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Business Intelligence Solutions in Retail

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Abstract. In today's world, BIG DATA, which essentially means a flood of data, is trending is the field of IT. The discoveries that can be made by industries using big data is massive and can often help industries increase their profits. The project we are going to be doing is going to help the retail sector in a massive way. We are going to be developing a Business Intelligence Tool for the Retail sector which can help analyze its customers and improve its business strategies. It is required by every industry today. As an additional feature we are also going to be integrating cloud computing to fetch the data from different sources and store it in the data warehouse.

Keywords: Big Data, Retail, Business Intelligence tool, Cloud computing.

1. Introduction

In today's world, where there is heavy competition, producers are realising the need to identify their customers and their interests and use it to their advantage. This is known as big data analytics is helping producers become top scale in their business. It is crucial to identify each customer's mindset and the best way to do this is to keep track of what they buy, what they search on the internet, their feedback, what pleases them etc. This is a large amount of data. Storing this data and analysing it and making the data display user friendly and informative is where business intelligence comes to play.

1.1. Business Intelligence

Business intelligence (BI) is a set of theories, methodologies, processes, architectures, and technologies that transform raw data into meaningful and useful information for business purposes. BI can handle large amounts of information to help identify and develop new opportunities. Making use of new opportunities and implementing an effective strategy can provide a competitive market advantage and long-term stability. BI technologies provide historical, current and predictive views of business operations. Common functions of business intelligence technologies are reporting, online analytical processing, benchmarking etc.

1.2. BI Applications

Business intelligence can be applied to the following business purposes, in order to drive business value.

1. Measurement – program that creates a hierarchy of performance metrics (see also Metrics Reference Model) and benchmarking that informs business leaders about progress towards business goals (business process management).
2. Analytics – program that builds quantitative processes for a business to arrive at optimal decisions and to perform business knowledge discovery. Frequently involves: data mining, process mining, statistical analysis, predictive analytics, predictive modeling, business process modeling, complex event processing and prescriptive analytics.

3. Reporting/enterprise reporting – program that builds infrastructure for strategic reporting to serve the strategic management of a business, not operational reporting. Frequently involves data visualization, executive information system and OLAP.
4. Collaboration/collaboration platform – program that gets different areas (both inside and outside the business) to work together through data sharing and electronic data interchange.
5. Knowledge management – program to make the company data driven through strategies and practices to identify, create, represent, distribute, and enable adoption of insights and experiences that are true business knowledge. Knowledge management leads to learning management and regulatory compliance.

In addition to above, business intelligence also can provide a pro-active approach, such as ALARM function to alert immediately to end-user. There are many types of alerts, for example if some business value exceeds the threshold value the color of that amount in the report will turn RED and the business analyst is alerted. Sometimes an alert mail will be sent to the user as well. This end to end process requires data governance, which should be handled by the expert.

2. Why Retail

Many industries use BI to increase their profits. If that be the case, why did we choose the retail sector alone? In the increasingly competitive and fast changing retail industry, retailers need to use all the tools at their disposal to operate more efficiently and increase revenue. Faced with mounting pressure to enter new sales channels, changing consumer demands, and continuing globalization, retail companies need information management solutions that allow them to make better business decisions. Retailers handle immense amounts of information – everything from supply chains to sales information to store operations. It's hard to keep track of important information and even to know which information is valuable, and retail companies need the tools to take advantage of the myriad information at their disposal. The information technology available today allows retailers to make better business decisions and to better target performance goals.

2.1. Business Intelligence Tools

Business intelligence tools are a type of application software designed to retrieve, analyse and report data. The tools generally read data that have been previously stored, often, though not necessarily, in a data warehouse or data mart.

There are various types of BI Tools such as spread sheets, OLAP tools, Dashboards etc. Our project is to create a dashboard type BI Tool. Before that we need to obtain data by using data warehouses

2.2. How it works

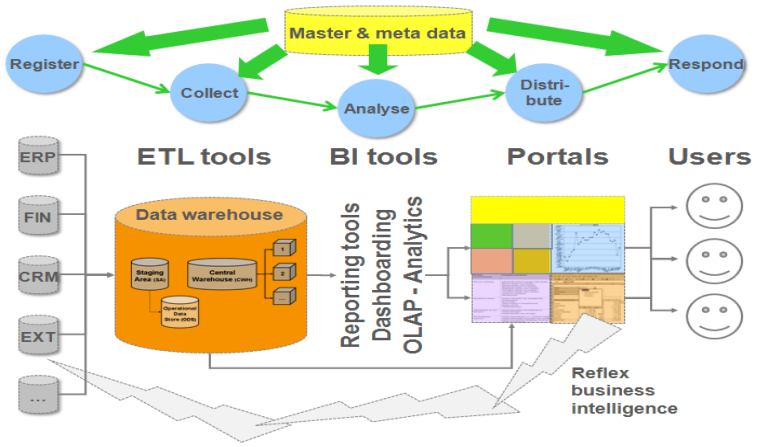

Fig.1. How it works

A data warehouse is a database that stores information from other databases using a common format. That's about as specific as you can get when describing data warehouses. There's no unified definition that dictates what data warehouses are or how designers should build them. As a result, there are several different

ways to create data warehouses, and one data warehouse might look and behave very differently from another. In general, queries to a data warehouse take very little time to resolve. That's because the data warehouse has already done the major work of extracting, converting and combining data. The user's side of a data warehouse is called the front end, so from a front-end standpoint, data warehousing is an efficient way to get integrated data. From the back-end perspective, it's a different story. Database managers must put a lot of thought into a data warehouse system to make it effective and efficient. Converting the data gathered from different sources into a common format can be particularly difficult. The system requires a consistent approach to describing and encoding the data. The warehouse must have a database large enough to store data gathered from multiple sources. Some data warehouses include an additional step called a data mart. The data warehouse takes over the duties of aggregating data, while the data mart responds to user queries by retrieving and combining the appropriate data from the warehouse. One problem with data warehouses is that the information in them isn't always current. That's because of the way data warehouses work -- they pull information from other databases periodically. If the data in those databases changes between extractions, queries to the data warehouse won't result in the most current and accurate views. If the data in a system rarely changes, this isn't a big deal.

3. Big cloud

The major problem with BI Tools as mentioned above can be overcome by integrating Cloud computing. For many years, cloud business intelligence was primarily the domain of startup vendors offering Software as a Service (SaaS) BI tools as alternatives to the traditional on-premises software sold by the BI market leaders. But cloud BI is becoming more mainstream as increasing numbers of corporate users embrace the cloud computing and SaaS models as part of their business intelligence strategies: About 25% of organizations surveyed by consulting firm Enterprise Management Associates Inc. in 2011 said they were using BI applications in the cloud, and only 2% said they weren't considering or interested in cloud BI technology. Cloud BI's potential benefits are similar to those offered by cloud computing technology in general: reduced data center and IT management costs, faster deployment times, increased flexibility as business needs change. In many cases, though, cloud BI deployments are still relatively low-end in nature users looking to do analysis on sales data. Other organizations are using the cloud for proof-of-concept projects that later lead to in-house deployments of BI software, according to analysts and BI vendors. Thanks to the exponential growth in the use of unstructured data by companies, including social customer data, many decision-makers are wrestling with the most effective ways to analyze real-time data quickly and effectively. These escalating data demands are just one of the reasons there's growing market interest in cloud-based analytics. While Gartner forecasts the global business intelligence (BI) market to grow 9.7% this year to $10.8 billion, business analytics software-as-a-service (SaaS) is expected to grow three times faster than the total business analytics software market, according to Brian McDonough, research manager for IDC's Business Analytics Solutions research service. Cloud-based BI and analytics offer companies and business users multiple benefits. Businesses of all sizes can leverage vast computing and storage resources in the cloud without having to invest in expanding their existing IT footprints or IT support staffs. In addition, cloud-based BI and analytics provide business leaders opportunities to quickly gather and act on granular insights from a mix of structured and unstructured data.

3.1. Digital Dashboard

Digital dashboards may be laid out to track the flows inherent in the business processes that they monitor. Graphically, users may see the high-level processes and then drill down into low level data. This level of detail is often buried deep within the corporate enterprise and otherwise unavailable to the senior executives. Key performance indicators (KPIs) figure prominently in digital dashboards and allow users to get an "at-a-glance" view of their performance. While KPIs can be expressed in a multitude of ways, digital dashboards rely on data visualizations such as charts, gauges, or tables to summarize business performance. Years of research, development, experience, and improvement in enterprise information systems have converged to increase the necessity and desirability of a digital dashboard. Much like a vehicular dashboard, digital dashboards provide a consolidated view of key performance metrics to allow business users to diagnose and act on various business conditions. At the same time, dashboards can also be used to provide an in-depth

view of performance, drilling beyond key metrics and KPIs to get the who, what, where, when, why, and how of business performance. The key benefit of a digital dashboard is its ability to summarize huge volumes of data .The use-case for digital dashboards is highlighted by the need to see how all that data may impact a business process, but without overwhelming the user with too much, often redundant information. Digital dashboards offer a way to tell the story of organization's performance in a way that is reliable, trusted, and easy to digest. This is primarily why we opted for dashboards rather than OLAP Tools.

3.2. Decision making

Decision making can be regarded as the cognitive process resulting in the selection of a course of action among several alternative scenarios. Every decision making process produces a final choice.

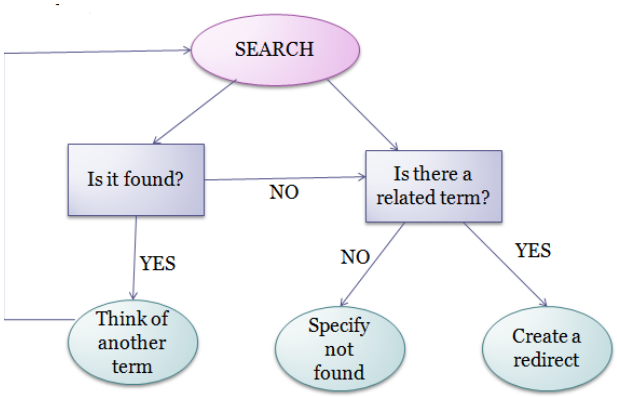

Fig.2. Decision making

3.3. Decision Support Systems

A decision support system (DSS) is a computer-based information system that supports business or organizational decision-making activities. DSSs serve the management, operations, and planning levels of an organization and help to make decisions, which may be rapidly changing and not easily specified in advance. Decision support systems can be either fully computerized, human or a combination of both. DSSs include knowledge-based systems. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions. Three quantitative models typically used by DSSs: Sensitivity, What-if analysis ,Goal-seeking analysis .

3.4. EIS Tools

An executive information system (EIS) is a type of management information system that facilitates and supports senior executive information and decision-making needs. It provides easy access to internal and external information relevant to organizational goals. It is commonly considered a specialized form of decision support system (DSS).EIS emphasizes graphical displays and easy-to-use user interfaces. They offer strong reporting and drill-down capabilities. In general, EIS are enterprise-wide DSS that help top-level executives analyze, compare, and highlight trends in important variables so that they can monitor performance and identify opportunities and problems. EIS and data warehousing technologies are converging in the marketplace. Most EISs offers the following capabilities:

Consolidation – involves the aggregation of information

Drill-down – enables users to get details, and details of details, of information

Slice-and-dice – looks at information from different perspectives

3.5. K-MEANS Algorithm

k-means clustering is a method of vector quantization originally from signal processing, that is popular for cluster analysis in data mining. k-means clustering aims to partition n observations into clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells. The problem is computationally difficult (NP-hard); however, there are efficient heuristic algorithms that are commonly employed and converge quickly to a

local optimum. These are usually similar to the expectation-maximization algorithm for mixtures of Gaussian distributions via an iterative refinement approach employed by both algorithms. Additionally, they both use cluster centers to model the data; however, k-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes.

Given a set of observations (x1, x2, …, xn), where each observation is a d-dimensional real vector, k-means clustering aims to partition the n observations into k sets ($k \leq n$) S = {S1, S2, …, Sk} so as to minimize the within-cluster sum of squares (WCSS):

$$\arg\min_{\mathbf{S}} \sum_{i=1}^{k} \sum_{\mathbf{x}_j \in S_i} \|\mathbf{x}_j - \boldsymbol{\mu}_i\|^2$$

where μi is the mean of points in Si.

4. Conclusion

Business Intelligence has been a buzzword for years. Organizations saw it as optional or unnecessary. In the current environment, Business Intelligence has become a necessity. Organizations in any industry look for relevant information to make decisions. Just as cash is the lifeblood of any organization. Data is the lifeblood of any information system in the organization. The importance of collecting data in a systematic and structured way is critical to the success of any business. Management needs to have visibility into all aspects of the business. Not only from a financial point of view but also other metrics that are critical to measuring the business success such as operations, compliance and HR. Accuracy and speed are among the most critical factors. We will discuss the importance of how business intelligence play a major role in providing the organization with the critical information it needs to make good decisions. A simplified, easy to understand BI Tool for Retail is our target.

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