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## Accounting Implications Derived from Consumer Big Data

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ACCOUNTING IMPLICATIONS DERIVED FROM CONSUMER BIG DATA

by

Benjamin Boehrns

A Thesis Submitted in Partial Fulfillment  
Of the Requirements for the  
University Honors Program

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Department of Accounting  
The University of South Dakota  
May 2021

The members of the Honor Thesis Committee appointed  
to examine the thesis of Benjamin Boehrns  
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## ABSTRACT

### Accounting Implications Derived from Consumer Big Data

Benjamin Boehrns

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Consumer big data is changing the traditional framework of business by providing an unprecedented amount of information regarding consumer behaviors. Technological advances of the twenty-first century have enabled businesses to collect these behaviors within automated processes. The ease of data creation has led to companies creating, storing, and analyzing voluminous subsets of data in order to achieve a higher degree of competitive advantage. These datasets not only derive value from the physical information technology systems that provides the storage and the ability of analysis, but also contains an intrinsic value that is rarely captured within traditional accounting methods. The unique subsets of attributes and analyses that companies are generating from their customer databases, produces the intrinsic value within consumer big data. However, the intangible aspects of consumer big data are not recognized within financial statements leading to understated assets. Undervaluation is one of many challenges that faces the widespread usage of consumer big data. Businesses may begin to implement consumer big data into their decision-making processes in order to stay competitive within the information age. As consumer big data's usage increases, it will require changes to the current accounting framework with regards to: data system requirements,

big data analytics, valuation of consumer data, auditing standards, and privacy regulations that protect consumers' personal information.

**KEYWORDS:** Consumer big data, valuation, auditing standards, accounting education

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## **CHAPTER ONE**

### **Introduction**

Imagine operating a business that understands customer's preferences based on analyzing trends and historical data that is provided by each customer. Having the ability of offering substitutive products or services when a customer may be displeased with their current selections in order to maximize customer satisfaction. Businesses that have the tools necessary to complete this objective obtain a competitive advantage which increases sales, leading to higher profits. Through the increased usage of consumer big data, this may all become possible when implemented adequately with the appropriate equipment. As more individuals have the ability to gain access to technologies allowing data creation, businesses will develop procedures to capture the data and perform analytical measures which could lead to predictive results of various financial features. For example, Amazon in 2016 had two-hundred and seventy-eight million customer accounts that provided a large amount of information which could be analyzed based on purchasing behaviors (Wedel and Kannan 2016, 102). As consumers become increasingly comfortable with providing specific attributes to online retailers, the amount of data collected from consumers will increase exponentially as each additional attribute will be extrapolated per the number of customers that a business collects data from. Businesses will need to implement consumer big data into their decision-making processes in order to stay competitive within the information age. The increase of consumer big data utilization will require changes to the current accounting framework

with regards to: data system requirements, big data analytics, valuation of consumer data, auditing standards, and privacy regulations to protect consumers' personal information.

## **CHAPTER TWO**

### **Definition of Consumer Big Data**

Big data's definition continues to evolve dependent upon which innovative technologies are available during a specific time period. For example, prior to the widespread use of personal computers, the world's largest libraries may have been viewed as that era's "big data". Due to the sheer amount of knowledge within that particular facility when compared to information that is readily available to an individual. As the amount of information generated per day continued to increase due to companies such as Microsoft or Apple creating computers and other devices (i.e., cellphones, iPods, etc.) to be more accessible to the general public. The definition of big data appears to resemble how modern scholars have defined this era's large volumes of information. Big data is defined utilizing four particular features which differentiate it from any other type of data: volume, variety, velocity, and value (Dai et al. 2019, 99:2). It appears that other scholars are willing to interchange the fourth characteristic with another, equally as important term known as veracity (Cao et al. 2015, 423). It is important to include all five of these characteristics when defining big data because each of them provide additional insight into the complexities that revolve around such a convoluted topic.

Consumer data can be related to most forms of communication between a customer and a business. This may be in the form of product reviews, questionnaires the consumer filled out in order to purchase the product, shipping addresses, quantities purchased etc. (Noort et al. 2020, 416). However, businesses are collecting additional

demographics on consumers through the usage of background applications such as website cookies which enable the collection of the consumer's social media activity, website histories, amount of time spent on each webpage, etc. (Steinberg 2019, 97). This enables an almost limitless number of attributes that businesses can collect regarding their customers which then leads to an unconceivable amount of data being collected per participating online businesses. Thus, the first key characteristic of big data has been recognized: volume. It is widely accepted that the sheer size of the data collected on consumers regarding terabytes to petabytes contributes to the unique opportunities that big data holds for its users (Wedel and Kannan 2016, 102). As technology progresses and allows for more attributes to be collected by businesses, the amount of data will increase proportionally. This leads into the second characteristic of big data which focuses on the different methods of data collection: variety.

The different attributes that businesses are collecting from consumers leads to numerous types of data entering their databases. Questionnaires are the most common method businesses use to obtain useful information about their customers. These can be associated with the information given when a customer creates an account or is completing a purchase with regards to an online store. This creates what is known as structured data due to the various fields (i.e., name, email address, phone number, etc.) containing the appropriate information as labeled per the field name. However, businesses are tracking much more data than what basic questionnaires can collect. Consumers are providing an information trail through the means of texts, consumer reviews, social media posts, etc. which provide businesses with a form of unstructured data (Guha and Kumar 2018, 1724). This textual data is deemed to be unstructured due

to the nature of various writing styles of individuals which contributes to additional difficulty when analyzing data. Furthermore, businesses have also begun to collect pictures and videos posted on social media in order to obtain additional insight regarding customer relations (Noort et al. 2020, 416). These various forms of data (structured, unstructured, images, etc.) are attributed to the “variety” characteristic of big data. Businesses who can optimally utilize various forms of data are leveraging more opportunities that are available through the usage of big data.

Another characteristic which helps to define big data relates to the speed of the data creation: velocity (Cao et al. 2015, 423). Velocity is a crucial component of big data as it provides a holistic meaning to volume. As volume is with relational to the sheer amount of data being collected, velocity can be explained by the frequency that the data is collected. Most people relate this to the number of customers that provide information in the forms of questionnaires from online shopping. This form of big data did not exist even a few decades ago when consumers would shop at their local stores which may only provide transactional data to the business. The potential speeds at which data is created is only possible with the successful implementation of computers and wireless devices which generated an unprecedented amount of information to be collected (Dai et al. 2019, 99:2). By combining the flexibility of shopping anywhere with an internet connection with the short amount of time for consumers to fill out a questionnaire, post a tweet, click “like” on another social media post, etc. the possibility has been created for a large subset of data to be collected at a relatively fast pace. In addition to data submitted by customers manually, additional data can be collected in an automated manner through tracking web histories, or social media posts (Vasarhelyi et al.

2015, 385). The information may be readily available; however, businesses must be able to extract relevant data which can be used to aid decision-making. The benefits that consumer big data can provide to businesses which correctly implement it are immense which leads to the next characteristic: value.

As the business models of the modern age focus on increasing service quality through high customer satisfaction, fast delivery times and high product customizability; businesses must enact each feasible advantage that is feasible in order to stay competitive in markets with increased costs associated to customer satisfaction. Each of these improvements to the customer experience are costly to organizations therefore motivating them to pull every inch of profitability from various sources which nevertheless has contributed to the vast growth of the data analytics with regards to consumer opinion data. The National Institute of Standards and Technology (NIST) has deemed the term “data science” as the “extraction of actionable knowledge directly from data through a process of discovery” (NIST 2015). The proper utilization of data science brings forth the numerous opportunities allotted by the collection of consumer big data. Without the ability of retrieving usable information trends from the big data generated from consumers, there would be no benefits of investing in such a technology. Businesses derive value from the data that they collect from their consumers by creating meaningful predictions with relation to product demand, or by identifying business channels in need of improvements (Chong et al. 2015, 5142). One may argue that this is an intuitive aspect of any sort of action that a business may invest into. No business with any sort of going concern principle driving their functions would invest into facets that would not be beneficial in some sort of manner. For that reason, there is a general consensus with

regards to the value attribute as being self-explanatory. However, discussing the various benefits that consumer information may bring to a firm is an important step in understanding the value of investing in such technology. Nevertheless, businesses will find that some of the data that is collected is unusable or not as valuable as other forms of data which helps to explain the fifth and final characteristic of big data: veracity.

When viewing the review section of products, there is always one person in the world who may leave a review which does not pertain to the product in any conceivable way. Individuals may provide false information with regards to various demographics most notably with age. These, along with various other reasons are what gives consumer big data an adequate amount of uncertainty which scholars have deemed as “veracity” (Sridhar and Fang 2019, 980). With any product or service, there will be a portion of the goods (or time in reference to a service) which may be unusable or below quality standards leading to waste. For example, a house builder will attempt to minimize waste with regards to the wood being used for buildings walls. However, there is sometimes unavoidable scraps as the result of framing a house, or even collecting consumer data for future use. Furthermore, as a framer could possibly change some of the measurements or improve the plan to minimize the amount of waste, the same can be completed by a business in order to reduce the amount of unusable information that is collected. There are various methods of completing this which will be discussed in a later section. Nevertheless, the organizations that can reduce this information waste when implementing collection of consumer big data will earn higher returns on their investments in the data technology. This will in turn create a higher value that big data is

bringing to the business thus creating a higher motivation to continue to invest and improve the technologies in order to obtain a competitive edge.

Consumer big data is a unique technology which provides different amounts of benefits and is primarily based on the implementation techniques of the business. Some business leaders may be weary of big data due to the complexity of analyzing it, the cost of the equipment required in order to implement it correctly, or various other reasons. The key component of implementing a profitable usage of big data is without a doubt, the data system infrastructures that are purchased in order to perform the complicated algorithms to achieve some sort of beneficial insights. These infrastructures may include the specific hardware that is being used such as servers, computers, etc. along with software which is being utilized to sift through the large volume of data being collected from a business' consumers. The value that big data can bring to an organization becomes virtually zero if there is not sufficient technology implemented which can utilize the data to its fullest capacity. Additionally, if the cost of acquiring the data is more than the potential benefits from analyzing the data, then it does not follow financial reasoning to continue with the endeavor. Businesses spend time and money on developing their data systems in order to retrieve useful information from the analyzing of the consumer big data. This is exactly what makes the data systems management of an organization an important aspect which must not be overlooked when implementing the usage of consumer big data.

## **CHAPTER THREE**

### **Data Management System**

Businesses have been forced to modernize with the advent of various systems needed in order to collect, store, and analyze the influx of data generation throughout the twenty-first century. Data infrastructure developed into enterprise resource planning systems (ERPs) which fosters integration between the various facets of business (i.e., finance, operation, supply chain management, human resources, etc.) to improve efficiency throughout the entire organization (Guha and Kumar 2018, 1731). ERPs were a partial solution to the decentralization of information throughout an organization by providing a framework for different disciplines within a business to utilize the same program in order to obtain necessary information that the business may need. This fostered collaboration between the business functions which was significantly more difficult before ERPs were implemented. For example, instead of human resources requesting information from finance with regards to budgeting for employee expenses, perhaps management within human resources can just pull current budget reports and analyze each department's current financial position. These advantages of ERP systems are continuously used in today's business world, however there are limitations that prevent businesses from implementing big data without investing additional capital into their data management systems.

The key challenge that a data management system must overcome when analyzing big data are the issues regarding unstructured data. Scholars have estimated

that roughly ninety percent of big data is in the form of unstructured data which creates an overwhelming challenge of finding a system which will properly analyze the data (Warren et al. 2015, 398). Businesses have begun to adopt big data analytics (BDA) systems as a solution to the variety obstacle of consumer big data. Oliver Müller and et al. stated in their 2018 article, *The Effect of Big Data and Analytics on Firm Performance: An Econometric Analysis Considering Industry Characteristics* that “In contrast to traditional data warehouses optimized for processing structured numerical data in batch mode, these [Big Data Analytics] technologies are also designed to handle unstructured (e. g. , from social media) and streaming (e. g. , from sensor networks) data” (496). In order to understand the difficulties that unstructured data imposes onto a data management system, businesses must first develop adequate knowledge of the processes that the system must perform to take advantage of the opportunities posed by big data. These processes include: data generation, storage, retrieval, and analysis.

As previously stated, generation of consumer big data occurs through the interactions between consumers and businesses. These can be direct relationships in the form of questionnaires or indirect relationships in the form of background applications obtaining information on a consumer’s website history, social media, etc. The opportunities to collect consumer data will continue to increase at unparalleled amounts due to the advancements of personal computing and digital mobile devices (Noort et al. 2020, 421). Furthermore, the increased generation of data has forced businesses to invest more into their information technology (IT) infrastructure in order to adequately utilize the high volumes of information from their consumers. The first obstacle that must be

handled is the difficulty of ensuring that systems can sufficiently store the astronomical amounts of data that is being produced.

Data storage is a necessary component in any IT infrastructure due to the aggregation of datasets. Datasets can be defined as the system which is responsible for storing and managing the data in order for the information to be utilized at a future date (Dai et al. 2019, 99:4). This creates the ability for businesses to collect data throughout a year and use the combined datasets in order to create correlations between various trends within the data and their success or lack thereof regarding firm performance. Without data storage, the entire IT infrastructure would fail since the vast majority of data that is being generated is not utilized until a later date. However, data storage systems have challenges that the company's IT personnel must keep in mind while deciding on which systems will suite their needs. Dai and et al. summarize these challenges in their 2019 article, *Big Data Analytics for Large-Sale Wireless Networks: Challenges and Opportunities* to include: reliability, scalability, and efficiency (99:13-99:14). Reliability revolves around the amount of trust that can be placed into the storage infrastructure. If the investments into data generation are to be made, businesses must ensure that the collected data will be available for use at a later date through the means of adequately safe storage. The next difficulty of scalability pertains to the issues of expanding storage exponentially to match the growth of data generation. Traditional relational databases struggle with consumer big data due to its voluminous nature (Wedel and Kannan 2016, 103). Efficient storage systems must have the ability to scale appropriately with the unprecedented increase in data generation or businesses would simply create more data than they have the ability to adequately provide storage for. Lastly, efficiency describes

the ability of the storage system to perform various tasks such as initial storage, retrieval, and analysis. Traditional data storage methods which may use more standard software packages may struggle with performing tasks at an unacceptable rate of speed (Johnson et al. 2018, 27). Storage systems that can store high volumes of data are virtually useless if retrieving the data takes an amount of time that is infeasible for day-to-day operations. Simple analyses of datasets as large as seen in consumer big data must be able to be completed within a reasonable amount of time in order to be useful to the organization. The most time-consuming sets of data to analyze is the unstructured consumer data collected from reviews, social media, among other sources which creates an important requirement of any data management system that is being used to analyze consumer big data. These systems must have the ability to accurately transform unstructured data into a format that is readily usable for any sort of analysis.

Despite the significant advances in computing, software struggles to accurately identify important aspects of individual's writing styles. More recently, some of these issues have been alleviated with the emergence of text analytics. For example, this may include identifying positive reviews of a product versus if the consumer was not pleased with what they received. Scholars have successfully implemented solutions such as WordNet in order to accurately depict the underlying meaning of consumer reviews (Jin et al. 2016, 3026). By giving consumer reviews an additional, opinion-based dimension, such as adding a "positive" or "negative" attribute allows for further analyses of the consumer data with the goal of finding correlations. WordNet allowed Jin to automate the process of depicting customer experiences as positive or negative with particular products by using keywords within a consumer review. Sentiment analysis is by no

means a perfect system as some reviews contains words that are somewhat neutral such as “decent”, however this is a great step in transforming unstructured data into a more structured format. By giving additional attributes to unstructured data, businesses can better understand the percentages of “positive” reviews which would not have been possible before by simply storing the consumer reviews within their databases. There are many other methods available in order to aid in the transformation process of unstructured data, most notably, taxonomy. Taxonomy classifications are currently used when transmitting financial information into formats such as XBRL in order for immediate analyses to be conducted without requiring any additional reformatting (Cho et al. 2019, 4). These classifications are required in order to map out the accounts that a company may use to the appropriate financial statement field which is necessary due to businesses possessing vastly different structures for their chart of accounts. For example, a retail business may have the contra revenue account of sales discount and another retail business may use wholesale discount. If these were uploaded solely based upon their names, analysis conducted by external users may not be able to identify each iteration of sales discount that each business utilizes. This mapping system is similar to creating relational databases that use foreign keys throughout the tables in order to create relationships between the tables. These transformation processes among other requirements of data systems that are being used to analyze big data would not be possible without the combination of current in-house database management systems and additional systems that are more aligned to utilize consumer big data.

Businesses should not disregard their current systems for the sole reason of wanting to implement more usage of big data. Legacy systems may be more capable of

aiding various business functions through pulling financial, or employee information while big data management systems are more closely aligned with storage and analysis of high volumes of data. Current ERP systems allow businesses to improve the efficiency of their current practices while big data management systems allow organizations to search for new innovations to improve various facets (Müller et al. 2018, 491). In order for analysis of consumer big data to be conducted, Müller also argues that traditional ERP systems are necessary for providing employees with basic database skillsets while also perhaps providing additional information such as customer service statistics, manufacturing analyses, etc. Scholars have also coined the term data ecosystem, which provides the necessary context of understanding the intricate workings of these complex IT infrastructures which utilizes a plethora of data management systems to achieve their goals (Cho et al. 2019, 2). Business leaders may hesitate to utilize big data due to the incorrect notion of needing to rebuild their data infrastructures entirely. However, this cannot be any further from the truth since many traditional systems provide support to recently developed big data systems. However, there may be a requirement of a substantial investment in capital and trainings in order to adequately implement the usage of consumer big data. This may lead to a desire to outsource particular data infrastructure needs in order to prevent immediate investments.

Outsourcing any sort of business function has been a common solution throughout the business world. This may be a suitable option with regards to material manufacturing however it can become quite costly in the realm of data management. Several companies such as IBM, Teradata and others are selling services that help businesses with the challenges associated with implementing big data systems (Cao et al. 2015, 427).

However, users of these services may pay a premium for additional services provided by the outsourcing firm. This may be a viable option for businesses with low amounts of cash available, however, businesses that have the funds will want to invest into their own systems and expert employees in order to benefit from larger margins from the implementation of consumer big data. Additionally, outsourcing may raise the issue of privacy integrity with regards to consumer data that can seem to be quite intrusive. Nevertheless, there are many benefits with outsourcing database necessities, especially for much smaller businesses who do not have the resources to implement costly big data systems. Outsourcing would allow these family-owned businesses to still remain competitive by utilizing the advantages of big data while also providing a framework for them to afford the new tools available to them. Additionally, without proper knowledge of database systems or analytics, businesses may find themselves spending even more capital trying to implement their own system rather than simply outsourcing. In order to make the correct decision to outsource or not, businesses must understand the benefits of utilizing big data analytics (BDA). This will give business leaders the courage of spending the appropriate amounts of cash to receive the potential benefits that big data analytics may provide.

## **CHAPTER FOUR**

### **Big Data Analytics**

Once businesses have aligned the appropriate systems to generate, store, and retrieve consumer big data, the next step is employing big data analytics in order to decipher important information which will determine future strategic decisions. Scholars have defined big data analytics as “the process of inspecting, cleaning, transforming, and modeling Big Data to discover and communicate useful information and patterns, suggest conclusions, and support decision making” (Cao et al. 2015, 424). Big Data Analytics provides organizational value to data collected from consumers. Business leaders would receive no benefit to receive only a large database of consumer data without the tools to create correlations between the business’ success and identifiable demographics. By utilizing big data analytics, businesses can expand their knowledge prior to decision-making by identifying customer behavior or preferences between different product lines (Jin, et al. 2016, 3024). Big data analytics is a necessary component for businesses to utilize the competitive advantage of consumer data which is needed to maintain current market shares. Researchers have found that by adopting “data-driven decision making”, companies have been able to increase their output by five to six percent higher than initially expected (Müller et al. 2018, 492). However, these researchers' conclusions relied on the notion of decision-making supported by additional data positively impacted manufacturing output, this same trend could be applied to other types of businesses such as retail. Increased actionable information will without a doubt increase employee

productivity, quarterly sales, or whichever other metric a business may use to track their performance. Organizations have attempted to take advantage of the benefits associated with increased information which began with the traditional consumer survey.

In essence, traditional consumer surveys were the first step towards the modern consumer big data movement throughout business leadership. They were employed in order to gain additional insight into consumer thoughts about specific subjects (i.e., product reviews, customer service satisfaction, etc.). Businesses have begun to understand that there were fundamental challenges that traditional customer surveys simply could not overcome within the consumer big data environment. Businesses can employ various background applications in order to track consumer's website histories, social media perspectives, or other facets of consumer opinions at a much higher rate of generation that simple traditional survey methods just cannot do (Sridhar and Fang 2019, 981). This mass data generation is also done without the input of the consumer which essentially guarantees that an individual who visits the company's webpage will contribute to the database. Traditional surveys require the consumer to spend the time and energy of filling the survey out in order to obtain any additional usable information. Furthermore, traditional surveys will only obtain information on the specific questions that the business utilizes within the consumer surveys. Big Data Analytics can include various inlets of data in order to strengthen various analytical conclusions such as consumer data, weather data, census data, etc. (Warren et al. 2015, 401). These adaptations provide flexibility within the big data analytics systems which allow for nearly infinite data components to provide more advanced information for decision

making. Businesses who are skeptical of big data analytics may choose to employ similar tactics with the most notably being consumer sampling.

Without recent technological advances, analyzing trends within an entire dataset which contains high volumes of data would be simply unheard of. It is resource intensive and often impractical to comb through billions of records within an adequate amount of time without significant help from modern technology. This is the primary reason for the birth of sampling. Random sampling attempts to create the perfect segment of a population that is adequately reporting all aspects of the whole population that a sample is representing. For example, a business may have one hundred thousand customers. However, the business may only have the technology to gather product information on one thousand of their customers. Now the one thousand customers who submitted a product review could show that ninety percent of the reviews showcase high customer satisfaction while the remaining ten percent represents disgruntled customers. Should the business leaders use this information to enhance their decision making? Does this sample of only one percent of the total customer base showcase that the population overall has a roughly ten percent dissatisfaction for whichever product that is being reviewed? As with any predictions, there are margins of error which help explain why samples sometimes do not represent the population as a whole. Additionally, those differences could be more dramatic in the case of consumer data and businesses due to the inability to create a true “random sample”. Based on traditional surveys, consumers who are more likely to fill out a survey could perhaps be biased toward satisfied customers. This is a dilemma that scholars have identified and have argued that the margin of error (i.e., variance) can be reduced from using a larger volume of data within the analyzing process (Wedel and

Kannan 2016, 104). Consumer big data's characteristic of voluminous data aligns with this proposition accurately due to simply having more of the customer base's opinions within the analytical calculations. Wedel and Kannan go on to state that "large volumes of data will support richer representations of data-generating mechanism (DGM)" which DGM could also be referred to as data-generated insight (Wedel and Kannan 2016, 104). Essentially, the larger pool of data that a business can obtain data from, the more accurate assumptions can be made from trends identified from that data. This is the exact reason as to why big data analytics is so appealing. Business leaders need accurate information when making important product decisions such as customization, price, shipping terms, and so forth. Natural markets that businesses and consumers are involved within contain a level of information asymmetry that can affect decisions from both companies and customers. Big data analytics is a possible solution to reducing the amount of information asymmetry for businesses which allow several benefits to their customers such as lower prices, personalization, etc.

Information asymmetry is prevalent throughout any natural market, a prime example is transactions within the banking industry. When individuals request a bank loan, they are required to give the bank a plethora of information regarding income, credit history, etc. This provides the bank with additional insight into the customer's (person requesting a loan) motivations with regards to repaying the loan. Correlations can be created between this market and the market of a retail business and one of their customers. By obtaining additional information through various big data analytic techniques, business may be able to more accurately predict satisfaction levels which may lead to an accurate estimation of customers who will purchase additional products

(Warren et al. 2015, 400). Furthermore, techniques with the goal of limiting information asymmetry can be expended towards other predictions such as product demand, returns and allowances, warranty estimations, etc. In recent headlines, Target elicited criticism when their analytical teams accurately predicted a teenager to be pregnant prior to her creating any sort of baby's wish list or any other predictor that reveals the pregnancy (Sidgman and Crompton 2016, 172). However, big data analytics can be seen as more invasive than is necessary which may incite legislation to regulate the enormous one-sided system to improve the standing of the consumer. The issues of privacy and willingness among other things will be discussed later, but it is important to address that within current statutes, business can improve their understanding of their customer opinions through the usage of big data analytics. In order for businesses to utilize the benefits that can be found within big data analytics, the IT infrastructure must include a system of visualizing the results of the analytical tests.

The dire need of a visualization can be represented with regards to a computer and its operating systems such as Windows by Microsoft. Windows provides a graphical user interface (GUI) for consumers to interact with while utilizing their personal computers. Without this interface, consumers would be required to have knowledge to use command line terminals in order to complete a simple task such as opening a web browser. This same issue revolves around big data analytics. If there were no applications to create readable visualizations of analytical insights, users would need to have data expertise in order to interpret the results of the massive consumer data collection. Scholars have also argued that big data analytics systems would not be able to function properly without dedicated data visualization systems (Tang et al. 2017, 1128). This creates an

environment of intricate data systems that act together in order to obtain the competitive advantage of collecting massive amounts of consumer data. Business leaders may be discouraged regarding implementation of these systems since they need to create operational data generation, storage, analytical, and visualization systems in order to obtain the benefits of consumer big data. However, the businesses that choose to complete these tasks and implement successful big data analytics systems obtain incredible value from the data that they collect from their consumers. Furthermore, consumer data contains value which is arbitrarily based upon the success of the implementation of the big data system. This leads to the next important discussion of identifying an appropriate standard of valuing consumer data within a company's financial statements.

## CHAPTER FIVE

### Valuation of Consumer Big Data

The valuation of business assets is a process that has long been shrouded with being characterized as convoluted. Valuation in itself is one of the facets of life that is hard to describe accurately for every situation. Some have defined value in the economic sense as being what someone else would be willing to pay in order to receive the object which is being measured for its valuation. Before discussing possible remedies, which could be used within the valuation process of consumer big data, people must understand the typical standards which drive the valuation of assets. Fair market value is deemed to be the appropriate price at which an item should be sold for between two willing parties. The Financial Accounting Standards Board (FASB) indicates that “fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date” (FASB, ASC 255-10-20). This valuation would occur on the date of sale (i.e., the measurement date) and becomes the motivator for a particular price within the transaction. Fair market value provides a system for assets to appreciate or depreciate depending on factors such as upkeep, improvements, etc. Furthermore, the price to which a business would pay for an item would then become its related cost, subsequently its “value” within the organization. This notion is conceived within the historical cost principle which sets the value of an asset within the company’s financial statements as equaling the price paid for the asset (ASC 255-10-20). Nevertheless, these explanations are sound for assets that are

transferring between two unrelated parties. The same principles do not apply unilaterally for assets that are being created within an organization.

Manufacturing firms have inventory accounts for tangible property such as raw materials, work-in-process, and finished goods. The valuation of each inventory account is based upon the cost of inputs that had created the item to be placed within their respective account. For example, a manufacturing plant may place into their finished goods inventory account an average of one hundred units. The cost derived from each finished unit would comprise of the amount of raw materials and labor units utilized in order to manufacture the one hundred units. This is a continuation of the historical cost principle which showcases that the cost of a finished unit is comprised of the cost of each of the parts within the unit. If the business paid a dollar for raw materials and two dollars for the labor associated with manufacturing, the total cost represented within the finished goods inventory account would equal three dollars multiplied by the total number of units that were finished. It is important to understand that this simplistic example is used to only showcase the accounting principles in question, not to act as a representation of manufacturing firms' inventory accounts. It becomes much more complex with multiple product lines, raw materials, and labor units. However, it is necessary to derive from this explanation that the value of assets which is created within a company is based solely on the historical cost of its units. The question may be asked to which valuation method should be used for assets that are derived within a company that may not have any sort of historical cost. This is the challenge that businesses face who generate intangible assets from within their operations.

Arguably the most notable intangible asset on common financial statements is in the form of goodwill. Scholars have deemed goodwill which has not been recognized through a sale as internally generated goodwill (IGG) (Paugam et al. 2018, 382). Internally generated goodwill is essentially the intangible asset within a business which arises from specific and unique management practices, brand images, customer relationships, etc. The only notable difference between goodwill as seen on franchisee's financial statements and internally generated goodwill is that the value of the intangible asset has not yet been realized. Goodwill is the benefits from a particular business which some may see as a valuable investment into the purchasing transaction of a business. For example, a local car shop may sell their business at a premium which would indicate that after all of the fair market values of each asset has been summed and their liabilities have been subtracted, their asking price would be higher than what the business' financial statements show it is worth. This extra price being paid by a customer is what is known as goodwill. Goodwill is only recognized upon realization through the sale or acquisition of the business (Paugam et al. 2018, 385). Purchasers who are willing to pay above fair market value for businesses must be gaining some sort of benefit. Any intangible asset is difficult to apply a standard of valuation prior to the realization, and consumer big data highlights this issue. The first step in creating a solution to this challenge is determining the asset class of consumer big data.

Consumer big data has been developed between the current standards of accounting principles. Some may argue that the data is tangible due to it being held within servers or other specific equipment, thus making it an tangible product. Scholars have found that data meets the criteria of an intangible asset primarily because it lacks

physical substance, is separated from goodwill, and can increase future economic benefits (Sidgman and Crompton 2016, 171). The valuation that is derived from any sort of intangible asset is on the basis of increasing overall profits within the foreseeable future. If this did not occur, businesses would not be sold at a premium thus incurring goodwill, nor would companies invest into collecting massive amounts of consumer data. However, this value is not being recognized within businesses' financial statements unless the data were purchased from data aggregation firm. If this were the case, consumer data would be simply valued at the cost of purchase. Often times, the business itself is generating the large sets of consumer data which leads to financial representation to be undermined due to these large unrecognized intangible assets (Sidgman and Crompton 2016, 170). By continuing this practice of not recognizing internally generated intangible assets, financial markets are under-informed which may lead to misleading financial markets.

There are several methods of accurately depicting the true value of an asset without the need of a realization transaction. Researchers have argued that by analyzing the future economic benefits which may arise from particular intangible assets may be a great starting point in order to understand the true impact of the asset, this is deemed as the "income approach" (Sharma 2012, 63). Unfortunately, determining the economic impact of consumer big data is more of an estimate than what is typically allowed within accounting standards. As iterated above, the economic value of consumer big data depends on numerous factors with regards to the consumer base, IT infrastructure, big data analytical methods, etc. Scholars have agreed that consumer big data must be valued based upon the accurate insights that the entire analytical system can create rather than

based upon its “volume, velocity, or variety” (Simsek et al. 2019, 972). This leaves consumer big data within a unique limbo which leads to the data not holding any sort of valuation due to the fear of over-valuation. However, there is a possible solution that may address each of the concerns while still allowing for businesses to report a portion of the value within their financial statements.

Following the income approach of valuation, there could be a form of estimation that allows for an accurate representation of consumer big data value. First, the IT infrastructure that is purchased in order for the data to be analyzed is without a doubt already classified as an asset on balance sheets. These systems are no different than personal computers that are used by employees. This discussion is solely for the valuation of the large datasets of consumer data that modern businesses have begun to collect for a competitive advantage. It is nearly impossible to predict the exact future economic benefit that a dataset of consumer demographics would provide to the company. Just as the numerous amounts of benefits which are allotted by implementing consumer big data, there are just as many challenges that inhibit the efficient usage of the data analytic system. Furthermore, the useful life of the data may become dependent on external factors such as competition, technological improvements, knowledge of IT experts, etc. (Sidgman and Crompton 2016, 172). However, a beginning portion of understanding the value of consumer big data can utilize the historical cost principle which is showcased throughout tangible and recognized intangible assets. The costs of generating consumer data such as webpage development, questionnaire development, etc. may be used in order to determine a basis for valuation. Additionally, there may be an estimation process involving revenues prior to utilizing consumer big data while still

adjusting for natural increases in market share. For example, a business could determine the average increase of revenues from several previous periods, then compare the average with the change in revenue during the period of big data implementation. Without any identifiable differences of business practices which may naturally increase revenues (i.e., acquisitions, production increases, etc.), the increase or decrease change in revenue when compared to previous periods may be utilized as an approach to deliver some form of valuation upon consumer big data. This solution would address the efficiency of implementation by only recognizing an estimated amount of the change in revenue which would likely reflect the company's implementation success. Furthermore, applying these estimation standards would allow businesses to increase their net assets on their balance sheet which may have dramatic effects throughout financial measures. Although, this would create an additional workload for auditors charged with ensuring the accuracy of financial statements. The increased amount of estimation may lead to manipulating the value of their internal generation of consumer big data in order to achieve unethical advantages. Additionally, external users may not be educated within such valuation methods, leading to distrust towards the financial integrity of firms who generate large amounts of consumer data. This is an important issue which auditing standards would be required to address in order for consumer data to be recognized within the balance sheet prior to the current standard recognition process.

## **CHAPTER SIX**

### **Auditing Standards**

Implementing consumer big data will without a doubt, require substantial changes to current auditing standards. Assets are of increased interest to auditors since over valuation of total assets may lead to an overstatement for equity, thus increasing stockholder's equity. Allowing businesses to recognize internally generated consumer data as an asset will lead to extensive auditing processes in order to ensure valuation estimations are correct. Nevertheless, there are possible advancements to make within the auditing profession by utilizing consumer big data as an approach of increasing the certainty of management assertions. Auditors may implement the same big data analytic techniques on various datasets such as consumer data, transactional data, etc. This would decrease the variation which can be found within transactional sampling methods which are common practice today. The first obstacle that the auditing profession would need to overcome is the financial statement impact that valuing internally generated consumer data may have on external users.

Regardless of the valuation method used in order to accurately represent the future benefits from consumer big data, there will be management assertions that auditors would be required to assess. Intangible assets tend to be of higher scrutiny due to their inherit subjectivity, especially when there is little to no recognition of internally generated intangible assets (Kohlbeck and Warfield 2007, 23-24). This is because estimation of future economic benefits is a very difficult task to complete in a

standardized method. However, for the sake of this paper, the assumption will be made that accounting principles allow the above estimation process for internally generated consumer big data. Auditors would need to complete the same estimation calculations that management had done in order to provide an adequate amount of assurance to external users. In addition to confirming the estimation assertions for consumer big data, auditors would need to inspect the data and systems itself. This would ensure that companies are not creating fraudulent data in order to increase their total assets, or even perhaps ensuring that consumer data is privately held within a company. The inherent value of consumer big data is found within the aggregation of several attributes about a specific businesses' customer base. It is conceivable that the data would lose value if it was readily available to other competitors (Sidgman and Crompton 2016, 173). There are explicit internal control standards within the auditing profession to ensure that the company's accounting system has accurate data and is not omitting transactions that occurred. Consumer big data can have relatively the same standards applied to ensure the accuracy of the information within the large consumer dataset. By ensuring the consumer data is relevant and accurate, auditors can then utilize the data along with other sources in order to perform additional substantive testing upon other facets that are currently already audited. This leads to the advantageous concept of continuous auditing that appears to be within the grasp of auditing firms who wish to embrace technological advancements within the profession.

Current auditing standards focuses on providing a certain level of assurance for financial statements that represent historical activities. This has deemed the profession as "backward" looking in a sense that financial statements only represent the previous

periods and those are the management assertions that auditors are testing. Continuous auditing would transform the auditing profession to test more recent assertions made by management rather than waiting for year-end. Scholars have defined continuous auditing as “the ability to use correlation models with vast amount of high-velocity data, in order to pinpoint transactions or events of audit interest by becoming significantly more useful when applied continuously” (Cao et al. 2015, 427). In order for a successful implementation of continuous auditing, auditors would need access to accounting information systems at all times. This would be dramatically different from the current standard of businesses providing information to auditors upon request. By having access to all readily available accounting data, auditors would be able to perform analytical techniques on various sources of data such as transactional, consumer, etc. during the specific period in question. Continuous auditing may then help create a movement towards increasing the frequency of reporting in order to update external users more often than annually. Businesses would levy real-time transactional processing along with consumer data analytics to provide more accurate reporting metrics to external users which would then influence financial markets, stock prices, and so forth (Cho et al. 2019, 12). The difficult step in implementing continuous auditing and reporting would revolve around obtaining appropriate knowledge of big data analytics along with traditional reporting methods. Auditors and management will need to invest into training staff in these areas if they want to successfully incorporate continuous reporting into their companies.

Implementing new accounting and auditing practices which allow for consumer big data to be recognized on financial statements (i.e., internally generated consumer

data) while also being an effective tool of prediction analysis, would require immense training. Inherent value of consumer data relies upon the effective usage of analytical tools in order to obtain adequate information which may lead to an increase in future economic benefit. This same principle applies to auditors since it would not be possible to provide proper assurance if they are not equipped with the proper knowledge and tools. There has been a shift throughout the auditing profession, when accounting records transformed from writing to computerized. Auditors will utilize the best available tools in order to provide the most accurate assessments of financial statements for external users. This is apparent through the beginning stages of data analytics and artificial intelligence being implemented by some of the world's largest accounting firms (Cao et al. 2015, 426). Also, auditors will need to understand the dramatic transformation of their duties in the world of continuous auditing. Furthermore, auditors will need to focus on the internal control systems to ensure an accuracy of consumer data systems which the Public Company Accounting Oversight Board (PCAOB) has already distinguished as an important step in assurance (Borthick and Pennington 2017, 3). Additional training of identifying impractical information will also become a necessary component of an auditor's judgement. Consumer big data brings forth unprecedented amounts of unstructured data which may become difficult for auditors to identify possible issues that may take precedence over others (Brown-Liburud et al. 2015, 454). Brown-Liburud further defines this prevailing challenge with consumer big data as possible "information overload" which may lead to certain inefficiencies that auditors must overcome (Brown-Liburud et al. 2015, 455). However, the most prevalent change to the auditing profession

will revolve around an increasing degree of responsibility which will result from providing assurances on more available data.

Auditing professionals utilize a third-party doctrine which allows for some amount of error when completing routine audits of financial statements. Due to the inherent accuracy issues of sample testing, other auditing methods lead to an acceptable amount of error within the audit. The public's opinion on this may shift if auditors are utilizing more company data such as complete consumer lists, customer demographics, thorough transaction lists, and so forth. Providing an unqualified opinion to a company that is not fairly representing their financial statements is rare and a terrible situation for all parties involved. However, auditors may utilize consumer data in order to prevent providing an unqualified opinion to businesses who may be inaccurately representing their financial statements. Consumer big data may also be used by auditors in order to improve the accuracy of their assurance by utilizing analytical tools to test the entire dataset. If an auditor reviews a dataset and identifies a few anomalies, the value of their assurance would be justified. This may increase the pressures placed upon auditors to produce assurance with a dramatically decreased number of acceptable errors; however, financial markets may positively respond to the increased accuracy. In the end, auditors will be rewarded by implementing big data within their assurance practices by company's accepting higher auditing fees. Additionally, the improved assurance along with foreseeable legislation will lead to private financial crises becoming a thought of the past.

Internal controls are another component of auditing that must not be overlooked when implementing revisions to current standards. Auditors must have the tools and skills in order to provide assurance that a business' consumer big data is free from any

material inaccuracies which may have an impact on the valuation estimation. The recent scandal regarding Wells Fargo and its millions of fraudulent bank and credit card accounts is a great example which showcases the high importance of creating sound internal controls (Ragothaman et al. Wells Fargo, 2). Auditors may need to adapt current procedures in order to adequately provide assurance that the internal controls within a company's data infrastructure are performing satisfactorily in the prevention of inaccurate records. This becomes increasingly important if accounting standards are revised to allow for reporting of internally generated datasets such as consumer big data. Auditors will need to adopt advancing technologies in order to identify inaccurate records which may lead to the discovery of inadequate internal controls.

Auditing standards are ever-changing which contributes to a sound system of governing regulations that allow financial systems to remain strong. The desire towards unethical financial decisions, especially regarding financial reporting must be thwarted through the adoption of new auditing principles. Professionals must enact new thought processes and decision aids in this new environment where big data is prevalent. Accounting firms that welcome the technological advancements in order to improve their auditing opinions will thrive while firms who wish to remain out of the mainstream movement will fall behind and eventually fade out of existence. The world is moving towards unprecedented amounts of information and businesses will begin to drastically increase their usage of such data. Furthermore, the advent of asset recognition of various forms of data will force auditing firms to ensure the estimation method used by management is accurate. There will be a dramatic shift of thought within the auditing profession as the auditor's opinion has much less room for error. External users are

relying on auditors to make accurate judgements upon management assertions, particularly during times of change in management practices. Businesses and firms should expect challenges along the path of implementation but should not be discouraged because of the obstacles. Dramatic changes within the information sectors of society will always demand the school of thought to be revised, and the implementation of consumer big data is not an exception from that.

## CHAPTER SEVEN

### Challenges of Implementing Consumer Big Data

There are enormous challenges which will arise from the implementation of consumer big data as a mainstream technology for businesses and their supply chain partners. Just as the auditing profession will need to adapt new provisions in order to properly guide their decision-making, business leaders must identify and understand the challenges associated with consumer data. It is the businesses and accounting firms who overcome these obstacles that will reap the benefits that big data contains within itself. The individuals and organizations who wish to underestimate the difficulties of adopting new technologies will be led down a path of capital waste, data inefficiencies, and eventually lose their competitive edge over their respective market share. Challenges are to be faced when implementing any sort of drastic transformation of the primary framework, which a business utilizes to produce goods and serve its community. Consumer big data provides businesses with immense amounts of behavior prediction benefits. However, these benefits are not obtained without the cost of in-depth planning and a clear understanding of the various problems from implementing a coherent system. These challenges may include data quality, the size of data, equipment requirements, and a conservative organizational structure. Many of the challenges from consumer big data relate to the attributes that create the abundance of benefits which simpler forms of data simply do not provide (i.e., volume, velocity, variety, veracity and value). The first

challenge to be reviewed will be the issues surrounding the quality of the consumer data that is available to businesses.

As previously noted, consumer big data is created through various forms of surveying and background applications that collect several data points on customers. However, there is manipulation which can occur that may result with inaccurate data being collected unknowingly. For example, a customer may use a virtual private network (VPN) to mask their current location when browsing various websites. This may lead to a background application collecting a falsified location which then will be stored on the customer's record within the customer data tables. The overall impact of this particular example is more than likely immaterial, however there are many more possible examples of incorrect data being imported into a business' database. Customers can provide false information on customer surveys with the hopes of obtaining future discounts if they leave a negative review. Families may use the same account login leading to a dramatically inconsistent purchasing pattern which is attributed to the individual who originally signed up for the account. Data duplication is another area of concern leading to additional problems such as inadequate data storage, unnecessary analysis, etc. (Dai et al. 2019, 99:10). The benefits surrounding consumer big data begin to diminish when the quality of the data decreases thus creating inefficiencies and may eventually lead to inaccurate analysis. Scholars have recognized that it is the duty of professionals to "identify whether the data are drawn from the most relevant sources and whether the data are accurate in order to produce valuable results with less time and effort" (Cho et al. 2019, 15). This may be completed through various methods such as algorithms that identify redundant data within the database (i.e., duplicate customer records), or business

leaders applying a degree of skepticism if the results of analyses appear to be suspicious. Assuring that the data is comprised of primarily accurate records should be the first priority of businesses who wish to implement consumer big data. Analyses' accuracy relies on the quality of the data that is being collected, inaccurate or redundant data may lead to incorrect conclusions (Dell 2017, 226). Data redundancy may contribute to an unnecessary increase in the size of data collected, leading to inefficiency issues.

Consumers have numerous attributes which may be collected by businesses in order to provide the most accurate and beneficial analysis. Business leaders must enact priorities and have a clear understanding of which attributes may be more beneficial than others when implementing consumer big data. For example, collecting various demographic data points such as age, gender, or geographic location may yield insightful conclusions leading to a higher caliber of decision-making. This may not be the case for other attributes such as form of payment, time spent entering payment information, or shipping method. Any customer attribute has the potential of providing beneficial knowledge, however businesses must have the ability to identify the attributes that contribute little to no value to the organization. This is a partial solution to minimizing the size of data being collected, which allows for more actionable data to be stored in the same data infrastructure. Additionally, information overload may occur due to the vast amounts of data and possible conclusions when analyses are interpreted (Brown-Liburd et al. 2015, 455). The results of big data analytics may lead to business leaders requiring additional time to sort through difficult inquiries. Information overload can be reduced by providing trainings to business leaders that develop skills of identifying irrelevant information. Another possible solution would be to create a filtering system within the

visualization tool so that business leaders can focus on specific portions of the analysis. Organizations that can implement protocols to reduce the overall volume of data collected, stored, and analyzed will obtain a competitive edge in the form of efficiency. Large volumes of data that require an impractical amount of time to analyze becomes virtually worthless. Data must be analyzed in order to provide any benefit to the company that invests in its collection (Warren et al. 2015, 404). The amount of data that can be collected, stored and eventually analyzed relies on the data infrastructures that companies implement. Utilizing consumer big data may be a more daunting task for smaller companies which do not have established data systems, while large companies may find the challenges of implementing big data as a small roadblock. Appropriate data systems create yet another barrier for companies that wish to utilize consumer big data due to its costly nature.

The complexity of data infrastructures leads to the utilization of consumer big data not being possible at all businesses. An adequate degree of IT knowledge is required to successfully introduce appropriate data systems along with the immense amount of capital required to purchase these systems. IT systems that have the ability of implementing a degree of big data analytics cost millions of dollars which creates a barrier that only large companies may have the opportunity to utilize consumer data benefits. For example, IBM's PureData System for Analytics which is an application that provides processing for big data was estimated in 2018 to have a three-year cost of \$39 million, while other systems may be greater than \$50 million (Müller et al. 2018, 489). The capital requirements for implementing consumer big data lead to large conglomerate corporations obtaining additional competitive advantages within their marketplace.

Smaller companies must develop more cost-effective strategies in order to compete with big data analytic systems providing business leaders predictive insights. Corporations that have the available capital to invest into these data systems must identify the system requirements that best suits their business. For example, a medium sized retailer will have dramatically different big data analytic needs than a large super chain such as Wal-Mart. Choosing an appropriate data system is key to successfully implementing big data technologies within an organization. Businesses may find themselves overspending which leads to financial difficulties and underutilized capital expenditures or they may underspend and lose the efficiency that is crucial to the success of big data analytics. Just as the value of an invention relies on the ability of institutions to manufacture it, big data's value relies on the effectiveness and efficiency of big data analytics. In order to ensure that big data analytics will be performed efficiently, careful consideration must be used when selecting the IT infrastructure that will complete these tasks. The willingness to approve these large IT purchases remains one of the most challenging issues to overcome. Acceptance from business leaders and the entirety of the company overall may become difficult to obtain.

Successful implementation of consumer big data ultimately relies on the attitudes of business leadership and the professionals who will be utilizing the conclusions from big data analytics. Individuals may become engrained within their own departments and have developed specific methods for completing their workload. Management who leads businesses to improve on a continuous basis more than likely will adopt new technologies that may provide additional insight into their competitive market. Companies that embrace data-driven decision making and understand the challenges that are involved

with implementing consumer big data will have more success in its implementation than businesses who are not fully committed to the implementation process (Wedel and Kannan 2016, 115). Managers will always face specific challenges when implementing new technologies, however it is the leaders who can overcome these issues that ultimately will obtain the benefit that technologies like big data can provide to their organizations. The cultural problems that big data can create for a company can be resolved through the determination of business leadership and their support of “integration and unification of the many islands of data and analytical capabilities that could exist throughout the organization” (Simsek et al. 2019, 975). The company’s overall attitude towards big data and its implementation is dramatically influenced by the leadership’s optimism and the abundance of planning prior to implementing consumer big data. Additionally, certain safeguards can increase the acceptance of big data by both the company’s employees and consumers. Proper utilization of big data will showcase a company’s responsibility to its stakeholders that will only benefit the company’s overarching image. Businesses must utilize consumer big data with ethics at the forefront of any strategic decision made. Developing internal controls that provide consumers with assurance that their data remains private and is secure will be paramount in the successful implementation of consumer big data as a widespread technology within the business community.

## **CHAPTER EIGHT**

### **Privacy and Security**

Consumer's willingness to provide businesses with various data points relies on the trust that is placed within the internal controls of the company's databases. Individuals may hesitate in filling out customer profiles, providing credit card numbers or any other form of data delivered, if the customer feels that the data will not remain private or is not secure within the company's IT infrastructure (Guha and Kumar 2018, 1728). This loss of data due to lack of trust between consumers and various businesses will lead to a decrease in sales, thus decreasing annual profits. For this reason, businesses must develop their information infrastructure with data security as one of the most important design features of the overall system. Security can be defined as the ability of deterring outside threats such as data leaks, hacked systems, etc. while privacy is ensuring that the data collected is being used for the original intended purpose (Dai et al. 2019, 99:27). Businesses have the most control over privacy because they can control the usage of data collected from their customers. Security is much more difficult to adequately provide due to the influence of third parties and the lack of information regarding current hacker technologies. Implementing proper security protocols can be seen more as a "cat and mouse" scenario with the security systems adapting to the technologies available to hackers. Companies should first disclose the gathering and usage of data to their customers. Transparency is key to creating the essential foundation that a consumer-based trust can be formed upon. Through commitment to adhering to the

company's data sharing policies, a consumer-based trust will continue to grow.

Consumer data is valuable to not only the businesses that collect the data, but also to the individual consumer who is providing potentially sensitive information. It is critical that businesses disclose their intentions with the consumer data and perhaps even create a system where an individual may opt out if they do not feel comfortable sharing the information.

Proper disclosure of consumer data usage along with strict adherence to those policies can provide businesses with a positive image within their respective communities. This aspect of business can be viewed in businesses which do not rely on the collection of consumer data. For example, if a particular restaurant was known to be untrustworthy, then patrons would be less inclined to allow their waitress to take their credit card out of sight to the cash register. Businesses that condone or perhaps even rely on unethical practices will eventually lose their competitive advantage within the marketplace. This is magnified within the online shopping market where the vast majority of consumer data is collected. There are few alternatives to completing an order if a customer distrusts the company's credit card processing protocols. Looking back at the restaurant example, customers may pay with cash if they distrust the company's system. The online order would more than likely simply not occur since there is not an easily available alternative to providing a credit card. Companies that provide easily understandable disclosures with regards to consumer data are bound by those policies. This creates a degree of trust from the customer which leads to online sales being fulfilled instead of forgone. Adequate disclosures are merely the first step in developing a sense of trust from the customer base. Ultimately the business must act within ethical

boundaries when utilizing consumer data for their own benefit. The companies that can enact proper ethical guidelines with regards to consumer big data will have the opportunity of utilizing big data's benefits while minimizing unnecessary costs from misuse of the data.

The idea that businesses should adhere to internal guidelines which were created within the bounds of societal norms while conducting their sales or services is not by any means a new concept within the business environment. For example, an employee of a valet company is entrusted with a valuable asset that is owned by their customers, the customer's vehicle. The agreement between the patron in need of a parking service and the valet company is simply that the vehicle will be securely parked and then retrieved at the request of the customer. The value that is derived is viewed as the valet driver ensuring the customer's vehicle is secure and additionally providing a time-saving aspect which can merely be regarded as convenience. This is nearly the same scenario that is conducted between a company and its customers when information is requested. The customer information is the asset owned by the customer, the car in the above analogy. While the valet driver can be equated to the businesses' internal guidelines that direct the usage of the data that is collected from their customers. Just as the customer entrusts the car to the valet driver, customers must develop a degree of trust with the businesses that are requesting the information. As the trust between consumers and businesses are developed, customers may be willing to provide additional information which will lead to additional procedures within data analytics (Sidgman and Crompton 2016, 178). Customers may only be willing to provide the country where they live to newer businesses that have an undeterminable track record with safeguarding data. However, if

a business has a well-established reputation, then customers may be more willing to provide street addresses. This can be used to track spending habits by zip code leading to more informed strategic decisions. One of the best ways of developing a reputation of good faith is simply by respecting the privacy of customers while also adhering to any policies that have been disclosed to them (Wedel and Kannan 2016, 113). Markets for consumer data do exist and the companies that are at the forefront of collecting the data have the most responsibility in ensuring that their customer's data is appropriately used and assure appropriate security measures are implemented within the data infrastructure.

Customers provide information, some of it may be considered personal, to businesses in exchange for a beneficiary component which may aid the consumer. This may be in terms of increased customization, convenience, shipping, etc. which provides something of value to the customer (Noort, et al. 2020, 415-416). There would be no reason for customers to provide the information if there was no benefit to be received from the transaction. For example, a customer may not provide their address if they are purchasing a digital product that will be delivered through the internet. The business may have an analytical need for the customer's address, but since the customer is not deriving a benefit from the exchange, then the particular business may have difficulties in collecting the necessary amounts of consumer data. This need of the customer requiring some sort of benefit is the exact scenario that leads to a secondary market for customer data. A marketing firm may not be able to collect the data directly from the customers due to a lack of benefit perceived by the customer. However, the same marketing firm can offer to purchase the consumer data from online retailers, or other businesses that have accumulated large amounts of data from their customers. This relationship creates

the distinction between the primary data collectors and the secondary users of the consumer data.

The websites that are directly collecting the data from their customers are referred to the primary users of the consumer data. Primary data collectors have an obligation to their customers to “understand and respect the privacy expectations around possible secondary use of the information” (Martin 2015, 55). Martin goes on to deem the primary data collectors as “gatekeepers” of their customer’s information with their obligation being derived from the trust that was developed between their business and the customer (Martin 2015, 55). The possible consequences that arise from selling data on secondary markets may lead to potential breaches of security and lawsuits for the primary collector. It becomes very difficult to ensure the company that is purchasing the data is reputable, will adhere to the guidelines set forth, and will provide the same amount of data security as the primary collector. Additionally, the purchaser may choose to sell the data to another party which further increases the likelihood that the measures developed to protect consumers will begin to be minimized. This is likely due to the lack of relationship between the customer and the data aggregator. Various guidelines that increase the privacy of the consumer may be viewed as unnecessary barriers that increases costs which leads to lower profits (Huerta and Jensen 2017, 108). As a particular set of customer data is continuously resold within the marketplace, the business desire to prioritize the privacy and security of the data may decrease. This is due to the lack of connection between the data aggregator and the original customer's data which is being repurchased. Some businesses may argue that their obligation to protect the data is even greater than the primary collector due to the different usage and the lack of

awareness from the customer. This may create ethical dilemmas for the data aggregators who choose to reduce the amount of protection for the data in order to maximize profits. The open market begins to fail in this scenario due to the disregard for consumer data for the sake of profits which leads to an increase in reluctance for the customer to provide the data in the first place. Regulations that will prevent this from happening are necessary in order to not only protect the consumer, but also generate a degree of trust automatically.

Revolutionary ideas and technology create a challenging dynamic for legislatures whose purpose is to protect the interests of society from the greed of a few. Consumer big data has developed a vacuum for legislation since laws regarding privacy may be outdated and have not adapted with the changes to data collection, storage and processing (Wedel and Kannan 2016, 113). Without regulations, businesses that are involved in the consumer data markets are left to self-regulate through the creation of company policies and their moral compasses. Additional regulations surrounding the protection of consumer data will not only protect the consumers, but also the businesses that collect and sell the data. Company guidelines may not be sufficient in entirely protecting consumers, which leads to regulations creating an opportunity to reduce negative events from occurring and the business' creditability decreasing. There has been an increase in regulations for consumer data throughout Europe which has adopted measures to protect consumers from wrongful collection and usage of their information (Sidgman and Crompton 2016, 173). The rest of the world needs to echo Europe's plans in order to dictate the protection of consumer data within the newly establishing market. New pieces of legislation may even create new opportunities for businesses to adopt innovative marketing methods if they are deemed to be acceptable by their governments. Without

the regulations, businesses may be reluctant to adopt particular technologies due to the fear of consumers or society viewing innovative applications of data usage as invasive.

## CHAPTER NINE

### Further Actions for Consumer Big Data

Consumer big data is transforming the landscape of business as technologies are developed and become more readily available. Business leaders have always sought to obtain more information than their competitors and consumer big data is another opportunity to gather additional insight. Big data can be utilized for much more than simply improving upon already established ideas such as strategic decisions, auditing techniques, or predictive analysis. As technology is improving, the number of opportunities for big data also increases due to the decreased amount of processing times. It is now conceivable to utilize consumer's data to help consumers improve their daily lives which leads to higher profits for businesses who can take advantage of the data. The first theoretical concept that consumer big data may be used for revolves around utilizing the data of an individual to selectively suggest products, prices, and brands that the individual may have never desired. This is a phenomenon that has been utilized to a certain degree within particular industries, however the idea is transformed further into a technique that can be utilized across several industries. Often referred to as personalized pricing, Steinberg has discussed the ability of utilizing consumer big data to personalize the shopping experience for each and every individual who seeks a participating business (Steinberg 2019, 98). Steinberg goes on to discuss that currently the idea of personalized pricing is more accurately described as group pricing which can be seen in various industries (Steinberg 2019, 98). The insurance industry is a great example of group

pricing which is in display currently within markets. An insurance company provides value to its customers by a way of mitigating risk. This is achieved by having a population of people paying into a fund that then can be utilized to provide assistance to an individual based upon their insurance policy. For an example, a thousand people hold automobile insurance through the same company, and that company continues to be profitable as long as only a few people require financial assistance due to a vehicle accident or some other event covered by the customer's policy. Think of it as one thousand people are paying each other's misfortunes and the insurance company withholds a percentage as a fee for gathering the people and resources. However, when insuring something such as a vehicle, the insurance company will factor in their risk assessment to determine what each individual will contribute towards the fund. Several factors are taken into consideration such as gender, age, scholarship, etc. which will aid the insurance company in determining the average risk of the individual. This is a great example of group pricing due to males potentially charged a higher insurance rate than females, and individuals with lower grades may not have the opportunity of reducing their premiums. The insurance industry attempts to utilize a personalized pricing approach when utilizing an individual's driving record as a factor towards premium cost. However, this is not the only factor of an insurance premium. It can be argued that the insurance industry remains to be closely aligned with group pricing. Personalized pricing would transform group pricing by determining the price of goods and services based upon what an individual is willing to pay.

Market economies work on the notion that suppliers are willing to sell a product at a particular price that buyers are also willing to purchase at the set price. However,

when determining the price for a product that has numerous buyers such as groceries, developing a system to determine the optimal price for a good is nearly impossible. Each buyer has different preferences, income, and other factors that may contribute to their decision in purchasing goods at a particular price. Personalized pricing would theoretically utilize the consumer's data in order to accurately predict the maximum price that an individual would be willing to pay for a particular good or service (Steinberg 2019, 100). Steinberg goes on to refer to this method of pricing as "big-data driven personalized pricing" or BDPP. Utilizing this pricing methodology may become problematic for a business if they would be required to disclose that prices paid by consumers are dependent on several factors. This would increase the reluctance to voluntarily provide information which may be used to change their prices such as income, marital status, etc. One of the only instances where personalized pricing has successfully taken some form is through the tuition assistance programs at various universities (Steinberg 2019, 100). People are willing to provide various details about their personal, and financial histories in order to obtain some sort of need-based assistance for their schooling expenses. Although, this is a system that tends to only decrease the price for individuals who simply cannot pay the normalized fees. Some may argue that this program would be much more unsuccessful if it applied a lower standardized price and raised the price based upon the ease of payment by certain individuals. The success of the current financial assistance programs at universities relies on the fact that most assistance is tied to some sort of measurable attribute such as scholarship, community involvement etc. Additionally, the federally insured student loan program also creates a sense of normality for individuals with lower income earning

families which may require some sort of credit, or favorable loan terms. Furthermore, education is a facet towards human progression and the society overall benefits from a higher educated population regardless of the price each individual paid. Society however, does not benefit from a gallon of milk having a range of prices in order to maximize profits for the business. That would create a one-sided market which would only harm consumers.

Big data may also provide a more realistic approach to the ever-connected devices within communities that create a web known as the Internet of Things (IoT). In 2014, there was more than fifteen billion devices with some sort of sensor that was recording information and transferring it to a network (Wedel and Kannan 2016, 103). Consumer big data can be utilized along with these sensors in order to provide customers with unique experiences such as immediate ordering, expiration tracking, and so forth. The same technologies that are utilized within manufacturing plants may now be viable in everyone's homes with the advent of RFID technology along with specialized refrigerators and cabinets. Consumers may connect unique data from their customer account with sensors within their homes to automatically order groceries, paper products or any other item that is widely used within the household. Customer records also may be altered to provide preferences for the availability of particular items. For instance, a family may desire to have coffee and donuts delivered every Monday morning for a great start to the new week. This could be created as a preference under the customer's record which would only be completed per the request of once per week while other items such as milk, or soda would be automatically ordered upon depletion. There are nearly unlimited possibilities that may be created from the advent of consumer big data and

more sophisticated technologies within the homes of individuals. Just as the refrigerator and freezer changed the scope of groceries within homes, the increased usage of big data will change the way that families operate within the next century.

Another aspect of consumer big data which will need be addressed in the near future is adequately providing education to the future accountants of the world.

Currently, accounting programs are focused on the main aspects of accounting: financial, managerial, auditing, and tax which help to build a strong foundation for any aspiring accountants. However, a key component that may be overlooked within these curriculum programs is advancing technologies due to their complexities. Future accountants must know the technologies that may change the landscape of the accounting profession in its entirety prior to completing the necessary coursework to begin in that career. This is very important in order to prevent individuals obtaining degrees that may be difficult to utilize after graduation. For example, people may not choose to obtain a degree in cashiering with the advances of self-checkouts that are becoming much more popular in societies. The same can be said for accounting, it is detrimental to a university's program if it does not provide an adequate outlook on what the profession may become within the near future. There is little value in providing coursework in completing accounting journals manually if a very small percentage of businesses do not utilize technology for their book-keeping. Consumer big data continues to change the landscape of the accounting profession which can be observed through the changing preferences of employers. "A study by PricewaterhouseCoopers in cooperation with Business Higher Education Forum and Gallup found that 69 percent of employers say that by 2021 they will prefer job candidates with data science and analytics over ones without but that only 23 percent of

educators say that their graduates will have these skills” (Müller et al. 2018, 495). It would be intriguing to observe if PwC’s prediction is accurate, however graduates not fulfilling employer’s expectations is believable because coursework revolving around developing technologies are currently not required in accounting programs. A promising method to ensuring that universities change their accounting coursework to include the profession-altering technologies is providing a comprehensive update to the Certified Public Accounting (CPA) exams to include the developing technologies. Universities would respond by changing coursework because falling behind in average passing rates may become detrimental to the program and the university overall. Drastic changes to large, standardized exams such as the CPA exams are difficult to achieve, however it is required in order to provide graduates the essential skills in order to become successful within their careers.

## CHAPTER TEN

### Conclusion

Consumer big data will become more prevalent within the business community as technology advances continue to lower the entry barriers, and business leaders become increasingly aware of the competitive advantages that consumer's data may provide. Value is derived from consumer big data through the utilization of its characteristics: volume, variety, velocity, veracity and value. These defining attributes of big data creates the opportunity for businesses to strategically utilize a combination of the attributes to create analysis to improve their decision making. Proper data system infrastructures are required to give businesses the ability of storing the large quantities of data, while also efficiently processing the different types of data present within consumer big data. Equipment and application improvements may be a substantial investment for a small business which may be infeasible. Furthermore, the rapidly changing technological environment may force some products to be outdated in a relatively quick timeframe. This is what drives the demand for outsourcing of data storage and analysis. Businesses may pay a premium price in order to push the risk of improving its data infrastructure onto the company providing the data analyses. As consumer big data becomes increasingly used within the business community, accounting standards may need to be revised in order to adequately showcase true valuations of an organization.

Internally generated assets such as customer records, are not recognized within the financial statements until a sale occurs and there is a definite realization of value.

These assets are more than likely intangible due to the nature of manufacturing tangible assets allowing for realization of value to occur during the manufacturing process. However, as consumer big data usage increases, businesses will recognize the cost of data infrastructure upgrades, and not the intellectual value of unique data collection techniques, innovative business approach or any other strategic advantage that the company is utilizing to gather their consumer's data. One approach to providing a valuation of consumer big data is to measure the future economic benefit that the additional information may provide to business leaders. If a change within current accounting standards is approved, then auditing standards will simultaneously have to adjust in order to provide assurance services on the valuation of their client's consumer datasets. Additionally, auditors may also have the opportunity to utilize the datasets to verify transactions that occurred along with current auditing approaches. Furthermore, auditors will need to provide assurance that the client's internal controls are adequately preventing inaccurate, or duplicate entries within their consumer datasets. This is essential in providing an accurate valuation because duplicate data entries may inflate estimates used in deciding the valuation of the business' consumer data.

Transforming valuation and auditing standards is only a small portion of the challenging landscape that must be overcome in order to adequately implement consumer big data. Businesses face difficulties in purchasing data infrastructures that can provide efficient storage and analysis of the large quantities of data. Another concern is the quality of the data. Algorithms must be created that can delete the customer records with invalid identifying components. Another challenge is ensuring consumers that their personal information is protected and the system has the appropriate software to prevent

data loss. Primary websites must have adequate disclosures regarding the usage of their consumer's data and must adhere to any ethical regulations established by their companies in order to protect their consumers. Once these and other challenges are overcome, the future will be transformed through the widespread utilization of consumer big data. Consumers can utilize the Internet of Things to have the opportunity to connect technology within their homes to online retailers. This will pave the way of automatic purchasing based on usage. Businesses will also have the opportunity to improve strategic decision-making by analyzing the preferences of each of their customers. Thus, businesses will prefer data analytical skills within their employees, leading to a change in curriculums. The university programs that embrace technology and relay the plethora of information to their students will become sought after by businesses and high school graduates alike. There are several requirements that must be met in order for consumer big data to transform the daily lives of people and patience will be required. Businesses must always act with integrity and consumer big data should be utilized in a manner that prevents harm to consumers. If businesses can refrain from quick profits that may jeopardize their customer's data, then consumer big data will become a necessary tool within the business landscape.

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