Using Big Data for Customer-Centric Marketing

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Abstract

This chapter deliberates on "big data" and provides a short overview of business intelligence and emerging analytics. It underlines the importance of data for customer-centricity in marketing. This contribution contends that businesses ought to engage in marketing automation tools and apply them to create relevant, targeted customer experiences. Today's business increasingly rely on digital media and mobile technologies as on-demand, real-time marketing has become more personalised than ever. Therefore, companies and brands are striving to nurture fruitful and long lasting relationships with customers. In a nutshell, this chapter explains why companies should recognise the value of data analysis and mobile applications as tools that drive consumer insights and engagement. It suggests that a strategic approach to big data could drive consumer preferences and may also help to improve the organisational performance.

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Introduction

Technological advances have brought significant increases in the speed of memory and in the processing of information. Notwithstanding, cheap storage including cloud facilities allow users to collect and store data like never before. This chapter suggests that companies ought to embrace "big data" as it could unleash new organisational capabilities and value. Therefore it explains the notion of "big data" and sheds light on how it may differ from traditional analytics and marketing information systems. It may appear that the use of data and its analyses are becoming ubiquitous practices. As a matter of fact, Google in 2002 had received over 2 million search queries per minute (Tepper, 2012). In 2014 that figure had more than doubled (Gunelius, 2014). Moreover, every minute there are over 200 million messages that are sent by email. Furthermore, every minute there are nearly 2.5 million status updates on Facebook and 300,000 tweets on Twitter, and this list goes on (Gunelius, 2014). Evidently, data has become the new currency for connecting people to products in this digital age (Lohr, 2012). As a result, there has been a dramatic surge in the use of data. Nowadays, users can easily access multiple sources of digital data that is readily available through websites, social media networks as well as from mobile devices, including smart phones and tablets (Fortunati, Manganelli, and de Luca, 2015; Yang, Kim and Yoo, 2013). These developments have inevitably led to endless opportunities for marketers to leverage themselves and gain a competitive advantage by using big data analytics.

Therefore, this contribution sheds light on the "new" notion of big data and gives a short overview of some emerging analytics. Notwithstanding, it also underlines the importance of customer-centricity in marketing. Consumers have become digitally educated buyers and are often more tech savvy than businesses. Arguably, it is in the businesses' interest to learn new skills, so that they engage in marketing automation tools; that could be applied to create relevant, targeted, and valuable customer experiences. As today's marketing endeavours are closely tied to social, businesses are striving to nurture one-to-one relationships with stakeholders. This is one of the best ways to acquire new customers. Businesses ought to distinguish themselves among others through all of the digital clutter - by capturing their consumers' attention so that they can hear their marketing communications. Very often marketers are not capable of creating, managing and organising customer experiences. Therefore this conceptual

chapter explains why businesses ought to embrace big data in order to improve their interactions with consumers and prospects. Relevant information and data could help businesses to better serve their customers as they will know what they need, want and desire. This will inevitably lead businesses to satisfy their customers and their retention.

Background

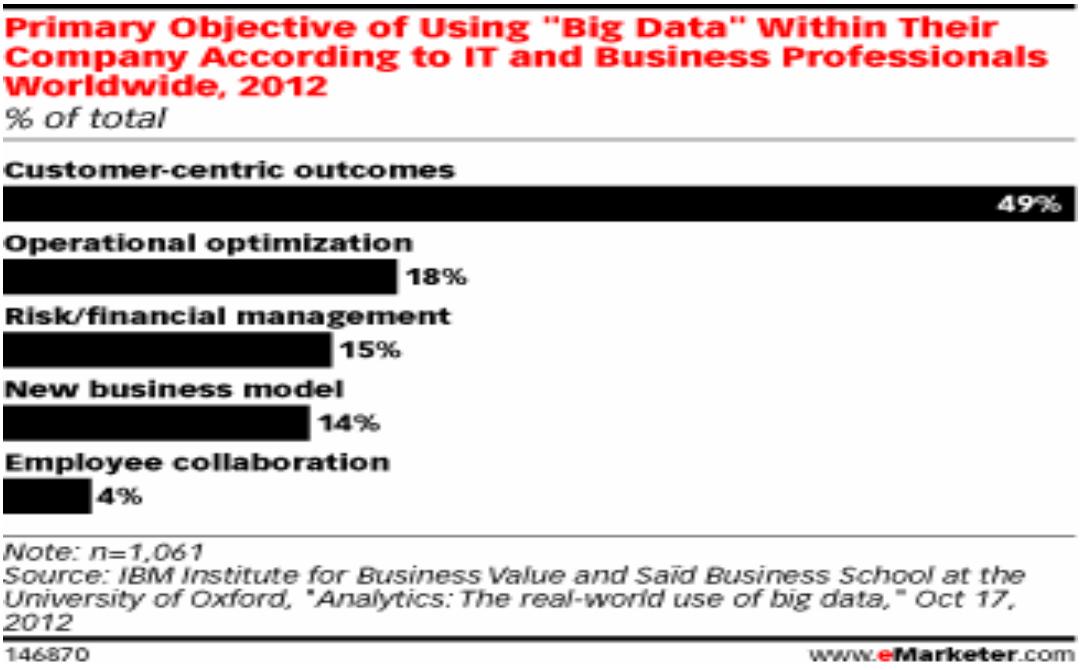
In this day and age, digital data has dwarfed analogue content and continues to grow at an exponential rate. This data is being collected and stored in massive amounts by search engines including Google, Bing and Yahoo as well as by e-commerce conglomerates such as eBay and Amazon. In addition, more information is being gathered by social media giants like Facebook, Twitter, Linkedin et cetera. Here are some of the unique pieces of data each social network is collecting:

- **"*Facebook's interest/social graph*:** The world's largest online community collects more data via its API than any other social network. Facebook's "like" button is pressed 2.7 billion times every day across the web, revealing what people care about.
- ***Google+'s relevance graph*:** The number of "+1s" and other Google+ data are now a top factor in determining how a Web page ranks in Google search results.
- ***LinkedIn's talent graph*:** At least 22% of LinkedIn users have between 500-999 first-degree connections on the social network, and 19% have between 301-499.The rich professional data is helping LinkedIn build a "talent graph."
- ***Twitter's news graph*:** At its peak late last year the social network was processing 143,199 tweets per second globally. This firehose of tweets provide a real-time window into the news and information that people care about. Fifty-two percent of Twitter users in the U.S. consume news on the site (more than the percent who do so on Facebook), according to Pew.
- ***Pinterest's commerce graph*:** More than 17% of all pinboards are categorized under "Home," while roughly 12% fall under style or fashion, these are windows into people's tastes and fashion trends.
- ***YouTube's entertainment graph*:** What music, shows, and celebrities do we like? YouTube reaches more U.S. adults aged 18 to 34 than any single cable network, according to Nielsen. YouTube knows what they like to watch.
- ***Yelp's and Foursquare's location graphs***: These apps know where we've been and where we'll go. Foursquare has over 45 million users and 5 billion location check-ins".

(Business Insider, 2014)

The majority of internet users seem to prefer using mobile devices rather than laptops or PCs (Fortunati et al., 2015). According to (Forbes, 2013), "87% of connected

devices sales by 2017 will be tablets and smartphones". Last year's mobile data traffic alone was twelve times the size of the entire global internet in the year 2000 (Cisco, 2013). Data collection has also benefited from the growth of geo-location data services like satellites, near-field communication and global positioning systems that track users' movements that measure traffic and other real-time phenomena (Bonometti, 2012; Nair, Misra, Hornbuckle, Mishra and Acharya, 2013). New anonymous cookie-less data capture methods are connecting consumer data with matching geolocation-based data (Mahatanankoon, Wen and Lim, 2005). On the other hand, in the past; businesses did not have the means to capture, store and analyse such data. Now, companies can economically gather and store all data from each and every customer transaction.It may appear that the main objective for companies worldwide is to use this data to achieve customer-centric outcomes as reported in Table 1.



(eMarketer, 2012a)

Nearly half of IT and business professionals reported that customer-centricity is their primary goal for Big Data this year. That was more than twice the number who cited operational optimisation, where other objectives were even farther behind (eMarketer, 2012a).These methods are increasingly empowering marketers to hyper-target consumers with real-time mobile ad campaigns before, during and after in-store activity as they drive conversions. Geolocation capabilities not only enable

advertisers to capitalise on a lead at the right time, but they can also offer valuable insights into shopping habits and consumer behaviours (Vaynblat and Chahal, 2014).

Given the volume and velocity of big data, traditional approaches to decision-making are often not appropriate in such settings. In real-time monitoring contexts, organisations need to adopt a more continuous approach to analysis and decision-making that are based on a series of hunches and hypotheses (Davenport, Barth, and Bean, 2012). Unsurprisingly, sensor analytics, geo-location and social data capture were some of the latest trends that were announced during the 2015 Consumer Electronics Show. Consequentially, it is envisaged that the volume of data collection is expected to grow even further. Gartner (2012) estimated that by 2016 big data will drive $232 billion in information communications technology (ICT) spending and will create 4.4 million IT jobs, globally.

Crunching Big Data

For decades, businesses have been using data in some way or another to improve their operations. For instance, an IT system could support small enterprises in their customer-facing processes. It may help them identify fraud in real time. Alternatively, large corporations may possess complex systems that monitor and detect any changes in consumer sentiment. Such data involve continuous flows of information for the business. Previously, data analysts performed multiple analyses to interpret their data sets. "Today, streaming analytics process the data during an event to improve its outcome" (Davenport et al., 2012). The terms of "big data" and "analytics" are increasingly being used to describe data sets and analytical techniques in applications ranging from sensor to social media that require advanced and unique storage, management, analysis, and visualisation technologies (Boyd and Crawford, 2012; Chen, Chiang and Storey, 2012). Usually, big data analytics are dependent on an extensive storage capacity and processing power, requiring a flexible grid that can be reconfigured for different needs (Goel, Hofman, Lahaie, Pennock, and Watts, 2010). Valuable data could be retrieved from the Web, including; social media content and video data among other content (Yang, Kim and Yoo, 2013). For example, Security First boosted its productivity and customer satisfaction by using content analytics to bridge social media and the claims process. Similarly, Banco Bilbao Vizcaya Argentaria has improved its online reputation with analytics that

quickly responded to online feedback (IBM, 2015). Notwithstanding, data could be presented in different forms; ranging from recorded vocal content (e.g. call centre voice data) or it can even be genomic and proteomic data that is derived from biological research and medicine.

Big data may have originated by Silicon Graphics in the mid-1990s. It has since gained more popularity as it is often used to describe the latest advances in technologies and architectures. For instance, nowadays big data and marketing information systems predict customer purchase decisions. This data could indicate which products or services customers buy, where and what they eat, where and when they go on vacation, how much they buy, and the like. Giant retailers such as Tesco or Sainsbury every single day receive long-range weather forecasts to work 8-10 days ahead. Evidently, the weather affects the shopping behaviour of customers (Christison, 2014). For example, hot and cold weather can lead to the sales of certain products. Apparently, weather forecasting dictates store placement, ordering and supply (and demand) logistics for supermarket chains. Lohr (2012) also reported that other retailers, like Walmart and Kohl's analysed their sales, pricing and economic, demographic data. These big retailers strive to tailor product selections and determine the timing of price markdowns. Lohr (2012) went on to say that shipping companies, like U.P.S. were mining data on truck delivery times and traffic patterns in order to fine-tune their routing. This way the business will become more efficient and incur less operational costs. Davenport and Kim (2013) held that business ought to take action based on analysis. They recounted the story of a restaurant chain that wanted to investigate the profitability of each item on its menu. When the executives were asked what they intended to do with the results of that analysis, they decided to focus their study on pricing and not profitability. Therefore, big data extracts value by capturing, discovering and analysing very large volumes of data in an economic and expeditious way (Villars, Olofson and Eastwood, 2011).

Recently, many industry leaders, including McKinsey (Manyika, Chui, Brown, Bughin, Dobbs, Roxburgh, and Byers, 2011), IBM (Schroeck, Shockley, Smart, Romero-Morales and Tufano, 2012) and SAS (2011) among others have released relevant studies and case studies on big data. IBM, Microsoft and SAS were using similar terminology to describe big data as a "situation where the volume, velocity

and variety of data exceed an organisation's ability to use that data for accurate and timely decision-making" (SAS, 2011). New technical approaches to storing and managing enormous volumes of new data have recently evolved. This has inevitably led to a significant reduction in the cost of keeping data. Moreover, these insights suggest that big data can be linked with production applications and timely operational processes to enable continuous improvements. For example, IBM (2015) reported how predictive analytics was being used by Becker Underwood to improve their inventory turn and forecasting accuracy. Another case study has indicated how Recology has optimised its sales performance and created more effective business plans by using business intelligence analytics. Davenport et al. (2012) suggested that credit card companies were a good illustration of this dynamic. The authors maintained that direct marketing groups at credit card companies created models to select the most likely customer prospects from a large data warehouse. In the past, the process of data extraction, preparation and analysis took weeks to prepare and organise. Eventually, these companies realised that there was a quicker way to meet most of their previous requirements. In fact, they created a "ready-to-market" database and system that allowed their marketers to analyse, select and issue offers in a single day (Davenport et al., 2012). Therefore, this case indicates that businesses became much more effective (and efficient) in their processes through iterations and monitoring of website and call-centre activities. They could also make personalised offers to customers in milliseconds as they kept tracking responses over time.

Of course, businesses ought to determine the utility of data storage in order to create business value. At the same time, data continuously requires capturing, filtering, and analytical flows that can swamp traditional networks, storage arrays and relational database platforms (Goel et al., 2010). Notwithstanding, the explosion of digital activity, particularly from ecommerce and social media has led to the dissemination of meaningful data that is being created each and every second. In a sense, online businesses have always known that they were competing on how well they understood their data (McAfee and Brynjolfsson, 2012). From a business perspective, it is important to acquire this data quickly, in high velocities if it has to be useful. For instance, data velocity in the utilities industry has become pervasive through the increased usage of smart meters. In the past, energy companies might have obtained one million meter readings a month. With the advent of smart meters,

the utility could obtain a million meter readings a minute. At times, big data is capturing and storing unstructured or semi-structured forms of data. Yet, this digital content may not necessarily be considered as "data" in its traditional sense (Boyd and Crawford, 2012).

Arguably, such content may include; text messages, document images, pictures, video clips et cetera. As a matter of fact, the document management and editing worlds, consider these types of unstructured data as content. For many years, insurance companies have kept records of pictures and documents and stored them in claims processing systems. Similarly, the banking sectors, used to store cheque images on optical disks. In the manufacturing industries, statistical process control methods used to generate large volumes of sensor readings. Such analytical practices were carried out in the past, for many years. Hence, the increased volumes and velocities of digital data could be meaningful only if its content is purposeful for companies. Otherwise, businesses could be spending money to store useless volumes of trash.

The business environment is currently witnessing a sea of change in IT activity. Some firms have experienced optimal results when they integrated analytics within their core business, operational and production tasks (Goel et al., 2010). As the volume of data explodes, organisations require better IT tools that are reliable, robust and capable of being automated. At the same time, the analytics, algorithms and user interfaces they employ are expected to facilitate interactions with the people who work with such tools. Moreover, IT organisations ought to train and recruit competent individuals with new digital literacies. During the last decades, there has been an ongoing requirement for skilled professionals in this promising area of study. Highly qualified individuals are expected to support the organisation's data and information management. Therefore, employees who handle big data are expected to be knowledgeable and experienced in data analyses. In addition, they may need to adapt to a continuously changing environment. "Data scientists understand analytics, but they also are well versed in IT, often having advanced degrees in computer science, computational physics or biology or network-oriented social sciences" (Davenport et al., 2012). In some industries, such as online social networks, gaming

and pharmaceuticals, data scientists are an integral part of the research and development team.

Data Analyses for Business

Apparently, big data has prompted organisations to reconceive their basic predispositions about the relationship between business and IT roles (Boyd and Crawford, 2012). In the past, the analytics function involved monitoring, controlling processes and notifying management about anomalies. At the same time, big data was constantly changing. The organisations that quickly recognised these changes have gained a competitive edge over their rivals. With marketing information systems, the most vaunted business and IT capabilities used to be stability and scale. Now, the new advantages of big data are based on discovery and agility, as more businesses are crunching data to improve their productivity levels and financial performance.

Next-generation IT processes and systems should be capable of exposing any contingent issues in data flow and procedures. Big data environments ought to make sense of the content they gather. This means that IT applications need to scrutinise and report on a wide variety of dimensions; including customer interactions, product usage, service actions and other dynamic measures. As a matter of fact, new varieties of digital content are increasingly emerging (e.g. online textual messages and web logs). These new varieties of digital content may bring value only if they can be used strategically to increase the financial or market performance of business. Of course this may well depend on industry-specific and company-specific factors.

Arguably, the expansion of big data use has been generated by the web and online communities. Ecommerce vendors including Amazon and eBay have surely transformed the market through their innovative and highly scalable e- commerce platforms and product recommender systems. Moreover, internet giants like Google and Facebook are leading the development of web analytics, cloud computing and social media platforms. The emergence of user-generated content on fora, newsgroups, social media networks and crowd-sourcing platforms has offered another opportunity for researchers and practitioners to “listen” to marketplace stakeholders; including customers, employees, investors and the media (Doan,

Ramakrishnan and Halevy, 2011). Businesses are increasingly collecting and analysing data from many sources to meet customer-centricity. Mayer-Schönberger and Cukier (2013) maintained that much of the value of data is derived from secondary uses that were not intended in the first place. They went on to suggest that every dataset can have some intrinsic, hidden, not-yet-unearthed value.

According to research from IBM and the Saïd Business School at the University of Oxford; nearly nine in 10 companies were using transactional data, and three-quarters were collecting log data in 2012. This study indicated that business practitioners also gather data from events, emails and social data (eMarketer, 2012a). Having said that, many potential applications could skim along the edges of what might be ethical, moral or even legal. For example, a person's social network might be used to determine his or her credit risk. Such data is often rich in customer opinion and contains relevant behavioural information.

Pang and Lee (2008) held that online review sites and personal blogs may provide opinion-rich information that may be explored through textual and sentiment analysis. Social media analytics capture fast-breaking trends on customer sentiments about products, brands and companies. Businesses may be interested in knowing whether there are changes in online sentiment and how these correlate with sales changes over time. Of course, in big data environments it's important to analyse, decide and act expeditiously. Needless to say that it isn't enough to be able to monitor a continuing stream of information. Businesses should be quick in their decision making and take action. Organisations need to establish processes which determine when specific decisions are required. Arguably, consumer sentiment analysis may not be designed for automating decisions, but could be better suited for the real-time monitoring of the environment (Goel et al., 2010).

Successful businesses strive to understand their customers' personas so that they target them the right content with the relevant tone, imagery and value propositions. Therefore, advertisers continuously gather consumer data and use it well to personalise every aspect of their users' experience. They strive to take advantage of the consumers' cognitive behaviour as they try to uncover and trigger consumer frailty at their individual level (Boucher Ferguson, 2013). It may appear that companies gather data on their customers in order to manipulate the market. They

use big data to delve into the enormous volume of information their business collect, generate or buy. Of course, companies may use what they know about human psychology and consumer behaviour to "set prices, draft contracts, minimise perceptions of danger or risk, and otherwise attempt to extract as much rent as possible from their consumers" (Boucher Ferguson, 2013).

Behavioural targeting is nothing new in digital marketing. When firms hold detailed information about their consumers, they may customise every aspect of their interaction with them. Certain marketing practices could possibly lead to unnecessary nuisances. For instance, customers are frequently bombarded with marketing endeavours including email promotions that are often picked up as spam. Therefore, one-size-fits-all messages could also have negative implications on prospective customers. At times, direct marketing could prove as the most effective way how to reach consumers, when it is used wisely and diligently. Perhaps, there could be scope for business to consider realigning their incentives with consumers by using data-driven marketing. Many businesses seem to have learned to use databases of customers and prospects. They gather this information to communicate and build relationships. This data collection may possibly drive new revenue streams and build long-term loyalty. Eventually, businesses could use this database to deliver promotional content to remind customers on their offerings. These consumer lists whether they are automated or in the cloud should always be used to deliver enhanced customer experiences. Customer-centric marketing is all about satisfying buyers. Customers may in turn become advocates for the consumer-oriented business. Therefore, effective marketing information systems are actually the beginning of successful customer relationship management. Technology is instrumental for businesses in their ongoing interactions with people. In this day and age, marketing automation is helping businesses to engage with individuals whether they are customers or not.

Digital media is supporting many businesses to map out how customers receive promotions, messages, newsletters and even advertisements. Moreover, relevant data may also help these businesses to keep a focus on their customer needs and wants. For instance, Chevalier and Mayzlin (2006) investigated publicly available consumer reviews from the two leading online booksellers, Amazon.com (Amazon) and

BN.comandNoble.com (BN.com) to construct measures of each firm's sales of individual books. Although, BN.com and Amazon allowed customers to post reviews on their site, it transpired that the latter corporation was successful in its engagement with consumers. In a similar vein, Resnick and Zeckhauser (2002) found that 99% of the feedback ratings on ebay.com were positive.

Evidently, word of mouth could drive sales and profits. However, without data, businesses could not keep a track record of their marketing effectiveness and performance stats. Engagement metrics; including, email-open rates, click through rates, pay per click and the like, enable marketers to continually fine tune their individual customer targeting. Many individuals are becoming quite active on social media channels including Facebook, Twitter or Google Plus. These modern digital marketing tools are helping business to engage in social conversations with consumers. Social networks have inevitably amplified the marketers' messages as they support promotional efforts (Lane, Miluzzo, Lu, Peebles, Choudhury and Campbell, 2010).

Business intelligence, big data and analytics

Recent developments in big data include; predictive analytics and preventative analytics (Halavais, 2015). Analytics have changed the way human behaviour is measured and perceived. Through advancements in technologies, marketers can extract value from very large data sets. Very often, data is collected for a particular purpose. However, with the latest analytics, the usage of big data has expanded dramatically in recent years. In fact, companies can benefit if they reuse the same data to extract other value from it. Perhaps, it would make sense for companies to acquire data that they do not own or have not previously collected. Very often, businesses do not consider big data as an important part of their business strategy. However, its value must not be undermined. For instance, predictive analytics could quantify the likelihood that a particular person will do something — whether it is defaulting on a loan, upgrading to a higher level of cable service or seeking another job (Siegel and Davenport, 2013). It may appear that it anticipates human behaviours that many not have not happened yet. Such predictive data will be based on large amounts of current and past indicative information that have been collected from

multiple sources (Halavais, 2015). Business are gathering big data from a wide range of sources. They analyse it in many different ways to improve their marketing performance: "Chickasaw Nation has used predictive and patron analytics to reduce its month-end close processes by 50%. This way it has improved customer experience. In a similar vein, predictive tools and smart cards enabled Singapore Land Transit Authority to provide a more convenient transportation system to commuters and leisure passengers. Moreover, First Tennessee Bank has managed to increase its marketing response rate by using predictive analytics to better target offers to high-value customers (IBM, 2015).

Siegel and Davenport (2013) explained how quantitative techniques can be deployed to find valuable patterns in data; such data enable companies to predict the likely behaviour of customers, employees and others. For instance, Davenport and Kim (2013) gave an example of a company that wanted to learn the success rate of its direct mail campaign. They pointed out that very often businesses would like to quantify how many consumers buy their products after receiving direct mail. Yet, they went on to suggest that businesses should ask; "How many people who wouldn't have bought the product will now buy it after receiving the mailing?" (Davenport and Kim, 2013). In this case, causality is important. In fact, it is in the company's interest to measure how effective its mailing was.

All individuals leave a "digital trail" of data as they move about in the virtual and physical worlds. This phenomenon is called, "data exhaust". Initially, the "digital trail" was an interesting term that was used to describe how Amazon.com used predictive analytics in order to suggest items for its customers. Similarly, Fedex has predicted which customers were most likely to defect to competitors. Even, Hewlett-Packard had identified employees that were on the brink to leave their company. This valuable data has allowed the corporation's management to take necessary decisions in anticipation of staff turnover. Moreover, Citizens Bank has used such data analyses to curtail losses through fraudulent activities.

Although, individuals tend to regularly repeat their habitual behaviours, predictive analytics cannot determine when and why they may decide to change their future preferences. Of course, every person is unique. The possibility of "one off" events must never be discounted. Yet, a firm with sufficient scarce resources and inclination

will still be in a position to exploit how consumers deviate from rational decision making on a previously unimaginable scale (Boucher Ferguson, 2013). Curiously, Siegel and Davenport (2013) distinguished between forecasting and predictive analytics. They maintained that forecasting could estimate future sales, whereas predictive data will provide additional details of customer personas, segments and prospects. Siegel and Davenport (2013) referred to the "Prediction Effect" as they suggested that minor increases in the data accuracy of predictions can often lead to substantial savings in the long term. They gave specific examples of an insurance business that has saved almost $50 million a year by using predictive analytics. The company managed to do this by shaving half a percentage point off its loss ratio (i.e. the total amount paid in claims divided by the total amount collected in premiums) (see Hayashi, 2014). It may appear that these analytics are also consonant with preventative data. In this case, big data could help to reduce the likelihood of future contingent situations, particularly in the fields of healthcare, public services and law enforcement (Mayer Schonberger and Cukier, 2013). For example, machine learning algorithms are able to discover patterns that anticipate infections in premature babies before they even occur (Davenport et al., 2012).

Big data and analytics are continuously being gathered in new, innovative ways that have changed and improved businesses and their consumers' experience (Nair et al., 2013). The market is responding to the emerging demand for innovative corporate IT solutions. Many corporations require bespoken software that is suitable for their particular line of business. Moreover, they will inevitably need ongoing maintenance of such systems. A wide array of new products could support open platforms. These systems are designed in such a way to deal with elaborate data and analytics. For instance, Hadoop and MapReduce allow organisations to load, store and query massive data sets with parallel, distributed algorithms on a cluster. At the same time, they could also support advanced analytics on a large grid of inexpensive servers. For example, Hayashi (2014) explained how Progressive Corporation has gained a competitive advance over its rivals by using FICO credit scores and other relevant data to assess the likelihood of their clients' car accidents. In this case, the company adopted tools like Hadoop and MapReduce that made use of structured data (such as a person's age and income) and unstructured information (including text and images).

Extant relational databases are capable of handling a wide variety of big data sources. Statistical analytical packages are similarly evolving in order to work in conjunction with these new data platforms, data types and algorithms. Furthermore, big data is also being modified for those clients that may require cloud based services. Cloud-based service providers offer on-demand pricing with a fast reconfiguration facility. Another approach to managing big data is leaving the data where it is. In this case, "virtual data marts" allow data scientists to share existing data without replication requirements (Davenport et al., 2012). For example in the past, eBay Inc. had experienced replication problems throughout its various data marts. Recently, its virtual data marts have significantly reduced the scattered data and rectified its replication problems. Interestingly, eBay has also established a "data hub". In a nutshell, this hub is an internal website that facilitates data sharing and analyses across the organisation's networks.

Nowadays there are fewer inaccuracies in the measurement of big data. In addition, many applications of data can arise far from the purposes for which the data was originally intended for. However, business intelligence and predictive analytics could raise a number of concerns (Halavais, 2015). Many customers may be wary of giving their data due to privacy issues. The underlying question is; when does personalisation become an issue of consumer protection? In 2012, consumers learned that Target was using quantitative methods to predict which customers were pregnant. Very often, advances in technology are faster than legislation and its deployment. These issues could advance economic and privacy concerns that regulators will find themselves hard-pressed to ignore. It may appear that digital market manipulation is pushing the limits of consumer protection law (Boucher Ferguson, 2013).

Evidently, society has built up a body of rules that are aimed to protect personal information. Another contentious issue is figuring out the value of data and its worth in monetary terms. In the past, companies could have struggled to determine the value of their business; including patents, trade secrets and other intellectual property. Today, data has inevitably become part of accounting and financial reporting. Goel et al. (2010) underlined the importance of communicating and acting on analytical results. They argued that any quantitative data ought to be presented in

an engaging, user-friendly format. For example, Deloitte Consulting have developed a mobile app that enabled Delta Air Lines' executives to quickly query the airline's operations. For instance, when users touched an airport on a map, the system brought up additional data at their disposal. Executives could also drill further down to obtain granular information on staffing requirements, customer service levels as they identified problems in their airline operations (Davenport and Kim, 2013).

Mobile applications and analytics

Chen et al. (2012) reported that mobile computing is an effective channel to reach out to many users. They referred to the latest IBM technology trends survey which indicated that mobile devices could increase the productivities and efficiencies of organisations. It transpired that mobile software was the second most "in demand" area for research and development (Chen et al., 2012; Motiwalla, 2007). In addition, Gartner BI Hype Cycle also anticipated that mobile analytics was one of the latest technologies that may potentially disrupt the business intelligence market (Bitterer, 2011). Snider (2012) anticipated that the market for mobile advertising was escalating at a fast pace. As a matter of fact, eMarketer (2012b) has predicted that mobile advertising shall experience a surge from an estimated $2.6 billion in 2012 to more than $10.8 billion in 2016. Evidently, it may appear that there are niche areas for professional growth, particularly in this specialised field; more and more individuals are increasingly creating new applications for many purposes on mobile operating systems (Fortunati et al., 2015).

Recent advances in mobile communication and geo-positioning technologies have presented marketers with a new way how to target consumers based on their location (Feng, Luo and Keith, 2015). Location-targeted mobile advertising involves the provision of ad messages to cellular subscribers based on their geographic locations. This digital technology allows marketers to deliver ads and coupons that are customised to individual consumers' tastes, geographic location and the time of day. Given the ubiquity of mobile devices, location-targeted mobile advertising seem to offer tremendous marketing benefits (Fortunati et al, 2015). Yet, to date there has been little empirical evidence about the immediate and cumulative effectiveness of such mobile advertising.

In addition, many businesses are commonly utilising applications, including browser cookies that track consumers through their mobile devices as they move out and about (Shankar, Venkatesh, Hofacker and Naik, 2010; Mahatanankoon et al., 2005). Once the users leave these sites, the products or services they viewed will be shown to them again in advertisements, across different websites. Hence, businesses are using browsing session data combined with the consumers' purchase history to deliver "suitable" items that consumers like. Therefore, savvy brands are becoming proficient in personalising their offerings as they collect, classify and use large data volumes on consumers' behaviours. As more consumers carry smartphones with them, they are (or shall be) receiving compelling offers that instantaneously pop up on their mobile devices.

For instance, consumers are continuously using social networks and indicating their geo location as they use mobile apps. This same data can be used to identify where people tend to gather — information that could be useful in predicting real estate prices et cetera. This information is valuable to brands as they seek to improve their consumer engagement and marketing efforts. It may appear that businesses are using mobile devices and networks to capture important consumer data. For instance, smart phones and tablets that are wifi-enabled interact with networks and convey information to network providers and ISP's. This year, more brands shall be using mobile devices and networks as a sort of sensor data – to acquire relevant information on their consumers' digital behaviours and physical movements. These businesses have become increasingly interactive through the proliferation of near-field communication (NFC). Basically, embedded chips in the customers' mobile phones are exchanging data with retailers' items possessing the NFC tags (Dahlstrom and Edelman 2013:4). It is envisaged that mobile wallet transactions using NFC technology are expected to reach $110 billion, by 2017. The latest Android and Microsoft smartphones have already included these NFC capabilities. Moreover, a recent patent application by Apple have revealed its plans to include NFC capabilities in the next iPhone versions. This will inevitably lead to an increase in the use of mobile wallets (GSMA, 2015). Undoubtedly, the growth of these data-driven, digital technologies is adding value to customer-centric marketing. Therefore, analytics can enable businesses to provide a deeper personalisation of content and offers to specific customers.

This type of geo-based marketing message or offer is delivered at the right time and the right place. The brands that hold the most customer data can gain a competitive edge over their rivals. Of course, firms will need more than transaction history and loyalty schemes to be effective at this. They will require socio-demographic and geo-data that other businesses are not capturing, as yet (Bonometti, 2012). Interestingly, smart devices have opened new opportunities for advanced business intelligence. These new mobile technologies are capable of gathering fine-grained, location specific data that is also context aware for personalised content marketing. For instance, Apple's App Store offered around 1.4 million apps (Apple, 2015) and Android users were able to choose from more than 1.5 million apps (Statista, 2015).

Therefore, there are promising revenue streams in the mobile app market. Both Apple and Android are offering paid or free ad-supported apps in many categories, including games, social networking, photo, video, sports, health and fitness, travel, kids and much more (Bart, Stephen and Sarvary, 2014; Ha, Yoon AND Choi, 2007). There are also companies that have developed apps for business intelligence. For example, enterprise / industry-specific apps, e-commerce apps, and social apps (Chen et al., 2012). Evidently, the lightweight programming models of the current web services (e.g., HTML, XML, CSS, Ajax, Flash, J2E) as well as the maturing mobile development platforms such as Android and iOS have also contributed to the rapid proliferation of mobile applications (Chen et al., 2012). Moreover, researchers are increasingly exploring mobile sensing apps that are location-aware and activity-sensitive.

Feng et al. (2015) reported about an Asian mobile service company that has partnered with cinemas. In response to the location-targeted mobile advertising, it transpired that these Asian consumers inquired about movie information, booked tickets and selected their seats through their mobile app. Consumers who were physically situated within a given geographic proximity of the participating cinemas have received location-targeted mobile ads via text messages. These ads informed prospects what movies were playing in the nearby cinema and also explained how to purchase tickets through their phone. The consumers could also call the company's hotline to get more information from a customer service representative. Feng et al., (2015) also reported that besides location-targeted advertising, the mobile company

was also promoting movie ticket sales via mobile ads that targeted individuals according to their behaviour (not by location). Unsurprisingly, the company directed mobile-ad messages to consumers who had previously responded to previous mobile ads (and to those who had already purchased movie tickets in the past three months). Moreover, the company also promoted movies via instant message ads that appeared when mobile users logged onto the company's website (Feng et al., 2015). Mobile users received instant message ads via pop-up windows whenever they logged into the corporate site of their service provider.

Conclusion

Big data is fundamentally shifting how marketers collect, analyse and utilise data to reach out to customers. Analytics are helping companies to get new insights into how consumers behave. Therefore, big data should inform not consume marketing efforts. It is envisaged that as big data evolves, the IT architecture will develop into an information eco-system: a network of internal and external services where information is shared among users. Big data can support business in their decision making. It could be used to communicate meaningful results and to generate insights for a better organisational performance. New marketing decision-making ought to harness big data for increased targeting and re-targeting of individuals and online communities. On-demand, real-time marketing has become more personalised in nature, than ever. Companies that learn how to take advantage of big data will use real-time information from sensors, radio frequency identification and other identifying devices to understand their business environments at a more granular level (Shankar et al., 2010). This way business could come up with new products and services, as they can respond to changes in usage patterns as they occur. Big data and data-driven marketing could design new ways for consumers to interact with brands. The challenge for marketers is not to become dependent on big data to drive business strategies, but rather to recognise the value of big data as a tool to drive consumer insights.

Every customer contact with a brand is a moment of truth, in real-time. Businesses who are not responding with seamless externally-facing solutions will inevitably lose their customers to rivals. This contribution postulated that a strategic approach to data management could drive consumer preferences and will also help to improve the

firms' bottom line. It maintained that the crunching of big data within the context of an evolving analytics ecosystem can lead to better customer service and engagement.

Future Research Avenues

Possible areas of research include mobile social innovation for m-health (Free, Phillips, Galli, Watson, Felix, Edwards, and Haines, 2013; Eysenbach and Group, 2011) and m-learning; (Sharples, Taylor and Vavoula, 2010; Motiwalla, 2007), mobile social networking and crowd-sourcing (Lane et al., 2010), mobile visualisation (Corchado and Herrero, 2011), personalisation and behavioural modelling for mobile apps in gamification (Ha et al., 2007), mobile advertising and social media marketing (Bart et al., 2014; Yang et al., 2013). Google's (2015) current projects include gesture and touch interaction; activity-based and context-aware computing; recommendation of social and activity streams; analytics of social media engagements, and end-user programming (Dai, Rzeszotarski, Paritosh and Chi, 2015); Fowler, Partridge, Chelba, Bi, Ouyang, and Zhai, 2015; Zhong, Weber, Burkhardt, Weaver and Bigham, 2015; Brzozowski, Adams and Chi, 2015).

References

Apple (2015) App Store Rings in 2015 with New Records
Retrieved February 22th, 2015, from
http://www.apple.com/pr/library/2015/01/08App-Store-Rings-in-2015-with-New-Records.html

Bart, Y., Stephen, A. T., & Sarvary, M. (2014). Which products are best suited to mobile advertising? A field study of mobile display advertising effects on consumer attitudes and intentions. *Journal of Marketing Research*, *51*(3), 270-285.

Bitterer, A. (2011). *Hype Cycle for Business Intelligence*. Gartner Inc., Stamford, CT.

Bonometti, R. J. (2012). Technology Considerations for Competing in the "Big Data-Social-Mobile-Cloud Marketing Space". In Competition Forum, American Society for Competitiveness, 10(2), 209.

Boucher Ferguson, R. (2013). Is Digital Advertising a New Form of Market Manipulation? MIT Sloan. Retrieved February 25th, 2015 from http://sloanreview.mit.edu/article/is-digital-advertising-a-new-form-of-market-manipulation/

Boyd, D., & Crawford, K. (2012). Critical questions for big data. Information, Communication and Society, 15 (5), 662–679

Brzozowski, M. J., Adams, P., & Chi, E. H. (2015, April). Google+ Communities as Plazas and Topic Boards. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 3779-3788). ACM. Retrieved May 22nd, 2015, from http://static.googleusercontent.com/media/research.google.com/en//pubs/archive/43453.pdf

Business Insider (2014) Social Big Data: Each Social Network Is Using A Very Different Data Lens To Understand Users And Target Advertising Retrieved July 12th, 2015, from http://www.businessinsider.com/social-network-big-data-lens-2014-7

Chen, H., Chiang, R. H., & Storey, V. C. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. *MIS quarterly*, *36*(4), 1165-1188.

Chevalier, J. A., & Mayzlin, D. (2006). The effect of word of mouth on sales: Online book reviews. *Journal of marketing research*, *43*(3), 345-354.

Christison, A (2014). BBC Highlights How Sainsbury's & Tesco Supermarkets Maximize Weather Retrieved February 20th, 2015, from http://www.skymosity.com/blog/bbc-highlights-how-sainsburys-tesco-supermarkets-maximize-weather/

Cisco (2013). *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013–2018*. Retrieved January 17th, 2015, from http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.html

Corchado, E., & Herrero, Á. (2011). Neural visualization of network traffic data for intrusion detection. *Applied Soft Computing*, *11*(2), 2042-2056.

Dahlström, P., & Edelman, D. (2013). A l'aube du marketing «à la demande». L'Expansion *Management Review*, 151(4), 56-64.

Dai, P., Rzeszotarski, J. M., Paritosh, P., & Chi, E. H. (2015). And Now for Something Completely Different: Improving Crowdsourcing Workflows with Micro-Diversions. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (pp. 628-638). ACM. Retrieved May 17th, 2015, from http://dl.acm.org/citation.cfm?id=2675260

Davenport, T.H., Barth, P. & Bean, R. (2012). How 'Big Data' Is Different. *MIT Sloan Management Review* 54(1).

Davenport, T.H. & Kim, J. (2013). Keeping Up with the Quants: Your Guide to Understanding and Using Analytics Retrieved March 15th, 2015, from https://hbr.org/product/keeping-up-with-the-quants-your-guide-to-understan/an/11177-HBK-ENG

Doan, A., Ramakrishnan, R., & Halevy, A. Y. (2011). Crowdsourcing systems on the world-wide web. *Communications of the ACM*, *54*(4), 86-96.

eMarketer (2012a). Companies Focus on Customers When Harnessing 'Big Data' Retrieved January 28th, 2015, from http://www.emarketer.com/Article/Companies-Focus-on-Customers-Harnessing-Big-Data/1009552

eMarketer (2012b). eMarketer in the News: June 1, 2012 Retrieved January 28th, 2015, from http://www.emarketer.com/newsroom/index.php/emarketer-news-june-1-2012/

Eysenbach, G., & Group, C. E. (2011). Consort eHealth: improving and standardizing evaluation reports of Web-based and mobile health interventions. *Journal of medical Internet research*, *13*(4).

Fang, Z., Luo, X., & Keith, M.E. (2014). How Effective Is Location-Targeted Mobile Advertising? *MIT Sloan*. Retrieved January 28th, 2015, from http://sloanreview.mit.edu/article/how-effective-is-location-targeted-mobile-advertising/

Forbes (2013). *IDC: 87% Of Connected Devices Sales By 2017 Will Be Tablets And Smartphones* Retrieved March 15th, 2015, from http://www.forbes.com/sites/louiscolumbus/2013/09/12/idc-87-of-connected-devices-by-2017-will-be-tablets-and-smartphones/

Fortunati, L., Manganelli, A. M., & de Luca, F. (2015). Is mobile phone use associated with spatial dimensions? A comparative study on mobile phone use in five European countries. *Information, Communication & Society*, (ahead-of-print), 1-19.

Fowler, A., Partridge, K., Chelba, C., Bi, X., Ouyang, T., & Zhai, S. (2015, April). Effects of Language Modeling and its Personalization on Touchscreen Typing Performance. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 649-658). ACM. Retrieved May15th, 2015, from http://cslu.ohsu.edu/~fowlera/Fowler_CHI2015.pdf

Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P. &Haines, A. (2013). The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review. *PLoS medicine*, *10*(1), e1001362.

Gartner (2012). Big Data Drives Rapid Changes in Infrastructure and $232 Billion in IT Spending Through 2016. Retrieved January 20th, 2015, from https://www.gartner.com/doc/2195915/big-data-drives-rapid-changes

Goel, S., Hofman, J. M., Lahaie, S., Pennock, D. M., & Watts, D. J. (2010). Predicting consumer behavior with Web search. *Proceedings of the National academy of sciences*, *107*(41), 17486-17490.

Google (2015). Human-Computer Interaction and Visualization Research at Google. Retrieved May 20th, 2015, from http://research.google.com/pubs/Human-ComputerInteractionandVisualization.html

GSMA (2015). Mobile Wallets. *GSMA Intelligence*. Retrieved January 20th, 2015, from http://www.gsma.com/digitalcommerce/digital-mobile-wallets

Gunelius (2014). *The Data Explosion in 2014 Minute by Minute – Infographic* Retrieved January 28th, 2015, from http://aci.info/2014/07/12/the-data-explosion-in-2014-minute-by-minute-infographic/

Ha, I., Yoon, Y., & Choi, M. (2007). Determinants of adoption of mobile games under mobile broadband wireless access environment. *Information & Management*, *44*(3), 276-286.

Hayashi, A. (2014). Thriving in a big data world. *MIT Sloan*. Retrieved May 13th, 2015, from http://sloanreview.mit.edu/article/thriving-in-a-big-data-world/

Halavais, A. (2015). Bigger sociological imaginations: framing big social data theory and methods. *Information, Communication & Society*, *18*(5), 583-594.

IBM (2015). Big Data and Analytics: Explore Customer Stories. Retrieved July 12th, 2015, from http://www.ibm.com/big-data/us/en/big-data-and-analytics/case-studies.html#businessneed=marketing

Lane, N. D., Miluzzo, E., Lu, H., Peebles, D., Choudhury, T., & Campbell, A. T. (2010). A survey of mobile phone sensing. *Communications Magazine, IEEE*, *48*(9), 140-150.

Lohr, S. (2012). "The age of big data." *New York Times*. Retrieved May 12th, 2015, from http://www.nytimes.com/2012/02/12/sunday-review/big-datas-impact-in-the-world.html?_r=0

Mahatanankoon, P., Wen, H. J., & Lim, B. (2005). Consumer-based m-commerce: exploring consumer perception of mobile applications. *Computer standards & interfaces*, *27*(4), 347-357.

Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). Big data: The next frontier for innovation, competition (p. 9). and productivity. Technical report, McKinsey Global Institute.

Mayer-Schönberger, V., & Cukier, K. (2013). Big data: A revolution that will transform how we live, work, and think. Houghton Mifflin Harcourt.

McAfee, A., & Brynjolfsson, E. (2012). Big data: the management revolution. *Harvard business review*, (90), 60-6.

Motiwalla, L. F. (2007). Mobile learning: A framework and evaluation. *Computers & Education*, *49*(3), 581-596.

Nair, H., Misra, S., Hornbuckle, W. J., Mishra, R., & Acharya, A. (2013). Big Data and Marketing Analytics in Gaming: Combining Empirical Models and Field Experimentation. Retrieved April 12th, 2015, from http://research.chicagobooth.edu/~/media/ED2EE5800F254996AD59FA37978380A4.pdf

Pang, B., & Lee, L. (2008). Opinion mining and sentiment analysis. *Foundations and trends in information retrieval*, *2*(1-2), 1-135.

Resnick, P., & Zeckhauser, R. (2002). Trust among strangers in internet transactions: Empirical analysis of ebay's reputation system. *The Economics of the Internet and E-commerce*, *11*(2), 23-25.

SAS (2011). Big data defined: It's more than Hadoop Retrieved May 10th, 2015, from http://blogs.sas.com/content/datamanagement/2011/11/05/big-data-defined-its-more-than-hadoop/

Schroeck, M., Shockley, R., Smart, J., Romero-Morales, D., & Tufano, P. (2012). Analytics: The real-world use of big data. IBM Institute for Business Value—executive report, IBM Institute for Business Value.

Shankar, V., Venkatesh, A., Hofacker, C., & Naik, P. (2010). Mobile marketing in the retailing environment: current insights and future research avenues. *Journal of interactive marketing*, *24*(2), 111-120.

Sharples, M., Taylor, J., & Vavoula, G. (2010). A theory of learning for the mobile age. In *Medienbildung in neuen Kulturräumen* (pp. 87-99). VS Verlag für Sozialwissenschaften.

Siegel, E & Davenport, T.H. (2013). Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die. Wiley, New York.

Snider, M. (2012). *More Businesses Getting Their Game On*. USA Today, July 30.

Statista (2015) *Number of apps available in leading app stores as of May 2015* Retrieved May 16th, 2015, from http://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/

Tepper, A. (2012) How Much Data Is Created Every Minute? [INFOGRAPHIC] Retrieved May 12th, 2015, from http://mashable.com/2012/06/22/data-created-every-minute/

Vaynblat, D., & Chahal, G. (2014). U.S. Patent Application 14/155,267. Retrieved March 12th, 2015, from https://www.google.com/patents/US20140129660

Villars, R. L., Olofson, C. W., & Eastwood, M. (2011). Big data: *What it is and why you should care.* White Paper, IDC.

Yang, B., Kim, Y., & Yoo, C. (2013). The integrated mobile advertising model: The effects of technology-and emotion-based evaluations. *Journal of Business Research*, *66*(9), 1345-1352.

Zhong, Y., Weber, A., Burkhardt, C., Weaver, P., & Bigham, J. P. (2015). Enhancing Android accessibility for users with hand tremor by reducing fine pointing and steady tapping. In *Proceedings of the 12th Web for All Conference* (p. 29). ACM. Retrieved Ma7 20th, 2015, from http://dl.acm.org/citation.cfm?id=2747277