Introductory Guide to Technology Jobs

by

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Introduction

As I write this guide, the questions come up: Why this topic? Why now? Why me? Technology has become integrated into everything we do as a global society and as a global economy. Technology touches everyone in some way. From medical breakthroughs to social media, technology has an impact on our lives whether we think good or ill towards it.

Five of the most dominant companies in the world are technology-based: Amazon, Apple, Facebook, Google, and Microsoft. Even non-technology companies have become technology-based from GE's embracing of big data to the financial sector's embrace of new technology (fintech). The HITECH Act, passed as part of President Obama's 2009 stimulus package, required that all medical providers utilize electronic medical records.

With this rapid digitization, the job market has changed. New jobs have been created. Ten years ago the idea of a social media marketing professional did not exist. Meanwhile, old jobs have gone away. Secretaries and typists have been replaced by computers and now, products like Alexa. Technology will be a critical part of careers and this impact on the job market will no doubt impact economic development.

But why did I feel I should be the one who writes this guide? Three aspects of my career give me a unique perspective. First, I have spent 20 years working in engineering and information technology along with having an undergraduate degree in electrical engineering which I received just as the internet revolution went into high gear. Second, I also serve as an adjunct professor at two universities in their computer science departments. This positions allow me not only to teach college students but also to meet high school students who are interested in attending those colleges. So I get a chance to see the ambitions and struggles of the next generation of technology workers. Finally, I am active in local and

regional economic development where I live.

Economic development is interesting. It is definitely a multi-disciplinary topic. It involves not just economics but also finance, politics, public policy, and marketing. Education also plays a big part. Workforce development is vital; it's what builds the social capital needed for economic growth. However, how we develop the workforce is always tricky. Some think it is a matter of more resources. If we simply spend more on education, all is well. Others think we "over-educate". Their mantra is college is not for everyone. Still others think it is simply a matter of fitting the right pegs in the right holes. Experts say we need more cyber-security professionals so let's train as many people in cyber-security as possible. However, all of this positions miss vital points.

What is necessary is both a top-down view of job training along with a granular view built around the individual. If technology will be a key a factor in careers, I thought that a guide about technology that looks at careers from both ends would be beneficial.

Who is the intended reader of this guide? Everyone I hope. Thus, the rather uncreative title. Students (and their families) to include adults thinking of a career change. There is no shortage of career information, some good, some bad. Hopefully, this guide will allow students to organize their own due diligence and ask the right questions as they make decisions.

I hope guidance/career counselors at all levels read this guide. Counselors are forced to be generalists and often do not have the training in specific industries or careers. This guide can give them insight as they advise on educational and career decisions.

I hope educators at every level read this guide Courses and curricula tend to be taught in silos. This guide might let educators focus on the end state of education and take

an integrated approach to course development.

Business managers, owners, and human resources also should read this guide. Although most likely unintentional, the public receives a lot of mixed signals from employers looking to hire technology workers. We hear that there are not enough technology workers to fill the ranks yet at the same time, we read about lay-offs of technology workers. We hear about a critical skills gap but company re-training appears to be minimal. So perhaps, this guide can provide a framework for how we hire, train, and retain technology workers.

Policy-makers and elected officials might want to read this guide as well. Unfortunately, there seems to be a desire to fight globalization and technology in an attempt to move backwards to a nation-based industrial economy. The idea that this is possible is simply deceptive. There is no tariff high enough and no income tax rate low enough to bring us back to the 1950s economy. Instead, we should be focused on preparing our workforce to take advantage of technology and globalization. Maybe this guide could help.

Perhaps, my expectations of this guide are too high. However, it will be successful if even a handful of people find clarity in their career choices due to reading this guide.

The Organization

What are different types of organizations and companies that hire technology workers or any workers for that matter? We tend to organize companies by industry-sector or by size. These are great metrics for specific purposes. In terms of tech jobs though, it might be helpful to place organizations in three big "buckets".

The first bucket includes line organizations. These are organizations whose primary products and services are not technology products. Technology plays a supporting role. Most companies fall into this category regardless of size. Utilities, automobile, pharmaceuticals, aerospace, retail, and financial companies are line companies. The Dow Jones Industrial Average consists of 30 companies. All but 5-6 are line companies.

Of course, some may argue that some of these products are indeed technology. Some financial companies rely on algorithms to guide investments. Cars have more technology, including information technology, than NASA in its early days. These are fair points but these buckets are meant to be general. Also, technology is not the purpose behind these products. Technology enhances the products. Finally, the fact that this category can become muddled demonstrates the increasing role of technology. Perhaps, in later editions of this guide, this category will no longer be listed.

So this brings us to the second category: technology companies. What are considered technology companies? These are companies whose main product are technology or whose product is part of the information technology ecosystem. The 5-6 Dow Jones companies that are not line companies can be thought of as technology companies. These companies are Apple, Cisco, IBM, Intel, and Verizon. Though Verizon might also be considered a line company since it is a telecommunications conglomerate. IBM also has a strong consulting component (which we will discuss

next) through its Global Business Services Division. Again, these categories are meant to be broad groupings so much is left to interpretation. Many start-ups belong to this category as well.

The final company are what I would call consulting companies (in the broadest meaning of the word). These are companies that share knowledge, insight, or skills. Professional services firms such as accounting and law firms fall into this category as well as healthcare providers. Consulting firms such as Booz Allen, Accenture, and CapGemini obviously belong in this category.

Of course, there are companies and organizations that can fall into multiple categories. IBM has already been mentioned since they provide products and consulting. Amazon actually is considered a technology company although they are primarily a retailer and distributor. This is most likely because of the the popularity of their technology products such as Amazon Web Services, Alexa, and Kindle and that fact that their core competency of retail and distribution is technology-driven. How will they be classified in the future as they create physical retail spaces such as Whole Foods? Or will they have a consulting component as they explore healthcare? How will Walmart be classified as they expand into online retailing?

Government agencies and academia/education also can be considered in each of the different categories depending on what they do. Some agencies provide non-technology services and products. Other agencies and academia provide insight. Yet some agencies and academia provide technology products such as DARPA or university research programs.

Indeed, this framework is not perfect. However, it provides a reference point for examining technology jobs. The take-away point is that technology jobs exist in one form or another in all three types of organizations.

The Job

Technology jobs seem to be everywhere. Yet we never seem to be able to fill all of them. We invest in education and training yet nothing seems to work. Why is this?

Perhaps, we do not define technology jobs properly. We think all technology jobs are the same and incorrectly, think (or want) every technology job to make us a tech billionaire. We make the technology sector unique and special when it can best be viewed as any other sector.

If one were to operate a factory making widgets, would every job be the same? Obviously not. There are line workers in a factory. There are engineers and maintenance to keep the lines running. There are managers from foreman to executive leadership. Researchers are employed to design better widgets. There are also accountants and lawyers to support the factory. All of these jobs require different education, training, and certifications. People don't simply assume that everyone in manufacturing does the same thing. Matter of fact, manufacturing is in some respects a function of the industry for which it is making products, eg, cars, planes, etc. Technology should be thought of in similar terms.

So with that being said, let's divide technology jobs, regardless of organization or industry, into three main categories: academic, professional, and technician. It is important to note that these terms are used for convenience. They in no way indicate that any category is better or worse than the other, either in prestige or value. The differences lie in the training and career path.

This is why these categories are important. It provides individuals with a high-level map to career planning. They can decide what they really want to do and how much time and resources they want to invest in education and training. Misunderstanding of these categories creates bad

expectations and potentially career drift.

The Academics

When we think of academics, we rightly think of university professors doing research. However, in this case, academics will have a broader definition. Academics are technology workers in both the private, academic, and public sector who conduct research and development. They can be found in large companies as well as start-ups. They are the workers who design or create new products.

This group includes actual engineers(the term “actual” is used because engineer is over-used in the technology sector). This group includes scientists. Academics do complex programming.

Their educational credentials can include PhD and Master's level work. It should be noted that their fields of study may not be in computer science-related areas. For example, neuroscientists, psychologists, or linguists might be conducting technology-related research.

These jobs tend to cluster in particular areas such as Silicon Valley, Boston, New York City, and London. They also tend to be the first jobs created within a given field of technology.

The Professionals

This group of jobs effectively serve as the bridge between technology and broader business functions such as finance, legal, and operations. These jobs provide analysis, governance, and oversight of technology. Some examples of these jobs include: business analysts, project managers, IT auditors, and risk advisory.

These jobs usually require bachelors degrees and professional/master's degrees as well as certain certifications (eg, CISA, PMP, CPA). Majors for these jobs could be typical professional tracks such as accounting,

engineering, law, or even liberal arts. Depending on the area, public policy, business, or political science also might be beneficial.

Accounting deserves special attention. The audit, compliance, business understanding, and finance skills that are part of the accounting profession overlap with many IT governance aspects.

These jobs are usually not limited by geography. While they are the last category of jobs created in each field, they tend to be long-term and experience less churn.

The Technicians

This group of jobs is the largest group of jobs. Most jobs listed online are technician jobs. Even many jobs that seem otherwise such as many advertised as "engineering" jobs are actually technician jobs.

Technician jobs value experience over education. Usually, an associate's degree is sufficient along with technical certifications. Technicians basically can do basic script-writing and can use IT tools. They include administrators, architects, and specialists.

While these jobs can be high-paying, they do experience a lot of churn. These jobs are over time automated or are out-sourced. Therefore, if one chooses this career path, they must be prepared to constantly re-train.

These job categories are not mutually exclusive in terms of career development. There can be movement among them. For instance, a professional might benefit from expertise in a tool and thus, take on more technician job aspects. Technician jobs can form apprenticeships for the other fields. Currently, due to the relative newness of information technology, many Chief Information Officers have come from the technician ranks.

Technology Integration

There are those that think that technology will replace most jobs through automation completely. We have seen this already in factories as what were once tasks done by assembly-line workers have been replaced by robots. There is a belief that artificial intelligence will replace more academic jobs such as research. This is best thought of as the automationalist belief.

However, there is another school of thought that technology augments jobs and thus, increases productivity. For example, artificial intelligence will not replace research jobs but rather assist researchers as a tool. Technology will help people do their jobs better.

The impact of technology will probably depend on the jobs. If there is a scale of 1 to 10, with 1 being total automation and 10 being total augmentation, the integration of technology into jobs may be somewhere between depending on the task.

No matter which vision becomes a reality, technology is becoming a part of non-technology jobs. This is the Holy Grail of most technology companies. Companies want to make the technology so seamless and easy to use that it will be part of the everyday workflow of non-technology workers. Amazon Web Services continues to create products that become easier to use so that cloud specialists are no longer needed. Microsoft Office is a necessary part of most offices' toolbox as is email.

So for technology workers, there are two points to consider. First, understanding the goal of a lot of technology helps give insight into how to focus one's career in terms of product development. In other words, one can ask themselves if the projects in their job are making the use of technology easier and more widespread. If so, then there is likely more stability.

The second lesson approaches the trend from the opposite direction. If someone is a technology specialist, they should ask themselves if new products will make the tasks they perform part of any worker's job or simply be automated in the background.

While the integration of technology probably should not be a primary concern as someone navigates career choices, it should be in the back of one's mind.

Ambiguity

To say that technology can be ambiguous is an understatement. The purpose of this guide is to clear up some of the ambiguity in careers. However, sometimes the fields of technology can be deceptive. At best, when the names given to fields, they actually represent a multi-disciplinary field with many more specific fields. At worse, they create an impression that these fields are one size fits all.

So let's examine this ambiguity through the field of cyber-security. What is cyber-security exactly? Apparently, it is in demand as a career. What does it mean to be a cyber-security consultant? The answer is "it depends" because the term is vague.

Actually, cyber-security has many sub-fields. Network security is as the name indicates is protecting the network . End-point security is focused on protecting devices such as mobile phones, tablets, and laptops. Cloud security which again as the name indicates represents securing integration with the cloud. Application security is ensuring that a particular app or platform is secure. Within application security, there is database security of the particular application of databases. Regulatory compliance refers to ensuring that configurations comply with relevant laws and regulations such as HIPAA, FERC, and FFIEC. Access management looks at the technology and protocols that allow users to access a system. Incident management and computer forensics are the technology and practices that are implemented to limit exposure after a breach. Privacy is about protecting the rights of organizations' and individuals'.

Governance includes the organization practices that protect systems and data. Risk assessors examine the risks to systems and data and help develop the governance strategy. IT auditors periodically examine the performance of that strategy.

Indeed, many of these sub-fields overlap. While cyber-security may be the overarching term for all of these sub-fields, expertise and experience usually focuses on one or two.

These same relationship between general fields and specific sub-fields can be seen throughout technology fields. So when evaluating possible career fields, it is necessary to look deeper into the requirements of sub-fields.

Self-Evaluation

So how to approach a a career in technology? With all of this information, where does one begin. This can best be answered by a series of questions.

Where is my general interest?

This question is pretty basic. Are you interested in technology as a career? If so what particular area? Do you prefer information technology or perhaps, a specific area of engineering such as electrical engineering information?

What type of job do I prefer?

This is where you determine which of the job types listed previously, you prefer: *academic*, *professional*, or *technician*. This should not be determined by the perception of how much money you think you might make. An academic in a start-up may very well make far less than a technician in a large manufacturing firm. You should consider where your interests lie in doing research, being very hands-on, or wanting to hold a basic corporate/office-type job. Consider the pros and cons of each that were listed above. Please ignore the legends of tech billionaires and the myths perpetuated by reality television.

Choose a field or sub-field

This is where you start to specialize. Are you interested in one of the sub-fields of cyber-security or perhaps, you think that one of the sub-fields of artificial intelligence is where you would thrive.

It is necessary to do extensive research for two reasons. First, each of the fields or sub-fields can be intensive in different academic subjects. Data analytics is intensive with math and statistics. User interface and video game

design has a strong artistic component. Other fields are programming intensive. Technical writers should have strong language skills. So hopefully, this research will help you align with your interests.

The second reason for the research is job types of academic, professional, or technician, do not exist in every field or sub-field. Cyber-security and its sub-fields may provide for all three job types. However, blockchain technology is focused more in the academic area in terms of jobs (as of this writing). So your research may require you to go back to the previous question of the type of job desired.

Design your education plan

Once you know your field/sub-field and job type, you can start deciding on an education plan. You can choose the level of education as discussed in the discussion of job types earlier. You can choose educational institutions that are strong in the fields as well as the subjects needed to succeed.

Again research is essential. If one wants to become an IT auditor, then perhaps a bachelor's degree in accounting with electives in computer science or even public policy might be the answer. Deeper research may yield even more interesting opportunities. A career in an academic job type focusing on social engineering may make a PhD in psychology or sociology useful.

High school students have been subjected to a highly political debate. On one side is the argument of a bachelor's degree at all costs. Everyone must get a bachelor's degree because it increases future earnings. The other side is the idea that college is not for everyone. Resources are wasted on useless degrees and/or directionless students so the argument goes. Both arguments are wrong in that they limit expectations and potential. By high school students coming up with an education plan after career research, they develop a path

that supports career aspirations versus being forced into career path based on educational choices.

This whole process of self-evaluation can seem daunting at first blush. It seems that one is planning their whole life all at once through a couple of questions. However, it is important to remember several points.

First, as mentioned earlier, there is movement within job types. Second, a lot of subjects related to one field also are applicable in other fields as are many degrees within fields. To use the example of accounting, one can study for a degree in accounting with the intent of being IT auditor only to later decide to focus on taxes. So, a great deal of flexibility exists in this process.

Policy Proposals

Technology careers do not exist in a vacuum. Public policy impacts the decisions people make and often time, either set up individuals for success or failure. There are some basic policies to prepare individuals for the careers in technology that work for them.

Create and implement an universal basic technology curriculum

As mentioned earlier, there are skills and subjects inherent to each technology field. It is essential to catalog these subjects and integrate those that are required across the most fields into a core curriculum for all k-12 students. Those less widely required could become electives. This curriculum should be mandated regardless of whether or not a student is considered college-bound.

Obviously, similar initiatives have been designed and implemented. However, this must be done universally.

Strengthen guidance counseling in middle and high schools and career counseling in colleges

Counselors should receive more intensive training built around career assistance. Since the landscape is always changing, this training must adapt. It also may be worthwhile to rotate counselors into the human resources departments of various industries to learn real-world hiring practices. Another option may be to create a national career counseling corps for retired and mid-career professionals to assist counseling departments in preparing students.

Integrate community colleges into career paths

It is not unusual for community colleges to partner with four-year institutions. Students attend community college then transfer the credit to the four-year college. The

point is to save money. This concept can be applied to technology careers.

A student can attend a community college and receive an associate's degree and training in a technology field. Perhaps, they receive certifications and training in multiple sub-fields. Upon graduation, they work 1-2 years in their field as technicians. After working in their field for that period time, they are given the opportunity to transfer their credit towards a higher degree with the goal of working in academic or professional job types. Of course, if they wish, they can continue to working as a technician and receive additional training.

Promote the military as a career builder

Sometimes, we as a society view the military as monolithic organization where everyone simply shoots weapons. However, it is far more nuanced than this. The military provides training and jobs in a variety of technology fields and sub-fields, often through the national guard and reserves. Additionally, the military also provides educational assistance towards college. So essentially with a part-time effort, an individual can receive training, experience, and assistance towards developing their career. There must be more promotion of this opportunity.

Obviously, this list of policy recommendations is not exhaustive. Any recommendation should take a highly analytical view of the technology job landscape as this guide attempts to do.

Conclusion

Hopefully, this guide has been helpful. Even if the reader does not agree with every statement made, the key is to spur discussion and assist in developing a framework for technology career decisions.

A reliable, well-trained stream of technology workers would be beneficial for everyone. Individuals would have jobs. Companies would be able to meet their corporate goals. The country would benefit from economic growth.

About the Author

Joseph Ingemi is technology consultant based in New Jersey with 20 years of experience. He holds a Bachelor's Degree in Electrical Engineering from the United States Military Academy at West Point and a Master's Degree in Public Policy from Duke University.