BUSINESS ANALYTICS: CURRENT STATE & CHALLENGES

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ABSTRACT

At present time and state of the market where businesses and organizations are striving hard to survive and improve performance due to high availability of similar products and services, business processes or products are playing less and less significant role when it comes to differentiate oneself from the others. As a result, more and more firms are leaning towards selecting one or a few distinctive capabilities on which they base their strategies on and then apply extensive quantitative analysis to support the selected capability. In this paper we have examined how analytics is delivering values for various internal and external processes. Form an internal view point, processes related to financial, manufacturing, research and development, and human resources are significantly using analytics. From an external process view point, analytics is presently used in client relations, marketing, supply chain optimizations and in few other processes. We have presented the business functions in different industries that are currently generating insight from analytics and also pointed out areas that could benefit from an analytical approach. In conclusion, we have drawn attention to the challenges that are inevitable when embarking on the analytical journey and commented on the approach that should be taken.

KEYWORDS: Analytics, Predictive Analytics, Decision Support System

At present time and state of the market where businesses and organizations are striving hard to survive and improve performance due to high availability of similar products and services, business processes or products are playing less and less significant role when it comes to differentiate oneself from the others. As a result, more and more firms are leaning towards selecting one or a few distinctive capabilities on which they base their strategies on and then apply extensive quantitative analysis to support the selected capability. Thus, analytics themselves are not strategies but they do enhance the capabilities selected by the strategies to a higher level (Koussis et al., 2013). This is more evident from a recent survey by Bloomberg BusinessWeek Research Services which indicates 97% of companies with revenue of more than $100 million are using some form of business analytics (Pettey and Meulen, 2012). Every organization and business are producing overwhelming amount of data in various forms through daily operations from both internal activities and external interactions as well as indirect activities or sources over which they have no control such as a social network blogger writing comments about a product or service who never used or purchased it. Some are captured and others are going unnoticed. Most businesses capture only a fraction of the naturally produced information which results from their day to day operations for relevant decision making. Such data are usually captured by various internal systems already in use and are relatively easy to consume.

As more and more firms are increasingly leaning towards capturing these data using data mining, data warehousing and various process and technologies and utilizing them to derive competitive and value creating actions, budget for analytic solutions is rapidly growing. Gartner predicts that big data will drive $28 billion of IT spending in 2012 (Sharma et al., 2010). BA systems are an important strategic investment for many organisations (Koussis et al., 2013) and often they are significant investments. Benefits of business analytics are discussed in numerous literatures as well as sizable number of case studies have been conducted to comment on general benefits of utilising analytic solutions. However, not a lot of research has been done on the underlying factors that possibly contribute to such benefit resulting from BA systems. In this paper we have primarily focused on the current and potential usage of business analytics and briefly discussed a few theoretical frameworks that can be used for future empirical investigation of BA systems orimplementations.

BUSINESS INTELLIGENCE VS. BUSINESS ANALYTICS

It is often seen that the concept of Business Intelligence and Analytics are used as if they are synonymous. Probable cause of this confusion is that they both are data centric and used in decision making tasks. However this is an incorrect view and we would like to define the terms here for clarification purpose.

Business Intelligence

BI primarily comprises of a set of tools such as ETL, Data warehouse, Metadata and a set of processes that operates on historic (existing) data of the organization to present a static view of the current state.

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There are several definitions of BI available but we have chosen the definition provided by Mike Biere in his book "Business Intelligence for the Enterprise" (Wal-Mart Corporation, 2010):

"Business Intelligence is the conscious, methodical transformation of data from any and all data sources into new forms to provide information that is business driven and results oriented."

Business Analytics

The concept of "Business Analytics" existed since 19th century when Frederick Winslow Taylor theorized Scientific Management approach in his book "Principles of Scientific Management", first published in 1911 (Wal-Mart Corporation, 2010). However, it started to draw more and more attention since early 70's when the scholar of IS community began to research and develop a class of systems known as "Decision Support System" (Laursen, 2011). Analytics can be performed by various means from the simplest means like pen and paper to highly sophisticated SAS modules. Researcher T. Davenport and J. Harries defines analytics as: "Extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions" (Koussis *et al.*, 2013).

LITERATURES

Some of the recent literatures have utilized resource based view of firm (Pettey and Meulen, 2012) and dynamic capability prospective to formulate theoretical framework that helps explain how farms derive performance gain via competitive actions from dynamic business analytic capabilities (DBAC) and potentials moderating variables that might influence the process at various stages. Sharma *et al.*, (2010) extended the model of Sambamurth (Colbert *et al.*, 2012) and incorporated variables such as "cross functional training", "Social Capital", "Independence", "Autonomy", "Transactive Memory" etc. and hypothesised about their effects on competitive actions and organizational performance gain resulting from dynamic business analytics capabilities of a farm. Other variables such as "Analytical talents", "Level of integrations" and "Top management commitments" could also be of interest while examining the impact of business analytics in an organizationalcontext.

Clark *et al.*, presented a conceptual, theoretical model drawn from findings about various types of decision support systems described in the literatures. The term Management Support Systems (MSS) is used to label this broad class. The model presented by Clark *et al.*, shows major constructs identified from the analysis of literature and their influences on the success of a management support system. A subsection of this framework can be used as a theoretical lens to examine and explain organizational success that results from employing analytical solutions.

Since primary focus of this paper is to review the current state of business analytics, examining any of the theoretical frameworks or the underlying factors is out of scope for this paper.

In the following sections, we will briefly discuss how BA is currently used in various industries to derive benefits and some major challenges that need to be addressed by an organization to be successful in its implementation of a Business Analytics solution.

CURRENT USAGE OFANALYTICS

As adoption of analytics is growing in very rapid pace, a discussion of the usage of analytics in various industries is beyond the scope of most papers due to the long list and variations of the implementation. For the purpose of this paper, we, therefore, have focused on the use of analytics from a business process perspective which applies to a wide range of industries utilizing analytics today. The boundaries of these process oriented view are not always clearly defined and one process may overlap with other. In this paper we have divided the applications of analytics in to two broad categories which are: Internal process analytics and External process analytics. Form an internal view point, processes related to financial, manufacturing, research and development and human resources are significantly using analytics. From an external process view point, analytics is presently used in client relations, marketing, supply chain optimizations and in few others.

Analytics in Financial Performance Management

Managing financial performance effectively and efficiently is the key to survival and success for any business. This reality has been felt well all along and even increasingly at present time by corporations, small or medium businesses, government entities and even non-profit organizations due to tremendous competition, complex business environments and extended global recession.

- Analytics are commonly applied in the following

financial activity Financial Close, consolidation, and reporting

- Financial Risk assessment

- Cost Management
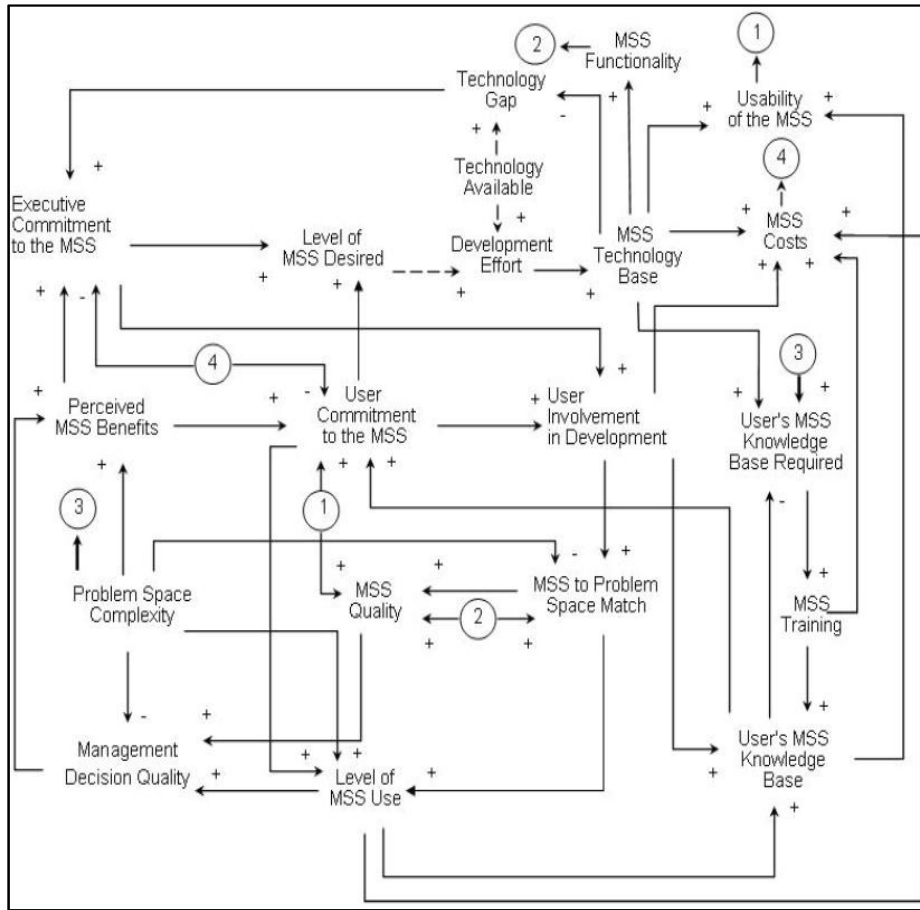
- Investments like merger and acquisitions

Figure 1: Dynamic structure of the Management Support System

Financial Close and Consolidation

Generally the term "Financial close" refers to a corporation's ability to complete its accounting cycles and produce financial statements for internal management reporting, stakeholder reporting and external legal reporting. "Financial consolidation" refers to the corporate reporting thatrolls up multiple organizational entities with a unified perspective recognizing the currencies, complex ownership, management and legal reporting structures.

Fast and accurate financial consolidation process leads to a faster closing and reporting for the businesses which are crucial to both internal management and the stakeholders. Fast closing not only helps the company to maintain a good and reliable image to the investors but also allows the management to access financial information quickly which enables them to focus on problems, better strategic decision making and on trends for future decisions. In addition, today's complex regulatory and compliance requirements such as International Financial Reporting Standards (IFRS), EU Accounts Modernisation Directive, and the Sarbanes-Oxley Act have posed additional challenges on businesses regarding consolidation and reporting activities.

To deal with these challenges at present, businesses are increasingly adopting business intelligence and decision support systems with analytic engines. This enables them to spend more time looking ahead rather than dealing with financial roll ups, reporting errors, processing time and fear of failedcompliance.

Traditional forecasting methods which heavily rely on past numbers of revenue and sales are clearly not enough for most business in today's competitive and less predictable business environment. Mistakes in future prediction of performance are almost always penalized by the investor thus resulting in reduction of the company value and loss of investor confidence in the long run. As analytic solutions highly integrate with several business entities and receive input from wide variety of sources, they can help the user identify key metrics and trends hidden in hundreds of internal and external resources as well as offer a significant positive contribution in performance assessments and performance forecast.

Financial Risk Assessment

Risk is defined as the probability of an event happening that might have a negative impact on the planned course of actions and the financial risk is inherent to every business to a certain degree which presents a threat to its success as the financial risk represents the probability of a potential financial loss. Financial risks for a business or corporation can be categorized in many different way but common areas include investment risks (i.e. Cash flow risk, Default risk, Reinvestment rate risk, Interest rate risk, Currency risk etc.)

Many businesses and most financial institutions are increasingly utilizing analytics due to large structured data and significant improvements in the currently available analytic tools to operate on those data, not to mention that the failure to assess financial risks correctly can have a devastating impact on the business which drives the CFO's to lean towards fact based decision making rather than intuitions. A recent global study, which included more than 450 risk management analytics professionals in three industries, conducted by Accenture Risk Management-London indicates that 73 percent of banking respondents foreseeing more than a 10 percent rise in expenditure related to the company's analytical ability. Financial institutions are leading investors and adaptors of analytics tools for financial risk assessment as they allow the users to incorporate various external factors and world events into the risk model in addition to the standard risk factors. Integration across various data sources and incorporation of a large industry related factors do provide the financial institutes a superior actionable insight inassessing the risk associated with customer, non-performing loans, and liquidity and investment portfolios.

Cost Management

To ensure profitability from any business activity, properly managing the cost is essential. Cost Management provides the management with a better understanding of what drives the costs in any business or organization and eventually allocating them appropriately which ensures efficiency competitiveness and profitability of the business. Failure to manage costs effectively results in a "revenue oriented" model where the revenue seems to be incremental with a very little cost due to unabsorbed costs which might reduce the profit significantly. Even though cost management is not a highly analytical activity, taking an analytical approach can lead to greater cost absorption and more accurate pricing decisions about the product orservices.

While a traditional cost allocation model assigns direct, indirect and overhead costs directly to products and service lines, customers or channels, it can easily result in a misallocation of costs due to its straight forward cost assignment method. Use of analytics in cost management is allowing the organizations to effectively implement a more advanced cost allocation models such as "Activity Based Costing (ABC)". Statistical methods such as correlation analysis allow the business to select good cost drives based on the correlation between the cost driver and incurred expenses which allows the ABC to accurately allocate costs to cost objects by using causal relationships. This provides the decision makers actionable insight required for optimize activities which eventually results in better pricing for products orservices.

Analytics in Manufacturing and Quality Control

Use of analytics has long been existed in the area of manufacturing and product quality control where the companies apply detailed statistical analysis process to determine the optimal production quantity based on current and future market demands assess product quality during the production process and products already in the market based on internal and external feedback related to defects. Analytics are also being used by many product and services oriented companies to determine the optimal configuration for their product or services for a given target market based on customer requirement analysis which enables the companies to reduce product lines by eliminating unprofitable and low demand products orservices.Some of the common areas where analytics can be applied in manufacturing are:

Manufacturing Scheduling and Production Planning

For most manufacturing businesses, plant capacity is the more or less fixed, at least in the short term. So, designing for the peak demand most often might results in unused capacity and designing for the average might be a bottle neck at times. Analytics can certainly address such challenges for manufacturers. For example, Advanced Planning and Scheduling (APS) systems can be used to produce schedules for what to make in which plant and at what time by assessing plant capacity, material availability, and customer demand. In addition, Real time Performance Management (RPM) systems used at the manufacturing industries provide a real time manufacturing data to users throughout the enterprise and actionable information that not only allows the manufacturer utilize the plant facility efficiently but also react to unforeseen events such as rapid change in demand and supply.

Inventory Optimization and Order Management

Unmanaged inventory levels can be a major source of cost for any manufacturer over the time. This typically comes in the form of over-stock costs and stock-out costs. Usage of business intelligence in the manufacturing industry allows the business to accurately track inventory usage, inventory costs and slow moving items. Integrating the inventory information to the order information, analytic solutions can allow the manufacturer to better manage the order lifecycle by providing a 360-degree view.

Warranty analysis and Quality Control

Analytics has long been applied in manufacturing industry for assessing the quality of the products by analyzing the defects or complaints. Often warranty analysis is used for early detection of major issues, problem prioritising based on cost benefit analysis, and process related problem identification, warranty accrual forecasting and service contract optimizations.

Honda's "early warning" program is a good example where warranty related service records are propagated from dealers to manufacturer thus allowing Honda to resolve any potential issues before it becomes a problem.

Analytics in Human Resources

A pure usage of internal analytics is in the area of Human resources. In the "New Science of Human Capital" Boudreau and Ramstad presented a HR and talent decision framework which shows a parallel structure for the investment in human capital to that of finance and marketing where the investment in human capital eventually generates a sustainable strategic success for an organization.

Human capital of a company and the organizational success is strongly connected as people are often the most valuable asset for an organization. This is also the most expensive asset but they are rarely our most measured asset. Even though many companies at present are employing analytical solution related to HR but they doing it on a limited scale that applies only to a subset of the HR domains.

However, a more recent framework targeting HR introduced by Dr. Jac Fitz-enz and the predictive initiative group known as HCM:21 (human capital management system for 21st century) takes an integrative and predictive approach towards human capital management which supports a broad range of business objectives as well as specific solutions around hiring, engaging and developing talent.

Google's People's analytics group is another notable example of the usage of predictive analytics that outlines four levels of sophistications which are: counting, clever counting, insight, andinfluence. Counting is all basic data related to present workforce of an organization such as headcount, attritions, promotions etc. Cleaver counting utilizes formula and model on the top of basic counting in conjunction with projected organizational growth to model difference scenarios for short term such as two to three years. Insight is concerned with underlying causes that drives the trends in a projected scenario. Once the current or projected organizational shape has been identified, we can manipulate the underlying causal factors to influence the shape of the organization as desired.

Common HR domains where an analytic approach is and can be applied are:

- Employee Absenteeism
- EmployeeSeparation
- Talent acquisition and talentretention
- Job performance / TalentManagement

Employee Absenteeism

Absenteeism is defined as any failure to report for or remain at work as scheduled, regardless of reason. Even though most companies allow some forms of

absenteeism in their policy but it can be costly at times. In U.S. workplaces in 2005, the direct cost (excluding opportunity costs) was about $660 per employee per year. Absenteeism has long been a topic of research and significant progress has been made in understanding the causes of absenteeism. Leveraging analytics can enable to identify the unique causes and calculate the total cost of absenteeism more accurately. This eventually helps the management grasp the severity of the problem and create a baseline for evaluating the effectiveness of the absence controlprogram.

Employee Turnover

Employee turnover refers to the process of an employee leaving the organization and getting a replacement for that employee. Employee turnover can be a substantial source of expense for an organization or business, yet many organizations are unaware or failing to measure the true cost of the turnover. Wal-Mart, for an example, employed 2.1 million associates worldwide in the year 2010 and the average rate of employee departure for retail industry in 2009 was 25 percent. If we assume the same rate for subsequent years, Wal-Mart will have to find replacement for about 525,000 employees every year which can be quite substantial cost in terms of recruiting and training. So, it can be easily seen that employee turnover could be a major source of challenge if the HR is not forward looking. Predictive analytics for HR can identify workforce trends and forecast changes before they happen which enables the business to maintain an optimal humancapital.

Talent Retention and Talent Acquisition

Retaining talent truly is critical for achieving the company's strategic objectives.HR analytic solutions that are predictive in nature are capable of identifying patters that lead to volunteer termination and applies those patters to general employee population to identify employees that are likely to terminate. For example, if a company's talent management system becomes aware that an employee recent added a high demand certification and his current salary is well below the industry average of those who currently holds similar certification, theSystem could indicate a possibility of volunteer termination for this employee. Based on this insight the management can initiate the retention initiatives to retain the employee.

However, employee separation is unavoidable which calls for talent acquisition.

Analytics in Supply Chain Management

Supply Chain Management (SCM) is the activity of effectively and efficiently managing the entire process of acquiring raw materials, converting them into finished products and finally delivering them to the end customer. SCM consists of five basic components which are: Plan, Source, Make, Deliver and Return. One of the primary goals of SCM is to get the right product at right place on right time at the lowest cost thus maximizing profit for the business. Since the supply chain itself involves a lot of external components, for most businesses it possess a very complex and challenging scenario to manage if effective. Besides the obvious problems like stock outage, there are numerous risk factors at each step of the supply chain such natural disaster, political instability, regulatory changes or sudden scarcity of key ingredients can cause major disruptions in the supply chain. In the face of these challenges, to get a greater visibility of the entire supply chain and proactively manage various risk factor businesses are increasingly applying analytics tools and techniques today. Probably the most obvious success stories when it comes to applying supply chain analytics is "WAL-MART" which buys its products from 17,400 suppliers in eighty different countries.

The main elements of a supply chain include purchasing, operations, distribution, andintegration typical applications ofAnalytics:

• Demand Planning

• Inventory and Operations Planning Modeling

• Routing

• Scheduling / Sales and Supply Planning

Demand Planning

Demand planning or forecasting is one of the critical tasks for any business that tries to determine how much of a product a business will be selling at certain point in time for a target region or market. This estimate eventually influences other major decisions like the procurement, inventory, staffing requirements, working capital etc. Given the significance of this activity, use of analytic techniques or statistical methods is a must for any business to generate an accurate forecast and be successful.

Forecasting process can been seen as an effort to estimate the mean of an underlying demand distribution; however sole reliance on the estimated mean is almost certain to generate a must less accurate forecast as it does

not take into account factors like demand variability or demand uncertainty, supply constraints, production capacity, product profitability, and market share objectives etc. Therefore, coming up with good forecast is more involved than just estimating the mean of the demand distribution. It's true that most company uses past demand or sales data to estimate the future but it is often not case for many businesses due to various reasons including new products and end-of-life products.

Forecast for stable products can be generated with reasonable accuracy by applying statistical analysis to noise reduced (i.e. Unique events or promotions) historical sales data and adjusting the predictions of analysis by up-to-date information such as new or lost account, future promotions or events that will have an impact on sales. However, demand forecasting for new products or end-of-life products are not so straight forward because various factors such as manufacturing delays, competitors actions or customer attitude. Analytics solutions not only improve the forecast accuracy based on various statistical models but also they can incorporate customer and management inputs, events and promotions as well as product lifecycle information.

Sales and Operations Planning

Sales &Operations planning is a methodology for coordinating supply chain and demand management decisions thus better aligning the demand and supply for an organization or business. Although most operations management focuses on "Aggregate Planning" which assumes that the demand for product or services are given thus failing to take into account the effects of demand uncertainty and constraints.

Sales & Operations planning takes into account this demand uncertainty and supplier constraint and helps the business to identify what demand to plan for. It not only allows the business to respond to unexpected events affecting the demand or supply but also lets the business to set targets about their products and services so that the business is better positioned even when facing unexpected events.

Operating solely based on unbiased forecast where one assumes that the demand is known is not feasible due to demand uncertainty and supplier constraint, and it will often lead to stock out or over stocking costs in addition to poor service level, lost customers, loss of reputations, low inventory turnover and low operating margin. A more effective approach to deal with this uncertainty would be to acquire the

knowledge of the demand distribution instead. A lack of effective SOP fails to capture these risks and eventually cause a greater challenge for the operations, resulting in incremental costs for the company.

In reality, most businesses are faced with challenges like capacity and supplier constrains for example- production capacity limits for a manufacturer, Minimum order quantity set by a manufacturer, transportation availability, working capital availability etc., optimizing profit for multiple products in different stages of the product life-cycle, imprecise information about the demand distribution and optimizing multiple competing objectives. Facing with these complex issues, an analytic approach can significantly improve the Sales & Operations planning process by providing a greater insight into the demand variability since most business now a day possess a huge amount of historic sales, demand and other relevant data in their data warehouse.

Customer Analytics

From retailer to service, most businesses are acquiring a vast amount of customer data every day through sales, support calls, general inquiries and other forms of transactions as well as customer interactions. Since increasing current customer base and retaining existing customers have become a real challenge in the face of intense competition at the market place, business are increasingly applying analytics - both descriptive and predictive - to these customer centric data to gain competitive advantage. An analytical approach is being used in various customer facing processes to attract and retain customers, price optimization, brand management, create new sales opportunities from customer interaction, managing customer life cycle and delivering personalized contents to the customer.

Probably the most significant usage of customer centric analytics today are the e-commerce where the customer interaction data is captured at a highly granular level as well as stored in a very structured forms thus making it very easy to operate on. Individually identifiable transaction data allows the businesses to offer appropriate products and highly relevant promotions to their target customers. Service industries are also taking advantage of this analytical approach to identifiable transaction data to tailor their service pricing for example identifying profitable and high-risk customer from past and other relevant data and adjusting the prices accordingly to maximize the profit margin, However it's more challenging for the retail industry where some form

of incentive, such as discount cards, is required to encourage the customer to provide identity information which can eventually be used for analyzing the purchase behavior of individual customers.

Applying descriptive and predictive analytics to customer centric data can enable a business to enhance and optimize its customer relationship management (CRM) strategy in four key areas which can be better explained by using the "Wheal Model" discussed by Laursen (2011) in Business analytics for customer intelligence.
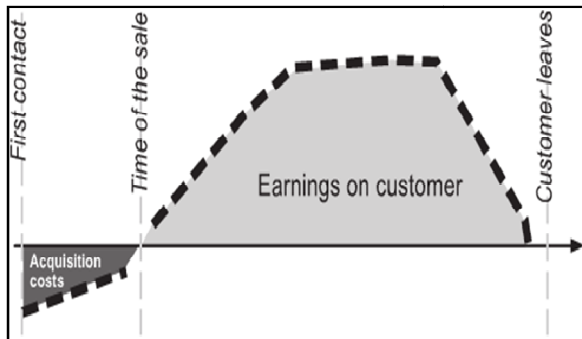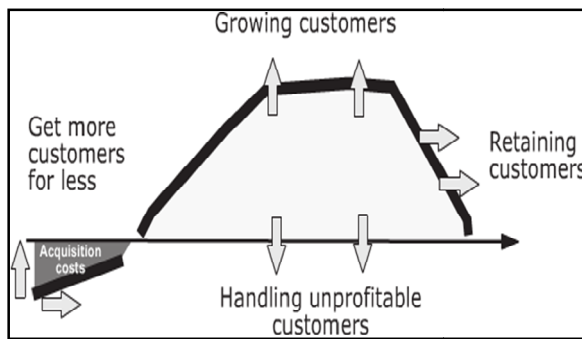

Figure: 2

Figure: 3

1. Prioritizing customers according to theirvalue

2. Acquiring newcustomers

3. Growing existing customerbase

4. Retaining customer

Predictive analytics can bring significant benefits in acquiring new customers and retaining existing customers. Data on user's online activities such as clicks on objects, time spent on a particular page, search terms or recent purchases are easily collected by most e-commerce vendor or obtained from other 3rd party sources for analyzing customer behavior and target ads with accuracy and relevancy which is more likely to

result in a sale at a lower acquisition cost. Since for most companies, acquisition of new customers is more expensive and difficult in a competitive environment like todays, much analytical effort is also exerted on customer retention. Analyzing historic and current transaction data as well as current interactions, analytic solution helps business to answer key retention questions like:

• Is this customer likely to leave? If so,why?

• What offer is most likely to persuade him-or-her tostay?

• Given the customer's predicted profitability and risk profile, what retention effort is justified?

Applying descriptive analytic techniques to historic transaction data from different company repositories or the data warehouse allows a business to segment its customer base based on the value of each customer to the business. This value segmentation then allows the business to allocate its time, effort and resources appropriate for each segment, develop different promotion strategies, deliver personalized contents and reduce product lines by targeting the product configuration for each segment rather than each individual customer.

ASSESSING PRESENT STATE AND CHALLENGES

In Competing on Analytics, researcher Davenport and Harris have divided organizations into five different levels based on their analytical initiatives and implementations which are:

• Level 1 (Analytically impaired): An organization has some data and management interest in analytics.

• Level 2 (Localized analytics): Functional management builds analytics momentum and executives' interest through application of basic analytics.

• Level 3 (Analytical aspirations): Executives commit to analytics by aligning resources and setting a timetable to build a broad analyticalcapability.

• Level 4 (Analytical companies): Enterprise wide analytics capabilities under development; Top executives view analytics as corporate priority.

• Level 5 (Analytical competitors): Organization routinely reaping benefits of its enterprise-wide analytics capabilities and focusing on continuous analytics renewal.

These divisions will help an organization to assess where it stands on its analytical journey, moving from one stage to another will certainly pose some challenges that an organization will have to overcome for a successful transition.

Common challenges to an analytical initiative are often related to process and policy such as:

• Big Data: How to analyze them?

• Structured vs. Unstructured contents

• Use of smarter analytics or predictive analytics

• Budget for analytics

• Cost of ownership for analytical investments

• Top management buy-in for an analytical approach Availability of analytical talents in an organization

• Organizational silos or localized analytics showing only a slice of a pie

• Capturing the details / data in the system in right form so that analytical operations can be performed on them

CONCLUSION

In this paper we have attempted to give a general overview of business analytics in which we have demonstrates how businesses are deriving benefits by leveraging analytics in their daily operations across industries.

We have also presented a few theoretical frameworks in this paper to encourage further research in this area to examine what are the success factors and how they influence other existing components through empirical investigation like case studies.

Finally, we have presented the challenges lies ahead on the analytical path. It is true that not all of them apply to every company adapting an analytical solution. For example, analytic solutions for Wall Street might get away without worrying about the big-data challenges as the data they deal with is highly structured but someone trying to analyze customer perception towards a product by synthesizing physical and digital feedback/reaction to the actual sales other available sources definitely need to address the issue of combining structured and unstructured data.

While many analytical endeavor fails due to lack of alignment between organization's analytical strategy and decision making process by the managers, combining

a wide sources of a data and the building an intelligent model on top of it definitely offers a wider view of the business environment. Thus, an integrated approach to data sourcing, model building and organizational transformation is essential for deploying an effective analytical solution that does produces insight for the organization and translates into competitive advantage.

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