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RESEARCH ARTICLE

BUSINESS INTELLIGENCE (BI) IN SUPPLY CHAIN MANAGEMENT

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ABSTRACT

Companies in the manufacturing and service sectors have realizing that to achieve economies of scale they need to formulate management policies based on modern business strategies. Best way of optimizing their product or service for market at the same time. The use of information technology in almost every type of industrial process has contributed to the development of the strategies and tactics. The strategies that support product development or facilities development have to move at a much faster speed than ever before. Modern business strategies lay stress on using the latest communication tools such as video conferencing and e-mail for improving communication within the organization as well as with clients. Modern characteristics of management techniques are: Systematic, Analytical, Quantitative, Applications of management techniques, Traditional methods of management are primarily based on behavioural sciences, The conventional methods of management, Modern management techniques, Statistical techniques, Mathematical techniques, Simulation study/model System analysis, Linear programming, Inventory control, Precedence and arrow diagramming, Network analysis PERT CPM, Financial techniques, Precedence Evaluation Review Technique (PERT) and Critical Path Method (CPM), Network representation i.e. Activity on Arrow (AOA) system and Activity on Node (AON) system. Management by Objectives (MBO), Identifying the Key Result Areas (KRAs), Total Quality Management (TQM), Error proofing (pokayoke) is the managerial process. All these are under purview of Business Intelligence. Here a briefed note has been prepared citing real-life data.

INTRODUCTION

Business intelligence (BI) can be defined as a collection of approaches for gathering, storing, analysing and providing access to data that helps users to gain insights and make better fact-based business decisions. It should be defined wider than just referring to BI software applications and analytics to incorporate a more strategic approach to better decision-making. Business intelligence (BI) is the set of techniques and tools for the transformation of raw data into meaningful and useful business relevant information to help strategy maker to take business decisions. Business intelligence (BI) has two basic different meanings related to the use of the term intelligence. The primary, less frequently, is the human intelligence capacity applied in business affairs/activities. Intelligence of Business is a new field of the investigation of the application of human cognitive faculties and artificial intelligence technologies to the management and decision support in different business problems. The second relates to the intelligence as information valued for its currency and relevance (Jayanthi Ranjan, 2005).

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The basic components of Business Intelligence are gathering, storing, analysing and providing access to data (see Figure below).

Gathering Data: Gathering data is concerned with collecting or accessing data that can then be used to inform decision making. Gathering data can come in many formats and basically refers to the automated measurement and collection of performance data. For example, these can come from transactional systems that keep logs of past transactions, point-of-sale systems, web site software, production systems that measure and track quality, etc. A major challenge of gathering data is to be sure that the relevant data is collected in the right way at the right moment. If the data quality is not controlled at the data gathering stage then it can jeopardise the entire BI efforts. Storing Data : Storing Data is concerned with making sure the data is filed and stored in *Fig 2* appropriate ways to ensure it can be found and used for analysis and reporting when required. When storing data the same basic principles apply that one should use to store physical goods i.e. books in a library, he are trying to find the most logical structure that will allow him to find easily and use the data. The advantages of modern data-bases (often called data warehouses because of the large volumes of data) is that they

allow multi-dimensional formats so one can store the same data under different categories - also: called data marts or data-warehouse access layers. Like in the physical world, good data storage starts with the needs and requirements of the end users and a clear understanding of what they want to use the data for.

Fig-1. Components Relationship

Analysing Data: The next component of BI is analysing the data. The data that has been gathered and inspect, transform or model it in order to gain new insights that will support business decision making. Data analysis comes in many different formats and approaches, both quantitative and qualitative. Analysis techniques includes the use of statistical tools, data mining approaches as well as visual analytics or even analysis of unstructured data such as text or pictures.

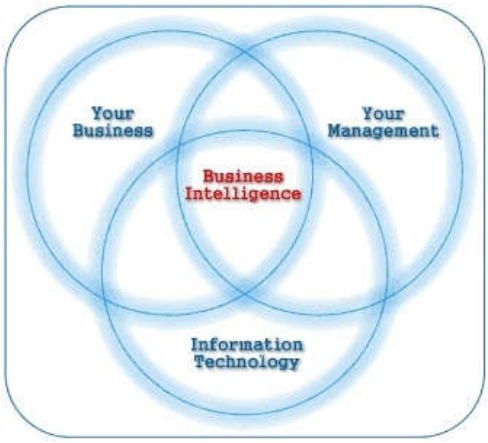

Fig 2: Relationship pattern (http://www.corporateserve.com/)

Providing Access

In order to support decision making the decision makers need to have access to the data. Access is needed to perform analysis or to view the results of the analysis. The former is provided by the latest software tools that allow end-users to perform data analysis while the latter is provided through reporting, dashboard and scorecard applications. Business Intelligence is more than Software Tools and Technology The term Business Intelligence is often used in a very narrow way to refer to software applications used to analyse an organization's raw data. Terms often associated with BI in an IT sense are data mining, online analytical processing, querying and reporting.

In fact, ownership of BI is very often in the IT functions of companies. The reason for this is not that they possess the best analytical capabilities but because they are overseeing the implementation of software tools - so called Business Intelligence (BI) applications. The problem is that despite huge investments in BI software and solutions in recent years many organisations are still failing to convert data into strategically valuable knowledge. IT infrastructure and software alone cannot make this happen - BI must be owned by business leaders and managers who are supported by IT. Today's BI applications come with a lot of out-of-the-box functionality that allows managers to start analysing data even without the help of statisticians and IT professionals.

Why Business Intelligence

Business intelligence (BI) is a technology-driven process for analyzing data and presenting actionable information to help corporate executives, business managers and other end users make more informed business decisions[1]. BI encompasses a variety of tools, applications and methodologies that enable organizations to collect data from internal systems and external sources, prepare it for analysis, develop and run queries against the data, and create reports, dashboards and data visualizations to make the analytical results available to corporate decision makers as well as operational workers. In short it is

- To gain data driven insight anything related to business performance
- To monitor current business performance
- To Increase profitability and identify new business opportunities

Facts and dimensions form the core of any business intelligence effort. These tables contain the basic data used to conduct detailed analyses and derive business value. In this article, we take a look at the development and use of facts and dimensions for business intelligence. Here's a list of business intelligence skills for resumes, cover letters, job applications and interviews. Required skills will vary based on the job for which you're applying, so also review our list of skills listed by job and type of skill.

Following Skills are necessary for Business Intelligence Professionals

The need for business intelligence professionals is clear. As this industry continues to grow, succeeding in business intelligence may take a combination of technical skills and capabilities, along with a broader frame of reference for the work and how it's carried out and measured.

For technical skill sets (may be from mathematics, statistics, economics, but engineering background is preferred), it may be helpful to have experience in:

- Relational databases,
- SQL,
- Basic programming skills,
- Reporting software familiarity,
- Analysis skills

In addition to technical skills, business intelligence professionals should build their soft skill sets, or skills that allow them to lead not only the business but also people using the insights uncovered: Macro-perspective, Communication skills.

Following are the Specific Business Intelligence Skills

- Adapting to Changing Priorities,
- Ability for analysis,
- To be analytical,
- Knowledge for analyzing Trends in Business Intelligence, Assessing Client/End User Needs,
- Attention to Detail,
- Capable to business Intelligence Dashboards and Reports,
- Knowledge in business Intelligent Development,
- Clear Idea about business Strategies,
- Coaching
- Outlook about collaboration,
- Communication Skill,
- Consulting outlook,
- Coping with Deadline Pressure,
- Creating and Running What-If Simulations,
- Critical Thinking,
- Customer Service,
- Data Controls knowledge,
- Data Management skill,
- Idea about Data Modeling,
- Data Oriented skill,
- Debugging Data Output Irregularities,
- Defining Data Access Methods,
- Delegating,
- Designing/ Modifying Data Warehouses,
- Designing Enterprise-Level Reporting,
- Developing Complex / Multi-Data Source Queries for Management,
- Developing Complex SQL Queries and Reports,
- Drawing Consensus,
- Evaluating Business Intelligence Software,
- Facilitating Meetings,
- Facilitating the Creation of New Data Reporting Models,
- Facility with Web Analytic Tools,
- Influencing Others to Adopt Data Solutions,
- Innovative,
- Insights,
- Instructing,
- Interpersonal,
- Leadership,
- Leading Cross-Functional Teams,
- Listening,
- Maintaining Technical Documentation for Solutions,
- anaging Relationships with Vendors,
- Managing Stress,
- Mentoring,
- Microsoft Excel,
- Microsoft Integration Services,
- Microsoft Office,
- Microsoft PowerPoint,
- Monitoring Data Quality,
- Motivating Staff,
- Multitasking,
- Negotiating,
- Organizational,
- Presentation,
- Prioritizing,
- Problem Solving,
- Project Management,
- Quantitative, 59. Representing Data Graphically,
- Reporting,
- Reporting Tools,
- Researching Solutions to User Problems,
- Results Oriented,
- SAP Business Solutions Toolset,
- Solution Oriented,
- Solutions,
- Solution Development,
- Statistical Analysis,
- Strategic Thinking,
- Systematic Thinking,
- Teamwork,
- Technical,
- Testing Data Solutions Prior to Deployment,
- Time Management,
- Training End Users,
- Translating High Level Design into Specific Implementation Steps,
- Verbal Communication,
- Visio,
- Writing

Supply Chain Management

Supply chain management (SCM), the management of the flow of goods and services (http://www.aelp.org.uk/supply/details/supply-chain-management-guide/, published 2013, accessed 31 March 2015). It includes the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption. Company makes a product from parts/components/materials purchased from suppliers, and those products are sold to customers, said company have a supply chain. Some supply chains are simple, while others are rather complicated. The complexity of the supply chain will vary with the size of the business and the intricacy and numbers of items that are manufactured.

Supply chain management is interconnected or interlinked networks, channels and node businesses combine in the provision of products and services required by end customers in a supply chain (Harland, 1996). Supply-chain management has been defined as the "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally." Supply chain management (SCM) is the management of the flow of goods. Company makes a product from parts/components/materials purchased from suppliers, and those products are sold to customers, said company have a supply chain. Some supply chains are simple, while others are rather complicated.

The complexity of the supply chain will vary with the size of the business and the intricacy and numbers of items that are manufactured. SCM practice draws heavily from the areas of industrial engineering, systems engineering, operations management, logistics, procurement, and information technology, and strives for an integrated approach.

Origin of the term and definitions

The term "supply chain management" entered the public domain in the year 1982 when Keith Oliver, a consultant at Booz Allen Hamilton, used it in an interview for the Financial Times. The term was slow to take hold. It gained currency during mid-1990s, when a flurry of articles and books came out on the subject. In the late 1990s it rose to prominence as a management buzzword, and operations managers began to use it in their titles with increasing regularity (David Jacoby, 2009; Andrew Feller *et al*., 2006; David Blanchard, 2010). However, the concept of a supply chain in management was of great importance long before, in the early 20th century, especially with the creation of the assembly line. The characteristics of this era of supply chain management include the need for large-scale changes, re-engineering, downsizing driven by cost reduction programs, and widespread attention to Japanese management practices. However, the term became widely adopted after the publication of the seminal book *Introduction to Supply Chain Management* in 1999 by Robert B. Handfield and Ernest L. Nichols, Jr., (Mentzer, 2001) which published over 25,000 copies and was translated into Japanese, Korean, Chinese, and Russian.[11] Six major movements can be observed in the evolution of supply chain management studies: creation, integration, and globalization (Movahedi, 2009), specialization phases one and two, and SCM 2.0.

Commonly accepted definitions of supply chain management include:

- The management of upstream and downstream value-added flows of materials, final goods, and related information among suppliers, company, resellers, and final consumers.
- The systematic, strategic coordination of traditional business functions and tactics across all business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole[10]
- A customer-focused definition is given by Hines (Hines, 2004): "Supply chain strategies require a total systems view of the links in the chain that work together efficiently to create customer satisfaction at the end point of delivery to the consumer. As a consequence, costs must be lowered throughout the chain by driving out unnecessary expenses, movements, and handling. The main focus is turned to efficiency and added value, or the end-user's perception of value. Efficiency must be increased, and bottlenecks removed. The measurement of performance focuses on total system efficiency and the equitable monetary reward distribution to those within the supply chain. The supply chain system must be responsive to customer requirements (Movahedi *et al*., 2009; Lambert, 2008)."
- The integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders (Martha, 1997).
- According to the Council of Supply Chain Management Professionals (CSCMP), supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes coordination and collaboration with channel partners, which may be suppliers, intermediaries, third-party service providers, or customers. Supply chain management integrates supply and demand management within and across companies. More recently, the loosely coupled, self-organizing network of businesses that cooperate to provide product and service offerings has been called the *Extended Enterprise*. A supply chain, as opposed to supply chain management, is a set of organizations directly linked by one or more upstream and downstream flows of products, services, finances, or information from a source to a customer. Supply chain management is the management of such a chain (Mentzer, 2001).

Supply chain management software includes tools or modules used to execute supply chain transactions, manage supplier relationships, and control associated business processes. Supply chain event management (SCEM) considers all possible events and factors that can disrupt a supply chain. With SCEM, possible scenarios can be created and solutions devised. In many cases the supply chain includes the collection of goods after consumer use for recycling. Including third-party logistics or other gathering agencies as part of the RM re-patriation process is a way of illustrating the new endgame strategy. From above stated discussion it is revealed that elements of the Supply Chain are:

Customer: The customer starts the chain of events when they decide to purchase product that has been offered for sale by a company. The customer contacts the sales department of the company, which enters the sales order for a specific quantity to be delivered on a specific date. If the product has to be manufactured by the company, the sales order will include a requirement that needs to be fulfilled by the production facility.

- **Planning**: The requirement triggered by the customer's sales order will be combined with other orders. The planning department will create a production plan to produce the products to fulfill the customer's orders. To manufacture the products the company will then have to purchase the raw materials needed for production.
- **Purchasing**: The purchasing department receives a list of raw materials and services required by the production department to complete the customer's orders. The purchasing department sends purchase orders to selected suppliers to deliver the necessary raw materials to the manufacturing site on the required date.
- **Inventory**: The raw materials are received from the suppliers and checking quality and accuracy those to move into the warehouse. The supplier will then send an invoice to the company for the items they delivered.

The raw materials are stored until they are required by the production departments.

- **Production**: Based on a production plan, the raw materials are moved inventory to the production areas. The finished products ordered by the customer are manufactured using the raw materials purchased from suppliers and delivered it by the inventory. After the items have been manufactured and tested, they are stored back in the warehouse prior to delivery to the customer.
- **Transportation**: When the finished product arrives in the warehouse, the shipping department determines the most efficient method to transport the products so that they are delivered on or before the date specified by the customer. When the goods are received by the customer, the company will send an invoice for the delivered products.

Trade Services and the Supply Chain

To ensure that the supply chain is operating as efficient as possible and generating the highest level of customer satisfaction at the lowest cost, companies have adopted Supply Chain Management processes and associated technology[15]. Supply Chain Management has three levels of activities that different parts of the company will focus on: strategic; tactical; and operational.

- **Strategic**: At this level, company management will be looking to high level strategic decisions concerning the whole organization, such as the size and location of manufacturing sites, partnerships with suppliers, products to be manufactured and sales markets.
- **Tactical**: Tactical decisions focus on adopting measures that will produce cost benefits such as using industry best practices, developing a purchasing strategy with favored suppliers, working with logistics companies to develop cost effect transportation and developing warehouse strategies to reduce the cost of storing inventory.
- **Operational**: Decisions at this level are made each day in businesses that affect how the products move along the supply chain. Operational decisions involve making schedule changes to production, purchasing agreements with suppliers, taking orders from customers and moving products in the warehouse.

Supply Chain Management Technology

If a company expects to achieve benefits from their supply chain management process, they need to require some level of investment in technology. The backbone for many large companies has been the vastly expensive Enterprise Resource Planning (ERP) suites, such as SAP and Oracle. These enterprise software implementations will encompass a company's entire supply chain, from purchasing of raw materials to warranty service of items sold. The complexity of these applications does require a significant cost, not only a monetary cost, but the time and resources required to successfully implement an enterprise wide solution. Buy-in by senior management and adequate training of personnel are keys to the success of the implementation. There are now many ERP solutions to choose from and it is important to select one which fits the overall needs of a company's supply chain.

Since the wide adoption of Internet technologies, all businesses can take advantage of Web-based software and Internet communications. Instant communication between vendors and customers allows for timely updates of information, which is the key in management of the supply chain.

Key Issues in Supply Chain

Globalization of manufacturing operation, Safety and quality products, Shorter lead time, less inventory and better throughput, Supplier base consolidation, Access to latest technology are the stress areas of Supply Chain management. So now it is clear that Key Issues in Supply Chain are:

Monitoring Current Sales Performance of Products across Geography/ Demography Demand Planning: Existing or New Products Cost Optimization: Production, Inventory and Logistics Management

BI in SCM

"Business intelligence is the use of computing technologies for the identification, discovery, and analysis of business data such as sales revenue, products, costs, and incomes," notes Techopedia. Business intelligence allows companies to turn data into information—that capability is where one can draw the line between standard reporting and BI. Companies are most attracted to supply chain BI tools for their coveted ability to make sense out of the seemingly endless array of data that has become available through the continuing adoption of logistics technologies such as TMS, warehouse management solutions (WMS), and supply chain execution systems. While access to data is key, being able to find, understand, and use that data to make strategic decisions that improve supply chain effectiveness is crucial. Business intelligence allows companies to turn data into information - that capability is where we draw the line between standard reporting and BI. Historically, reporting about merely extracting data has been getting it out of a system and into a spreadsheet or a database, where a company would then try to slice and dice it, and turn it into useful information. Today's BI tools are taking that extra work out of the equation, offering up data in easy to understand and digest informational formats, presented in a more visual way. BI tools for supply chain users typically fall into three categories, viz: Reporting, Real-time dashboards, Benchmarking.

Delivering this BI data via real-time dashboards and reports makes it easier for analyzing the data is presented in a comprehensive set of formats—graphs show trending visibility, and radial dials display performance within ranges—based on type of data, data elements. The depth and frequency of data available provides the necessary basis for process decisions and strategy evaluation. For instance, the BI data called to management's attention a drop-off in delivery performance that occurred in a certain lane within a short time. Examining this red flag closer, the company decided to change carriers to fix the problem. One can then able to monitor performance to make sure it improved, and if one incurred any costs associated with the change. Having the BI data has also kept the company from over-reacting when issues arise that do not signal a larger problem in the supply chain.

Sometimes, exceptions are just that—exceptions. One store may receive a late delivery due to any number of issues. But with BI capabilities, one can determine if any late delivery is just that, and not a broader issue. It also allows actionable visibility to performance and cost information, enabling for optimizing results. Without the BI portal, it had had to devote time and resources to sifting through a lot of data. Business intelligence in Supply Chain Management is based on i. Logistics and Operations, ii. Demand Management, iii. Procurement and Supplier Management, iv. Opportunity and Risk Management

Logistics and Operations Management

The mission of Logistics and Operations Management is to produce the appropriate goods or services in the right quality and quantity, and to distribute them to the right place at the right time, thereby making the greatest contribution to the organization. In a business environment, Logistics and Operations Management encompasses the design, implementation and management of systems for efficient deployment of personnel, physical facilities, raw materials, in-process inventories, finished goods and related information or services. Logistics and Operations Management covers the whole supply chain, from the acquisition of raw materials, through production, to the point of consumption. Logistics and Operations Management analysts must be proficient in the use of quantitative models and computers, and communicate effectively. Logistics and Operations Management are composed of four components e.g. i. Warehouse flow optimization, ii. Inventory planning, iii. Ordering and Replenishment, iv. Transportation Network Management.
Warehouse optimization is a discipline of vital importance for many organizations. Optimization and automation of a warehouse can help save time, space, and resources, reduce picking mistakes and manual handling, and improve flexibility, ergonomics, management, and communication. Warehouse Management Systems (WMS) become important and more complex and users find it quite hard to manage. The software market offers large variety of solutions with different system requirements and possibilities, and to choose the suitable system for every company is not quite an easy task, because it is influenced by many aspects which must be considered, and one of these aspects are optimization methods based on automated processes for tasks dynamically changeable in time. The WMSs which drive logistic warehouses and distribution centers are core elements of the material and goods flow in logistic chain and they will be subjected to further investigation in following text related to optimization of technical and operational structure.

This is the process of determining the optimal quantity and timing of inventory for the purpose of aligning it with sales and production capacity. Inventory planning has a direct impact a company's cash flow and profit margins especially for smaller businesses that rely upon a quick turnover of goods or materials. A replenishment order is an order that a supplier creates in SAP Supply Network Collaboration (SAP SNC) to inform about certain quantities of products that he or she intends to deliver to a customer on a certain date and time. In SAP SNC, a replenishment order is an order of order document type VGOR. Replenishment and inventory are closely related.

The inventory planning process establishes the optimal inventory levels that must be maintained to meet expected service levels for demand fulfillment. To understand this one needs to explore the replenishment (or re-ordering) process. In doing so, he will also establish the decision parameters an inventory planning process provides for the replenishment to work at its most optimal levels. Transportation Network Management a system of networks for transportation, communication and distribution of energy, goods, and services. The complex structure and cost of these sub systems demand that existing facilities be rationally designed. Network analysis techniques can be of great value in the design, improvement, and rationalization of complex large scale systems. With Ryder Transportation Management, one also get:

- Freight Bill Audit and Payment
- Price benchmarking
- Carrier sourcing and contracting
- Transportation Management System (TMS)
- Shipment planning and execution
- Mode optimization
- On-time performance reporting
- Assured capacity

Demand Management: Demand Management is a planning methodology used to predict, plan for and manage the demand for products and services. This can be at macro levels as in economics and at micro levels within individual organizations. Demand management has a defined set of processes, capabilities and recommended behaviors for companies that produce all manner of goods and services. Companies often lead in the application of demand management practices to their demand chains; demand management outcomes are a reflection of policies and programs to influence demand as well as competition and options available to users and consumers. Demand management begins with an in-depth perception of existing business requirements, historical buying behavior and expected requirement for the service or product sourced by an organization. This research includes an assessment of purchase orders, service or product specifications and strategic business plans.

Demand management helps streamline purchasing techniques. When applying demand management, key considerations include:

- Available options for volume discounts
- Order timing's impact on pricing
- Whether or not the best suppliers are being utilized
- Precise attention to described contract processes

Forecasting Demand: Forecasts are becoming the lifeline of business in a world, where the tidal waves of change are sweeping the most established of structures, inherited by human society. Commerce just happens to the one of the first casualties. Survival in this age of economic predators, requires the tact, talent and technique of predicting the future. Forecast is becoming the sign of survival and the language of business. All requirements of the business sector need the technique of accurate and practical reading into the future.

Forecasts are, therefore, very essential requirement for the survival of business and its development. Management requires forecasting information when making a wide range of decisions.

Price Optimization and promotion management: Price and Promotion Management synchronizes promotion planning, forecasting and price optimization with supply chain, advertising and price execution. A company can more efficiently and accurately manage a wide range of processes: Increase awareness and understanding of how customers react to pricing and promotions; Applying a consistent, systematic approach to improve and automate one's daily activities, including the review of in-season performance; Realign performance goals based on automatic, system-generated recommendations; Incorporate the effects of price adjustments and promotions into a single demand forecast that is shared enterprise-wide; Align purchasing and fulfillment decisions with anticipated demand; Automatically generate high volumes of significantly versioned ads with maximum efficiency; Streamline and automate trade event and promotion programs for better results; More efficiently establish everyday pricing that best adheres to category pricing strategies while minimizing the impact on store labour. Price Optimization Models are mathematical programs that calculate how demand varies at different price levels, combining that data with information on costs and inventory levels to recommend prices that will improve profits. The modeling allows companies to use pricing as a powerful profit lever, which often is underdeveloped.

Price Optimization Models can be used to tailor pricing for customer segments by simulating how targeted customers will respond to price changes with data-driven scenarios. Given the complexity of pricing thousands of items in highly dynamic market conditions, modeling results and insights helps to forecast demand, develop pricing and promotion strategies, control inventory levels and improve customer satisfaction. Companies use Price Optimization Models to:

- Price Optimization Models help businesses determine initial pricing, promotional pricing and markdown (or discount) pricing:
- Initial price optimization works well for companies with a stable base of long life-cycle products-grocery stores, drug chains, office—supply stores and commodities manufacturers
- Promotional price optimization helps set temporary prices to spur sales of items with long life-cycles-newly introduced products, products bundled together in special promotions and loss leaders
- Markdown optimization helps businesses selling short lifecycle products subject to fashion trends and seasonality—airlines, hotels, specialty retailers and mass merchants

Procurement and Supplier Management : "Procurement is the business management function that ensures identification, sourcing, access and management of the external resources that an organisation needs or may need to fulfill its strategic objectives"[Katrina Whittleston , 2016]. Procurement is the business management function that ensures identification, sourcing, access and management of the external resources that an organization

Graphical abstract

Needs or may need to fulfill its strategic objectives. Procurement and supply management involves buying the goods and services that enable an organisation to operate.

Supplier Analysis and support in procurement decision: The selection of the most suitable supplier for a procurement process has a markedly strategic aspect for a company. Lack of uniformity in the terms used to define the phases or components of a procurement process as well as in the election of the critical variables used to select the most suitable supplier. For optimizing such a selection wide variety of individual and integrated methodologies have been developed by many individual. Suppliers' evaluation-and-selection model has also been developed. These models homogenise the terminology involved in such processes and fulfils three main goals. First, models allow the joint assessment and comparison among new and historical suppliers, identifying the key evaluation factors in each case.

Second, models allow the inherent knowledge about evaluation to be flexibly adapted to the type of product to be purchased. Finally, a FDSS is proposed to make the model operational. Some of those models are robust enough to improve the main shortcomings of more simplistic methods (e.g. those based on weights) and eases the comprehension of the embedded knowledge within the supplier evaluation processes. Simultaneously, these methods avoids the complexity of real-life implementation that many of some more sophisticated hybrid methods proposed in recent times – not free of certain additional disadvantages. Finally, the practical usefulness of the methods is ascertained through an empirical test in a specific business environment. One such model can be outlined as the graph given here (Nazario García, 2013).

Highlights of Supplier Analysis and support in procurement decision (Nazario García, 2013).

- One has to design a model to select suppliers in procurement processes which evaluates bids made by new and historical suppliers.
- Model's performance is to be evaluated by a variable weighting system and by a fuzzy decision support system (FDSS).
- Results obtained by the FDSS adapt better to the actual behaviour of the purchase of commodities than weights methods.
- System is flexible enough to fit the policies specific to a specific type of product and a particular business sector.
- Test the acceptance of the proposed model has been validated by a survey test.

Information sharing with partners: Information sharing can radically improve the way global companies and their partners do business, especially in the wake of increasingly globalization and outsourcing, which has and will continue to have a profound effect on supply chain operations. Drastic development can be achieved by assigning an individual or team to work on trading partner relationships; consciously mapping information flows between partners to assure consistency and timeliness; and sharing the benefits of collaboration fairly between partners (Ellram, 2008).

Exchanging information such as inventory levels, forecasting data, and sales trends, companies can reduce cycle times, fulfill orders more quickly, cut out millions of dollars in excess inventory, and improve forecast accuracy and customer service. Information sharing can be applied to almost all the core domains of corporate operational activities. Starting from the development chain process where information sharing can happen in the product design stages and product life cycle management activities with both internal and external partners. In the customer chain processes information sharing can help in formulating customer experience strategies, increase customer service effectiveness and operations. Key to supply chain success depend iff buyers and suppliers agree and come forward for collaboration sharing of information. Information sharing can be most effective and least disruptive for all concerned when done by implementing the available technological tools, which would accomplish the process in a controlled and secured way thereby streamlining the global supply chain operations.

The psychological barriers around information sharing are real and imperative. Sometimes there is a real and justified fear that information sharing across the corporate boundaries can turn into a competitive disadvantage. By formulating effective business policies, agreements and business plans that an enterprise can use to establish guidelines and rules for exchange of information with supply chain partners can help assuage those barriers. This will ultimately help mitigate the fear of information sharing and improve efficiency and create new opportunities for all stakeholders.

Opportunity and Risk Management: In project terms an opportunity is something (tangible or an "effect") identified within the project deliverables that could unlock or otherwise facilitate a positive or beneficial effect. Such effects are sought and documented within the Business Case to counterbalance and justify the cost. Opportunities are the same things though are largely uncovered or noticed during the evolution of the project rather than by-design at the beginning or business case time.

Risk is an uncertain event or condition that, if it occurs, has an impact on at least one project objective. So, by strict definition, opportunity is risk. This seems counter-intuitive, but one can this of it like this: person don't know if the opportunity will happen, so the risk is that it may or may not or that he could miss for capitalizing on it. In this backdrop, a critically important part of any Enterprise Risk Management (ERM) strategy is Opportunity Management. In some organizations, Opportunity Management specifically refers to understanding and correctly bidding on business opportunities. It can also mean taking an upside view of risk and identifying opportunities throughout the organization. Companies with a strong Opportunity Management culture are often at a competitive advantage, spotting opportunities and acting on them more quickly than the rest of the marketplace. So staying ahead of the competition with real-time data management has to win more business with consolidated, comprehensive information. It means industry has to take benefits of using Active Risk Manager (ARM) for Opportunity Management. No one can forget, probability of loss arising when resources are irreversibly committed one opportunity and a better opportunity presents itself.

Supplier Analysis and support in procurement decision: Supplier selection, evaluation and development have become more crucial tasks of procurement and supply managers. When organisations increasingly expand their markets and supply chains globally, new suppliers need to be selected and/or developed based on new performance criteria. Besides, more critical business areas such as product development, process design, logistics, and customer relationship management, are outsourced these days, seeking to leverage a greater level of value and competitive advantage for the whole supply chain. Supplier selection and evaluation studies have been largely dominated by mathematical models which try to rate and rank suppliers based on a number of pre-defined factors such as cost, quality, service, and delivery (De Boer *et al*., 2001; Ho *et al*., 2010). However, in an era of new trends in products and services outsourcing, there is an increasing need to employ theories from other relevant disciplines such as economics, strategy, statistics, probability and organisational behaviour to supply management and supplier selection/evaluation/ development research (Ellram *et al*., 2008; McIvor, 2009). Although cost, quality and delivery are still the main supplier selection/evaluation criteria and the centre of supplier development programmes (Cheraghi *et al*., 2011; Krause *et al*., 2002), the implications for the long-term capabilities of the whole supply chain have to be considered. Among influential theories in management studies are resource-based view (RBV) and transaction cost economics (TCE). Both have made valuable contributions to understanding business phenomena for years and have been considered in operations and supply chain studies more recently (Hunt *et al*., 2012; Rungtusanatham *et al*., 2003). RBV, views the firm as a set of valuable and rare resources and assets that can enable the firm to achieve competitive advantage, and long-term superior performance (Barney, 1991). TCE identifies and explains the conditions suitable for a firm to manage an economic exchange internally, and the conditions under which it should manage an economic exchange externally (Williamson, 2005; https://www.cranfield.ac.uk/...supply.../theory-informed-supplier-management).

BI in Supply Chain: Explanatory Model

The demands for a high quality product and services are rising. Customers want the right product, at the right place and in timely fashion. Modern manufacturing has driven down the time and cost of the production process, leaving supply chains as the final frontier for cost reduction and competitive advantage (Nenad Stefanovic *et al*., 2006). In such environment organization cannot be viewed as a single business entity, but rather as a part of the supply chain that is competing with other chains on the market (Lambert *et al*., 1998). Supply chain management (SCM) was seen as an opportunity for cost reduction through optimization, and real-time collaboration with trading partners. Given the increasing competition in today's tough business climate, it is vital that organizations provide cost effective and rapid access to business information for a wide range of business users, if these organizations are to survive into the new millennium. The solution to this issue is business intelligence (BI) system, which provides a set of technologies and products for supplying users with the information they need to answer business questions, and make tactical and strategic business decisions.

Gathering, managing and utilizing data has been a major activity for all the organizations over the years. Giving a meaningful shape to disparate sources of data lying at different operational systems, databases and applications, is very difficult task. Being able to consolidate and analyze this data for better business decisions can often lead to a competitive advantage, and learning to uncover and leverage those advantages is what business intelligence is all about. By providing wider visibility to plans and supporting data, BI tools increase the return on existing SCM applications because they help companies understand where and how they deviate from their plan objectives. In addition, they provide shared data availability that encourages a global perspective on business performance. Supply Chain Intelligence is a new initiative that provides the capability to reveal opportunities to cut costs, stimulate revenue, and increase customer satisfaction by utilizing collaborative decision making (Haydock, 2003). Supply Chain Intelligence (SCI) takes broader, multidimensional view of supply chain in which, using patterns and rules, meaningful information about the data can be discovered. There's no doubt that the power of business intelligence (BI) can greatly enhance the value of supply chain management (SCM) investments. But traditionally, SCM BI integration wasn't so easy to achieve.

Analytical tools were generally not able to "plug and play" with SCM, making real integration complex and problematic. SCM information gains value when it is analyzed, especially if that analysis can take in a broader view of the enterprise. This kind of integration was neither common nor easy until recently, when platforms such as SAP began offering modules that could provide a BI window on SCM. In the last couple of years, the popularity of predictive analytics offerings has increased significantly, as many companies looking to improve their existing business intelligence and analytics faculties are looking to the field of predictive analysis to enhance these capabilities, and in some cases even replace them. But, is predictive analysis really the new BI? Is it a replacement for the good old business intelligence offerings? Or is it really just the evolution of BI?. Predictive analysis, BI in Supply Chain, is a branch of a broader discipline called data mining, which comprises important data analysis activities such as exploratory data analysis, descriptive modeling, pattern and rule discovery, data retrieval, and predictive modeling.

Purpose is to focus the predictive modeling scenario that the discipline of predictive analysis is based on predictive analytics. Predictive analytics consists of those tools that make it possible to perform the tasks of a predictive analysis process, which involves the use of various analytical and statistical techniques to build a mathematical model in an attempt to predict the future outcome of a certain scenario of study. From statistics to game theory, predictive analysis techniques make use of historical data to create predictions, usually by capturing relationships between explanatory (independent) variables and "predictors" (predicted variables) from past events. Two major modeling types can be applied: classification (for predicting categorical/discrete variables such as yes/no, likelihood of an event to occur or not occur, risk levels, etc.) and regression (for continuous variables, such as blood pressure, liquid levels, etc.) That is Predictive Analytics the New Business Intelligence.

Conclusion

There is no theoretical support for explaining the existence or the boundaries of supply chain management. A few authors, such as Halldorsson *et al*. (2003), Ketchen and Hult (2006), and Lavassani *et al*. (2009) have tried to provide theoretical foundations for different areas related to supply chain by employing organizational theories, which may include the following:

- Resource-based view (RBV),
- Transaction cost analysis (TCA),
- Knowledge-based view (KBV),
- Strategic choice theory (SCT),
- Agency theory (AT),
- Channel coordination, *v.* Institutional theory (InT), *vi.* Systems theory (ST),
- Network perspective (NP),
- Materials logistics management (MLM),
- Just-in-time (JIT),
- Material requirements planning (MRP),
- Theory of constraints (TOC),
- Total quality management (TQM), *xiii.* Agile manufacturing,
- Time-based competition (TBC),
- Quick response manufacturing (QRM),
- Customer relationship management (CRM),
- Requirements chain management (RCM),
- Available-to-promise (ATP),
- Supply Chain Roadmap® (Krause *et al*., 2002)

From above discussion one may conclude giving stress in the following areas (vom Brocke, 2010):

BI upgrades the quality and timeliness of data to facilitates decision making process

Management information needs have expanded and business intelligence has evolved to meet these needs. For example, Business Objects, Cognos and Hyperion performance management applications were often seen as specialised reporting tools for accountants. They are now seen as business intelligence tools and have been acquired by SAP, IBM and Oracle to complete their BI stacks. Entrepreneurial spirit and business judgment, human ability to weigh intangibles and ambiguity, is important in decision making. But the risks of personal bias, repeating past mistakes, acting on guesses or following hunches unnecessarily, can be limited if a culture of evidence based decision making is fostered. Business leaders and management accountants must be alert to the potential of current developments in the role of the finance function (finance transformation) and business intelligence (BI). The combination of these developments provides an opportunity to reshape decision making and improve performance. Enterprise resource planning (ERP) systems have done much to improve processes and rationalise operational data but information still gets duplicated and copied on to multiple systems, making it difficult to ensure consistency and security. Finance, sales and operations reports rarely agree. Even when the data comes from the same ERP source, the reports may not reconcile because of the extract process or how the report was written.

Over recent years specialist software houses have developed performance management applications to address the shortcomings of the accounting modules offered by the major ERP vendors.

BI enables effective performance management

Effective business performance management consists of a set of management and analytic processes, supported by technology, that enable businesses to define strategic goals and then measure and manage performance against those goals. Core business performance management processes include financial planning, operational planning, business modeling, consolidation and reporting, analysis, and monitoring of key performance indicators linked to strategy. It involves consolidation of data from various sources, querying, and analysis of the data, and putting the results into practice. Business performance management is contained within approaches to business process management (Halldorsson *et al*., 2003).

Business performance management has three main activities:

viz. *i.* selection of goals, *ii.* consolidation of measurement information relevant to an organization's progress against these goals, and *iii.* interventions made by managers in light of this information with a view to improving future performance against these goals. As business performance management activities in large organizations often involve the collation and reporting of large volumes of data, many software vendors, particularly those offering business intelligence tools, market products intended to assist in this process. Marketing efforts of software vendors mislead business performance management is often incorrectly understood as an activity that necessarily relies on software systems to work, and many definitions of business performance management explicitly suggest software as being a definitive component of the approach. Components are, : *i.* Procurement, *ii.* Production/ Manufacturing, *iii.* Inventory Management, *iv.* Logistics, *v.* Sales Management

Improves reliability of forecast and reduces uncertainty in Supply Chain

To be successful competitor in business, manufacturers are required to produce products of a quality acceptable to customers and to deliver those products at competitive cost with highly reliable delivery times. Achieving high quality levels, timeliness of deliveries, and efficient processes along the supply chain cannot be reliant on a single organization, but should be ensured through collaboration and coordination with trading partners. From production to delivery to the customer end increasing uncertainty has made the task of satisfying customers more challenging. Efficiency along the supply chain is important to maintain acceptable product prices, but flexibility to deal with time-varying or dynamic demand could be even more important nowadays. With the high probability that customers will suddenly increase, reduce, cancel, or move forward or backward their orders, supply chain players need to be more flexible in many respects. This may include the need to change capacity levels, to use different transportation modes, to switch supplier, to deal with small lot sizes and to have short or even negligible changeover times. Although it is important to remain competitive in the market, supply chain flexibility is costly and flexibility dimensions are not equally important for every supply chain. Therefore, a supply chain should carefully assess how much flexibility is really needed because increased flexibility does not always result in greater economic income. Hence, it is necessary to decide the right degree of supply chain flexibility and the appropriate strategy that should be adopted to respond to the need for flexibility. In this respect, companies may just reactively build up safety stock or add safety buffers to the lead time, or pursue more proactive paths such as redesigning products or supply chain networks. In spite of its importance, there have been very few works that attempt to classify flexibility strategies and to relate the typology of uncertainties to those strategies. So it is most important to address the following questions in an explorative manner: (1) What strategies have companies pursued to improve flexibility in the supply chain? (2) In dealing with uncertainty, do companies tend to reactively buffer themselves or use more proactive strategies?

Implementation of BI is critical for whole SCM process

Business intelligence is about improving decision making in SCM. It involves developing processes and systems that collect, transform, cleanse and consolidate organisation wide and external data, usually in an accessible store (a data warehouse), for presentation on users' desks as reports, analysis or displayed on screens as dashboards or scorecards. It is about using the information available to a business to improve decision making. With technology, the right information can be accessed, analysed and presented at the right time to the right people in the right format. But it must then be used by them to inform evidence based decision making. This requires leadership and cultural change. There is no doubt that BI application in SCM offer potentially significant financial and operational performance improvement capabilities. They are certainly worth considering and can offer an exceptional return on investment (ROI). But one should be careful that "potential" and "actual" are very different and the road from one to the other is often long, expensive and arduous.

The challenge with using BI solutions in performance management in SCM is that the numbers are perceived to be personal. People are frequently measured, evaluated and paid based on the data. If the information is wrong or the human dimensions of the implementation are not adequately provided for, employees will avoid using the BI system and will start making their own—or not using anything at all, which is far more costly to the organization and unreliable to boot. While most organizations have a lot of metrics, they are not always the right metrics or used in the right way. Organizations do not always put enough time and thought into defining the correct Critical Success Factors; Key Performance Indicators (KPIs); Performance Indicators; and Results Indicators, even when companies do have the right metrics, they are often not incorporated into the management processes in an integrated, level-appropriate way (Halldorsson *et al*., 2013). Metrics have to be applied continually every day at each level in the organization in order to translate into actual performance improvement—the essence of performance management. A BI system can enable this process but it will not in and of itself deliver the required outcomes.

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