99,690	$ 11,195,187,000	$ 23,149,600,902	$ 34,344,787,902	$ 14,724,213,000	$ 30,446,981,774	$ 45,171,194,774	$ 10,826,406,872	32%
15-1131	Computer Programmers	$ 87,530	$ 21,908,759,000	$ 55,247,548,436	$ 77,156,307,436	$ 20,333,219,000	$ 51,274,492,616	$ 71,607,711,616	$ (5,548,595,820)	-7%
15-1132	Software Developers, Applications	$ 106,710	$ 100,755,582,000	$ 211,393,586,613	$ 312,149,168,613	$ 126,526,047,000	$ 265,462,164,422	$ 391,988,211,422	$ 79,839,042,809	26%
15-1133	Software Developers, Systems Software	$ 111,780	$ 47,092,914,000	$ 96,705,577,812	$ 143,798,491,812	$ 51,854,742,000	$ 106,484,019,813	$ 158,338,761,813	$ 14,540,270,000	10%
15-1134	Web Developers	$ 74,110	$ 11,894,655,000	$ 34,338,971,100	$ 46,233,626,100	$ 13,443,554,000	$ 38,810,525,592	$ 52,254,079,592	$ 6,020,453,492	13%
15-1141	Database Administrators	$ 89,050	$ 10,409,945,000	$ 23,728,913,020	$ 34,138,858,020	$ 11,344,970,000	$ 25,860,252,513	$ 37,205,222,513	$ 3,066,364,493	9%
15-1142	Network and Computer Systems Administrators	$ 86,340	$ 33,145,926,000	$ 76,260,376,369	$ 109,406,302,369	$ 34,717,314,000	$ 79,875,741,958	$ 114,593,055,958	$ 5,186,753,590	5%
15-1143	Computer Network Architects	$ 107,870	$ 17,183,691,000	$ 34,776,889,364	$ 51,960,580,364	$ 18,089,799,000	$ 36,610,698,973	$ 54,700,497,973	$ 2,739,917,609	5%
15-1151	Computer User Support Specialists	$ 54,150	$ 36,377,970,000	$ 128,817,728,962	$ 165,195,698,962	$ 40,217,205,000	$ 142,412,812,296	$ 182,630,017,296	$ 17,434,318,333	11%
15-1152	Computer Network Support Specialists	$ 67,510	$ 12,914,663,000	$ 40,736,168,957	$ 53,650,831,957	$ 13,731,534,000	$ 43,312,790,204	$ 57,044,324,204	$ 3,393,492,246	6%
15-1199	Computer Occupations, All Other	$ 91,080	$ 37,597,824,000	$ 89,303,131,900	$ 126,900,955,900	$ 41,441,400,000	$ 98,432,473,388	$ 139,873,873,388	$ 12,972,917,488	10%
17-2061	Computer Hardware Engineers	$ 119,650	$ 7,705,460,000	$ 14,224,591,213	$ 21,930,051,213	$ 8,184,060,000	$ 15,108,106,196	$ 23,292,166,196	$ 1,362,114,982	6%
43-9011	Computer Operators	$ 45,320	$ 1,667,776,000	$ 7,296,317,085	$ 8,964,093,085	$ 1,268,960,000	$ 5,551,545,608	$ 6,820,505,608	$ (2,143,587,477)	-24%
	Total, IT Career Family		$ 474,476,719,000	$ 1,063,555,878,736	**$ 1,538,032,597,736**	$ 533,322,936,000	$ 1,190,034,514,297	**$ 1,723,357,450,297**	$ 185,324,852,561	12%
00-0000	Average, All Occupations	$ 50,620	calculated by multiplying direct employment by occupational mean annual wage	calculated by multiplying indirect employment by mean annual wage of all occupations (00-0000)	sum of direct and indirect earnings	calculated by multiplying direct employment by occupational mean annual wage	calculated by multiplying indirect employment by mean annual wage of all occupations (00-0000)	sum of direct and indirect earnings		
		from BLS - occupational wages are multipled by employment to deterimine earnings; average wage of all US occupations is used for indirect earnings calculations								

Appendix I. US Output Calculations, 2018-2028, IT Career Family Occupations

Occupation Code	Occupation Name	2018 Output per Direct Job in 2012 Chained USD	2028 Output per Direct Job in 2012 Chained USD	Output in Chained 2012 USD	Output in Chained 2012 USD	2018-2028 Change in Output	Output Change Rate 2018-2028
11-3021	Computer and Information Systems Managers	$ 278,377.16	$ 343,426.72	$ 115,359,494,198	$ 158,354,061,216	$ 42,994,567,018	37%
15-1111	Computer and Information Research Scientists	$ 287,653.03	$ 341,364.72	$ 9,118,600,931	$ 12,630,494,656	$ 3,511,893,725	39%
15-1121	Computer Systems Analysts	$ 250,954.68	$ 285,430.03	$ 159,080,169,330	$ 196,918,179,355	$ 37,838,010,025	24%
15-1122	Information Security Analysts	$ 280,170.19	$ 321,366.43	$ 31,463,112,163	$ 47,465,821,468	$ 16,002,709,306	51%
15-1131	Computer Programmers	$ 288,756.50	$ 339,373.60	$ 72,275,752,849	$ 78,836,486,805	$ 6,560,733,956	9%
15-1132	Software Developers, Applications	$ 341,255.81	$ 397,574.18	$ 322,213,738,579	$ 471,403,709,153	$ 149,189,970,574	46%
15-1133	Software Developers, Systems Software	$ 327,934.95	$ 372,305.43	$ 138,158,995,926	$ 172,712,489,599	$ 34,553,493,673	25%
15-1134	Web Developers	$ 310,399.85	$ 358,316.49	$ 49,819,175,842	$ 64,998,610,524	$ 15,179,434,681	30%
15-1141	Database Administrators	$ 312,605.86	$ 374,205.65	$ 36,543,625,614	$ 47,673,799,673	$ 11,130,174,059	30%
15-1142	Network and Computer Systems Administrators	$ 285,889.69	$ 330,125.12	$ 109,753,051,695	$ 132,743,312,000	$ 22,990,260,306	21%
15-1143	Computer Network Architects	$ 386,558.67	$ 452,749.77	$ 61,578,796,122	$ 75,926,136,492	$ 14,347,340,370	23%
15-1151	Computer User Support Specialists	$ 245,949.17	$ 295,474.06	$ 165,228,653,854	$ 219,448,587,952	$ 54,219,934,097	33%
15-1152	Computer Network Support Specialists	$ 426,607.40	$ 520,461.13	$ 81,609,994,755	$ 105,861,794,625	$ 24,251,799,870	30%
15-1199	Computer Occupations, All Other	$ 301,586.36	$ 329,950.08	$ 124,494,849,380	$ 150,127,285,365	$ 25,632,435,985	21%
17-2061	Computer Hardware Engineers	$ 270,337.76	$ 320,139.50	$ 17,409,751,949	$ 21,897,541,664	$ 4,487,789,715	26%
43-9011	Computer Operators	$ 253,385.50	$ 292,577.94	$ 9,324,586,552	$ 8,192,182,334	$ (1,132,404,218)	-12%
	Total, IT Career Family			**$ 1,503,432,349,740**	**$ 1,965,190,492,882**	$ 461,758,143,142	31%
		calculated based on BLS output data	calculated based on BLS output data	calculated by multiplying direct employment by 2018 output per direct job in 2012 chained USD	calculated by multiplying direct employment by 2018 output per direct job in 2012 chained USD		

Appendix J. PR Employment Projections for IT Career Family Occupations

Occupation Code	Occupation Name	2016 Direct Employment	2026 Projected Direct Employment	Change 2016-2026	Change Rate 2016-2026	2026 Employment Mix Percentage	Average Annual Openings
11-3021	Computer and Information Systems Managers	1,280	1,320	40	3%	10%	100
15-1111	Computer and Information Research Scientists	-	-	-	0%	0%	-
15-1121	Computer Systems Analysts	1,210	1,250	40	3%	10%	80
15-1122	Information Security Analysts	320	400	80	25%	3%	30
15-1131	Computer Programmers	1,610	1,440	(170)	-11%	11%	80
15-1132	Software Developers, Applications	500	660	160	32%	5%	50
15-1133	Software Developers, Systems Software	600	560	(40)	-7%	4%	30
15-1134	Web Developers	-	-	-	0%	0%	-
15-1141	Database Administrators	470	500	30	6%	4%	30
15-1142	Network and Computer Systems Administrators	830	810	(20)	-2%	6%	50
15-1143	Computer Network Architects	600	650	50	8%	5%	40
15-1151	Computer User Support Specialists	3,190	3,230	40	1%	25%	240
15-1152	Computer Network Support Specialists	650	690	40	6%	5%	50
15-1199	Computer Occupations, All Other	420	430	10	2%	3%	30
17-2061	Computer Hardware Engineers	290	290	-	0%	2%	20
43-9011	Computer Operators	1,030	840	(190)	-18%	6%	80
	Total, IT Career Family	**13,000**	**13,070**	**70**	**1%**	**100%**	**910**

Appendix K. PR Employment Calculations, 2016-2026, IT Career Family Occupations

Occupation Code	Occupation Name	Indirect Employment Multiplier	2016 Direct Employment	2016 Indirect Employment	2016 Total Employment	2026 Projected Direct Employment	2026 Projected Indirect Direct Employment	2026 Projected Total Employment	2016-2026 Change in Total Employment	Total Employment Change Rate 2016-2026
11-3021	Computer and Information Systems Managers	4.296	1,280	5,499	6,779	1,320	5,671	6,991	212	3%
15-1111	Computer and Information Research Scientists	4.081	-	-	-	-	-	-	-	0%
15-1121	Computer Systems Analysts	4.080	1,210	4,936	6,146	1,250	5,100	6,350	203	3%
15-1122	Information Security Analysts	4.072	320	1,303	1,623	400	1,629	2,029	406	25%
15-1131	Computer Programmers	4.360	1,610	7,020	8,630	1,440	6,279	7,719	(911)	-11%
15-1132	Software Developers, Applications	4.423	500	2,211	2,711	660	2,919	3,579	868	32%
15-1133	Software Developers, Systems Software	4.535	600	2,721	3,321	560	2,539	3,099	(221)	-7%
15-1134	Web Developers	4.227	-	-	-	-	-	-	-	0%
15-1141	Database Administrators	4.010	470	1,885	2,355	500	2,005	2,505	150	6%
15-1142	Network and Computer Systems Administrators	3.924	830	3,257	4,087	810	3,179	3,989	(98)	-2%
15-1143	Computer Network Architects	4.313	600	2,588	3,188	650	2,803	3,453	266	8%
15-1151	Computer User Support Specialists	3.788	3,190	12,084	15,274	3,230	12,235	15,465	192	1%
15-1152	Computer Network Support Specialists	4.207	650	2,734	3,384	690	2,903	3,593	208	6%
15-1199	Computer Occupations, All Other	4.274	420	1,795	2,215	430	1,838	2,268	53	2%
17-2061	Computer Hardware Engineers	4.363	290	1,265	1,555	290	1,265	1,555	-	0%
43-9011	Computer Operators	3.917	1,030	4,034	5,064	840	3,290	4,130	(934)	-18%
	Total, IT Career Family		13,000	53,333	**66,333**	13,070	53,655	**66,725**	392	1%
		calculated based on BLS industry multipliers	from BLS projections	calculated by multiplying indirect employment multiplier by direct employment for each occupation	sum of direct and indirect employment	from BLS projections	calculated by multiplying indirect employment multiplier by direct employment for each occupation	sum of direct and indirect employment		

Appendix L. PR IT Household Earnings Calculations 2016-2026

Occupation Code	Occupation Name	2017 Mean Annual Wage	2016 Direct Earnings	2016 Indirect Earnings	2016 Total Earnings	2026 Direct Earnings	2026 Indirect Earnings	2026 Total Earnings	2016-2026 Change in Total Earnings	Total Earnings Change Rate 2016-2026
11-3021	Computer and Information Systems Managers	$ 79,670	$ 101,977,600	$ 159,090,484	$ 261,068,084	$ 105,164,400	$ 164,062,061	$ 269,226,461	$ 8,158,378	3%
15-1111	Computer and Information Research Scientists	$ 62,450	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0%
15-1121	Computer Systems Analysts	$ 45,400	$ 54,934,000	$ 142,808,446	$ 197,742,446	$ 56,750,000	$ 147,529,386	$ 204,279,386	$ 6,536,940	3%
15-1122	Information Security Analysts	$ 43,920	$ 14,054,400	$ 37,699,885	$ 51,754,285	$ 17,568,000	$ 47,124,856	$ 64,692,856	$ 12,938,571	25%
15-1131	Computer Programmers	$ 48,260	$ 77,698,600	$ 203,097,385	$ 280,795,985	$ 69,494,400	$ 181,652,319	$ 251,146,719	$ (29,649,265)	-11%
15-1132	Software Developers, Applications	$ 57,430	$ 28,715,000	$ 63,977,035	$ 92,692,035	$ 37,903,800	$ 84,449,686	$ 122,353,486	$ 29,661,451	32%
15-1133	Software Developers, Systems Software	$ 62,120	$ 37,272,000	$ 78,711,395	$ 115,983,395	$ 34,787,200	$ 73,463,968	$ 108,251,168	$ (7,732,226)	-7%
15-1134	Web Developers	$ 37,770	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0%
15-1141	Database Administrators	$ 48,880	$ 22,973,600	$ 54,523,972	$ 77,497,572	$ 24,440,000	$ 58,004,225	$ 82,444,225	$ 4,946,654	6%
15-1142	Network and Computer Systems Administrators	$ 47,040	$ 39,043,200	$ 94,229,138	$ 133,272,338	$ 38,102,400	$ 91,958,556	$ 130,060,956	$ (3,211,382)	-2%
15-1143	Computer Network Architects	$ 51,660	$ 30,996,000	$ 74,860,462	$ 105,856,462	$ 33,579,000	$ 81,098,833	$ 114,677,833	$ 8,821,372	8%
15-1151	Computer User Support Specialists	$ 31,440	$ 100,293,600	$ 349,584,859	$ 449,878,459	$ 101,551,200	$ 353,968,368	$ 455,519,568	$ 5,641,109	1%
15-1152	Computer Network Support Specialists	$ 39,050	$ 25,382,500	$ 79,105,169	$ 104,487,669	$ 26,944,500	$ 83,973,179	$ 110,917,679	$ 6,430,010	6%
15-1199	Computer Occupations, All Other	$ 62,450	$ 26,229,000	$ 51,928,118	$ 78,157,118	$ 26,853,500	$ 53,164,502	$ 80,018,002	$ 1,860,884	2%
17-2061	Computer Hardware Engineers	$ 66,600	$ 19,314,000	$ 36,608,187	$ 55,922,187	$ 19,314,000	$ 36,608,187	$ 55,922,187	$ -	0%
43-9011	Computer Operators	$ 22,140	$ 22,804,200	$ 116,713,045	$ 139,517,245	$ 18,597,600	$ 95,183,454	$ 113,781,054	$ (25,736,191)	-18%
	Total, IT Career Family		$ 601,687,700	$ 1,542,937,577	**$ 2,144,625,277**	$ 611,050,000	$ 1,552,241,582	**$ 2,163,291,582**	$ 18,666,305	1%
00-0000	Average, All Occupations	$ 28,930	calculated by multiplying direct employment by occupational mean annual wage	calculated by multiplying indirect employment by mean annual wage of all occupations (00-0000)	sum of direct and indirect earnings	calculated by multiplying direct employment by occupational mean annual wage	calculated by multiplying indirect employment by mean annual wage of all occupations (00-0000)	sum of direct and indirect earnings		
		from PR BLS - occupational wages are multipled by employment to deterimine earnings; average wage of all Puerto Rico occupations is used for indirect earnings calculations								

Appendix M. PR Output Calculations 2016-2026, for IT Career Family Occupations

Occupation Code	Occupation Name	2016 Output per Direct Job in 2012 Chained USD	2026 Output per Direct Job in 2012 Chained USD	Output in Chained 2012 USD	Output in Chained 2012 USD	2016-2026 Change in Output	Output Change Rate 2016-2026
11-3021	Computer and Information Systems Managers	$ 112,356.62	$ 138,611.47	$ 143,816,480	$ 182,967,142	$ 39,150,662	27%
15-1111	Computer and Information Research Scientists	$ 153,057.61	$ 181,637.13	$ -	$ -	$ -	0%
15-1121	Computer Systems Analysts	$ 137,750.30	$ 156,674.00	$ 166,677,868	$ 195,842,504	$ 29,164,636	17%
15-1122	Information Security Analysts	$ 162,669.45	$ 186,588.38	$ 52,054,224	$ 74,635,350	$ 22,581,126	43%
15-1131	Computer Programmers	$ 147,164.12	$ 172,961.01	$ 236,934,238	$ 249,063,861	$ 12,129,623	5%
15-1132	Software Developers, Applications	$ 233,985.79	$ 272,601.10	$ 116,992,894	$ 179,916,723	$ 62,923,829	54%
15-1133	Software Developers, Systems Software	$ 182,536.30	$ 207,233.95	$ 109,521,778	$ 116,051,010	$ 6,529,232	6%
15-1134	Web Developers	$ 151,638.41	$ 175,046.93	$ -	$ -	$ -	0%
15-1141	Database Administrators	$ 149,710.01	$ 179,210.75	$ 70,363,706	$ 89,605,376	$ 19,241,670	27%
15-1142	Network and Computer Systems Administrators	$ 165,367.98	$ 190,955.21	$ 137,255,424	$ 154,673,718	$ 17,418,294	13%
15-1143	Computer Network Architects	$ 170,304.51	$ 199,466.04	$ 102,182,707	$ 129,652,929	$ 27,470,221	27%
15-1151	Computer User Support Specialists	$ 133,998.72	$ 160,981.01	$ 427,455,901	$ 519,968,648	$ 92,512,747	22%
15-1152	Computer Network Support Specialists	$ 235,211.62	$ 286,958.24	$ 152,887,552	$ 198,001,182	$ 45,113,631	30%
15-1199	Computer Occupations, All Other	$ 162,310.04	$ 177,575.04	$ 68,170,218	$ 76,357,269	$ 8,187,051	12%
17-2061	Computer Hardware Engineers	$ 132,341.32	$ 156,721.30	$ 38,378,984	$ 45,449,177	$ 7,070,192	18%
43-9011	Computer Operators	$ 140,815.06	$ 162,595.65	$ 145,039,513	$ 136,580,345	$ (8,459,168)	-6%
	Total, IT Career Family			**$ 1,967,731,485**	**$ 2,348,765,233**	$ 381,033,748	19%
		calculated based on BLS output data and discounted based on Puerto Rico wage rate	calculated based on BLS output data and discounted based on Puerto Rico wage rate	calculated by multiplying direct employment by 2016 output per direct job in 2012 chained USD	calculated by multiplying direct employment by 2028 output per direct job in 2012 chained USD		

Appendix N. PR IT Scenario Comparison Total Employment Projections, 2016-2026

			Scenario #1 - hypothetical projection based on US growth rates			*Scenario #2 - hypothetical projection based on US occupational mix*			*Scenario #3 - hypothetical projection based on targeted action by Invest Puerto Rico*		
Occupation Code	**Occupation Name**	**Indirect Employment Multiplier**	**2026 Projected Direct Employment**	**2026 Projected Indirect Direct Employment**	**2026 Projected Total Employment**	**2026 Projected Direct Employment**	**2026 Projected Indirect Direct Employment**	**2026 Projected Total Employment**	**2026 Projected Direct Employment**	**2026 Projected Indirect Direct Employment**	**2026 Projected Total Employment**
11-3021	Computer and Information Systems Managers	4.296	1,424	6,119	7,543	1,077	4,629	5,706	1,424	6,119	7,543
15-1111	Computer and Information Research Scientists	4.081	-	-	-	86	353	439	-	-	-
15-1121	Computer Systems Analysts	4.080	1,317	5,372	6,689	1,612	6,576	8,188	1,317	5,372	6,689
15-1122	Information Security Analysts	4.072	421	1,714	2,135	345	1,405	1,751	400	1,629	2,029
15-1131	Computer Programmers	4.360	1,494	6,515	8,010	543	2,367	2,910	1,440	6,279	7,719
15-1132	Software Developers, Applications	4.423	628	2,777	3,405	2,770	12,253	15,024	795	3,516	4,311
15-1133	Software Developers, Systems Software	4.535	661	2,996	3,657	1,084	4,915	5,999	675	3,061	3,736
15-1134	Web Developers	4.227	-	-	-	424	1,791	2,215	-	-	-
15-1141	Database Administrators	4.010	512	2,054	2,566	298	1,194	1,491	500	2,005	2,505
15-1142	Network and Computer Systems Administrators	3.924	869	3,412	4,281	940	3,687	4,626	869	3,410	4,279
15-1143	Computer Network Architects	4.313	632	2,724	3,356	392	1,690	2,082	650	2,803	3,453
15-1151	Computer User Support Specialists	3.788	3,527	13,359	16,886	1,735	6,574	8,309	3,527	13,359	16,886
15-1152	Computer Network Support Specialists	4.207	691	2,907	3,598	475	1,999	2,475	691	2,907	3,598
15-1199	Computer Occupations, All Other	4.274	463	1,978	2,441	1,063	4,544	5,607	430	1,838	2,268
17-2061	Computer Hardware Engineers	4.363	308	1,344	1,652	160	697	857	290	1,265	1,555
43-9011	Computer Operators	3.917	784	3,070	3,853	65	256	322	840	3,290	4,130
	Total, IT Career Family		13,730	56,342	**70,072**	13,070	54,931	**68,001**	13,848	56,854	**70,702**
	employment improvement over current projection (# of jobs):		660	2,687	**3,347**	-	1,275	**1,275**	778	3,199	**3,977**

Appendix O. PR IT Scenario Comparison Household Earnings Projections 2016-2026

			Scenario #1 - hypothetical projection based on US growth rates			*Scenario #2 - hypothetical projection based on US occupational mix*			*Scenario #3 - hypothetical projection based on targted action by Invest Puerto Rico*		
Occupation Code	Occupation Name	Indirect Employment Multiplier	2026 Projected Direct Employment	2026 Projected Indirect Direct Employment	2026 Projected Total Employment	2026 Projected Direct Employment	2026 Projected Indirect Direct Employment	2026 Projected Total Employment	2026 Projected Direct Employment	2026 Projected Indirect Direct Employment	2026 Projected Total Employment
11-3021	Computer and Information Systems Managers	4.296	1,424	6,119	7,543	1,077	4,629	5,706	1,424	6,119	7,543
15-1111	Computer and Information Research Scientists	4.081	-	-	-	86	353	439	-	-	-
15-1121	Computer Systems Analysts	4.080	1,317	5,372	6,689	1,612	6,576	8,188	1,317	5,372	6,689
15-1122	Information Security Analysts	4.072	421	1,714	2,135	345	1,405	1,751	400	1,629	2,029
15-1131	Computer Programmers	4.360	1,494	6,515	8,010	543	2,367	2,910	1,440	6,279	7,719
15-1132	Software Developers, Applications	4.423	628	2,777	3,405	2,770	12,253	15,024	795	3,516	4,311
15-1133	Software Developers, Systems Software	4.535	661	2,996	3,657	1,084	4,915	5,999	675	3,061	3,736
15-1134	Web Developers	4.227	-	-	-	424	1,791	2,215	-	-	-
15-1141	Database Administrators	4.010	512	2,054	2,566	298	1,194	1,491	500	2,005	2,505
15-1142	Network and Computer Systems Administrators	3.924	869	3,412	4,281	940	3,687	4,626	869	3,410	4,279
15-1143	Computer Network Architects	4.313	632	2,724	3,356	392	1,690	2,082	650	2,803	3,453
15-1151	Computer User Support Specialists	3.788	3,527	13,359	16,886	1,735	6,574	8,309	3,527	13,359	16,886
15-1152	Computer Network Support Specialists	4.207	691	2,907	3,598	475	1,999	2,475	691	2,907	3,598
15-1199	Computer Occupations, All Other	4.274	463	1,978	2,441	1,063	4,544	5,607	430	1,838	2,268
17-2061	Computer Hardware Engineers	4.363	308	1,344	1,652	160	697	857	290	1,265	1,555
43-9011	Computer Operators	3.917	784	3,070	3,853	65	256	322	840	3,290	4,130
	Total, IT Career Family		13,730	56,342	70,072	13,070	54,931	68,001	13,848	56,854	70,702
	employment improvement over current projection (# of jobs):		660	2,687	3,347	-	1,275	1,275	778	3,199	3,977

Appendix P. PR IT Scenario Comparison Output Projections 2016-2026

			Scenario #1 - hypothetical projection based on US growth rates		*Scenario #2 - hypothetical projection based on US occupational mix*		*Scenario #3 - hypothetical projection based on targted action by Invest Puerto*	
Occupation Code	**Occupation Name**	**2028 Output per Direct Job in 2012 Chained USD**	**2026 Projected Direct Employment**	**Output in Chained 2012 USD**	**2026 Projected Direct Employment**	**Output in Chained 2012 USD**	**2026 Projected Direct Employment**	**Output in Chained 2012 USD**
11-3021	Computer and Information Systems Managers	$ 138,611	1,424	$ 197,416,986	1,077	$ 149,338,131	1,424	$ 197,416,986
15-1111	Computer and Information Research Scientists	$ 181,637	-	$ -	86	$ 15,703,005	-	$ -
15-1121	Computer Systems Analysts	$ 156,674	1,317	$ 206,323,028	1,612	$ 252,557,053	1,317	$ 206,323,028
15-1122	Information Security Analysts	$ 186,588	421	$ 78,529,946	345	$ 64,393,420	400	$ 74,635,350
15-1131	Computer Programmers	$ 172,961	1,494	$ 258,441,623	543	$ 93,880,166	1,440	$ 249,063,861
15-1132	Software Developers, Applications	$ 272,601	628	$ 171,162,422	2,770	$ 755,229,304	795	$ 216,717,871
15-1133	Software Developers, Systems Software	$ 207,234	661	$ 136,913,118	1,084	$ 224,626,861	675	$ 139,882,914
15-1134	Web Developers	$ 175,047	-	$ -	424	$ 74,193,901	-	$ -
15-1141	Database Administrators	$ 179,211	512	$ 91,794,537	298	$ 53,346,988	500	$ 89,605,376
15-1142	Network and Computer Systems Administrators	$ 190,955	869	$ 166,006,678	940	$ 179,408,079	869	$ 165,940,075
15-1143	Computer Network Architects	$ 199,466	632	$ 125,990,416	392	$ 78,158,903	650	$ 129,652,929
15-1151	Computer User Support Specialists	$ 160,981	3,527	$ 567,725,946	1,735	$ 279,360,164	3,527	$ 567,725,946
15-1152	Computer Network Support Specialists	$ 286,958	691	$ 198,320,691	475	$ 136,378,547	691	$ 198,320,691
15-1199	Computer Occupations, All Other	$ 177,575	463	$ 82,205,889	1,063	$ 188,785,983	430	$ 76,357,269
17-2061	Computer Hardware Engineers	$ 156,721	308	$ 48,272,107	160	$ 25,047,278	290	$ 45,449,177
43-9011	Computer Operators	$ 162,596	784	$ 127,425,503	65	$ 10,637,593	840	$ 136,580,345
	Total, IT Career Family		13,730	**$ 2,456,528,894**	13,070	**$ 2,581,045,376**	13,848	**$ 2,493,671,819**
	output improvement over current projection (chained 2012 USD):		660	**$ 107,763,661**	-	**$ 232,280,144**		**$ 144,906,586**

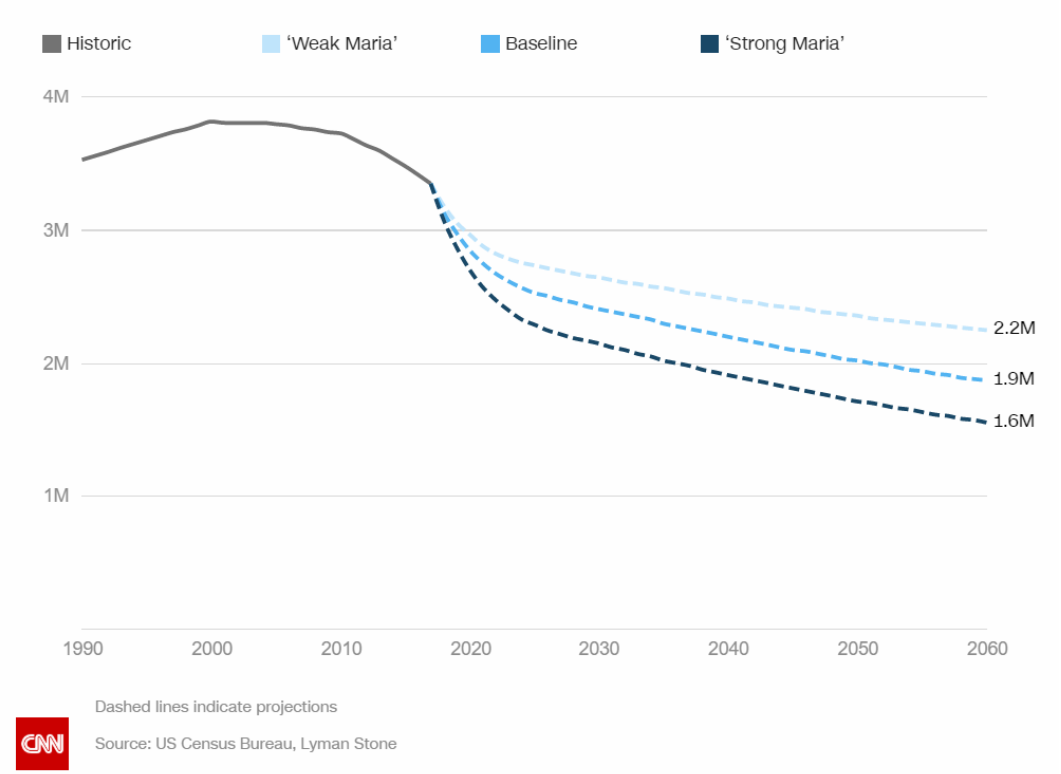
Appendix Q. Conceptual Invest PR IT Program Budget with Risks and Mitigation Strategies

Conceptual Budget - IT Cluster Recommendations					Assumed wage:	$ 60,000.00
					Calculated hourly labor rate:	$ 28.85
Category	Action	Anticipated labor effort (in person hours)	Labor Costs	Other Costs	Total Costs	Comment
Research	Define value proposition for Puerto Rican IT sector	80	$ 2,307.69	$ -	$ 2,307.69	
Research	Identify trends and practices that promote IT workforce develop	80	$ 2,307.69	$ -	$ 2,307.69	
Research	Blue sky initiatives	20	$ 576.92	$ -	$ 576.92	
Research	Be a source to government and firms	40	$ 1,153.85	$ -	$ 1,153.85	
Partner	Establish consortium of IT firms in Puerto Rico	80	$ 2,307.69	$ 5,000.00	$ 7,307.69	4 meetings per year
Partner	Make contacts with industry organizations	120	$ 3,461.54	$ -	$ 3,461.54	
Partner	Partner with colleges and universities	20	$ 576.92	$ -	$ 576.92	
Partner	Partner with government to develop projections	20	$ 576.92	$ -	$ 576.92	
Sponsor	Incent blue sky work with competitions, grants	0	$ -	$ 250,000.00	$ 250,000.00	
Sponsor	Grants for business trianing programs	0	$ -	$ 250,000.00	$ 250,000.00	
Sponsor	Sponsor conferences, events, and speaker series	0	$ -	$ 100,000.00	$ 100,000.00	
Communicate	Advocate with government and funding agencies	80	$ 2,307.69	$ -	$ 2,307.69	
Communicate	Educate firms	80	$ 2,307.69	$ -	$ 2,307.69	
Communicate	Craft promotional messaging	80	$ 2,307.69	$ -	$ 2,307.69	
Communicate	Inetegrate into unified promotional material	240	$ 6,923.08	$ 10,000.00	$ 16,923.08	
Measure	Develop scorecard to measure firm, institution success	360	$ 10,384.62	$ 15,000.00	$ 25,384.62	
Measure	Issue annual survey to partners	120	$ 3,461.54	$ 5,000.00	$ 8,461.54	
Other	Contingency	0	$ -	$ -	$ 135,192.31	
Total	**Total Costs**	**1420**	**$ 40,961.54**	**$ 635,000.00**	**$ 811,153.85**	

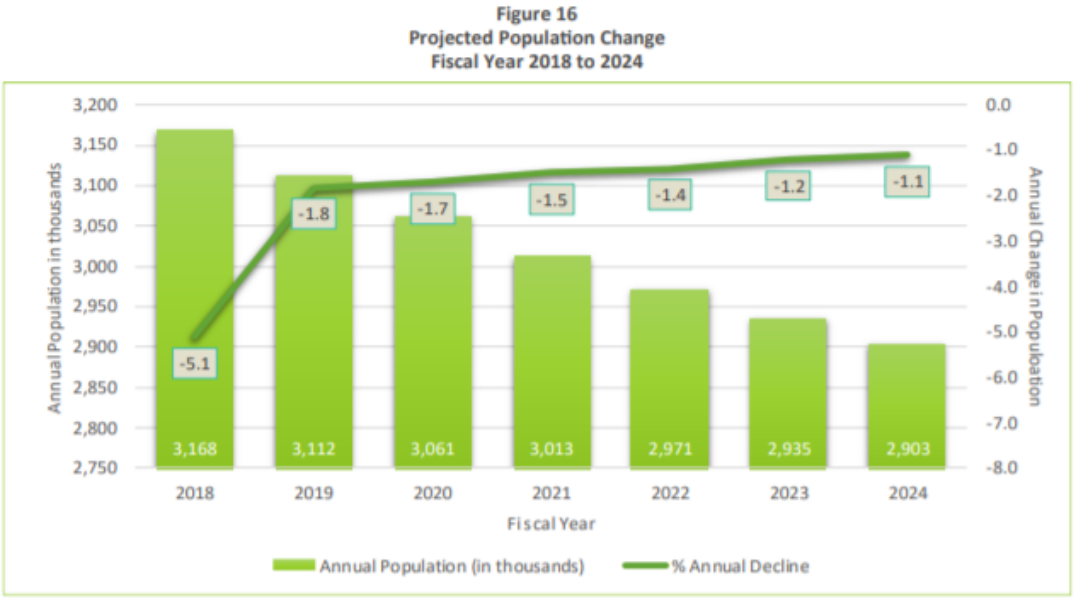
Risks	Mitigation Strategies
Scope creep/budget overruns	Include contingency, establish milestones and measure against them, identify items that can be cut if needed
People effort overage	Measure amount of time spent on various efforts, adjust and reallocate budget as needed periodically
Opportunity costs of other initiatives/industry foci	Due dilligence effort on other industries prior to initiating IT investment, maintain flexibility to go other routes

(Source: Team Analysis)

Appendix R. Puerto Rico Population Projections – CNN[79]

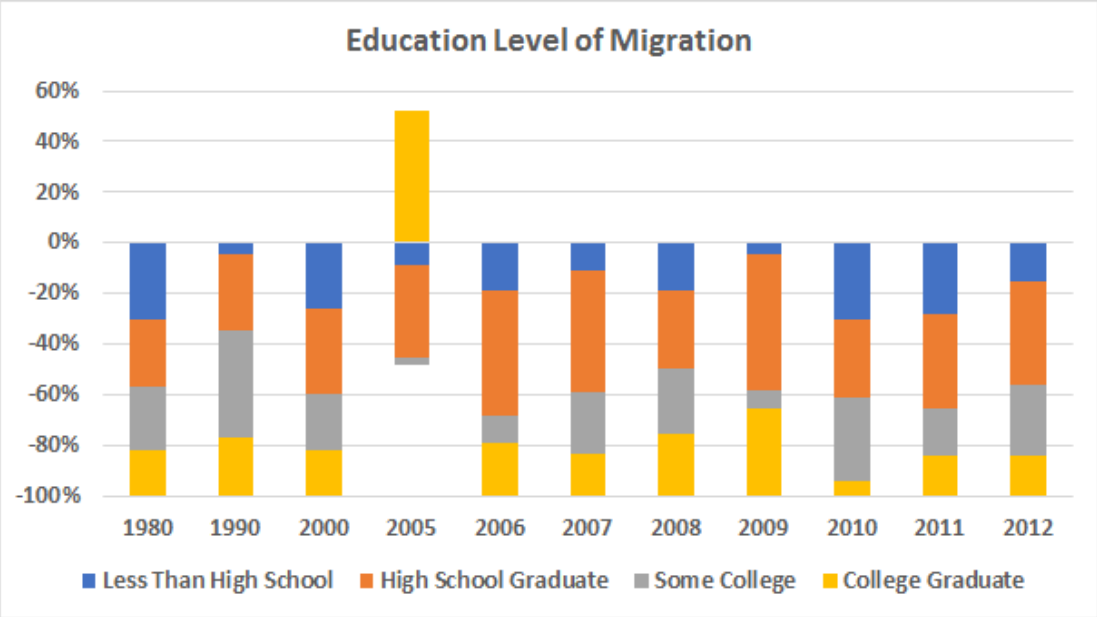


Appendix S. Puerto Rico Population Projections - Economic Report[80]



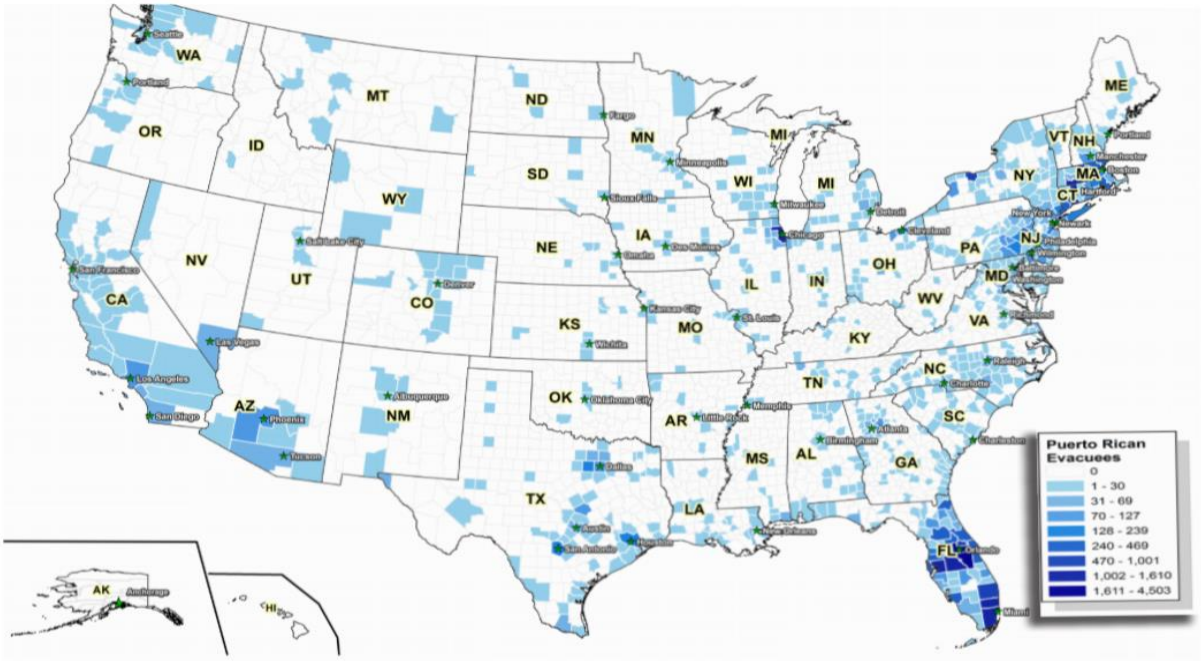
Source: Fiscal Plan for Puerto Rico: https://drive.google.com/file/d/13wuVn04--JKMEPKu-u-djZJHqTK-55aV/view.

Appendix T. Talent Breakdown of Outmigration[81]



Team analysis of New York Fed Data

Appendix U. FEMA Migration Heatmap[82]



Appendix V. Target University Breakdown

School	Student Population (Total)	% Hispanic	Hispanic Students (Total)	PR Club	Source
University of Central Florida	69,525	26.7%	18,563	Puerto Rican Student Association	https://www.ucf.edu/about-ucf/facts/
Polytecnic University of PR - Orlando				?	
Florida International University	58,787	61.0%	35,860	?	https://opir.fiu.edu/factbook2016/dash.html
Polytecnic University of PR - Miami				?	
University of Miami	17,811	26.0%	4,631	Latin American Studies Puerto Rico	https://irsa.miami.edu/fast-facts/
Florida State University	42,876	19.3%	8,275	Puerto Rican Student Association	https://ir.fsu.edu/facts.aspx
University of Pennsylvania	26,675	7.5%	1,989	Penn Club of Puerto Rico	https://diversity.upenn.edu/diversity-at-penn/facts-and-figures
Penn State University	84,482	6.3%	5,349	Puerto Rican Student Association	https://budget.psu.edu/factbook/StudentDynamic/MinorityEnrolbyEthnicity.aspx?YearCode=2017&FBPlusIndc=N
University of Mass Amherst	30,593	8.0%	2,447	Latinx American Cultural Center	https://www.umass.edu/diversity/data-policies
Boston University	33,355	8.8%	2,935	Puerto Rican Student Association	https://datausa.io/profile/university/boston-university
Harvard	31,120	8.2%	2,552	Harvard Club of Puerto Rico	https://datausa.io/profile/university/harvard-university#enrollment
University of Texas Austin	51,525	20.4%	10,511	Puerto Ricans at UT Austin	https://datausa.io/profile/university/the-university-of-texas-at-austin#enrollment
Texas A&M	69,465	21.9%	15,241	Puerto Rican Student Association	https://accountability.tamu.edu/All-Metrics/Mixed-Metrics/Student-Demographics

(Sources within table)

Appendix W. Career Fair Best Practices[83]

Before the Fair

- Set goals
  - What are the main goals?
- Organize and Review
  - Develop logistics for attending fair
- Pick and Train reps
  - Who can communicate and sell PR/firm the best?
- Communicate attendance
  - Connect with student clubs and let them know you're coming

During the Fair

- Have an attractive booth
  - What will attract students to the booth? Giveaways?
- Prepare for anticipated questions
  - Prepare best answers for question student will ask
- Know your pitch
  - What is your sales pitch?
- Be engaging
  - How will you engage with students and develop relationship?
- Follow Up!
  - Follow up with students

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