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Rolling data analytics to improve enterprise performance with special reference to supply chain function.

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ABSTRACT

Data , information and Knowledge are the terms we hear frequently, many a time we experienced those are the similar terms, But in a defined scope those three terms interact with each other and have different meanings. Those terms also interact with each other as a hierarchy. In today's business competition, data is being considered as one of the major parameter for planning or decision making. Decision making is driven by data analytics in both ways as corrective and proactive decisions today. The importance is increasing for more and more data to rely on decisions being taken in this competitive situation.

Today's business is vast; each function of business is dealing with decision making and risks associated with it. Not all the decisions are judgmental and situation based but today decisions based on data are playing an important role. The organization and its functions deal with different data and different data sources. Many large scale organizations have focused on data analytics as organizations core function or important function that is also outsourced to some external data analytics firm, where huge data is processed in meaningful information to take relevant decisions.

Today organizations can see growing appreciation towards the return from big data and many executives are realizing importance of data in planning. This research paper is highlighting on data analytics terminologies, todays scenario, types of analytics, importance in business environment, few challenges with implementation of analytics in business & expected future trends in analytics. Moreover this paper is focused on industry trends & some recently done research outcomes in data analytics domain. The major tilt in this research paper is all Business analytics related topics are tilted towards supply chain function due to interest of researcher.

Keywords: Data, Information, Knowledge, wisdom, business analytics, data analytics

INTRODUCTION-

Interaction of data, information and Knowledge-

Data is a raw form; it can be in the usable or non-usable form but is a fact of the world. Data has almost no meaning till it is processed to next step i.e. information. Data can be processed in different form (like categorizing, calculating, condensing..etc) to get meaningful information. Information is useful because it is answer to different questions like what, why, where, how many..etc. Knowledge is the defined aspect out of Information.

Zins has suggested that knowledge, being subjective rather than universal, is not the subject of study in information science, and that it is often defined in propositional terms, while Zeleny has asserted that to capture knowledge in symbolic form is to make it into information, i.e. that "All knowledge is tacit".
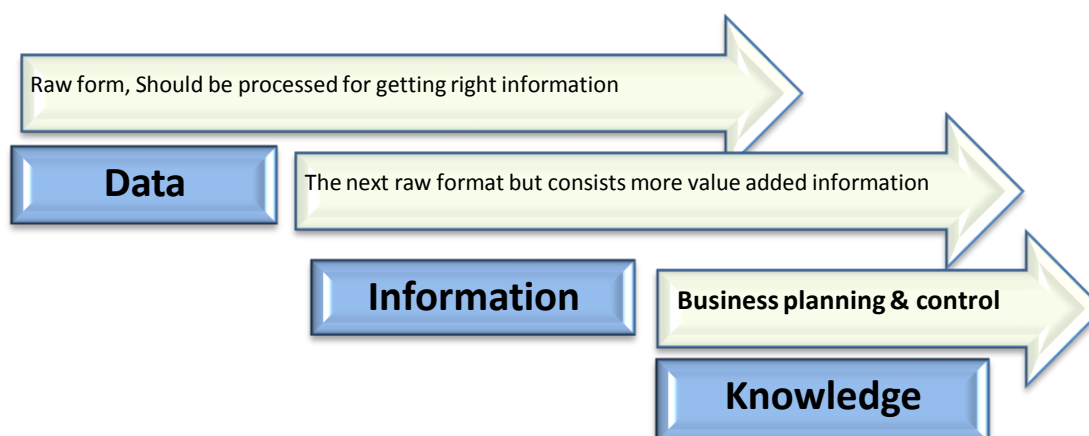

Figure 1 : Data, Information & Knowledge relationship

Research Methodology

Researcher has used both Secondary and Primary data for the research work, Major research paper is focused on secondary data taken from research papers, Thesis, reference books and special focus is given on white papers and case studies from top consulting firms like APICS, Protiviti...

Secondary data: It is defined as data that has been collected earlier for some purpose other than the purpose of the present study. Any data that is available prior to the commencement of the research project is secondary data, and sometime secondary data is also referred as historical data.

Primary Data : Primary data is collected through observation of Industry experts

Literature Review

Although Analytics is defined in different way, Analytics can be defined as the discovery of meaningful patterns in data where recommended actions or decision making is developed as a core objective. Especially valuable in areas rich with recorded information, analytics relies on the simultaneous application of statistics, computer programming and operations research to quantify performance. Analytics often favors data visualization to communicate insight and it can be purposed to solve the real problems.
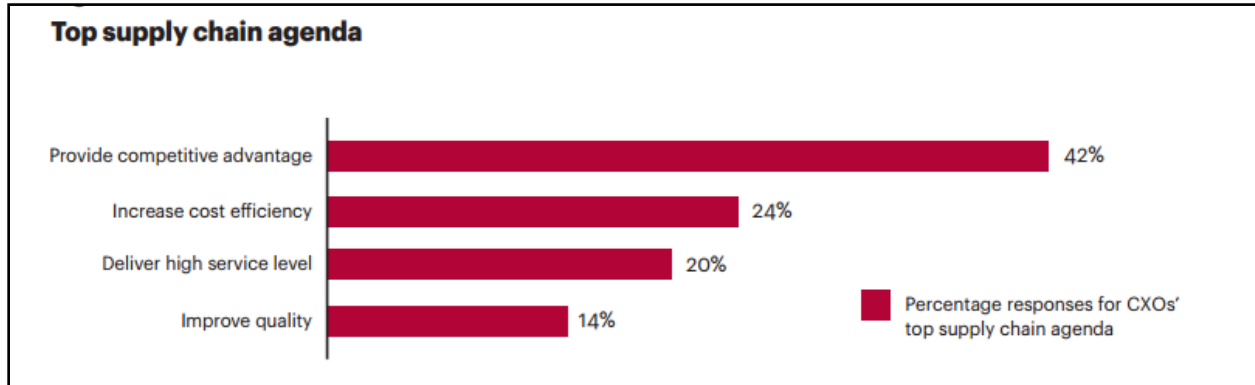
Firms may commonly apply analytics to business data, to describe, predict, and improve business performance. Specifically, arenas within analytics include predictive analytics, enterprise decision management, retail analytics, store assortment and stock-keeping unit optimization, marketing optimization and marketing mix modeling, web analytics, sales force sizing and optimization, price and promotion modeling, predictive science, credit risk analysis, and fraud analytics. Since analytics can require extensive computation (see big data), the algorithms and software used for analytics harness the most current methods in computer science, statistics, and mathematics.

There is a significant upswing in using data analytics in recent years, International Data Corporation mentions that more organizations are recognizing importance of data sources and data driven decisions. Bloomberg BusinessWeek research studies conducted a survey amongst 930 respondents (April–May 2011) states that 97% of the organizations are using some form of business analytics which was 90% in the survey conducted two years ago (April-May 2009). In the same survey in 2009 21% respondents rated that analytics is integrated use across the entire organization while the rating was increased to 34% for same criteria in year 2011. This states that there is a trend of integrating a business data which is really necessary to visualize better picture of organization and relevance of organizations functions.

According to Dan Vesset, program vice president for IDC's Business Analytics Solutions group. He notes that IDC expects the market to grow at a 9.7 percent CAGR through 2017. With good reason: There is evidence that "data-driven decision making enabled by business analytics solutions" provides competitive differentiation for users, according to IDC.
The Big Data technology and services market represents a fast-growing multibillion-dollar worldwide opportunity and is expanding rapidly. A recent IDC forecast shows that the Big Data technology and services market will grow at a 27% compound annual growth rate (CAGR) to $32.4 billion through 2017 - or at about six times the growth rate of the overall information and communication technology (ICT) market.

In a study conducted by A.T. Kearney, It is a very crucial point mentioned in the analysis about emerging trends in supply chain. A.T. Kearney had conducted a survey of Chief executive level leaders (CEO, CPO, COO..) on the topic "Top Supply Chain Agenda" and it proved 42% executives focus on Supply chain agenda as providing competitive advantage, while 24% executives focus on increasing cost efficiency, 20% executives focus on delivering high level of service and remaining 14% focused on improving quality.

Top supply chain agenda

- Provide competitive advantage — 42%
- Increase cost efficiency — 24%
- Deliver high service level — 20%
- Improve quality — 14%

Percentage responses for CXOs' top supply chain agenda

Source: A.T. Kearney Analysis

There is always a challenge of increased cost of input, and cost of input constitutes around 60% of the total cost. Meanwhile from another side there are many constraints to increase sales price due to cut to cut competition and this has left with no choice than using input resources more efficiently with controlled manner. Inventory Management is one of the scientific and analytical approaches to overcome on such challenges. (**D. Chandra Bose, 2006**).

NenadStefanovic discusses in his research paper that performance management is all about monitoring, measurement and analysis of operational performance data and collaborative decision making. He highlights that many organizations have existing KPI for supply chain performance that are backward looking, it means those are monitored and analyzed to see what has happened? How and why this happened? Further Nenad guides on a performance measurement model with help of world known SCOR model concept where he advocates that Business intelligence tools and technologies are the best options to enable to react timely, to predict what will happen (Forward looking) and this helps supply chain team to have better responsiveness and less risks. On the similar topic **Kiran S. Patil** in his research paper studied brief on SCOR model and its benefit for the organization, Kiran feels that current KPI, scorecard and dashboards used to measure supply chain performance are not interlinked to strategy

Types of data analytics-

Although there are different types of data analytics are defined by different authors, this research paper is defining only four major types of analytics. According to the study while writing research paper it seems all type of analytics done is covered in those four major types mentioned below

1. **Descriptive analytics –** This analysis is done to understand what is happening by taking relevant data of the business / business function. One can see historical trends, patterns, present scenario through defined reports or business scorecards with defined performance metrics of business.

2. **Diagnostic analysis –** This is the analysis to understand why something has actually happened, I may be referred as like root cause analysis. Due to this analysis organizations usually focus on overcoming the issues, concerns or problems that are affecting business and hence providing clear views on Opportunities for improvements (OFI's).

3. **Predictive analytics –** This analysis is to find what could happen or what is likely to happen in future date. This analysis has major focus on decision making through historical trends and patterns movement. One can say this is the form of pro activeness from organization to take actions in present time to avoid something wrong happening in future.

4. **Prescriptive analytics-** Analytics part is not limited for past, present or future understanding but prescriptive analytics is extending a scope especially for decision makers. In this analysis more focus is given on what are the best actions or what actions can be taken. This analysis is playing an important role in decision making.
   Below table will briefly introduce four types of analytics with some real life examples.

Table 1: Types of data analytics and examples.

Analytics type	Brief meaning	An Example to support the definition.
Descriptive	Understand what has happened? Or what is happening now?	In a Supply chain order management process, it is possible to understand what is happening with order movement in every stage, like when order was due, when it is shipped, past dues, transporters delays which will give a better picture of On time delivery, order failures, Percentages of past dues …etc.
Diagnostic	Understand why this happened?	Considering same example above if one will take whole order management data for particular period, it may be easy to focus on issues like past dues, then it can be easy to identify which product line is most likely past due in the period, why this happened? Machine down? Suppliers delays?..etc. In a same data focus may be moved to another areas like transporter delays – Which origin and destination, which are the months or seasonal ?
Predictive	Understand what is likely to happen? / What will happen?	In manufacturing industrial scenario, one can see past trends of product sale, price and it will be easy to understand the future trend, the same is applicable to understand expected profit margin, sales, expected increase in customers, prices..etc.
Prescriptive	Understand What to do? What actions to be taken?	In a hospital industry once big data is available with patient name, age, disease, treatment and cure time required, it may be possible in future to treat new patients based on past data, the focus area will be moved to type of treatment appropriate for new patient.

Challenges in Data Analytics-

With growing volume of business and global competition, organizations are forced to solve real life problems at the earliest. Organizations can find challenges as well as several opportunities while dealing with big data. Data is found in variety of forms, size and complexities. To make sense out of big data it is really required to understand analytical techniques to find valuable and meaningful data patterns to present big data in simple way. Few major challenges in data analytics are outlined as below.

Skilled resources- One of the challenges today is to utilize business experts, while Domain knowledge experts are not likely to be experts in analytics or statistics to deal with a big data. The important aspect here to focus is to understand the data. Even if domain experts know what outcome is expected, what to analyze or what metrics are important for decision making but due to lack of analytical skills it becomes difficult for domain expert to overcome on real problems through analytics. In a simple way True value of data comes from understanding it properly to deliver business insights. Utilizing analytical experts to solve domain issues is much similar to how we can close the gaps between knowledge and expected results from business domains.

One of the survey from database vendor RainStorwith respondents from a variety of large-scale industries, including banking, communications, financial services, and manufacturing. Three-quarters of respondents said that better management of big data helps their organizations make smarter business decisions. And yet more than a third (37.5%) also said that analyzing big data is their biggest challenge.

Studies by Ventana Research (One of the leading benchmark research and advisory services firm, offers a range of services to support organizations seeking to improve their performance.) states that lack of resources is the major barrier to use innovative technologies

Data integration –Data integration is ability to combine data from different sources or data with different form is the key challenge for any analytics or analytical tool to be used.

Effective use of Big Data will need geospatial analysts of a different kind. They can be mathematicians, computer programmers, geographers, engineers, social scientists or business managers with ability to 'think out of the box' and look at processes like spatial interactions, spatial behaviour and spatial diffusion along with traditional geospatial techniques and create models which can work on streaming and static Big Data. These capabilities cannot be taught in classrooms but need to be encouraged through real life practices

According to Ventana Research "Selecting the right approach to big data integration is difficult when organizations lack knowledge of the functional requirements and best practices relevant to their industries, lines of business and IT. Deficiencies in existing software and data environments can further complicate the ability to choose wisely and so should be factored into the deployment decision-making process. Organizations must identify the types of integration being used or under consideration to handle data other than that formatted for relational databases, and evaluate processing capabilities and techniques to handle the proliferation of big data. IT professionals therefore must understand how to work with analysts and business management to deliver timely, benefit-based big data deployments."

Data management is one of the major problems which could be part of data integration as a whole. Major areas to focus in data management is storage, fraud detection, avoid data duplicity, focus on right data to avoid planning errors.

The UN-GGIM has identified that techniques such as graphical processing units (GPU), parallel processing and databases like NoSQL (Not only SQL) will help to analyse Big Data in seconds instead of hours. Big Data streams are fast, typically 10-100 times faster than transactional data. In such situations it is difficult if not impossible to analyse data in real time with SQL. NoSQL essentially works to bring SQL interfaces to the runtime, thus probably eliminating the need for data warehouses; it does not mean that SQL and data warehouses will go away. According to IBM, data warehouses will still be around to store pre-processed data which is of high quality and has a broad purpose. On the other hand, Big Data repositories do not undergo such rigorous pre-processing and the stress is more on discovery rather than value. Repositories may also have different characteristics, some may stress atomicity, consistency, isolation and durability (ACID) while others may be more relaxed and operate on basic availability, soft state and eventually consistent (BASE) basis

Cost – With increasing volume of a data concerns include increase in cost for data storage infrastructure, implementation of analytics tools and skilled employees/ employees trained to handle big data technologies and tools.

Today organizations have entered in a age of big data where new challenges and opportunities are identified every day due to which organizations have a major challenge of cost cutting initiatives to actually implement data analytics.

Changes happened due to rising analytics-

As analytics area has increased in different business areas, there are several changes seen in business environment that is showing business excellence. Few major changes can be highlighted as below.

It speed ups the business decision making that helps aligning business goals & strategies.

Real time decision making is now easy in business areas. Data analytics has improved competitiveness in business while information flow through many channels or business partners has become easy & essential.

Reporting automations, scorecards & Business intelligence tools has given in depth to analyze the data & to understand more meaningful patterns to take right decisions at right time.

If one cannot define a value then it is difficult to identify what is worth, Analytics has major contribution to define what is valuable to business, where to focus & what strategies are necessary.

Many organizations today are implementing business analytics as a culture & they are willing to be committed with fact based decision & solve complex real time problems. Thus majority of areas like identifying customers, new product developments, sales, supply chain & pricing are boosting in the performance with the help of analytics.

Analytics with reference to Supply Chain-

Almost all major players and globally known firms have accepted that complex supply chain problems can be resolved with the help of data analytics with interlinked systems that predicts disruptions, predictive risks. This leading to adoption of advanced tools incorporated with analytics and visualization.

Companies started looking in strategic way towards EDI, RFID ERP, & Information technologies into supply chain, this helps to reduce complexity of the process, reduces actual manpower and proves efficiency into workflow.

In todays supply chain, one of the major challenges faced by Global supply chain functions is aligning demand and supply, why it is so difficult? It is clear that today we have diverse consumer base, diverse customer requirements, multiple product lines and types, globally spread business networks, demand variations occur from end customer and applies throughout the supply chain, Supplier not able to meet demand by any way, real time data not available … and many more reasons have impact on supply and demand variations. To Come over on supply and demand related variance S&OP (Sales and operations Planning) team takes a key part of the process where they do forecasting and demand planning, Rough cut capacity plans, Identifying capacity constraints. The S&OP functions is moreover into data analytics side and this analytics drives decision making and action plans organization wide.

Top management meets weekly to review supply and demand positions for risk assessment and this process id referred as Sales and operations planning (S&OP) or some organizations also refer it as Sales, Inventory and operations planning (SIOP).In this meeting metrics are reviewed to understand previous plans and actuals, this process helps to improve predictability, to increase proactive actions and to minimize risks (Donald H. Sheldon, 2008)

According to an article on EBN online (Betting on Analytics as Supply Chain's Next Big Thing), "*Some industry experts claim that the day for real-time supply chain practices has come -- and is on the verge of being more mainstream, thanks to a multitude of cloud data management tools and increased corporate adoption of new supply chain software platforms coming to market. However, there's also acknowledgement that a necessary foundation for moving efficiently at real-time speed -- supply chain analytics -- is still very much at the beginning stages of development at many companies, and will take time to build out.*"[1]

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Information plays an important role and there shall be structured, defined and frequent communication amongst all supply chain partners. As there are multiple partners within the chain, it is difficult to understand actual requirement of end customer, the term is coined as Bullwhip effect. APICS (American Production and Inventory control society) defines Bullwhip effect as "An extreme change in the supply position upstream in a supply chain generated by a small change in demand downstream in the supply chain. Inventory can quickly move from being backordered to being excess"

Bullwhip effect can also be considered as distortion of demand along the supply chain which goes upstream in an amplified form (Abhilash Reddy Kothi, 2007).

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[1] http://www.industryweek.com/blog/supply-chain-analytics-what-it-and-why-it-so-important

Companies can reduce the bullwhip effect by increasing more visibility of demand information amongst partners and planning collaboratively with the effort of CPFR (Collaborative planning, forecasting & replenishment) (Sunil Chopra &ManMohanSodhi, 2004).

APICS (American production and inventory control society) and Protiviti (Global consulting firm) in their research paper concerned with risks associated in supply chain and some solutions, described many risks in overall supply chain activity and some of them concerned with core areas of materials management are Information integrity and availability risks, demand supply planning risk and integration, inventory and obsolescence risks, customer satisfaction risks and service risks, process inefficiency risks. Looking at above risks it is clearly visible that there are scattered areas where risks are associated in materials management and each risk has different impact on overall performance of materials function, supply chain and hence enterprise.

Moreover this research paper is a robust foundation of understanding each risks category and top three risks associated are categorized in this research paper are as below.

1. 66% respondents in survey feel that Supply Interruption is major risk –it means we could not fulfill customer demand due to supply are improper. This can be one of the reasons because of continuous supply and demand variations and improper management of supply demand in advance.
2. 55% respondents rated - Lack of senior's effectiveness in sales and operations planning (S&OP) process. If one see point 1 and point 2 discussed here then those interlink in terms of improper supply and demand management well in advance.
3. While looking at many scenarios in complex business and large data 49% respondents highlighted Lack of timely and accurate information for strategic initiatives is one of the major risks.

Thus Business analytics in supply chain plays a vital role and has been now considered as strategic approach to take up business analytics opportunities. Firms pay huge on getting business analytics incorporated in decision making process. It is always accepted that decisions from data are more useful than judgmental decisions.

Expected future of Business Analytics-

Every year volume of data is increasing with some folds while many of the organizations have considered data analytics is a driving part of business the trends in analytics, tools, experts, innovations, technologies are expected to be going up rapidly in coming future.

Future is expected with data integration to achieve the goals of real time data analytics and decision making on massive data sets.

It will be simple to bridge the gaps of expectations and present as new technologies, tools and involvement of Business intelligence is rising significantly. Now analysts can compare and correlate huge data easily, which leads to define meaningful patterns, trends and scorecards to measure key indicators of business. In a simple way data analytics is becoming a key driver for decision making, identifying improvement opportunities, defining strategies for future, Moreover the age of judgmental or situation based decision making is coming to end and focus is moving towards data based decision making in fact decisions are now output of analytics (Prescriptive analytics).

Many IT firms have developed analytical based software's & tools that can be used even by mid-sized organization to achieve cost effectiveness, in a future it is expected that basic level analytics will become more cost effective & mid-sized organization will also be able to implement analytics as a core function with increased focus.

According to survey by Intel (An organization that designs and builds technologies for computing devices) including 200 IT Managers working on data analytics projects

- Adoption of big data analytics tools such as the Apache Hadoop* framework and commercial distributions of Hadoop* is growing, with 25 percent of our survey group having already implemented these technologies and another 20 percent being in the process of deploying at the time of the survey.
- In 2012, IT managers were using both batch and real-time delivery of analytics equally, with a 50-50 split. However, that's changing—companies were expecting to do almost two-thirds of their analytics in real time by 2015.
- Security concerns and capital required were two major obstacles for big data analytics.

Apart from a business excellence one can see some other changes in industrial area as below

- Many employees are now looking forward with business analytics as a career, it is expected in future that analytics will be another core area of education, training & career development that will rise substantially in near future.
- Multinational organizations are entered in cost effective countries like India, china with analytics function in the form of BPO, KPO or IPO which are showing major contribution in service industry & national economy.

Conclusion-

Organizations those are not acquiring data analytics as a major business function should think of the future to understand what level of analytics can be implemented to gain benefit out of available data. Although all the organization has some form of analytics implemented but to move strategically organizations should thing whether there is need to expand the analytics and it is expected that majority of organizations will end up with answer "Yes" to this question.

On every level of organization there should be defined analytics and defined key indicators which should be monitored on regular defined periods.

As Business analysts are becoming valuable assets, there is a need for organization to invest in training and developments of this role. Training should include identifying data sources, analyze and the requirements, manage ongoing changes.

Data is a heart of analytics, to drive any successful analytics it is important to understand right data from right source at right time, the overall outcome of data analytics is depending on understanding right data.

As business users are putting more demands on requirements, it is necessary to better understand and improve the results in business processes, thus while implementing such key projects it is becoming necessary to develop a cross functional team of experts in analytics, domain expertise, IT team and related functional members if necessary.

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Tables & Figures-
Table 2: Types of data analytics and examples.
Figure 2 : Data, Information & Knowledge relationship.