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Big Data & Analytics: Tackling Business Challenges in Banking Industry

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Abstract

One of the key values of the banking industry has been its 'Customer-Focused' mindset, but in the new era, the trend is moving to being 'Customer-Centric'. This is because advances in technology and communication, combined with an explosive growth in data and information, have given rise to an even more empowered and aware global consumer. With this change in consumer dynamics; the banking industry has an opportunity to develop an improved customer engagement strategy. More than 70% of the banking executives worldwide say customer centricity is important to them, but do they really understand what that means? Being customer centric means; providing customer satisfaction in five core areas of the Customer-Bank relationship. The banks need to analyze their service and answer the following questions:

1. Do they really 'Know' their customers?
2. Is the 'Product-Channel' fit for their customers?
3. Are they providing a 'Multi-Channel' experience?
4. Are they making a genuine effort for 'Relationship Building'?
5. Do their customers have enough 'Confidence and 'Trust' in them?
6. How can the banks get an answer to these above questions? Well the answer is through "Big Data".

Keywords: Banking; Finance; Organization; Governance

Introduction

The banks have a vast variety and amount of customer data due to an increasing number of transactions through various devices, but they are only using a very tiny proportion to generate insights and enhance the customer experience. Data science goes beyond traditional statistics to extract actionable insights from information. It extracts not just the sort of information you might find in a spreadsheet, but everything from emails, phone calls, text, images, video, social media data streaming, internet searches, GPS locations and computer logs. Historically banks collected huge amounts of data but were unable to derive meaningful insights in a timely manner, which prohibited them to predict and respond to the changing consumer needs and led to missed opportunities. Today the Banking Industry truly believes that big data analytics offer a significant competitive advantage, and even then, only 37% of the banks actually have any hands-on experience with any live big data processes or policies. Banks are no longer questioning the benefits of big data, but some are still holding back. Apparently, 63% of the banks and financial institutions are just exploring and experimenting with it. As per another study by Dell, only 1 in 5 companies use advanced analytics report or utilize high volume or high velocity data commonly associated with big data and majority of firms seem to have their hands full with their own internal, "small" data [1]. One of the major reasons behind a slower adoption of big data in the banking industry is the organization structure and silos. According to, Deutsche Bank: Big data plans held back by legacy systems, February 2013, Big Data plans at Duetsche bank were held back due to legacy infrastructure, which resulted in 90% overlap of data since petabytes of data was stored across 46 data warehouses and

the bank constantly kept collecting data from the front end (trading data), the middle (operations data) and the back-end (finance data). In spite of having huge amount of data, the bank was unable to utilize it and get valuable customer insights since there was no efficient way to extract data, streamline it, and build traceability and linkages from the already existing traditional system [2]. Traditional relational databases have limits on field lengths leading to data loss and it resists complex images, numbers, designs and multimedia. Since they are isolated in nature, information cannot be shared easily from one large system to another for e.g., database at hospital billing department is unable to "talk" to the database at hospital HR department. Another reason that acts as a challenge in big data adoption is skills and talent gap. It is estimated that by 2018, United States alone would face a talent gap of about 200,000 professionals with deep analytical skills, and 1.5 million more to interpret and use findings effectively for decision making. According to Ryerson's University paper "Closing Canada's Big Data Talent Gap," Canada's Big Data Talent Gap is estimated to be about 20,000 professionals with deep data and analytical skills (roles of Chief Data Officer, Data Scientist, and Data Solutions Architect). The gap for professionals with solid data and analytical literacy to make better decisions is estimated at a further 150,000 professionals (Business Manager and Business Analyst). By improving labor market clarity, building the right type of talent and having the government act as a key enabler, can successfully overcome the talent gap. As per another study by Oracle, 60% of companies report that lack of data scientists hinders the success of their projects, 65% organizations are hampered by too little business intelligence and too few analytic applications developers and only 10% of employees are satisfied with the big data technology resources available to them to support analysis and decision-making. Data privacy, governance and compliance form the third biggest challenge when it comes to adopting big data. Big data have this

potential to invade privacy, do invasive marketing with an increased corporate control. A paper published by ISACA, highlighted how companies are leveraging data analytics for marketing purposes and how it could be a breach of privacy and security. In an example, how a retailer knew a girl was pregnant before her father did is an example of how invasive big data can be. In another example, where AOL released anonymized search logs for academic purposes, but users were easily identified by their searches. Therefore, it is highly crucial that appropriate guideline be set to prevent any privacy, security and ethical issues. Finally, big data projects are being held back by the high cost of setting up infrastructure to support the capturing of potentially hundreds of millions of data points each day. A lack of a business case and the need to integrate data sources are also holding back adoption, according to the Australian Big Data and Analytics study, published by Telsyte.

Apart from the challenges of adopting big data, the benefits are endless. According to Capgemini and EFMA, World Retail Banking Report, 2016, Banks that apply analytics to customer data have a 4% point lead in market share over banks that do not (Acquisition and Retention) and at a US Bank, analytics enabled a single customer view across online and offline channels, which improved the bank's lead conversion rate by over 100% [3]. The banks need to understand the benefits of big data analytics and assess their 'Big Data Maturity' by asking the following questions:

1. Is collection and analysis of data a crucial aspect of their business strategy?
2. Is big data analytics a key component of their day to day decision making?
3. Does Business and IT teams work in synergy?
4. Do they have a centralized analytics team?
5. Is their data structured to a level where data from different sources can be combined to create an integrated dataset?
6. Are they well equipped to meet the needs of the continuously growing data volume?
7. Do they have a robust data management framework and technology to do both predictive and prescriptive analytics on customer data?

According to BigData-Startups.com, With Proof of Concepts Rabobank Learned Valuable Big Data Lessons, 2013, Rabobank a leading Dutch multinational banking and financial services company, named big data as one of the 10 most important trends and started developing a strategy around it [4]. They created a list of 67 possible big data use cases, divided them into four categories – 'Fix organizational bottlenecks', 'Improve efficiency in business processes', 'Create new business opportunities' and 'Develop new business models'. For each of these categories they measured IT impact, time required for implementation, and business value proposition [5]. It started with using only internal data but later extended the scope of its big data program to include web data, click behavior, social network data, public data from government sources and macro-trend data etc. The bank built small clusters using open-source technology to test and analyze unstructured data sets, which kept costs low and offered the scalability to expand. A dedicated multidisciplinary team was setup to implement big data use cases that experimented with small and short implementation cycles. One of the use cases at Rabobank involved analyzing criminal activities at ATMs. Rabobank found that the proximity of highways and weather conditions increased the risk of criminal activities. The bank also used big data tools to analyze

customer data to find best locations for ATMs. Now, Rabobank is focusing to address more pressing big data issues around privacy concerns and data ownership.

In today's era where powerful new techniques like machine learning, algorithms and data science has enabled us to process data faster, better and cheaper, the array of possibilities is overwhelming from predictive marketing to cognitive computing [6]. For banks, mining of big data is a massive opportunity to stand out from the competitors and the industry sits on huge amount of data and it is all about unleashing this massive potential. And as this volume of data continues to grow, the potential for banks seems to grow exponentially as well. Banks can turn raw data into relevant information like trends, predictions, projections with unprecedented accuracy. Big data can help identify root causes of issues in real time, help understand benefits of targeted data driven campaigns, generate customer offers by understanding their spending patterns and buying behavior, improve customer loyalty by engaging customers and most importantly add value [7]. Big data enables the banks to use data and get actionable insights leading to increased customer lifetime value. Hence, adopting big data analytics can not only help the bank contain costs, boost profits and compete locally and globally, but also help resolve typical business challenges. Listed below are some of the major business challenges faced by banks and how big data helps in tackling them:

Business profitability

The key business challenge for Banks is increasing its revenue and margin. Big data help in identifying the services that customers want, price points for new services and helping customize services to drive new customer demands. Big data help in driving offers that matter to individual customers rather than generic approaches with non-optimal returns. Successful on-boarding can be followed with precise cross-selling, up-selling, next best offers and product bundling. Big data help the banks use techniques like 'Product Propensity Score' which is the key to unlocking insights from customer behavior data as it allows simultaneous combination, integration and analysis of data. Big data can help banks increase customer acquisition, increase revenue per customer, decrease costs to acquire and retain, reduce customer attrition and enhance their products. Big data are helping organizations get their arms around huge volume of data and make the prospects of gaining insights faster in a cost effective way. This can be proven by quoting a leading organization- Amazon, the pioneer in 'next best offer' [8]. The company employs collaborative filtering to predict a customer's product propensity. From this, Amazon generates its "you might also want" and "customers also bought" campaigns for each product purchased and viewed by the customer. This has led to a significant increase in Amazon's cross sales and revenue. Another great example is Money-Supermarket who measures offline and online user interactions across a range of channels looking for its interest in holiday, car hire and hotels to target customers for travel insurance. By combining data across all channels to build a customer profile has enabled Money-Supermarket to grow their revenue by 33%.

Customer attrition

What if the customers start leaving a bank for a competitor and the bank cannot predict that happening? It would be a disaster. A study reveals that if banks know a customer is going to leave, there is 50% better chance of retaining that customer. So how can big data help? Big data can predict customer churn or attrition by helping banks understand customer activities that might indicate that the client is

considering moving their funds elsewhere and by correlating this data and determining the statistical relevance of each activity [9]. Some of the indicators pointing to attrition could be cancellation of pre-authorized payments, customer complaints, social media sentiment, and major withdrawals. One of the organizations that successfully understand their customer potential churn is T-Mobile who uses billing analysis, where the product usage is calculated. If the frequency of calls to contacts that are using a new provider is increasing, this could imply that friends or family are switching providers, and the customer might possibly do so as well [10]. By identifying these customers and targeting them, T-Mobile USA achieved its target to decrease churn rate by 50% in just one quarter.

Customer acquisition costs

A McKinsey Global Institute Report found that marketing and sales consume about 15 percent of costs for banks. But how can big data help reduce these costs? Banks can use customer data insights to build effective and targeted promotions by correlating customer purchase history, customer profile data, and customer behavior on public social media sites that indicate areas of interest. These customers can then be offered special promotions specific to them. For example, if a person made a number of transactions at Whole Foods and liked the Food Network, the company could send a credit card with a special promotion for Whole Foods or the Food Network [11]. The strategy for saving cost is identifying the right customer, targeting that customer because there is a better chance to acquire that customer. The sentiment analysis tool helps identify the influential customer and help engage the right people and the ones who are critical to a successful acquisition strategy. This big data methodology is successfully used by HDFC bank in India, where the customer lifecycle is used to boost credit card activations. HDFC bank targets promotions with personalized messages to each lifecycle segment for an increased adoption. By using this strategy, the bank has been able to significantly increase their credit card acquisitions and reduce the cost per acquisition for each customer [12]. Another example is OCBC bank in Singapore leveraged a similar big data methodology and achieved a 20% increase in its customer satisfaction index by responding to customer needs after understanding their personal lifetime events and demographic profiles.

Marketing

Business leaders can no longer rely on their intuition to make decisions. Adding objectivity to those decisions with the help of data and analytics is unavoidable in today's era. Big data help in generating a consistent and complete customer view across products, channels and systems. It views the past, present and future to better understand and engage customers. Using big data analytics, banks can understand where and how a particular customer fits in the product lifecycle. Having this insight can have an incredible impact on marketing communication. A customer at the acquisition stage is probably more open to marketing messages than an existing customer. A customer who is planning on leaving the bank will be a better candidate for retention offers rather than a loyal customer [13]. Jeanswest, a retail company uses this methodology to understand their customer engagement. They target frequent shoppers with "thank you" offers, new customers with "welcome offers" and irregular shoppers with offers encouraging them to shop.

Risk Management

Big data offer significant opportunities in wide variety of risk domains, by utilizing insights of volume, velocity, variety and veracity. Big data technology is known to improve predictive power of the risk models, improve risk monitoring by providing real-time risk intelligence, enable evidence based decision making, resulting in significant cost savings [14]. Banks can switch from their traditional architecture and use open technologies like Hadoop ecosystem, which enables them to add significant value to existing traditional systems, databases and data marts by mapping sourced data and aggregating results [15]. For example, by using such big data methodology a bank can segment customers in risk profiles by using information on credit report, spending habits, social media profile, credit card repayments etc. Banks can then use these risk profiles for various activities like pricing customers on their credit products, offering pre-approved offers etc.

Fraud Detection

With growth in the digital realm, the banks have to face a huge challenge of fraud and scams. Staying vigilant to this digital distress is the only possible way to have peace of mind and combat losses. Machine learning uses algorithms to detect changes in digital networks. A designated team can review this and strengthen security measures [16]. Some of the most common ways by which machine learning helps in fraud detection is by identifying strange spending habits, combining supervised and unsupervised techniques to automate tasks, finding customer anomalies and verifying changes etc. Big data can help the banks prevent cyber-attacks, improve regulatory compliance, detect criminal behavior, and detect credit card fraud by understanding customer behavior.

Anti-money laundering

A report by Thomson-Reuters titled The Rising Costs of Non-Compliance, states that Standard Chartered was fined $340 million for anti-money laundering failings. The report also notes that a parallel enforcement action against Deloitte (citing the inadequacy of its consulting work on the bank's AML issues) led to a $10 million fine and a one-year ban on all consulting work at NYDFS-regulated firms. One solution to this problem lies in big data analytics and harnessing the power of Hadoop and moving from a static pool of data stored in a warehouse to a situation where data is fluid and actionable in real time. This enables a much more efficient ingestion, enrichment, analysis, and visualization of large, diverse and constantly changing data sets so they can be harnessed in the fight against Anti-Money Laundering.

Reputational risk

Banks can no longer solely rely on their experience to save their brand. Big data technology can understand consumer behavior to predict future market trends. For example, big data insights can be used to monitor the web to understand customer sentiment towards a bank's products, employees, board members etc. Amazon is a great example of how a company can use big data insight to build its brand. Amazon saw that internet penetration exacerbated by the growth of mobile phones and a new behavior where the customer preferred shopping online rather than in a physical store [17]. Amazon immediately jumped on the opportunity and heavily invested in analytical systems that enabled it to collect a lot of data about website

visitors, making it easier to target potential customers with future opportunities.

Broker and trade compliance

Big data can help identify trading misconduct by correlating unstructured content such as IM chats, emails, and telephone calls with trading activity. This can help protect the bank from regulatory issues by monitoring illicit trading activity.

Reduce data warehouse costs

An EDW (Enterprise Data Warehouse) is critical in generating operational reports for banks. But as the volume, variety, veracity and velocity of data increases, traditional systems can no longer run with efficiency. Hadoop overcomes this challenge by enabling the system to 'Scale-up' to any volume and store, combine, integrate and analyze all data types to generate insights. So big data help the banks by offloading expensive analytics and data preparation, discover the data and deal with various types of data.

New sales strategies

Banks are always finding new ways to design and develop new sales strategies/tools to increase their market share and always need a way to

test its effectiveness [18]. According to a study by Datameer, the product management team of a company designed an iPad application which was used to describe product benefits to its customers. The company correlated the use of iPad application with most the successful sale representative and found that those who used the iPad application had higher sales due to better customer engagement.

Methodology

These were some of the many advantages of using Big-Data tools and techniques. The main attributes of big data are- Data (structured to completely unstructured), Technology (such as Hadoop Ecosystem) and Size (huge volume, variety, velocity, veracity and Value) which makes it a powerful tool for business decision making, revealing insight and behaviors with much more speed and accuracy. Below are some common examples that focus on customer metrics and can help us in understanding some ways by "How" Big Data Technology helps resolve (Table 1).

Customer Metrics	Benefits to Banks	Sources of Data	Methodology	How?
Customer	Enhance products, services and marketing strategies	Social network, blogs, customer survey, call-logs, websites etc	Text Analytics Algorithm	Naïve Bayes can analyze documents and categorize them into positive and negative sentiments which can be scored as -1 and +1. This gives an overall total sentiment without having to read the entire text. Keywords can also be extracted for insights.
Opinions, Feelings and Attitudes			Link Analysis and Graph Theory	This methodology helps identify the most influential customers by providing them a leadership score. Decision trees are created to evaluate the interaction of that customer (considered as a node) with other customers. The high scoring customers are then targeted with offered and given special attention.
Customer Profile and Relationship	Understand customer profile, lifecycle, potential attrition	Customer KYC, transactions, social media feeds etc.	Neural Networks	Neural Networks can help predict the general financial condition and health of the bank. This methodology generates a two-dimensional map to identify problematic entities.
			Classification Algorithm	KNN clustering partitions the data points into small number of clusters, where K points are placed in space representing objects being clustered. These data points are initial centroids. Then each object is placed closest to that centroid which is most associated with. For example: customers with investments more than $500,000 are considered profitable and targeted with better credit offers at a better rate.
			Survival Analysis	This technique helps to predict if a customer is about to leave the bank or not. It divides customers into segments and compares them across time series.
Customer Goals and Objectives	Acquire new customers, Deepen existing relationships, Encourage product bundling	Transaction history, Profile data, Historical purchases	Market Basket Analysis	Link analysis technique is applied to find connection between products so that they can be bundled appropriately. For example: a customer who has recently opened a student account may also need a small student credit card for daily purchases and a student loan to fund their education.
			Linear Regression	Linear regression and decision trees can be used to understand a customer's propensity to a certain product by studying different attributes like income, demographics etc.

Table 1: Customer metrics.

I had an opportunity to interview a few senior managers responsible for data, analytics and reporting at 2 leading banks in Canada. The

overall impression was that all the banks in Canada (Big 5 including financial institutions and credit unions) have ensured that an

'Integrated Data & Analytics' framework sits at the core of any strategic focus and decision making. But despite an enormous focus, they believe that they are still not able to leverage data as an enterprise asset, which means that they are missing on huge opportunities when it comes to improving customer experience, driving profitability, managing risk and eliminating unwanted costs [19]. The Banking Industry in Canada looks upon the leader and pioneer in Big Data-Amazon and believes it has a long way to go.

One of the leading banks has tried to bridge this gap by focusing on building an in house enterprise analytical tool using Hadoop technology. This integrated data and analytics ecosystem reduces excessive cost and complexity that exists due to the traditional systems that currently run through the organization. This is enabling the organization to unlock data driven insights and eventually provide it a competitive edge [20]. An ongoing framework that focuses on streamlining data access, improving reporting functionality and accelerating the migration of legacy systems exists and forms a core value. Currently the bank uses services like Data security pool that provides secures data storage, an Enterprise data platform which is open for both structured and unstructured data, and an advanced Analytics tool. This is allowing the bank to power its business by using analytics and related capabilities to drive value. Using these tools the bank has been able to reduce cost of data integration through re-usability, reduce cost of business intelligence, consolidate analytics platform, enhance accuracy in data, increase speed and agility of data quality and delivery, and most importantly understand and anticipate their customer's needs to provide a great experience [21]. Some of the things that this bank is focusing on for the next few years is, starting to use visualization as a key component of information delivery for instance incorporating Tableau and establishing Hadoop reporting to build more innovative reporting capabilities, and implementing an advanced enterprise data warehouse that will allow the bank to use Data-as-a-Service for access to easy data. In addition to this, the bank is also focusing on enhancements like real-time interaction with clients, an automated file ingestion process, modernization of analytic tools, using Analytics-As-A-Service and integrating information across all channels. As a result the bank expects to have a future state which is way more advanced and aware of its customer. It aims to remove all existing complexities through an innovative ecosystem that enables scalability and agility, provide consistency in services across all analytics and reporting environments, improve capability to manage large volumes of data, make business decisions on trusted data rather than judgment and experience and finally contain cost by reducing fragmented small scale technology deployments [22].

Another leading bank in Canada is not far from achieving its dream of having an unparalleled processing power and cutting edge features, all at a reduced cost. The bank currently runs on an ETL staging that differentiate data extraction tools and techniques, a data mart that manages the data warehouse with different views and multiple tools that does analytical reporting [23]. But it aims to achieve a future state that will run on an enhanced enterprise data platform producing secure, catalogued, searchable data across the enterprise, an enterprise analytics tool that will use Hadoop technology providing scalability and agility by leveraging techniques like machine learning, complex analytics and predictive modelling and a platform that will use business intelligence tools, batch extraction and analytics tools. Using Hadoop the bank aims to achieve a processing power which was not initially possible and has enabled proactive data-driven insights, accomplish simple analysis like ad-hocs and complex analysis like modelling and machine learning etc. This combination of faster

processing, data modelling, visualization technique and advanced analytics will be achieved by using techniques like Spark that allows cluster computing and big data processing and machine learning, Scala/R/Hive programming languages, Native Hadoop Tools like MapReduce/Flume/Pig, and Git-repository collaboration for application development. While adopting big data technology, this bank has taken into consideration important aspects like disaster recovery & backup management, distributed interactive reporting, alignment and attestation of basic standards, adhere to PIA (Privacy Impact Assessment)/PIPEDA standards and avoid any TRIMS/ Privacy/Audit alerts [24]. Once the target state is achieved, the bank will be able to establish the enhanced enterprise data platform as a central data storage, provide 360 degree view of the customer, make information easily accessible, streamline and automate data preparation and reporting, and free analytics capacity to focus on high value projects. The bank estimates that in the target state, the focus of its analytics team on high value projects will increase from 20% to 75%, which will prioritize advanced analytics and visualization over data reporting [25-32].

Clearly, both the banks have a huge focus on adopting Hadoop and establishing an ecosystem that utilizes an integrated data and analytics approach. Even though the ecosystem functionality differ at both the banks but the foundational capabilities were fairly similar. Below is a glimpse of how the target state ecosystem looks like (Figure 1).
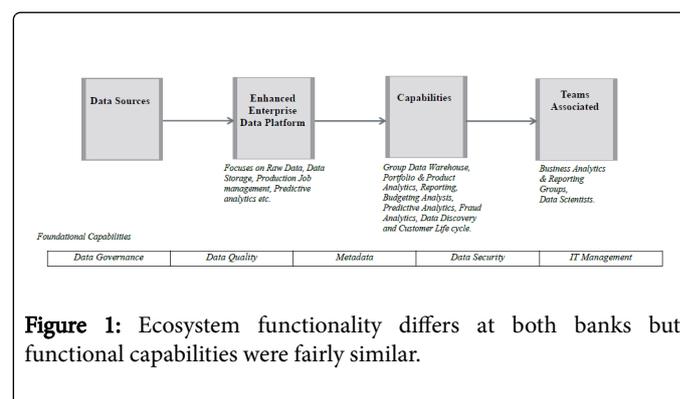

Figure 1: Ecosystem functionality differs at both banks but functional capabilities were fairly similar.

Canadians are moving away from traditional methods of banking and looking for ways that are convenient, quick and less time consuming. To stay ahead and ensure customer needs are met, here are some other ways how Canadian Banks are leveraging Big Data.

Royal Bank of Canada

The Royal Bank of Canada is a Canadian multinational financial services company and the largest bank in Canada. The bank serves over 16 million clients and has 80,000 employees worldwide. The bank is headquartered in Toronto, Ontario. According to a news release in 2016, RBC announced that it was partnering with the University of Toronto to invest in artificial intelligence and machine learning with an aim to keep Canada on the forefront as a leading center of development. The RBC Research in Machine Learning team, academics from the University of Toronto and teams within the bank working on artificial intelligence and machine learning collaborated to provide expertise and help solve business challenges. RBC's vision is to become a digitally-enabled relationship bank and it is changing how it has worked in the past by moving away from the legacy systems. Artificial Intelligence and Machine Learning is known to improve customer personalization, identify patterns and connections that

humans can't, and answer questions about banking issues in real-time [33].

Toronto Dominion Bank

The Toronto-Dominion Bank is the second largest bank in Canada by market capitalization, headquartered in Toronto. It is also a top-10 bank in North America. Globally, it ranks as the 19th largest bank in the world, according to Forbes. Commonly known as TD, the bank was created in 1955 through the merger of the Bank of Toronto and The Dominion Bank. The bank and its subsidiaries have over 85,000 employees and over 22 million clients worldwide. Providing a legendary customer experience is a core value for TD. From campaigns like #TDThanksYou to highly sophisticated customer experience indexes, TD understands that customers are interacting with technology differently and have much higher expectations from the businesses that they deal with. TD has heavily invested in Big Data and Analytics which is proven by the fact that TD's analytics modelling activity can now interpret about five years of consumer data in just 15 minutes. TD aims to crush data faster, reduce fraud rates, and most importantly cut the need to gather the same information from consumers over and over again, aggravating them and reducing a bank's speed. Recently, to improve TD Bank's model for measuring sales performance, the bank examined historical data on branch performance to record some crucial data points, such as customers' commuting patterns, neighborhood demographics and competition in the area. It then looked at the opportunity that each store location had by product to have a much prescribed goal, which was aligned with the customers' needs. For example, a certain branch in a certain area had customers with a high demand for small-business accounts; the model helped in resource planning to ensure that particular branch had employees with a strong small business background and expertise. For this, TD also partnered with Novantas, a management consulting firm, to support the project's data needs. TD also launched its TD Innovation Lab, considered as a high-energy idea factory that uses design thinking and tech know-how to help the staid, blue-chip bank harness new technology and disrupt its own operations before they're disrupted by competitors from the startup world [34].

The Bank of Nova Scotia

The Bank of Nova Scotia operating as Scotiabank is a Canadian multinational bank. It is the third largest bank in Canada by deposits and market capitalization. It serves more than 23 million customers in over 55 countries around the world and offers a range of products and services including personal and commercial banking, wealth management, corporate and investment banking. With assets of $896.487 billion, Scotiabank shares trade on the Toronto and New York Stock Exchanges. According to an article published in 2016, Scotia bank has focused on optimizing its "'Customer Engagement Program" for the last few years. It did analysis in order to understand the pain points of its customers to eliminate any unpleasant experiences and push to focus on customer service rather than product promotion. Their underlying strategy looked at a "one-to-one customer-focused" approach. With the traditional approach, Scotiabank employees would call customers to offer them products which may or may not resonate with the customer's financial objectives. But with the new approach, Scotiabank aimed at better understanding their customer preferences. For example: The bank started targeted those customers who visited their website, clicked at products but did not pursue with applying for that product. With the use of big data and analytics, the employee at

contact center would know this customer behavior and engage the customer to talk about the products, which may have signified during previous online interactions.

The Bank of Montreal

The Bank of Montreal, operating as BMO Financial Group and commonly shortened to BMO is one of the Big Five banks in Canada. It is the fourth-largest bank in Canada by market capitalization and based on assets, and among the ten largest banks in North America. The bank officially began conducting business on November 3, 1817, making it Canada's oldest bank. The company is ranked at number 131 on the Forbes Global 2000 list. In 2016, BMO partnered with Verint, a global leader in actionable intelligence solutions to implement Verint Speech Analytics. For this, BMO was also named the winner of its 2016 Engage Global Customer Awards Program in the "Enriching Interactions" category. BMO leveraged the speech analytics solution to create a Customer Experience Analytics team that has become a trusted source of insights for customer and agent experience. BMO leveraged speech analytics to create substantive categories, identify call drivers, and develop mitigation tactics to proactively address them effectively across the organization. In one example, the organization took corrective action that resulted in a reduction of 3,000 calls per month. BMO also identified the top five drivers of repeat calls, developing training materials, employee communications and manager coaching to address the root causes [35].

The Canadian Imperial Bank of Commerce

The Canadian Imperial Bank of Commerce commonly referred to as CIBC, is one of the Big Five banks in Canada. The bank is headquartered in Toronto, Ontario. The bank has three strategic business units: Retail and Business Banking, Wealth Management, and Capital Markets. Globally, CIBC serves more than 11 million clients, and has over 40,000 employees. The company ranks at number 172 on the Forbes Global 2000 listing. CIBC was named the strongest bank in North America and the 3rd strongest bank in the world, by Bloomberg Markets magazine. According to an article, Marketing gets personal at CIBC with Big Data push, CIBC Bank mentioned that they are sitting on under-utilized data that could complement new metrics and do a better job if leverages properly. Their focus towards their customer's needs, preferences, and behavior forms the basis of their new strategy and demonstrate a fundamental thing: "that we know them". When CIBC's partnership with Aeroplan ended in 2014, it worked towards retaining customer loyalty by launching Aventura. CIBC used FICO (a U.S. firm founded in 1956 and best known for calculating credit scores) to gauge consumers' preferences, predict their future behavior, and tailor customer service and marketing to them accordingly. FICO used various algorithms and created a database of over 7,000 information variables to produce metrics on CIBC's travel rewards clientele. Based on transaction data – such as how often a customer checked their credit card balance, paid it down or used the card to make purchases – FICO "could monitor where a client was starting to disengage, hence, predicting churn or attrition. FICO used CIBC's existing pool of customer data to ensure the email or call was relevant to each client's profile and preferences. It was noted that the number of clients signing up for offers made during the FICO pilot project increased by "greater than 3%." CIBC also saw its "cross-sell rates as high as 11%" for the customers that were engaged [32].

According to a white paper published in 2013, Big Data Analysis: The Next Frontier, Bank of Canada Review, current analysis of Bank of

Canada's macro-economic projections is heavily dependent on data and the macroeconomic data produced by official statistical agencies are published with a lag and are subject to revision. For example, GDP (Gross Domestic Product) is a quarterly series that is published with a two-month lag and revised over the next four years. The CPI (Consumer Price Index) a monthly series is published three weeks after the end of the reporting month. This discrepancy in the quality and timing of data has led Bank of Canada to use 'non-official data'. For example, the Bank's regional offices collect and analyze data obtained from quarterly consultations with businesses across Canada to gather their perspectives on such topics as demand and capacity pressures, as well as their views on economic activity in the future. These data, summarized in the Business Outlook Survey, provide a source of timely information that augments views gleaned from official data [35].

Conclusion

It takes 1 second to say the word "data" and in that one second people around the world generate about 10,000 tweets, make 2,000 skype calls, upload 5 hours of YouTube videos and send more than 3 million emails. Globally, we produce 2.5 Billion gigabytes of data in a day, and International Data Corporation (IDC) predicts number of transactions between firms and those between firms and consumers will reach 450 billion per day by 2020. In addition to these numbers, leading consulting firm PWC states that big data market has grown by $48 billion in the last 5 years. This is HUGE!!!!! So how do we collect this data, manage it, store it and most importantly use it? The answer is by using 'Big Data and Analytics' tools and technology. Banks need to prepare themselves for the future and analyze the continuously growing data, respond to the changing requirements in real time, adapt rapidly to changing data forms and types, learn patterns and predict outcomes, provide security and confidentiality to their customers, keep growing the bank profitability by providing targeted customer advice and most importantly protect their brand. As a result of adopting big data analytics, the banks can answer questions like:

1. What's really happening across the customer journey?
2. Which campaign combinations accelerate revenue?
3. Which offers drive customer loyalty?
4. What credit card behavior signals potential fraud?
5. How can we assess customer risk before extending credit?
6. How can we create more targeted campaigns?
7. How can we acquire new customer with a reduced cost strategy?
8. How can we know in advance is a customer is about to leave us and be proactive to reduce customer attrition?
9. What can we do to make our customers happy?

The banks have always collected data from its customers. One step ahead would be coupling the traditional information with big data (interactional data) for a better customer engagement leading to a greater customer lifetime value. Being able to identify root causes of any failures in real time, fully understanding the importance of data driven campaigns, generating customer offers based on their preferences, revaluating risk portfolios, increasing customer engagement and loyalty and personalizing the customer experience are some of the very basic benefits Big Data have to offer. It is evident that data driven decision are better decisions and there is clearly an opportunity for the banking industry to incorporate big data and analytics to improve business results, create a better products and experiences for their customers and enhance their brand value.

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