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AN ANALYSIS ON THE IMPACT ON SUPPLY CHAINS OF E-COMMERCE THROUGH
VOICE ASSISTANTS

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ABSTRACT

The use and development of voice assistants such as Apple's Siri, Amazon's Alexa, and Google Assistant have grown significantly in recent years. These voice assistants can be found in mobile devices, speakers, televisions, and a number of other electronics. These products are being used to conduct e-commerce, which has significantly changed the dynamics between businesses and consumers. With this shift in mind, this thesis will explore how the shift from focusing on a traditionally consumer driven e-commerce environment to focusing on winning the recommendation of an artificially intelligent customer through voice assistants will impact the supply chains for involved companies.

The research and data used for this analysis will be collected from reviewing information on current industry leaders in this space and aggregating opinions and predictions from professional services firms with expertise in this area as well.

The research has shown that companies who are selling a high volume of products via voice assistants will tend to become more focused on catering to a specific part of the recommendation algorithm, for example lowest cost or highest quality. This means that companies who are selling products on voice assistants will have to make changes to their supply chains to adjust and ultimately win a sale. Another viable option would be to enter into the voice assistant's ecosystem, which would require partnerships or sponsorships. However, before implementing any of these recommendations, a further analysis should be conducted to understand consumer preferences, supply chain synergies, and company relationships.

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Chapter 1

An Introduction to E-Commerce: From Concept to Reality

Long after the use of the bartering system and subsequent creation of currency, humans have begun utilizing the Internet as a marketplace through e-commerce. E-commerce is the buying and selling of goods and services via the Internet, and the concept was introduced over forty years ago. Since the late 1970s, e-commerce has grown exponentially, with another turning point at the brink. A brief overview of the history of e-commerce shows this rapid growth.

In 1979, an English inventor named Michael Aldrich created the basis of the idea, known as “teleshopping.” This became the predecessor of online shopping as it is known today, and it utilized technologies such as Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT). By connecting a television set to a transaction-processing computer, one could purchase items remotely. Over a decade later, the late 1980s and early 1990s saw the development of the Internet and the beginning measures of cyber security, which created the platform for the concept of e-commerce to exist in a larger scale. In the late-1990s, the .com bubble was exemplified by an extreme growth of Internet-based companies such as Amazon, eBay, Google, PayPal, and Yahoo (Miva, 2017). These, as well as subsequent companies, would then create the marketplace for e-commerce to exist.

As brick-and-mortar stores grew in the early 2000s, consumers were happy to go to a physical store to purchase items, occasionally offsetting an in-store experience with an online one. However, as the adoption of e-commerce grew, more consumers began shopping online and the rate was, and still is, rapid. In 2000, total sales in e-commerce were \$27.6 billion, growing to

over five times that at \$143.4 billion in 2009 (Nielsen Insights, 2015). This technology created a mutually beneficial marketplace – one in which buyers can shop at any moment from the convenience of their own home, and sellers can reach their customers at any moment in a low-cost manner. The growth is not expected to plateau anytime soon. In fact, the industry is at another major turning point with the creation of intelligent digital voice assistants, which creates yet another method of reaching customers in this e-commerce market.

Voice assistants, sometimes called intelligent digital assistants, are voice-activated intelligent machines that can act and process information based on a user's commands and requests. Perhaps most people are familiar with Apple's Siri or Amazon's Alexa, which responds when triggered by the user calling their respective names. The dynamic of the e-commerce industry is at the precipice of change for one major reason: these devices are now able to make purchases on its owner's behalf in seconds, without the owner having to stop what he or she is doing.

With this shift in mind, this thesis will explore how the shift from focusing on a traditionally consumer driven e-commerce environment to focusing on winning the recommendation of an artificially intelligent customer through voice assistants will impact the supply chains for many companies. The remainder of this thesis is structured as follows. The next section will give further context to voice assistants, describing the relationships that they have fostered with customers. The following chapter will focus on the industry and the major companies involved. Next is an analysis on the supply chain implications, and finally there are recommendations for what improvements supply chains can adopt to accommodate this shift and maintain competition.

Chapter 2

An Introduction to Voice Assistants

Sarah is getting ready in the morning when she remembers that her best friend's birthday is coming up next week. She decides that she would like to get her friend a coffee maker and places an order through her Amazon Echo, which is one of the most popular voice assistant-enabled speakers in the market currently with purchasing capabilities.

"Hey, Alexa," Sarah says, as her Amazon Echo lights up in response, "Buy a coffee maker."

The cylindrical speaker processes her requests and responds with the name and price of Amazon's top recommendation. It asks her to confirm or cancel the order. Sarah confirms, her credit card is charged, and in two days, a package arrives at her door. This type of e-commerce method has quickly been adopted by the masses. Over the 2017 winter holiday season, tens of millions of voice assistants were sold through Amazon alone, and research has shown that nearly half of regular users order online via their voice assistant (Gartenberg, 2017).

From the voice assistant's perspective, this is actually quite a straightforward method. Sarah is already a customer of Amazon, one of the world's largest online retail giants with over 310 million active customers as of 2017 (Statista, 2018). Sarah has an Amazon Prime membership where her address, billing information, and order history is already stored. When Sarah makes the command to her device, it has three responses when she wants to purchase something non-specific:

1. The voice assistant can make a recommendation about a new product, as shown in the previous example. Amazon has an artificially intelligent algorithm called "item-to-item

collaborative filtering,” which combines a number of metrics such as consumer preferences, similar products, similar consumers, and product popularity in order to make the best recommendation for both Amazon and the customer (Linden, Smith, and York, 2018).

2. It can reorder a previous purchase that was made by searching through the account holder’s purchase history. In this method, it overrides what Amazon would usually recommend as it is strictly following the most recent purchase of what the customer would like to order again (Linden, Smith, and York, 2018).

3. While not quite a complete purchase technically, the voice assistant is also able to just add items to the account owner’s online shopping cart, allowing the owner to review the items later and manually decide to continue or cancel the order. This is usually done when the item is too generic and there are too many options. The top recommendation will likely be added to the cart, but there is another option of adding several top choices automatically for the owner to make the final decision (Linden, Smith, and York, 2018).

Of course, if Sarah asks for a specific brand of item and gives details about it, Amazon’s Alexa will search for the product and purchase exactly that as well. In all of these possibilities, every item is Prime eligible, which is the network created around Amazon which could be compared to a loyalty program. Prime eligible products can be delivered in two days, and if the customer is not satisfied with the product, it is eligible for free returns as well, ensuring customer satisfaction. This maintains that every purchase made through Amazon’s Alexa stays within the Amazon ecosystem. No matter what product the consumer eventually settles on, it will benefit Amazon. Also, speaking with the voice assistant, the customer is able to check up on the status of the orders as well.

Although this example focused on Amazon, one of the largest companies in this space, there are a number of different companies that produce similar products to the Amazon Echo using their own respective voice assistant. The technologies behind the systems are similar enough to be able to parallel the previous example to many other voice assistants available on the market with purchasing capabilities. The popular voice assistants are used via smartphone, speakers, smart televisions, home appliances, and other electronics with a number of different service capabilities for the consumer depending on the company's ecosystem. They are all programmed to respond to a user after hearing a specific phrase as a wake word, usually the assistants "name," and they all have their own unique yet similar artificially intelligent algorithms to process the information and respond to the consumer.

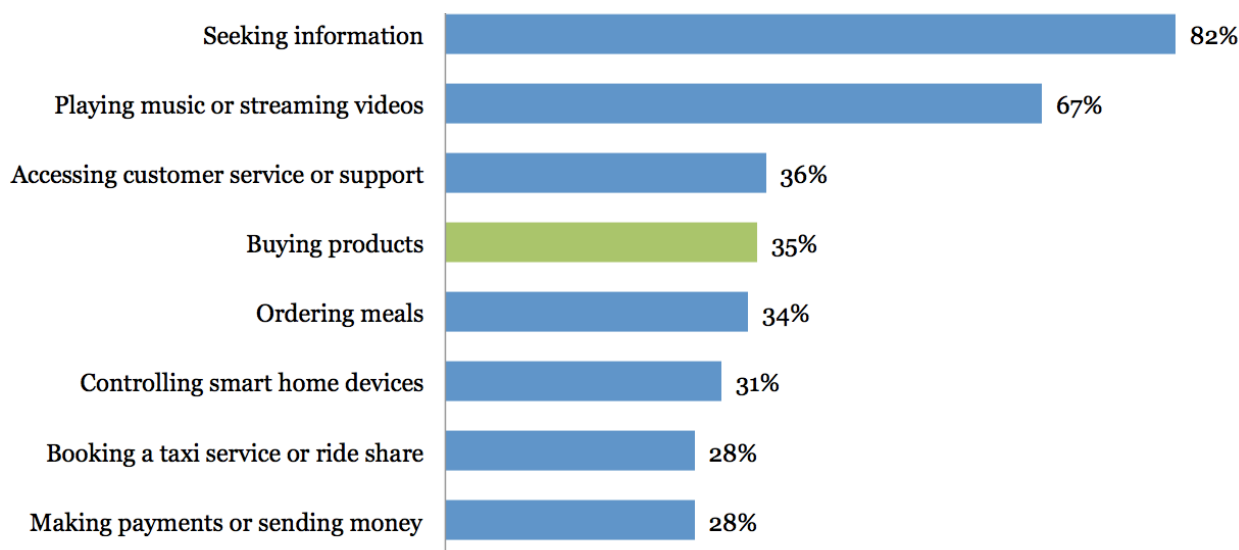
Chapter 3

The Voice Assistant Environment

Within the environment involving voice assistants, there are a few major companies that are dominating the industry. Amazon and Google have created similar competing products to collect information, streamline consumer transactions, and overall increase company revenue. Outside of these two major companies, there are also a few other smaller companies who are producing similar products in this market as well such as Apple, Microsoft, and Roku, but they have not seen significant levels of success that would pose threats to the aforementioned companies at this time. This chapter focuses on analyzing each of the major companies involved by addressing main product offerings, competitive advantages, and future potential, focusing specifically on the context of purchasing capabilities. All of these companies provide other products and services, but this analysis isolates the primary voice assistant-enabled products on the market and their online purchasing capabilities within the three most competitive companies in this industry.

On top of that, the voice assistant-enabled products discussed in this analysis also serve a variety of needs for customers, with purchasing capabilities as the fourth most utilized feature. Figure 1 shows the results of Capgemini Digital Transformation Institute’s conversational commerce survey conducted in November of 2017. This survey had over 2,500 participants spanning the US as well as parts of Europe, and the results show how people use their voice assistants. The most common uses were to find information such as news, appointments, reminders, or recipes as well as to play music or videos. This result is also in line with a 2017 Business Insider and Statista survey of Amazon Echo use, with the two most used functions being setting a timer and playing music (Dunn, 2016).

Figure 1. Users Who Have Used Voice Assistant Features Regularly



The findings of this survey show that only around one-third of voice assistant-enabled product owners regularly utilize the commerce capabilities available. However, this same research hypothesizes that as customers become more comfortable using this technology, that percentage will rise to close to fifty percent within three years. Additionally, since many customers are buying these products for a variety of reasons aside from the purchasing functions,

there is unrealized potential for these customers who already own this product to become a user of the commerce capabilities.

Understanding the providers and products of this technology contextualizes the supply chain implications caused from voice assistants as all involved companies have made supply chain changes to accommodate the rapid rate of adoption of voice assistant-enabled products as well as the trend of using these products to purchase goods online.

Amazon

As of 2018, Amazon dominates the online marketplace, with nearly \$178 billion in net sales in 2017 and over 300 million active users around the world (Statista, 2018). Amazon released the Amazon Echo to the public in June 2015, which was the first major speaker to include its digital personal assistant named Alexa in a compact speaker (Hao, 2018). Since then, Amazon has released numerous Alexa-enabled products including a smaller version of the speaker (Echo Dot), tablets (Fire Tablet), TV remote control (Fire Stick), which all include the capability to communicate with its user and act on behalf of the user via their Amazon account. In September of 2017 alone, Amazon launched five new Alexa-enabled products (Amazon.com Press Release, 2017). These Amazon products vary at different price points and have been rapidly adopted by the market, with over twenty million of Alexa-enabled products being sold in the 2017 winter season (Kinsella, 2017).

Amazon has a number of major competitive advantages that make it a strong incumbent in this industry. To begin, Amazon has first-mover advantage because they were the first major company to get a speaker with voice assistant capabilities out on the market quickly with a rapid

adoption rate. Especially given their strong e-commerce background, they were also able to integrate the purchasing capabilities immediately, further putting pressure on other companies with different backgrounds to compete in this area as well. Launching the first major voice assistant-enabled speaker allowed them to capture a large portion of the market while the other companies created competing products, which became a large barrier to entry for other companies with similar products later on (Hao, 2018).

Second, the Amazon ecosystem encompassing all of the products, services, and technologies involved in their network capture customers and create more outlets for Amazon to generate revenue from the same customer. For example, aside from the general online marketplace, Amazon also offers an annual membership called Prime, which offers free two-day shipping among other benefits. Over ninety million users have actively purchased Amazon Prime as of September 2017, which is nearly a forty percent increase from the previous year. These Prime users spend on average \$1,300 per year on purchases through the marketplace (Statista, 2018). With the added convenience of being able to connect an Amazon Prime account to Alexa-enabled products, many Prime users have continued to remain loyal to the Amazon brand. Amazon directly benefits from this type of relationship because they can continuously collect information on their customer, especially regarding their purchasing habits. Creating varying products and services enable Amazon to build an ecosystem around their customers that address their changing needs while still ensuring the revenue stays within the overall Amazon network rather than a competitor's.

Another aspect of the Amazon ecosystem is all of their subsidiaries. Amazon.com owns a number of companies such as Whole Foods Market and Zappos.com among others, allowing them to leverage the supply chains of each of these individual companies. For example, Whole

Foods Market is a supermarket chain focused on organic foods. Since the \$13.7 billion acquisition in August of 2017, Amazon is now able to offer two-hour shipping of food to homes in select areas by using various Whole Foods stores similarly to a distribution center (Bloomberg, 2017). This is a clear advantage that incentivizes customers to stay within the Amazon ecosystem and create barriers to make it challenging to leave the ecosystem as well.

For a period of time, it seemed as though Amazon would dominate this industry and receive major benefits from the creation of the first major retail-enabled voice assistant. However, other companies quickly developed highly competitive products, which certainly cut into Amazon's revenues and customer base.

Google

Over a year after the release of the Amazon Echo, technology giant, Google, launched the Google Home in November of 2016. The Google Home interacts with all products within their ecosystem, catering to customers who own other Google devices, and there are also a number of different Google Assistant-enabled products at varying sizes and price points. While Amazon's voice assistant is named Alexa, Google's is simply called Google Assistant and responds to the name "Google" as a wake word.

The largest difference between Amazon's and Google's products were that at original launch, the Google Home was not able to make purchases for the consumer in the manner that Amazon's products could, missing out on customers who valued this feature. However, since then, Google has announced that all of their voice assistant products will have purchasing capabilities by partnering with the brick-and-mortar giant, Wal-Mart, as well as other retailers

(Brown, 2018). Wal-Mart has been in a fierce competition with Amazon since it began struggling in the e-commerce battle many years prior, and they were happy to partner with Google instead. Just as Amazon has used its subsidiaries similarly to a distribution center, Google can easily leverage the ubiquity of Wal-Mart in the same manner, and Google is now able to offer over two million products from Wal-Mart to its customers (Capgemini, 2018). This large-scale partnership is significant enough to pose a major threat to Amazon and its existing infrastructure, and Google intends to continue growing these relationships (Brown, 2018). Since then, Google has created the same partnerships with Target, Home Depot, Walgreens, Costco, PetSmart, and other companies, allowing Google the supply chain infrastructure and product support to be able to supply similar services and products as Amazon. Perhaps Google can even soon supply a variety of products to customers faster than Amazon as their partnerships would allow them more physical locations than Amazon's network can currently reach. For example, customers are currently able to receive free two-day shipping, which is the same duration as Amazon Prime, but now, Google is offering the option to pick up certain products within a Target store within two hours, which is important to time-sensitive customers (D'innocenzio, 2017).

On top of this, Google Assistant users can now connect their Google Express accounts in the same way that Amazon Alexa users could connect their Prime accounts, except there is no annual fee. Additionally, customers can also connect to all partnered companies' loyalty programs, such as Target's loyalty card, to receive discounts (D'innocenzio, 2017). This expands the ecosystem and network surrounding Google Assistant.

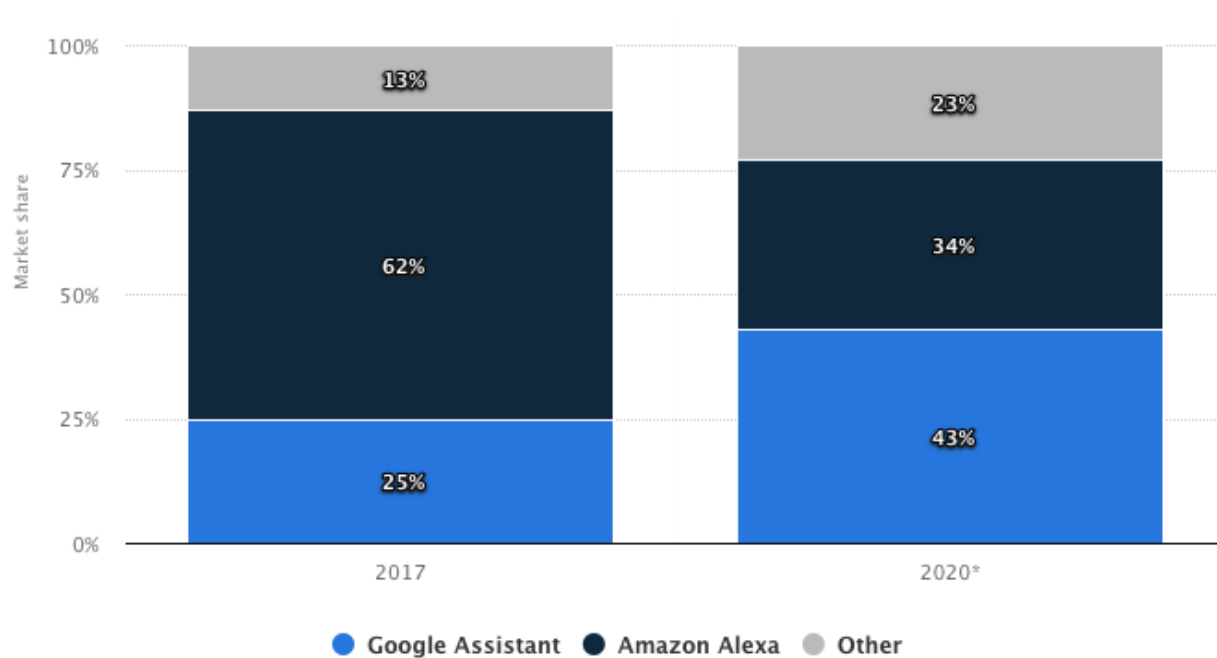
Within the voice assistant market, Google's major competitive advantage is their primary and core competency: consumer data. Google has an incredible amount of user information and

has been successful when recommending purchases online via target advertisement. In the same way, all Google Assistant products are also able to incorporate this type of product purchase recommendation. With all of the information that Google has been collecting on consumers since its inception coupled with their leading artificial intelligence and machine learning algorithms, Google's products have been known to be "smarter" than competing products. For example, in a study conducted by Stone Temple Consulting, 5,000 questions on various topics were said to both Amazon's Echo and the Google Home. Google Home was able to answer more than three times as many questions as the Amazon Echo and at a higher rate of accuracy at close to ninety percent (Enge, 2017). Also, the Amazon Echo responded with incorrect answers more than twice as often than the Google Home, suggesting that the Google Home is more likely to only respond to questions if it has an accurate answer. This should be no surprise given Google's immense search engine indexing capabilities. Another study conducted by digital marketing firm 360i tested over 16,000 questions and commands to both Alexa and Google and found similar results. A vice president at this firm involved in the research commented on the disparity in market share, even though Google Assistant greatly outperformed Amazon Alexa. He hypothesized that the almost two year head start that Amazon had coupled with the vast underutilization of many of the capabilities of these devices makes customers already tied into an ecosystem or unaware of how much smarter their devices could be. However, it is believe that the first-to-market advantage will fade quickly, and consumers will continue demanding higher levels of thought and intelligence from voice assistants (Hao, 2018).

Although Amazon is considered the market leader presently, much of professional services research predicts that Google will quickly reach and surpass the market share that Amazon currently holds. Many of these reports cite Google Assistant's dominance in artificial

intelligence and machine learning as the primary reason for this shift as consumers begin to rely more heavily on these types of products. Figure 2 shows the results of IHS Markit's 2017 Internet of Things report regarding current voice assistant market share and predicted 2020 market share.

Figure 2. Voice Assistant Market Share Predictions



Apple

Outside of the two major players of Google and Amazon, a few other companies have come into the mix recently as well, but none of them have posed a major threat to Google nor Amazon. Companies such as Microsoft, Roku, and Apple are all sharing that thirteen percent of market share shown in Figure 2. This section will analyze the largest competitor in this space outside of Google and Amazon: Apple. This analysis on Apple is being conducted to contextualize how strong the other two companies are, and what the challenges are for smaller

players in this industry. With Apple being the next largest competitor, one could see that the other smaller companies are likely having more difficulties.

Apple's voice assistant named Siri has been successful since its integration into iPhones. However, Apple has since released their version of a voice assistant speaker called the HomePod in February of 2018. The HomePod is considered to be a late response to the action that has already been taking place with commerce-capable voice assistants with Amazon and Google, especially given that it does not share many of the features that consumers have been valuing in the aforementioned products (Ranger, 2018). Instead of focusing on the commerce aspect of voice assistants, Apple has chosen to create a product that is currently just a physical speaker with the same Siri capabilities. This makes the HomePod currently a voice-enabled extension of its pre-existing products such as iMessage, iTunes, and Apple Music, all of which are features that can be accessed via iPhone. Additionally, it is priced at \$349, which is significantly more than Amazon and Google's comparable products, which are priced at \$180 and \$100, respectively (Apple.com, 2018). For this reason, it may be an unlikely beginning product for those who are interested in voice assistant speakers and are not already in Apple's ecosystem.

In the context of voice assistant enabled speakers to use for commerce, it is clear that Apple does not hold a significant competitive advantage in this situation, since their ecosystem is not one that accommodates the particular needs that this product is currently servicing. Apple simply is not the search giant that Google is, and in fact, Google is the default search engine for all Apple products, further giving data information to Google. Apple also is not able to compete with Amazon as a retail giant either as the supply chain infrastructure and relationships are not currently present within their systems. For these reasons, Apple is unlikely to be able to compete at the scale that Amazon and Google currently are in this specific space.

However, Apple's major competitive advantage overall is their brand loyalty, and offering the HomePod will allow customers who are loyal to Apple to be able to benefit from staying within the ecosystem due to compatibility across other Apple products. Customers who are regular users of other iOS products such as iPhones, Apple TV, and MacBook will likely prefer the convenience of cross-product integration of the HomePod, and it is likely that Apple will need to incorporate a purchasing feature outside of their own products in the near future to remain competitive. The HomePod may also be successful if Apple is able to find and service an unmet need within the market that is currently using voice assistant. Currently, the most realistic recommendation would be to improve sound quality to capture an unmet need of customers who use voice assistants more frequently for music or entertainment instead of commerce and information ("How Apple May Compete with Amazon's Echo and Google Home," Tsukayama, 2017).

Overall, it is challenging to believe that a product with significantly fewer features than competitors at a later release date warrants a two to three times higher price tag. However, if the smartphone war between Google's Pixel 2 and Apple's iPhone X signifies anything, it is that some customers are extremely loyal to Apple and will forgo certain features and capabilities and pay a higher price for an Apple product. Apple may be able to improve its current three percent market share in the future, but it is unlikely to have the infrastructure and data necessary to compete with Amazon and Google at a large scale in this particular space. If a company as significant as Apple is facing this many challenges, the smaller companies may be facing just as many if not more. For those reasons, it is likely for Amazon and Google to be the primary competitors with voice assistants.

Competitive Strategies

Amazon and Google have been competing aggressively in the voice assistant-enabled product market. Amazon, the e-commerce giant, regularly favors its own products over others, and in the opposite way is able to remove competitor's products from their marketplace as well. Amazon has decided to stop selling Google's smart home products, removing them entirely from the marketplace and precluding customers from purchasing them. On top of that, other commonly purchased Google items have been recalculated to appear as the final recommendation behind all other possible options when Alexa is asked for recommendations (Kovach, 2018). The logic behind this decision was to not enable a sale of a competitor's product, and Google responded in a similar way after yet another attack by Amazon. After Amazon prohibited their video services from being played on Google products, Google decided to remove YouTube, which Google owns, from all Amazon products including its TV and speakers in response (Morris, 2017). After Amazon continued to exclude Google products from their ecosystem, Google had to eventually respond.

Many customers are dissatisfied with the war between these two giants as frequently used services and products continue to get taken away. Amazon users are not happy to have limits on the products they are able to purchase, and Google users are being limited in which video services will be supported. Both of these companies would be able to best serve their customers by compromising and removing limitations from customers. Strategically, both companies are trying to defend revenues and prevent competitor successes. However, consumers in the future will likely favor products with complete consumer choice and freedom. If this feud continues in this way by removing services and product freedom from customers, it may open up an opportunity for the smaller companies to compete (Villas-Boas, 2017).

Chapter 4

Analysis of the Business and Supply Chain Impacts

In November 2017, marketing researcher and consultancy, Juniper Research, published a white paper titled, “Voice Assistants – The Next Advertising Battleground.” In this paper, the company hypothesized that fifty-five percent of US households will have at least one type of voice assistant platform in their home. Given that there are a number of different platforms including smartphones, tablets, speakers, TVs, cars, and wearables such as watches and glasses, the US market alone is expected to have over 870 million devices in the hands of consumers by 2022. This is a ninety-five percent increase over the 450 million estimated devices at the time of this article's publication (Juniper Research, 2018). It is clear that this technology will rapidly become ubiquitous, and companies are going to have to address this shift in how they communicate information to their customers in one way or another.

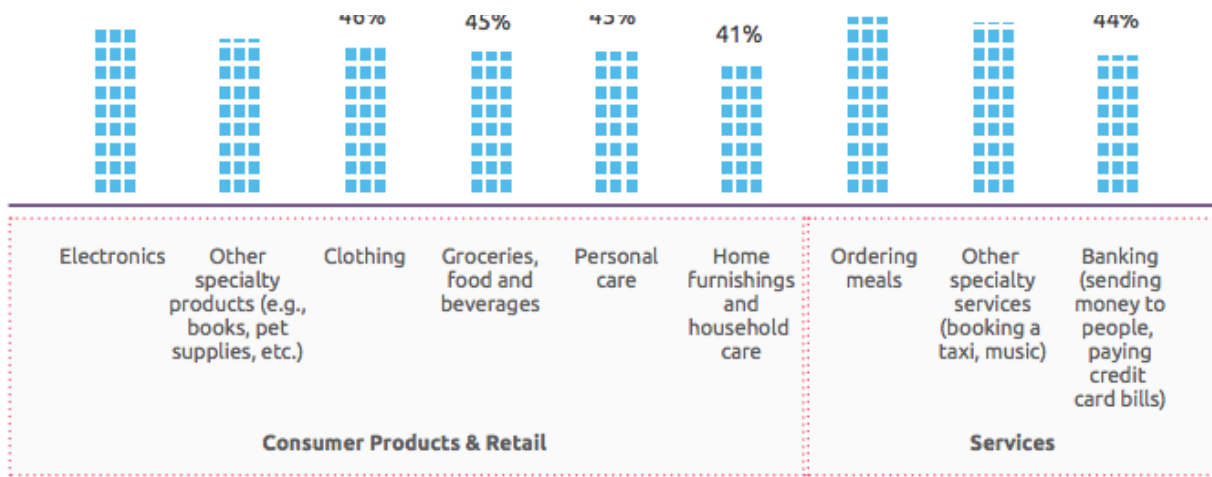
This analysis on the supply chain impacts will first look at the pressures added to the aforementioned companies creating the voice assistant-enabled products, Google and Amazon, as well as the necessary responses for companies who are selling products or services via voice assistants, such as Target and Wal-Mart.

Voice Assistant Suppliers

Companies such as Google and Amazon will have to focus on preemptively addressing future potential issues that can arise from the growing adoption of voice assistants. In particular, preventative measures must be taken to secure the technology and security behind their products as well as maintaining information collection as early as possible. Figure 3 displays the results

from Capgemini Digital Transformation Institute’s survey on consumers’ interests in using voice assistants for a number of different products and services. Between forty-one and fifty-two percent of customers are interested in using their assistant to purchase a variety of different products such as electronics, personal care, clothing, and groceries (Capgemini Digital Transformation Institute, 2018).

Figure 3. Level of Interest In Using Voice Assistants for Different Products and Services



Data Collection and Analysis

The findings in Figure 3 are in line with many of the current offerings that major voice assistants are capable of conducting. However, as this is an area where customers could be receptive to recommendations of particular consumer goods, it is imperative to collect high levels of information from each consumer as early as possible. Amazon and Google record, collect, and analyze every command given to their devices in order to better understand the customer. Amazon has created an intensive algorithm to calculate the products that a consumer would most likely want to purchase, and then creates a recommendation for that product.

Amazon collects information not only from previous purchases, but previous items that a consumer may have searched and considered, but ultimately did not purchase. On the opposite side, search giant, Google, has an immense amount of consumer information including preferences, product associations, and product relationships that have been collected since before voice assistants were released. This technology for data aggregation is already incorporated into their voice assistant products, and now with the recent release of purchasing capabilities, they will likely be able to receive even more information. Smaller or new suppliers of voice assistant-enabled products would be wise to have strong information collection systems in place prior to launching commerce capabilities. Additionally, significant investments into data centers, data analytics, artificial intelligence, and machine learning may be appropriate as well for companies who are interested in better serving their customers. In 2017, Google and Amazon made significant data center investments, raising total data center investments to \$20.0 billion from \$7.7 billion the previous year (Molla, 2018). A further analysis on how heavier investments into these areas will shape the future of voice assistants will be addressed in the following subchapters.

Partnerships

On the other side of the previous figure, around fifty percent of consumers are interested in using voice assistants for services such as banking, money transfers, taxis, and food ordering, which usually requires a partnership with another service or application. These types of partnerships are integral in expanding the number of services available to consumers, and likely companies with a larger reach with popular applications will be successful in this market. For

example, each of the companies should ensure that all of their voice assistants are compatible with major application-based services such as ride share services Uber and Lyft as well as person-to-person payment applications like PayPal. Not having these features could certainly be a deterrent for some customers as it could cause inconvenience. Having these features could be a benefit as they expand the reach and ecosystem surrounding these products.

Aside from services, partnerships with businesses to sell products are also important as well, such as Google's partnership with Target. This type of partnership will be more thoroughly analyzed from the partner company's perspective in later sections.

Cyber Security and Consumer Privacy

On top of this, since other companies would be involved in partnerships, it is important to vet each company and conduct due diligence to ensure that all parties understand consumer privacy and cyber security and the expectations and obligations. Companies who are incapable of supporting such high levels of privacy and information protection should not be considered for partnership as the liability would be also passed along to the company responsible for the voice assistant, who enabled the unsafe transaction. Recently, Facebook saw a similar issue with privacy breaches with a third-party application, but the blame fell heavily on to Facebook as the enabler of that action (Meredith, 2018). It would be wise for companies to protect customer data at all costs.

Google and Amazon also invest heavily into security measures as well. Google has recently created the technology to allow individual Google products to identify the user by voice.

This adds a layer of security for any types of transactions and protects personal details (Tsukayama, Why it matters that Google Home can now identify you by voice, 2017).

Regardless of the way consumers are using these voice assistant-enabled products, there are a few considerations that will remain universal in this market. First, cyber security must be prioritized. While having strong data collecting systems is important, it will be jeopardized if not protected properly, which could lead to serious data breaches, reputational damages, and stock declines as seen with previous security breaches with companies like Yahoo and Facebook (Meredith, 2018). With the rapid increase in the amount of information that companies are collecting and sharing about consumers, information protection and consumer privacy is paramount.

Companies Conducting Business via Voice Assistants

Aside from the companies who are making the actual voice assistant like Google and Amazon, there are also companies who are selling their products via these voice assistants such as companies who make toys, books, and beauty products that will be impacted. The major change is that they will all be competing to be the product that the voice assistant recommends when prompted by a user. Voice assistants all follow a complex algorithm created by the company to decide which products are best for the customer as well as the company. These algorithms consider partnerships, similarities between products, user reviews, price, purchase history, and other traits to find the best product to recommend. Usually a voice assistant will make the best recommendation, and if the user disapproves, it will make an additional recommendation using a similar algorithm. Although many of these algorithms are not explicitly

stated, many companies have conducted their own studies on this matter. Figure 4 shows the results of a study conducted by Bain & Company in October 2017 regarding Amazon Alexa's recommendation for products. Over a variety of items, the first recommendation was usually sponsored, a top search result, or an Amazon's Choice item, all of which will be explained in more detail. The second result, however, was usually just a top search result, which is typically a combination of search relevancy, past purchases, price, and ratings (Cheris, et. al., 2017).

Figure 4. Amazon Alexa's Product Recommendations



The following subsections analyze how companies may focus on making their products stand out by prioritizing a particular trait of the algorithm and the subsequent supply chain impacts.

Ecosystems and Partnerships

One of the major ways to compete to be the recommended product is to be part of each voice assistant's ecosystem, which is the network of accompanying products, services, and relationships surrounding a business. As previously mentioned, the largest companies creating voice assistant-enabled products have all built strong ecosystems around their products. Companies who are interested in selling products via voice assistants should choose a voice assistant ecosystem carefully. As previously mentioned, partnering with Google may win a company more product recommendations on Google products, but it may also prevent those same products from being recommended first on Amazon. For instance, Wal-Mart sells exclusively on Google and those same products will likely not be the top recommendation on Amazon if they are fulfilled by Wal-Mart (Del Rey, 2017). For companies that believe partnerships will be the key to success, it is important to consider all of the factors and relationship nuances involved in voice assistants to make sure any potentially lost sales are made up by the successes of the partnership.

Partnerships can also add immense supply chain pressures on to companies. For example, Google has been sustaining a successful partnership with Target. Through this, Google Assistant can offer two-day delivery of Target products, and in some instances, two-hour in-store pick up. Target certainly had to make improvements to their supply chain in order to accommodate this need for high response times and quick delivery (Target Press Release, 2017). However, this is also a beneficial relationship for Target as they can increase their reach to new customers and increase product sales.

In the same manner, Amazon works with sponsored products. A study conducted by Bain & Company in October 2017 suggests that Amazon regularly skips all standard

recommendations and prioritizes sponsored products as an initial recommendation if available. While the sponsorship is explicitly listed online, Alexa does not mention the sponsorship when giving the recommendation (Cheris, et. al., 2017). In this way, sponsoring or partnering with Amazon for a particular product may be an effective, albeit costly, method to win recommendations.

Lowest Price

Being the lowest priced product can be extremely beneficial. In particular, Amazon focuses heavily on offering low prices to customers and regularly favors products with low prices and high value (i.e. high ratings) to recommend, especially around holidays (Cheris, et. al., 2017). Customers may feel relatively price elastic to particular products, and these are the best ones to focus on lowering the price. These products are usually generic commodities that do not differentiate much on brand, such as bottled water or soaps or are specific products that customers likely will price compare such as televisions or toys. Bain & Company's research suggests holiday related products such as electronics, sports goods, and toys should especially consider low-price strategies (Cheris, et. al., 2017).

However, foc (Hashimzade, Myles, & Black, 2017)using on offering the lowest price requires major changes in the supply chain for these goods. Ultimately, the supply chain needs to focus on lowest cost methods at every opportunity. Low costs are usually negatively related to high levels of service and quality, which are aspects that may be important to customers depending on the product. A major way to cut costs and subsequently lower the price of a product without compromising margins would be to negotiate contracts at lower rates with

suppliers. However, tradeoffs such as longer lead times or larger order quantities could occur, leading to potential disruption to manufacturing as well as high levels of inventory holding costs.

Competing on costs is a serious supply chain strategy shift that should only be undertaken after much research and analysis. Companies should conduct market research first before deciding to compete on price as the potential decrease in service levels and quality could have negative repercussions. For instance, many people who are price sensitive for a television would still pay slightly more to ensure a much higher level of quality.

Furthermore, it is important to understand if the company and the product have the right offerings and capabilities to be able to realize synergies by competing on cost. If current supply chain systems would require significant overhaul and changes, it may be too expensive to change to a low-cost strategy and would thus lead to a longer duration necessary to realize benefits.

Finally, as a last resort, companies may also consider being a loss leader on a product if further analyses state that customers are highly price sensitive and that the product is integral to customer retention in the ecosystem. A loss leader strategy is one in which a product is not profitable, but it is still beneficial to the overall company by attracting new customers or by encouraging additional sales of products afterwards (Black, et. al., 2017). An example may be the video game industry, where consoles are sold at minimal margins, but the corresponding games and subscriptions, both of which are integral to enjoying the video game experience, are sold at much higher margins.

Highest Quality

Quality is another aspect that is important to customers when considering a purchase, and this is taken into account for product recommendations as well. For example, Amazon Alexa recommends “Amazon Choice” products approximately fifty-five percent of the time, which is decided using product ratings, sales, and rates of returns (Cheris, et. al., 2017). Companies who want to compete to be Amazon’s Choice need to be able to fulfill two-day shipping and compete on quality as well.

However, prioritizing high levels of quality involves a number of different aspects. First, high service levels are prioritized and quality checks are conducted frequently, which can be costly relative to companies who do not accomplish these tasks. High levels of transparency and data throughout the supply chain may also be necessary, which could lead to added costs in contracts with suppliers and distributors as well. Companies may also end up paying a premium to ensure suppliers are highly reputable and reliable, as risking either of these factors could lead to severe reputation damage on customers’ quality and service perception. There is likely some type of incentive available for customers as well to motivate them to review products positively online. Usually a high number of high ratings deem a product to be good quality online.

Although many of the improvements necessary to make in order to improve quality will increase costs and subsequently price, many customers are willing to pay a premium for certain products to ensure quality. The best products in this type of category would be those with strong brand loyalty or whose customers do not feel that the product could be substituted with another brand. Maintaining this high quality brand image is imperative, especially given that voice assistants are most likely to recommend a product that has already been purchased before by the consumer.

Chapter 5

Conclusion

Short Term

It is clear to see the growing changes with how businesses can communicate products to customers via voice assistants. As customers are increasingly supplementing in-store experiences with accepting an artificially intelligent device's recommendation for convenience, companies that conduct a high volume of business through these avenues should explore future accommodations to improve sales.

In the immediate future, interested businesses should research their customer preferences, understand product and supply chain capabilities, then investigate which options may be best for their particular situation. Businesses should consider pre-existing relationships and their own beliefs regarding other companies, and ultimately come to a decision regarding partnerships or sponsorships. Another option to consider may be to compete on price or quality. However, in this instance, it is especially important to examine supply chain capabilities to understand what improvements may be made and if synergies could be realized. Supply chains that do not have the capabilities to make the necessary improvements to be the lowest cost or highest quality may have a challenging time realizing significant returns on their investment. Businesses should then consider implementing possible changes reasonably quickly in order to continue to make improvements before voice assistant shopping grows exponentially and changes even more.

Long Term

In the long term, these companies are going to continue competing with their voice assistants, and they are going to continue learning new skills. These devices will grow increasingly in use and usefulness as they develop more skills and services. Both Amazon and Google invest heavily into artificial intelligence, deep learning, and device connectivity (i.e. Internet of Things). Given these investments, it is possible that these devices will be able to communicate information with each other and can make more intelligent recommendations by understanding the user and the context surrounding the situation.

The example mentioned in chapter two may look very differently with these improvements in technology. Sarah is getting ready in the morning when her voice assistant-enabled speaker reminds her that her best friend's birthday is coming up next week. Sarah then asks her voice assistant for a recommendation for a gift. It communicates with her best friend's devices and scrapes for relevant information as to what she may want, given that she has consented to having this information shared. Perhaps she has a wish list available, or the voice assistant is able to see what she has recently considered purchasing. Either way, the voice assistant processes this information and using artificial intelligence, it can make a recommendation (Capgemini Digital Transformation Institute, 2018). In this scenario, it turns out that her friend is actually not much of a coffee drinker, and it would have been unlikely for her to have a use for a coffee maker. Instead, the device recognizes that the friend actually prefers tea, and ultimately recommends that Sarah purchase a teapot. Then, Sarah confirms verbally that she would like to purchase a teapot as a gift for her friend. The voice assistant uses artificial intelligence and it searches through its marketplace to find a product that has been reviewed highly by others in a similar demographic as the friend. Again, Sarah's device is able to know

this information temporarily because it can communicate with the friend's device. Perhaps it is searching for products that are rated highly by females in their mid-20s from the Pennsylvania area. Eventually, within a moment, the device recommends a specific teapot to purchase that her friend will likely enjoy. Sarah verbally confirms and places the order. On top of this, now that her voice assistant is able to understand the context of this gift, it can even ask if Sarah would also like to purchase a card and gift bag that fits the dimensions of the item (Capgemini Digital Transformation Institute, 2018).

Overall, regardless of the changes that occur, some type of supply chain improvement should be considered to be able to cater to the ever-changing world of technology. Especially given the predictions of how rapidly voice assistants are expected to grow, companies should consider the impact on customer purchases and accommodate these changes.

Works Cited

Amazon Press Release. (2017, October 26). *Amazon.com Announces Third Quarter Sales up 24% to \$43.7 Billion*. Retrieved April 8, 2018, from Amazon.com: <http://phx.corporate-ir.net/phoenix.zhtml?c=97664&p=irol-newsArticle&ID=2311817>

Amazon.com. (2018). *About Placing Orders with Alexa*. Retrieved April 8, 2018, from Amazon.com Help: <https://www.amazon.com/gp/help/customer/display.html?nodeId=201807210>

Apple, Inc. (2018). *HomePod*. Retrieved April 8, 2018, from Apple.com: <https://www.apple.com/shop/buy-homepod/homepod>

Brown, M. (2017, December 20). *Amazon Echo vs. Google Home: One of these smart speakers is better than the other*. Retrieved April 8, 2018, from TechHive: <https://www.techhive.com/article/3243581/speakers/amazon-echo-vs-google.html>

Capgemini Digital Transformation Institute. (2018). *Conversational Commerce: Why Consumers are Embracing Voice Assistants in Their Lives*. Retrieved April 8, 2018, from Capgemini: <https://www.capgemini.com/wp-content/uploads/2018/01/dti-conversational-commerce.pdf>

Cheris, A., Rigby, D., & Tager, S. (2017, November 09). *Dreaming of an Amazon Christmas?* Retrieved April 8, 2018, from Bain & Company Insights: <http://www.bain.com/publications/articles/retail-holiday-newsletter-2017-issue-2.aspx>

Del Rey, J. (2017, August 23). *Google and Walmart are Partnering on Voice Shopping in a Challenge to Amazon's Alexa*. Retrieved April 8, 2018, from Recode: <https://www.recode.net/2017/8/23/16187752/google-home-walmart-voice-shopping-google-express-amazon-alexa>

D'innocenzio, A. (2017, October 12). *Target is joining forces with Google to take on Amazon*. Retrieved April 8, 2018, from Associated Press: <http://www.businessinsider.com/ap-target-joins-other-retailers-in-offering-voice-shopping-2017-10>

Dunn, J. (2016, October 4). *Here's How Amazon Echo Owners Actually Use Their Smart Speakers*. Retrieved April 8, 2018, from Business Insider: <http://www.businessinsider.com/amazon-echo-most-used-features-2016-10>

Enge, E. (2017, March 8). *Google Home vs. Amazon Alexa Showdown: Whiche One is Smarter?* Retrieved April 8, 2018, from Stone Temple Consulting: <https://www.stonetemple.com/google-home-vs-amazon-alexa-showdown-which-one-is-smarter/>

Gartenberg, C. (2017, July 10). *How to Shop on Amazon Using Alexa Voice Controls*. Retrieved April 8, 2018, from The Verge: <https://www.theverge.com/2017/7/10/15947672/amazon-alexa-voice-controls-shopping-prime-echo-how-to>

Hao, K. (2018, January 8). *Amazon Echo's dominance in the smart-speaker market is a lesson on the virtue of being first*. Retrieved April 8, 2018, from Quarts: <https://qz.com/1157619/amazon-echos-dominance-in-the-smart-speaker-market-is-a-lesson-on-the-virtue-of-being-first/>

Hashimzade, N., Myles, G., & Black, J. (2017). *A Dictionary of Economics*. Oxford University Press.

IHS Markit. (2018). *The Internet of Things: A movement, not a market*. Retrieved April 8, 2018, from IHS Market Whitepapers: https://cdn.ihs.com/www/pdf/IoT_ebook.pdf

Juniper Research. (2018). *Voice Assistants - The Next Advertising Battleground*. Retrieved April 8, 2018, from Juniper Research: <https://www.juniperresearch.com/document-library/white-papers/voice-assistants-next-advertising-battleground>

Kinsella, B. (2017, October 27). *Bezos Says More Than 20 Million Amazon Alexa Devices Sold*. Retrieved April 8, 2018, from Voicebot.ai: <https://www.voicebot.ai/2017/10/27/bezos-says-20-million-amazon-alexa-devices-sold/>

Kovach, S. (2018, March 2). *Amazon will stop selling Nest smart home devices, escalating its war with Google*. Retrieved April 8, 2018, from Business Insider: <http://www.businessinsider.com/amazon-wont-sell-nest-products-from-google-2018-3>

Linden, G., Smith, B., & York, J. (2018, Spring). *Amazon.com Recommendations: Item-to-Item Collaborative Filtering*. Retrieved April 8, 2018, from <https://www.cs.umd.edu/class/spring2018/cmsc644/Amazon-Recommendations.pdf>

Meredith, S. (2018, March 21). *Here's everything you need to know about the Cambridge Analytica scandal*. Retrieved April 8, 2018, from CNBC: <https://www.cnn.com/2018/03/21/facebook-cambridge-analytica-scandal-everything-you-need-to-know.html>

Miva. (2017, October 9). *The History of Ecommerce: How Did It All Begin?* Retrieved April 8, 2018, from Miva: <https://www.miva.com/blog/the-history-of-ecommerce-how-did-it-all-begin/>

Molla, R. (2018, March 15). *Google, Amazon, and Microsoft cloud businesses helped ore than double spending on data centers last year*. Retrieved April 8, 2018, from Recode: <https://www.recode.net/2018/3/15/17124300/google-amazon-microsoft-cloud-200-percent-jump-data-center-acquisitions>

Morris, D. (2018, March 3). *Amazon Won't Sell Google Nest Products*. Retrieved April 8, 2018, from Fortune: <http://fortune.com/2018/03/03/amazon-wont-sell-google-nest-products/>

Morris, I. (2017, December 31). *Google and Amazon's Childish Little fight Is Spilling Into Your Home*. Retrieved April 8, 2018, from Forbes: <https://www.forbes.com/sites/ianmorris/2017/12/31/google-and-amazons-childish-little-fight-is-spilling-into-your-home/#5228dd806fc8>

Nielsen Insights. (2015, May 3). *E-Commerce: It's an Evolution, Not a Revolution*. Retrieved April 8, 2018, from Nielsen: <http://www.nielsen.com/jo/en/insights/news/2014/e-commerce-its-an-evolution-not-a-revolution.html>

Ranger, S. (2018, January 26). *Apple HomePod: Late and pricey, but this smart speaker could still have one advantage over its rivals*. Retrieved April 8, 2018, from ZDNet: <https://www.zdnet.com/article/apple-homepod-late-and-pricey-but-this-smart-speaker-could-still-have-one-advantage-over-its-rivals/>

Simon, M. (2018, January 24). *5 ways HomePod will beat Amazon Echo and Google Home (and 5 ways it won't)*. Retrieved April 8, 2018, from Macworld:

<https://www.macworld.com/article/3250254/home-tech/homepod-vs-amazon-echo-vs-google-home.html>

Statista. (2018). *Amazon - Statistics & Facts*. Retrieved April 8, 2018, from Statista:
<https://www.statista.com/topics/846/amazon/>

Target Press Release. (2017, October 12). *Target Deepens Partnership with Google through Google Express Expansion, Voice-Activated Shopping and 2018 Target REDcard Payment Option*. Retrieved April 8, 2018, from Target.com: <https://corporate.target.com/press/releases/2017/10/target-deepens-partnership-with-google-through-goo>

Tsukayama, H. (2017, June 1). *How Apple may compete with Amazon's Echo and Google Home*. Retrieved April 8, 2018, from The Washington Post: https://www.washingtonpost.com/news/the-switch/wp/2017/06/01/how-apple-may-compete-with-the-amazon-echo-and-the-google-home/?utm_term=.3524b9fb6417

Tsukayama, H. (2017, April 20). *Why it matters that Google Home can now identify you by voice*. Retrieved April 8, 2018, from The Washington Post: https://www.washingtonpost.com/news/the-switch/wp/2017/04/20/why-it-matters-that-google-home-can-now-identify-you-by-voice/?utm_term=.732f28a4b7a9

Turner, N., Wang, S., & Soper, S. (2017, June 16). *Amazon to Acquire Whole Foods for \$13.7 Billion*. Retrieved April 8, 2018, from Bloomberg Technology:
<https://www.bloomberg.com/news/articles/2017-06-16/amazon-to-acquire-whole-foods-in-13-7-billion-bet-on-groceries>

Villas-Boas, A. (2017, December 11). *The Google vs. Amazon fight over YouTube is the perfect reason why you should buy a Roku*. Retrieved April 8, 2018, from Business Insider:
<http://www.businessinsider.com/roku-google-vs-amazon-youtube-fight-2017-12>

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- 1st Place – Sapphire Leadership Academic Program 2016
- 1st Place – Nittany Consulting Group Week 2016
- 2nd Place – KPMG International Semi-Finals 2017
- 3rd Place – PwC Challenge at Penn State 2015
- 3rd Place – Boeing at Penn State 2017
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PROFESSIONAL EXPERIENCE

PricewaterhouseCoopers

Consulting Intern – Banking Strategy, Technology, and Operations

New York, NY

Jun – Aug 2017

- Collaborated in identifying a target operating model and implementation plan to streamline and update the commercial lending process to prepare for future government regulations for a bank nearing \$50B in revenue
- Constructed process flows to reflect requirements gathering workshops as well as staffing models to estimate costs for a bank with over \$150B in revenue
- Created final RFP deliverables to be used at conferences with executives, ultimately resulting in winning client work
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Nittany Consulting Group

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- Formulated a three-year growth strategy for MorganFranklin Consulting, a 250+ employee firm with federal and commercial offerings, by analyzing FinTech and SaaS industry trends
- Recommended geographic growth opportunities, analyzed current competitors, and identified potential clients in order to provide insight for future growth plans
- Collaborated with the executive board and faculty to continuously develop and increase consulting opportunities

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- Collated data involving 13 electronic manufacturers via government-industry databases to find the effects of counterfeit or defective parts in the overall lifespan of specific electronics, alongside two professors

LEADERSHIP EXPERIENCE

LionTutors

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- Lectured microeconomic concepts to upwards of 100 students at a time in 4+ hour long sessions to improve student performance in exams and assignments
- Customized teaching methods to cater to individual student needs resulting in a better learning environment, strong positive feedback, and increased demand for tutoring

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