

Business Intelligence Systems in the Holistic Infrastructure Development Supporting Decision-Making in Organisations

Abstract

The aim of this review is analysing Business Intelligence Systems with regards to opportunities for enhancing basic leadership and improving decision making power in a contemporary organization. We took specifics of basic decision making procedure together with heterogeneity and scattering of data sources into thought – introduce Business Intelligence Systems as some all-encompassing framework of decision making. It has been demonstrated that the Business Intelligence may contribute towards enhancing nature of decision making in any organization, better consumer service and consumer loyalty. The review is centered around three essential segments of the BI frameworks, i.e. key information technologies, capability of key information technologies and BI applications that help various decision making in organization. This review is devoted not only to find out how BI is for decision making but how frequently these are applied in business practice

Keywords: *Business Intelligence, data mining, business decision-making, knowledge management, ETL (Extraction-Transformation-Load), OLAP (On-Line Analytical Processing)*

1. Business Intelligence Systems in Decision-Making

Decision making in organization has constantly included use of various information resources. Economic conditions demonstrate that organizations are more much of the time made to utilize external, disperse and semi-organized source of data.

In present world decision making, it is important to reach for information. In any case, it is knowledge that must be for the most part searched for. Information gives establishments to viable business activities. Procedural information (disclosing how to perform undertakings and take after methodology) ought to be joined by declarative information (showing what must be done), semantic information (portraying relations amongst facts) and casuistic information (that alludes to a few cases from the past). Tacit knowledge is an important piece of information in an organization (Søilen, pp 141, 2009). Organization that are intrigued to utilize information in decision making are compelled to Efforts undertaken to develop BI systems have resulted in many business solutions that allow for effective support of manager's work. Practice shows that the most significant business effects are obtained while using the following analyses offered by the BI systems: work out systems that empower them to change tacit information into explicit information. In this circumstance, organization think that it's important to make stores of information and information management frameworks, at the same time finding the best approach to match them with decision making supportive networks (Søilen, pp 139,2009).

These days, distinctive group of individuals take an interest in decision making (stakeholders, clients, supplier, and so forth.). The extent of a specific decision is as a rule of global nature. Local and worldwide interdependencies require more extensive trade of information and knowledge sharing, and better coordination of exercises attempted as opposed to everything that occurred before (Viehland, 2005).

Dispersion of data resources and their regularly tactic nature brings about some deficiency of the models of data management utilized for decision making (Bui 2000; Kersten, 2000; Power, 2001). Organizations that are intrigued to enhance nature of decision making, image or nature of accomplice management ought to incline towards the improvement of information technology infrastructure that will speak to a comprehensive way to deal with business

operations, clients, supplier, and so forth. (Wells, and Hess, 2004). Theories demonstrate that the previously mentioned prerequisites are generally met by Business Intelligence (BI) frameworks (Gray, 2003; Liautaud, and Hammond, 2002; Olszak, and Ziemba, 2004; Turban, and Aronson, 1998).

BI frameworks are alluded to as an integrated set of tools, technologies and program items that are utilized to gather, coordinate, analyse and make information accessible (Reinschmidt, and Francoise, 2000). The frameworks being referred to will support decision making on all management levels. They vary from conventional Management Information Systems by – most importantly – a more extensive subject range, multivariate analyses of semi-organized information that originate from various sources and their multidimensional introduction. The BI frameworks add to streamlining business procedures and assets, maximizing benefits and enhancing proactive decision making. The frameworks being referred to might be used while making different applications inside finance, keeping an eye on competition, bookkeeping, promoting, producing. The most critical segments of the BI framework comprise of (figure 1)

- Key information technologies that relate to information procurement and putting away i.e. ETL (Extraction-Transformation-Load) devices and information distribution centres;
- Information technologies potential that essentially alludes to adaptable examinations of information, and introduction of information, i.e. OLAP (On-Line Analytical Processing) systems and information mining; and
- BI applications that settling on different decision on production, deals, checking on competition, finance etc. (Kalkaota, and Robinson, 1999).

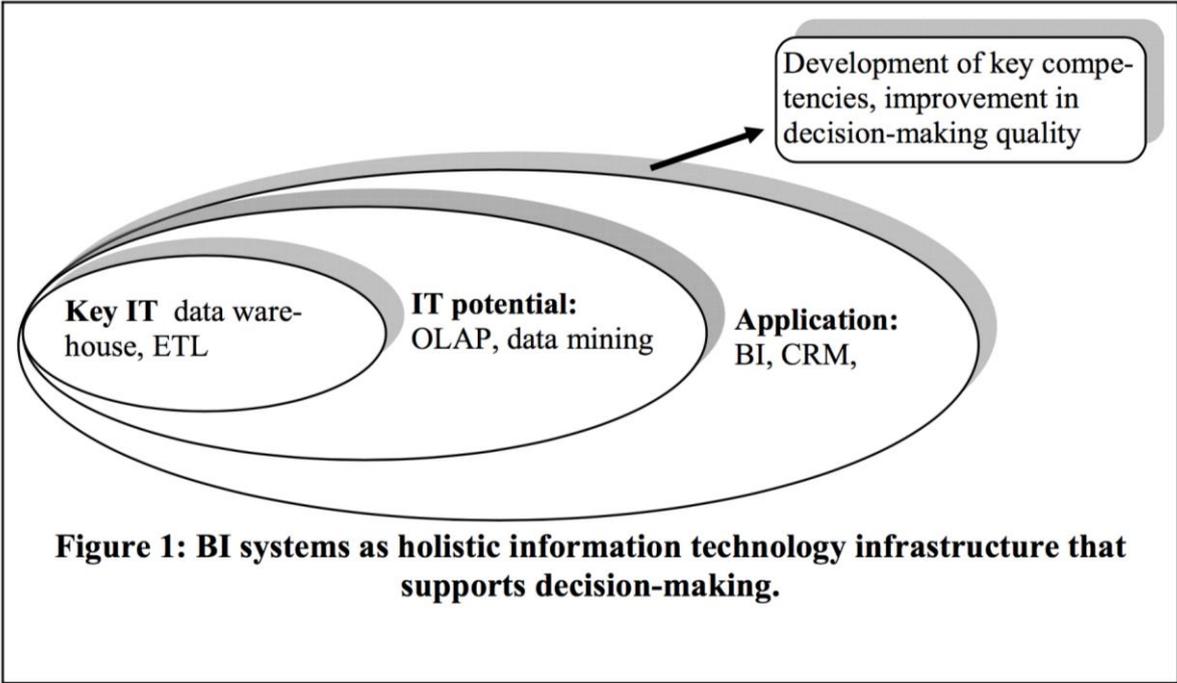


Figure 1: BI systems as holistic information technology infrastructure that supports decision-making.

Source: (Kalakota, & Robinson, 1999).

2. Key Information Technologies of Business Intelligence

Contemporary associations don't confront problems rising because of the absence of data. They are fairly concerned in view of data over-burden and data dispersion. Wishing to settle on viable choices, it is important to utilize diverse resource of data and after that, to integrand data if or when required. These days, information collections are thought to be significant innovations that support heterogenic basic leadership condition. They are accumulations of subject-situated, integrand, non-unpredictable, chronicled information that bolster hierarchical choices (Gray & Watson, 1998; Inmon1992). A plan of an information distribution centre or data warehouse may take a star schema, factographic data or certainty heavenly body. If there should arise an occurrence of a star construction, fact graphic information are put away in the focal table encompassed by reference tables including information on specific measurements that are vital while making decisions. In the snowflake pattern, each dimension may have a few own claim dimensions. It implies that reference tables are not deformatized. A diagram of a star grouping sort is an in the middle of arrangement (Søilen, pp150, 2009). A few tables are liable to demoralisation and others to standardization.

A data warehouse is transcendently used to store point by point data information and metadata. Detailed data information concern, for example, deals or generation volume in a given period. Keeping in mind the end goal to increment effectiveness of questions, data within the data distribution centre are liable to total. Information e.g. on deals might be accumulated in a land measurement, a day and age measurement or a product offering measurement, and so on. Then again, metadata incorporate data on information themselves (Søilen, pp 148, 2009). They encourage a procedure of extracting, changing and loading data through presenting source of information in the design of information distribution centres. Metadata are additionally used to computerize summary information creation and queries management. Utility of data distribution centres to a great extent relies on upon the nature of their data stored. ETL apparatuses are responsible for removing, changing and loading of data. Extraction includes getting access to data beginning from various sources (databases, content records, HTML and XML archives or email). Accordingly, of extraction, data are generally put away in the social database fundamentally encouraging further information preparing at the change organize. Programming that does extraction of data ought to likewise record data including extraction time, structure of source data, data place of beginning, and so forth (Søilen, pp 145, 2009).

Transformation of data is considered to be the most complex phase of the ETL process. The process is normally performed by method for traditional programming language, script language or the SQL language. Data transformation implies information unification, count of essential totals, ID of missing data or duplication of data. Data transformation tenets may concern principles of physical data structure unification, business principles that guarantee compatibility with a displayed domain and business principles that ensure semantic compatibility between related data. Data loading includes furnishing data distribution centres with information that are amassed and filtered. Since the process being referred to much of the time includes exchanging the framework into the offline mode, it is essential to limit the time that is important to exchange information. ETL tools might be divided into four categories (Meyer, 2001)

- ETL measures that stress extraction and loading of information;
- ETL or ETI that lean toward particular sorts of input or output data (e.g. they work exclusively in content of records or particular database formats), and solid and quick elements of information preparing and transformation.

- ETL measure that understand a procedure of data transformation generally well, in spite of the fact that they don't offer adjusting of various regular information designs.
- ETL measures that are finished integration environments furnished with various solutions that support users while building ETL frameworks system.

3. Potential of Key Business Intelligence Technologies

Heterogeneity of a decisional environment stimulation associations to search for powerful techniques of dissecting and drilling data. Right now, OLAP and data mining methods offer such potential. OLAP devices are for the most part gone for intelligent report era as per client's pre-characterized criteria (measurements), and streamlining of seeking gigantic data documents by methods for programmed generation of SQL inquiries. They take into consideration completing complex investigations of organization execution, customer relations, item gainfulness, and so on. They likewise give answers of the 'who?', 'what?', 'when?', 'imagine a scenario in which?' and "why?" sort. Multi-variation investigations completed on verifiable information (put away in information distribution centres) take into consideration anticipating future, setting patterns, client conduct, and competition conduct (Søilen, pp 140, 2009). Their successful acknowledgment empowers associations to identify shortcomings, weakness and hidden opportunities and chances (Olszak and Ziemba, 2003).

Data mining includes finding different patterns, speculations, regularities and standards in data assets (Hauke, Owoc, and Pondel, 2003; Kantardzic, 2002; Poul, Gatman, and Balint, 2003). Knowledge resulting from data mining might be used in two measurements, i.e. to anticipate (prediction), and to depict (portrayal) reality. Expectation includes utilizing definitely known factors to foresee future. For example, a prognostic model help – on the premise of recorded information – to evaluate earnings inside specific arrangement gatherings of items and client bunches (Søilen, pp152, 2009). Then again, reality portrayal by methods for information mining strategies empowers to make clear and justifiable for a person interpretation of knowledge gathered from the data in form of guidelines and tables. For example, mined knowledge on clients' purchase might be utilized to support choices concerning valuing strategies (Moss, and Alert, 2003; Reinschmidt, and Francoise, 2000).

A selection of data mining techniques requires figuring out if interpretation of data interdependencies or expectation is being searched for. Data mining is the most frequently considered associated with following types of activities.

- If there should be descriptive data mining – association, finding relations in the discovering, gathering and grouping exemptions and deviations.; and
- If there should be an occurrence of predictive data mining – arrangement, relapse or analysis of time arrangement; for clients it is critical that a method for exhibiting information is sufficient to their perception abilities, such potential is offered by content, realistic and sight and sound interface.

4. Business Intelligence Applications

Business intelligence frameworks incorporate a more extensive and wider group of users beginning from in controlling, money related reports and fund, through sales people, up to individuals from the board (RasMussen, Goldy, and Solli, 2002). Sectors that utilization business intelligence frameworks most frequently includes incorporate exchanging companies, insurance agencies, banks and a budgetary segment, broadcast communications and manufacturing organizations (see Table 1).

Table 1. Business Intelligence application areas

BI applications	Objective
Retail Industry	<p>Forecasting. Utilizing scanning data to forecast demand and based on the forecast, to define inventory requirements more accurately</p> <p>Ordering and replenishment. Using information to make faster decisions about items to order and to determine optimum quantities</p> <p>Marketing. Providing analyses of customer transactions (what is selling, who is buying)</p> <p>Merchandising. Defining the right merchandise for the market at any point in time, planning store level, refine inventory</p> <p>Distribution and logistics. Helping distribution centres manage increased volumes. Can use advance shipment information to schedule and consolidate inbound and outbound freight</p> <p>Transportation management. Developing optimal load consolidation plans and routing schedules</p> <p>Inventory planning. Helping identify the inventory needed level, ensure a given grade of service</p>
Insurance	<p>Claims and premium analysis. The ability to analyse detailed claims and premium history by product, policy, claim type, and other specifics</p> <p>Customer analysis. Analyse client needs and product usage patterns, develop marketing programs on client characteristics, conduct risk analysis, improving client service</p> <p>Risk analysis. Identify high-risk market segments and opportunities in specific segments, relate market segments, reduce frequency of claims</p>

<p>Banking, Finance & securities</p>	<p>Customer profitability analysis. Determinate the overall profitability of individual customer, current and long term, provide the basis for high-profit sales and relationship banking, maximize sales to high-value customers, reduce costs to low-value customers, provide the means to maximize profitability of new products and services</p> <p>Credit management. Establish patterns of credit problem progression by customers class and type, warn customers to avoid credit problems, to manage credit limits, evaluate of the bank's credit portfolio, reduce credit losses</p> <p>Branch sales. Improve customer service and account selling, facilitate cross selling, improve customer support, strengthen customer loyalty</p>
<p>Telecommunications</p>	<p>Customer profiling and segmentation. Determine high-profit product profiles and customer segments, provide detailed, integrated customer profiles, develop of individualized frequent-caller programs, determine future customer needs</p> <p>Customer demand forecasting. Forecast future product needs or service activity, provide basis for churn analysis and control for improving customer retention</p>
<p>Manufacturing industry</p>	<p>Sales. Provide analyses of customer-specific transaction data.</p> <p>Forecasting. Forecast demand, define inventory requirements.</p> <p>Ordering and replenishment. Order optimum quantities of items.</p> <p>Purchasing. Helping distribution centres manage increased volumes.</p> <p>Distribution and logistics. Can use advance shipment information to schedule and consolidate inbound and outbound freight</p> <p>Transportation management. Developing optimal load consolidation plans and ^{[[[]]]}routing schedules.</p> <p>Inventory planning. Identify the inventory level needed, ensure a given grade of service.</p>

Source: based on (Reinschmidt, & Francoise, 2000).

Many efforts have been try to develop BI system, but they all resulted in many different solutions that help's manager to work effectively but the following analysis shows the offered by BI system

- Analysis that Supports Cross Selling and up Selling
- Analysis that supports cross selling and up selling
- Customer segmentation and profiling
- Survival time analysis
- Analysis of consumer loyalty and consumer switching to competition
- Credit scoring;
- Fraud detection
- Fraud Detection
- Web-Farming (investigation of the Internet content).

4.1 Analysis that Supports Cross Selling and up Selling

Marketing strategies of strategically cross selling or up selling include pitching items to clients considering over their past purchases. Cross/up selling expands client's trust in the organization they manage, and lessens the danger of client's changing to competition. It prompts to a increment in organization's income and client loyalty level. Information model chooses marketing campaign goals ideally and, additionally, demonstrate the best cross/up selling offers for clients in a manner that they compare with clients' present needs. There are many advanced techniques that are utilized to discover interdependencies between purchased items. One of them - Market Basket Analysis – gives information on what sort of service and items ought to be sold together in sets or which set ought to be prescribed to a specific client. Utilizing classification models to choose clients who are the most powerless to a specific offer is another practical application which discuss about the possible solution. It permits to direct marketing activities accurately and therefore to decrease expenses of the campaign while at the same time expanding its viability.

4.2 Customers Segmentation and Profiling

Client segmentation and profiling depends on grouping clients in some homogenous fragments. BI frameworks empower both descriptive and prescient division. Inside expressive division the accompanying segmentations are done:

- Statistic segmentation (based on the information including client's income, age, sex, instruction, conjugal status, ethnic group, religion, and so forth.);
- Behavioural segmentation (based the information including recurrence of shopping, sum and kind of obtained items, and so on.); and
- Motivational segmentation (based on the factors that depict reasons of clients' purchase habit– this sort of information typically originates from polls and studies completed).

Prescient segmentation is helpful when it is important to recognize "great" clients from the "awful" ones. At the earliest reference point, a variable that portrays "great" clients are resolved (e.g. on the premise of aggregate shopping they have done as such far), and afterward, different factors that significantly impact the underlying variable are resolved. Such review permit to make a particular way to deal with a specific section of clients, and this approach is upheld by element refreshing of segmentation and analyses of clients' movement between segments. Segmentation and profiling of clients together with distinguishing proof of potential cross/up selling offers and testing of various theories empower to make a customized offer for having potential addressing future, new and loyal clients' needs. Segmentation and profiling of clients give some information that is helpful while outlining new items and tending to marketing campaigns. They consider a great deal more individualized client service and improvement of

advertising activities and deals, along these lines getting benefits from information concerning customers.

4.3 Analysis of Parameters Importance

Analysis of parameters significance takes into account assurance of the most vital (from the point of view of organization's advantages) factors that depicts items, procedures and clients in the circumstance when there are distinctive factors that portray analysed objects (Wijnhoven, 2001). Information is utilized to recognize directions to be taken while idealizing items and client service, and arranging marketing activities, and so forth (Søilen, pp 151, 2009). The Parameters analysis, stepwise relapse calculation or simulated neuronal systems are for the most part utilized as a part in this review.

4.4 Survival Time Analysis

Survival time analysis assesses client's survival time length and a probability that they leave amid that time (leaving is comprehended as client's changing to another supplier of a specific item). The analysis portrays a circulation of survival time for people of a given population, screens quality of different parameters effect on the normal survival time, and furthermore, it empowers to look at conveyances of survival time between various sub-populations. Exploiting this strategy, an organization might be given an important understanding into client conduct and discover some approaches to drag out client's survival time.

4.5 Analysis of Consumer Loyalty and Consumer Switching to Competition

Consumer loyalty are characterized into four classifications: time of co-operation, sum (volume) of co-operation, closeness of co-operation and nature of co-operation. It is entirely identified with investigations of client's changing to rivalry. That outcomes in recognizing clients who are slanted to leave an organization and join competition. Disclosure of components that bring about changing to competition empowers an organization to coordinate – fittingly - its activities that go for holding clients. In addition, recognizing group of consumers described by various risk levels of living takes into consideration development of viable dependability projects and more consideration paid to loyal consumers.

4.5 Credit Scoring

Credit scoring models empower to decide financial related hazard that is identified with specific consumers. Such a procedure might be performed at the exact second an agreement with a consumer and it depends on the information that originate from application shapes gave by a consumer subject to investigation. Credit scoring discovers its application in, inter alia, managing an account (loans, evaluation and resilience recently instalments) and in numerous different divisions related, for example, to leasing or renting property and hardware. Credit scoring might be performed by various models. Opting correct model depend upon the objective and analysed of specific data:

- Application scoring – utilized as a part of instance of new consumers; data on them is accessible just on the premise of the finished application frames;
- Behavioural scoring – focusing on extra data on consumer' track records; it predicts clients' future conduct; and

- Profit scoring – extending of the essential scoring model; it focuses not exclusively to likelihood of paying credits back by clients, additionally evaluates what kind of profit might be normal therefore of co-operation with a specific client; it is a more refined model since it considers a few extra economic variables.

4.6 Fraud Detection

Fraud Detection is a very much attempted and extraordinarily proficient technique because of which an organization may spare unlimited measures of cash, and keep great relations with clients. Fraud detection implies distinguishing proof of suspicious exchanges, orders and other illicit activity that objective an organization being referred to. Fraud detection models might be isolated into application appraisal and behavioural evaluation. The former is utilized to recognize suspicious clients at the early phase of marking an agreement with an organization being referred to, and depends on information got from submitted applications. The latter is figured on the premise of all information accumulated amid "lifetime" of client's movement including, inter alia, value-based information, utilization of service or performance track record. Fraud detection is regularly connected so as to avert MasterCard cheats (e.g. Web exchange fakes, telemarketing cheats or personality burglaries), rupturing of PC frameworks security, 'tax evasion', broadcast communications fakes, and so forth.

4.7 Logistics Optimizations

Logistics optimization issue includes offering the most ideal arrangement of logistics activities (counting transportation or conveyance), all the while taking definitely known restrictions and accessible potential into thought. Wrongly arranged arrangement of logistics optimization may bring about tremendous delays for instance, production that would therefore realize a need for bearing higher expenses - subsequently diminishing potential benefits to be acquired. Utilizing propelled information mining procedures, it is conceivable to demonstrate the best accessible answer for real and complex optimization issues. Nature of such arrangements is typically significantly higher than the quality offered by customary arrangements of optimization techniques.

4.8 Forecasting of Strategic Business Processes Development

Capacities to comprehend and gauge improvement of vital business forms make up an establishment of the right arranging of any business action. That is the reason, demonstrating of multidimensional figures in light of recorded, present and foreseen information is so critical. Analyses of time series make it conceivable to distinguish and investigations shrouded patterns and changes (e.g. in promoting information or deals information). Taking regular nature and other promoting components into thought, it is conceivable to anticipate potential conduct of market or clients, advancements of client desires and clients' buys.

4.9 Web-Farming

Web-farming includes efficient investigations of the Internet content keeping in mind the end goal to furnish an organization with topics and issues of principal nature for organization execution (Hackathorn, 1998). Web is increasingly as often as possible regarded as an effective asset of essential financial data on potential clients, providers and contenders, data on the most recent market deals, innovative patterns and advancement of the world economy. Along these lines, each organization that desires to remain its aggressiveness must investigate the web that

is comprehended as an important wellspring of learning. Web-farming offers a probability of consistent investigating of the Internet; finding essential business data there; procuring such data; sparing it in information distribution centre of an organization; and conveying prepared data to sufficient people or offices in an organization. Significant advantages acquired while doing web-cultivating incorporate lasting checking of key business data sources, extricating of fundamental actualities and their familiar coordinating with the inside arrangement of organization information putting away. Every one of these operations might be performed by methods for cutting edge information mining instruments.

5. Conclusion

Contemporary organizations have confronted a need for complex and semi-structured decision making strategies. Dispersion of data sources and decentralization of a basic decision making process in deficiency of present data managing models. In this circumstance, organizations are offered the business intelligence frameworks application. Business intelligence frameworks presents an incorporated environment that predominantly comprises of information distribution centres, ETL measurements, OLAP procedures and information mining. Such an environment takes into consideration completing various profitable business investigations that concern customer's behaviour. The environment makes it likewise possible to decide value settling (price) strategies, forecast organization advancement and streamline coordination exercises. Potential territories of BI applications include Customer Relationship Management (Silva, and Rahimi, 2004), active sales analysis, overall profitability analysis, assessment of liabilities, cost observing, market division to showcase, examination of advertisement and publicizing efforts, support of money related detailing, chance evaluation and misrepresentation examination. Hone demonstrates that business intelligence might be for the most part used for (Olszak, and Ziemba, 2004) are Increment in the viability of vital, strategy and operational arranging including first of all

- Densifying problems, providing analysis of deviation from realization of plans for specific organizational segments, for best and worst product in term of quality and employee along with market region and sales costs.
- Following the satisfaction level of customer along with keeping an eye on changing knowledge about market and trends, effectiveness of business and consistent customer relationships.
- Providing learning and experience emerged while creating and propelling new products onto the market, providing learning on specific business forms; and trade of learning among research groups and corporate offices.

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