Big Data Analytics for E-Commerce – Its Impact on Value Creation

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Abstract: Internet has transformed E-Commerce and customer now have access to wide range of products offered through E-Commerce websites. In order to remain competitive and defend market share, E-Commerce firms formulates online marketing strategies based on real time data. This has steered to a paradigm shift in the E-Commerce, where data is seen as a biggest asset to the firm in understanding specific needs of customers, predicting behavior, tailoring specific needs and offering performance metrics to assess effectiveness. E-Commerce firms are finding ways to extract meaningful information from larger datasets where data gets generated at greater velocity, different variety and at high volumes that are often referred to Big Data. E-Commerce firms are investing huge on Big Data Analytics to empower them to take accurate and timely decisions. This paper investigates how the use of big data analytics is perceived as value creator that can guide E-Commerce companies attain competitive advantage.

Keywords: Analytics for E-Commerce, Big Data Analytics, E-Commerce, E-tailing, Value Creation, Personalization, Dynamic Pricing.

I. INTRODUCTION

Internet today, has become an essential component of business and its remarkable impact on organizations' arrangements is obvious. This has led to tremendous growth in Indian E-Commerce. India's E-Commerce market was worth nearly $3.9 billion in the year 2009, it grew up to $12.6 billion in 2013. According to Indian Institute of E-Commerce, by 2020, India is expected to generate $100 billion online retail revenue. The sector will have to grow at 45% CAGR to reach a size of $80 billion by 2020 from the current level of $14.5 billion, according a study by RedSeeer Consulting.
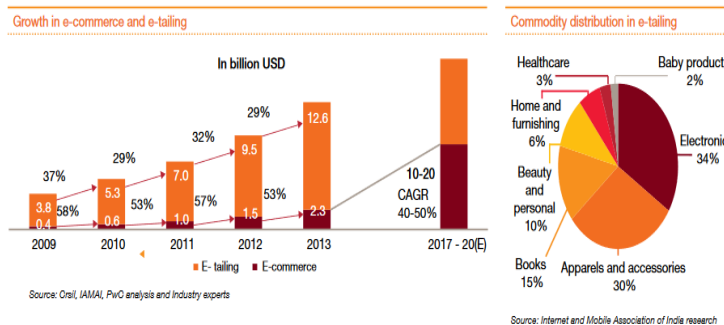

Fig.1 Growth in e-commerce and e-tailing
(Source:https://www.pwc.in)

For the E-Commerce firms, to grow and sustain, a potential way to create business value is through use of big data applications which can be grouped in personalization, dynamic pricing, customer service, predicting customer behavior, supply chain visibility, and managing fraud [1]. In addition, a firm with strong customer orientation is therefore considered to outpace its rivals since it better recognizes customer needs, regulates products and services, and therefore encounters customer needs [2].

In the recent past, many organizations have moved to online environment to achieve better growth, earn further profits and get closer to their customers by knowing them better. E-Commerce firms are using several online tools to enable online marketing strategies, strengthen customer engagement (using Web analytics tools), Social Media monitoring, Web Content Management systems and Customer Engagement Management [3].

E-Commerce companies, with the use of big data analytics achieve:
- •73% increased sales for companies which use Predictive Analytics than those who do not
- •45% of online shoppers are likely to buy on a website offering personalized recommendation

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•60% increase in business margins and a 1% improvement in labor productivity (McKinsey)

•45% of online shoppers are more likely to shop on a site that offers personalized recommendation (invest Consulting) (Source: www.euroitgroup.com), According to Wrik Sen, 2016, (Source: www.cxotoday.com), "Big Data Is Changing India's $100 Billon E-Commerce Market"

TABLE 1 GLOBAL GROWTH IN E-COMMERCE AND BIG DATA ANALYTICS

Year	Growth in the number of e-commerce customers worldwide (in millions)	Growth in e-commerce sales per customer worldwide (in US$)	Growth in big data analytics (BDA) market worldwide (in billions)
2011	792.6	1162	7.3
2012	903.6	1243	11.8
2013	1015.8	1318	18.6
2014	1124.3	1399	28.5
2015	1228.5	1459	38.4
2016	1321.4	1513	45.3

Source: Big data analytics in E-Commerce [1], Adapted from e-marketer
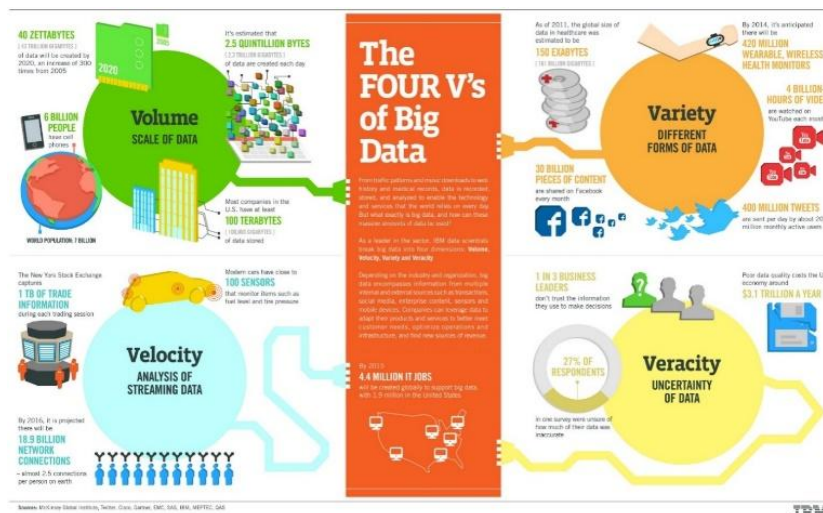
II CHARACTERISTICS OF BIG DATA

Fig.2 Four Vs of Big Data
(Source: http://www.ibmbigdatahub.com)

2.1 Volume
Volume refers to the massive amount of data that is created and can be processed using big data techniques.

2.2 Velocity
Velocity refers to the frequency at which data is generated as well as the expectancy of the data. It is the speed at which data is being generated, produced, created, or refreshed [18].

2.3 Variety
Most of the data that is generated today are either semi-structures or unstructured which accounts to 80% of total data. Variety refers to the different types and sources of data. In big data systems, data might be in the form of images or text from social networks or mobile devices, web logs, streamed video or audio [19].

2.4 Veracity
Veracity refers to the quality of the data. Data is of no value if it's not precise. It can be full of biases, abnormalities and it can be imprecise. This is one of the ill-fated characteristics of big data. As any or all of the above properties increase, the veracity (confidence or trust in the data) drops. Veracity refers more to the provenance or reliability of the data source, its context, and how meaningful it is to the analysis based on it.

2.5 Variability
Variability refers to data whose meaning is frequently changing. This is mostly the case when gathering data relies on language processing [20].Big data is also variable because of the multitude of data dimensions resulting from multiple disparate data types and sources.

2.6 Validity

Validity refers to how accurate and correct the data is for its intended use. According to Forbes (www.forbes.com), an estimated 60 percent of a data scientist's time is spent cleansing their data before being able to do any analysis. According to estimates, the average organization loses $13.5 million annually because of bad data (Source: http://www.firstpost.com)

2.7 Vulnerability

Big data brings new security concerns. The data generated is vulnerable and have been many big data ruptures. As reported by CRN: in May 2016 "a hacker called Peace posted data on the dark web to sell, which allegedly included information on 167 million accounts and ... 360 million emails and passwords for some organizations." (Source: https://upside.tdwi.org)

2.8 Volatility

How old does your data need to be before it is considered irrelevant, historic, or not useful any longer? How long does data need to be kept for? Because of the velocity and volume of big data, the volatility needs to be carefully looked into. (Source: https://upside.tdwi.org)

2.9 Visualization

Data visualization refers to understanding the significance of data by placing it in a visual context. Patterns, trends and correlations that might go undetected in text-based data can be exposed and recognized easier with data visualization software.

2.10 Valence

Valence refers to degree of interconnectedness and interdependencies in big data structures where a small change in one or few elements can have a small or big cascading effect on other elements. The more connected data is, the higher its valences. The most important aspect of valence is that the data connectivity increases over time. (Source: https://gist.github.com)

2.11 Value

The most important characteristics of big data are deriving meaningful business value from the data. Significant value can be found in big data by better understanding customers, target them, optimize the process and improve firms' performance. Value that includes a large volume and variety of data that is easy to access and delivers quality analytics that enables informed decisions. Greatest challenge of big data analytics is to create business value from this eruption of big data. [16].

III AIMS OF THE PAPER

The research question that initiated this conceptual study emphases on what role big data analytics plays in E-Commerce environment in creating business value?, thus creating an understanding on the impact of big data analytics on E-Commerce firm value creation.

3.1 To identify application areas of big data analytics for E-Commerce functions.
3.2 Identify different sources of big data in E-Commerce
3.3 To elucidate business value of big data for E-Commerce companies
3.4 Enlist future challenges of big data application

The scope of this study covers Indian E-Commerce firms using big data analytics. This research focuses on concepts and gives an insight into the phenomenon being studied.

3.1 Application of big data analytics for E-Commerce functions

Akter, S., & Wamba, S.F., 2016, in their paper, explained the most important applications of big data: personalization, dynamic pricing, customer service, predicting customer behavior, supply chain visibility, and managing fraud. [1]

3.1.1 Personalization

Big data analytics facilitates providing customers with personalized service or customized products [1]. It offers customized content and promotions for specific segments. According to Liebowitz, 2013, personalization can increase sales by 10 % or more and provide five to eight times the ROI on marketing expenditures [22].

3.1.2   Dynamic Pricing

In order to attract new customers, E-Commerce companies must be vigilant and vibrant while setting competitive price for the products [23]. E-Commerce firms need to actively influence the customer to buy at their site, which involves setting a competitive price [23]. Dynamic pricing is required as majority of products compete on price offered with other sites.

3.1.3   Enhanced Customer Service

Online retailers can use Big Data to provide an exceptional customer service experience. Providing excellent customer service can lead firms to achieve competitive advantage, even though the product or service is in the higher price segment [25].

3.1.4   Predictive Analytics to predict customer behaviour

Predictive analytics refers to the identification of events before they take place through the use of big data[28]. Big Data can enable you to predict product demand, consumer behaviour patterns & supply chain mechanics. With the use of big data it will be possible to predict future sales revenues, based on the combination of past sales data and predicted customer' preferences [1].

3.1.5   Fraud Detection and handling

Big Data can help aid in detecting fraudulent activities. If fraud is detected in real-time, it leads to a speedier resolution. When fraud detection pattern is combined with Big Data powered real-time detection, the system gathers the required intelligence to detect & negate fraudulent practices. Having right IT infrastructure E-Commerce firms can analyze data at an aggregated level to identify fraud [21]. In addition, E-Commerce firms are able to identify fraud in real time by combining transaction data with customers' purchase history, web logs, social feed, and geospatial location data from Smartphone apps [1].

3.1.6   Supply Chain Visibility

In the current market scenario, the service to track your goods ordered online while the goods are still in shipment has become the standard [1]. Customers expect specific supply chain information, such as the exact availability, status and location of their orders.

This involves intensive use of data infrastructure when E-Commerce firms have multiple third parties such as warehousing and transportation providers in their supply chain. The firms need to be able to rapidly gather information from all involved parties on all products to accurately provide expected delivery schedules to customers [28].

3.1.7   Big Data and Firm Performance

Implementers of big data analytics are associated with enhanced firm performance. The firms that invested in big data [5], had higher labor productivity levels and customer responsiveness than those who didn't. This is explained by the finding that big data technologies can increase the returns of management practices by improving the depth of insight that firms derive from interactions with customers, competitors, and suppliers, as well as the speed at which they respond.

3.2   Different sources of Big Data in E-Commerce

Big data is often generated by machines, people, and organizations.
a. Machine generated data are often referred to data generated from real time sensors.
b. Human generated data are referred to data generated through use of social media data, status updates, tweets, photos, and others.
c. Organizational generated data is referred to more traditional types of data, including business transaction information.

As mentioned in the research paper[1], data gets generated through following sources:
a. Transaction or business activity data: Structured data from retail transactions, customer profiles, distribution frequency and volume, product consumption and service usage, nature and frequency of customer complaints
b. Click-stream data: Click-stream data from the web, social media content, online advertisements (tweets, blogs, Facebook wall postings, etc.)
c. Video data: Video data from retail and other settings
d. Voice data: Voice data from phone calls, call centres, customer service

Big data can be either structured, semi-structured, or unstructured. Real value of data comes from combining these streams of big data sources with each other and analysing them to generate new insights.
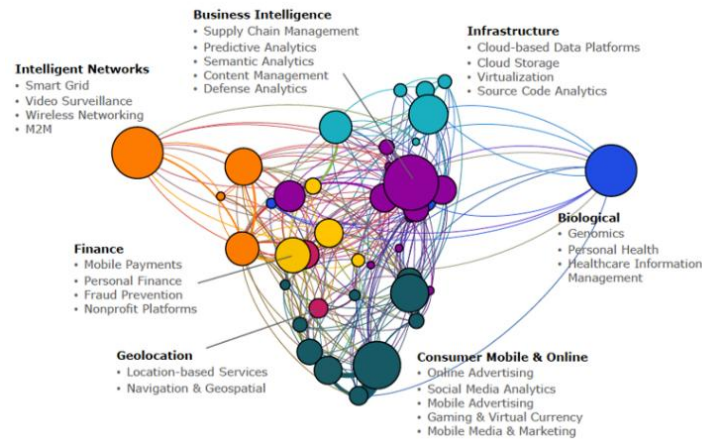
Fig.3 Enabling Technologies associated with big data applications
(Source: Imarticus Learning)

Following can be considered as the key sources of generating big data:
a. Social media and networking sites covering Facebook, LinkedIn, Twitter and blogs
b. Transactions over Internet through Purchasing/Selling (covering manual and automated), Banking activities covering EFTs and EDI.
c. Electronic gadgets (Mobile, Tabs) offering Calls, Messaging, Voice and video messengers, Location mapping, Use of App for transactions.
d. Sensors and network devises by use of Internet of Things, Internet connectivity with hardware devises, Sensors and Satellites

3.3 Business value of big data for E-Commerce companies

What makes big data valuable for E-Commerce companies?

Use of Big data allows firms to build better models, which produce results with higher precision. Big data enables you to hear the voice of every customer as against to customers at large. Many E-Commerce companies, use this information to personalize their communications with their costumers, which in turns leads to meeting consumer expectations and satisfied customers.

It is observed that by a consistent analysis of Big Data, firms will transform into 'intelligent enterprises' that will enhance their productivity and competitiveness in the market, thus optimizing their operations on precise information coming from various sources combined [30].

There is an essence for better relationship between firms within the strategic network in order to achieve competitive position. Having strategic networks can create value to E-Commerce firms by enabling access to information, technologies, markets and activities that are regarded as resources. Also strategic networks offer risk sharing, the opportunity to scale and scope more easily, knowledge sharing and learning [31].

Value can be derived "from the attenuation of uncertainty, complexity, information asymmetry, and small-numbers bargaining conditions". Value creation also happen when increasing the efficiency of a transaction, as improved efficiency reduces costs [31].

Personalized surfing practice is now common online. E-Commerce companies recommends products based on customer shopping histories or shares the preferences of other customers who have purchased products we are considering (Example: While searching for a hotel on some travel websites, it displays how many people are currently viewing the same hotel and how many rooms are left). Later, we see it when an item we were thinking about buying online, shadows us across the internet as ads.

E-Commerce companies use special software to analyse cookies and click stream on customer browsers, can identify patterns in customers' shopping habit and hence can provide customized offers, advertisements and discounts to such customer[32].

A scalable and high-performance Big Data analytics platform is critical to create value to any E-Commerce firm.

According to Gartner Research, Big Data can have impact on your firms business in three ways. It can extent help you to:
   a. Discover hidden patterns of data and offer meaningful insights
   b. Improve your decisions, by stirring information for decision makers
   c. Automate the business processes

A research firm with association with the Massachusetts Institute of Technology (MIT) in 2012 revealed that firms that used big data and analytics outpaced their peers by 5% in productivity and 6% in profitability. By harnessing enormous information, big data analytics helps businesses originate consumer-centric insights to improve business operations. (Source: Harvard Business Review)

As technology grows and becomes a more persistent incidence in day-to-day lives, big data will end up playing a superior role in driving E-Commerce.

3.4 Future challenges of big data applications

It is estimated over 80% of an enterprise data consists of data generated from supply chain partners, market surveys, emails, secondary research, real time sensors and consumers' social media data. The data may be coming is different shapes and sizes through flat file, relations database systems, XML or JSON etc. With the voluminous data, a firm faces several challenges for the future that needs to be addressed in a sophisticated manner.

Some of the key challenges for the future include:

3.4.1 Data integration
As most of the data is either unstructured or semi structured, the ability to combine them to derive at a meaningful information, leading to better business decisions are more important. Due to different variety, the challenge is how to handle and control the quality of data. Data integration should focus on reducing data complexity, increased data availability through increased collaboration that adds value to big data.

3.4.2 Data Volume
One of the key characteristics of big data is Volume. The question is, weather just the volume can give better insights about the business? And for this data needs to be acquired, stored, accessed and processed which is a challenging task for any systems. While processing larger set of data, cost considerations should be taken into account in addition to performance elements.

3.4.3 Availability of required skill set
There are several big data tools available in the market place that needs to be looked into. In addition, skilled people are required who know how to make use of it in an efficient manner. There is definitely shortage of people (like data scientists, Machine learning developers, data analysts, statisticians and mathematicians.2016 Predictions: Chief data officers will become the new 'sought after' personnel of IT. Self-service big data (BDaaS) portals will bond the gap between data scientists and business analysts, - Current estimates state that around one-third of chief data scientists spend up to 90 percent of their time "cleaning" raw data (Source: http://www.firstpost.com)

3.4.4 Data Privacy
When the data is collected, it has lot of personal information about the customers. People are/should be worried as to how information about them is being used that affects them. As their data gets monitored quite often during real time, the privacy is lost.

3.4.5 Data Security and Piracy:
With the huge amount of data that the companies have today about their customers, they must scale up the capability to make sure that this data/information is secure. In addition, several anti-theft elements have to be addressed in order to restore the piracy issues.

3.4.6 Legal aspects:
Once the companies collect and have the customer data, the question raises is "who is the owner of that data". Is it the person we are referring to or the person who generated? In case of negative consequences how situations needs to be handled and who will be held responsible.

IV CONCLUSIONS

The concept of big data refers to generation of data in huge volume that was never known earlier. Data is generated in several forms and different sources. In order to handle such voluminous data that is generated with greater velocity, new technologies are available for real time processing. Big data will bring changes in the way analysis is done and future events are predicted. It brings new opportunities and new markets directing towards precision marketing. Through use of big data analytics, consumers behavior online can be analysed and consumers interests can be predicted. This gives E-Commerce firms to optimize their marketing plans in real time by integrating all kinds and sources of data. Using big data and related technologies brings robust features to run E-Commerce businesses efficiently, thus creating value for firms. This is a gateway to survive and compete in the future. As the system has to handle voluminous data, managing such big data is not free from issues and challenges. Organizations trying to implement big data analytics should understand the technology and bring competent human resource to handle the same. Lack of skilled people in the market and deploying right people is an uphill task. Data privacy and security is one of the key challenges that arise while handling such data.

V SCOPE FOR FURTHER RESEARCH

Due to drastic increase in the number of electronic gadgets and use of other internet connected devices, it is certain that the data volumes will continue to grow exponentially in the future. To handle such data and situations, machine learning will have to play a bigger role in data preparation and using predictive analysis.

As stated earlier, data privacy and piracy challenges will continue to grow. There will be need to skilled human talent to manage the future by making use of and integrating with autonomous agents like smart devices, virtual personal assistants, robots etc.

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