THE CERTAINTY OF BI SYSTEM FOR SME

[1]Govinda Rajulu Lanke, [2]Dr.T.Bhuvaneswari
[1]Research Scholar, Dept of Computer Scienece, SCSVMV University, Kanchipuram-TN , India-631 561.
[2]Asst Prof, Dept of Computer Scienece L.N. Govt College, Ponneri-TN, India-601 204.
[1]govinda.lanke@gmail.com,[2]t_bhuvaneswari@yahoo.com

Abstract— **Business Intelligence (BI) is the key attention of in-depth application of enterprise information. This paper analyzes the necessities and difficulties in putting business intelligence into SMEs information, proposes small and medium enterprises BI application solutions in the use of software distribution method.**

BUSINESS INTELLIGENCE (Bl) is one of the simpler technology terms to understand. However, getting it right has proved to be one of the more difficult tasks for companies, large and small, to achieve. In simple terms, Bl is all about taking the volume of data that every company collects on a daily basis and turning it into a form that can be understood by decision makers. The ability to use historical information to make business decisions is the fundamental basis of a business.By transforming data into information and bringing together disparate sources of valuable information so they can be analysed. BI can enable SMBs to gain timely access to high quality, reliable business data and metrics. That enables them to make better-informed decisions, whether dealing with customers, suppliers or internal processes. Fundamentally, Bi enables companies to more easily identify and reduce costs and to take guesswork out of decisions that help drive top-line revenue growth.

Keywords: Decision Support Systems (DSSs), Data Warehouse (DW), Business Intelligence (BI), Small and Mid-Sized Enterprises (SMEs), Smart Business Systems (SBSs), Business Intelligence Systems (BISs).

I. INTRODUCTION

During the last decade, data warehouses (**DWs**) have become an essential component of modern decision support systems in most companies of the world. In order to be competitive, even small and middle-sized enterprises (**SMEs**) now collect large volumes of information and are interested in business intelligence (**BI**) systems. SMEs are regarded as significantly important on a local, national or even global basis and they play an important part in the any national economy.

Although many studies have been conducted on the need of decision support systems (**DSSs**) for small businesses, most of them adopt existing solutions and approaches, which are appropriate for large-scaled enterprises, but are inadequate for small and middle-sized enterprises.

Difficulties to obtain a BI system for SMEs

In spite of multiples advantages, existing DSSs frequently remain inaccessible or insufficient for SMEs because of the following factors:

- HIGH PRICE
- HIGH REQUIREMENTS FOR A HARDWARE INFRASTRUCTURE
- COMPLEXITY FOR MOST USERS
- IRRELEVANT FUNCTIONALITY
- LOW FLEXIBILITY TO DEAL WITH A FAST CHANGING DYNAMICS
- BUSINESS ENVIRONMENT
- LOW ATTENTION TO DIFFERENCE IN DATA ACCESS NECESSITY IN SMES AND LARGE-SCALED ENTERPRISES.

In addition, many projects fail due to the complexity of the development process. Moreover, as the work philosophies of small and large-scaled enterprises are considerably different, it is not advisable to use tools destined to large-scaledenterprises. In short, "one size does not fit all". Furthermore, there are a lot of problems in the identification of information needs of potential users in the process of building a data warehouse.

Thereby, SMEs require lightweight, cheap, flexible, simple and efficient solutions. To aim at these features, we can take advantage of light clients with web interfaces. For instance, web technologies are utilized for data warehousing by large corporations, but there is an even greater demand of such kind of systems among small and middle-sized enterprises. Usage of web technologies provides cheap

software, because it eliminates the necessity for numerous dispersed applications, the necessity of deployment and maintenance of corporate network, and reduces training time. It is simple for end-users to utilize web-based solutions. In addition, a web-based architecture requires only lightweight software clients (i.e., web browsers).

Thus, our objective is to propose original and adapted BI solutions for SMEs. To this aim, we first present and discuss web-based BI approaches, namely web data warehouses and web-based open source software for data warehousing. In Section. We finally conclude this paper and provide our view on how the research and technologies surveyed in this paper can be enhanced to fit SME's BI needs.

II. THE EMERGENCE OF SMART BUSINESS SYSTEMS(SBSs)

Today, the emergence of smart business systems (SBSs) is leading the way to optimizing a company's operations for changing times. Not only is computer technology changing more rapidly each day, but also are business requirements. Decision makers are being pressed to respond to customer needs and competitive threats in days and weeks instead of months or years.

In the past twentieth century, decision makers have utilized a wide range of information systems to improve their decisions. However, in this twenty-first century, there is need to take decision makers to a much higher level by providing them with the ability to "optimize the enterprise." More specifically, optimization refers to the ability to assess a myriad of possibilities in order to find the best one or near best one. At this time, the focus of smart business systems for the optimized organization centres on the functional areas of a typical company, in particular, corporate planning, marketing, manufacturing, and accounting. Such an approach can go beyond each functional area and tie in with the company's overall operations and its trading partners, thereby resulting in an integrated optimization approach. Essentially, the use of an optimization approach gives a typical company the necessary "smarts" to meet or possibly beat competition.

III. BUSINESS INTELLIGENCE SYSTEMS (BISS)

Fundamentally, business intelligence systems (BISs) make great use of data marts and data warehouses as well as operational databases for the purpose of measuring historical activity. Over time, however, business intelligence activities have been expanded to include other kinds of data, information, and knowledge that are future oriented. For example, software developers and their clients are integrating data mining tools to anticipate the future based on historical data, information, and knowledge, or visualization tools to quickly scan large amounts of relevant information and knowledge. Other companies are integrating text and images with data marts and data warehouses, using collocated document management systems or object relational databases. Also, there is a movement to "push" relevant information and knowledge to users in real time based on predefined business rules or collaborative arrangements among company personnel.

From this perspective, companies are looking at the organization holistically for a thorough understanding of its operations within a BIS operating mode. This generally means extending a company's functions, processes, and technology via E-commerce to its trading partners (i.e., customers and suppliers). A business intelligence system centres on managing internal and external information knowledge and their resulting intelligence in a proactive manner in order to create a competitive advantage that is linked to a company's achievable objectives and its measurable goals. It should be noted that an effective BIS operating mode centres on organizing and displaying business intelligence about important topical areas rather than trying to tell everything that is known. A business intelligence system can be looked upon as a set of tools and applications that allow decision makers to gather, organize, analyse, distribute, and act on critical business issues, with the goal of helping companies make faster, better, and more informed business decisions.

Business intelligence systems can be defined as systems for business that turn selected data, information, and knowledge into desired intelligence for business gain by decision makers. The type of system and software used is situational. Business intelligence systems employ various analytical and collaborative tools and utilize a database infrastructure—all within a global computer networking architecture. Overall, business intelligence systems provide decision makers with the ability to understand (i.e., the intelligence to gain insights into) the relationships of presented facts in the form of data, information, and knowledge in order to guide action toward a desired actionable goal. They provide decision makers with timely data, information, and knowledge for problem solving and, in particular, problem finding. As such, business intelligence systems are the forerunners of smart business systems.

IV. ESSENTIAL STEPS TO DEVELOPING AND IMPLEMENTING SMART BUSINESS SYSTEMS SUCCESSFULLY

Although there is no comprehensive approach nor is one anticipated in the near future to develop and implement smart business systems successfully, there are a number of suggested steps. Underlying all of these steps is the empowerment of a company's customers and employees to have a better understanding and more control over their total operations. The ultimate goal of a smart business system for

a typical decision maker is not to do a better job of understanding the company's inner workings, but rather to optimize its operations so that the company is run more effectively as well as efficiently in the short to long run.

Typically, there is an order that should be followed in undertaking these steps. They are as follows:

- **i.** Get support by starting at the very top of the company
- **ii.** Appoint a chief information officer to sponsor the smart technology
- **iii.** Select an experienced team to develop and implement the smart business system(s)
- **iv.** Select an effective smart business system design methodology
- **v.** Determine the appropriate data storage for optimizing results
- **vi.** Select appropriate software tools that canter on producing optimal or near-optimal results
- **vii.** Determine computer networking that ties in with smart technology
- **viii.** Develop important smart applications
- **ix.** Disseminate appropriate optimized results
- **x.** Focus on transforming optimized results into action

V. WEB-POWERED BI

The Web has become the platform of choice for the delivery of business applications for large-scaled enterprises as well as for SMEs. Web warehousing is a recent approach that merges data warehousing and business intelligence systems with web tech technologies. In this section, we present and discuss web data warehousing approaches, their features, advantages and possibilities, as well as their necessity and potential for SMEs.

5.1 Web Warehousing

There are two basic definitions of web warehousing. The first one simply states that web warehouses use data from the Web. The second concentrates on the use of web technologies in data warehousing. We focus on second definition in our paper.

Web-data warehouses inherit a lot of characteristics from traditional data warehouses, including: data are organized around major subjects in the enterprise; information is aggregated and validated; data is represented by times series, not by current status. Web-based data warehouses nonetheless differ from traditional DWs. Web warehouses organize and manage the stored items, but do not collect them. Web-based DW technology changes the pattern of users accessing to the DW: instead of accessing through a LAN (Local Area Network), users access via Internet/Intranet.

Specific issues raised by web-based DW include unrealistic user expectations, especially in terms of how much information they want to be able to access from the Web; security issues; technical implementation problems related to peak demand and load problems.

Eventually, web technologies make data warehouses and decision support systems friendlier to users. They are often used in data warehouses only to visualize information. At the same time, web technology opens up multiple information formats, such as structured data, semi-structured data and unstructured data, to end-users. This gives a lot of possibilities to users, but also creates a problem known as data heterogeneity management.

Another important issue is the necessity to view the Web as an enormous source of business data, without whose enterprises lose a lot of possibilities. Owing to the Web, business analysts can access large external to enterprise information and then study competitor's movements by analysing their web site content can analyse customer preferences or emerging trends. So, e-business technologies are expected to allow SMEs to gain capabilities that were once the preserve of their larger competitors. However, most of the information in the Web is unstructured, heterogeneous and hence difficult to analyse.

5.2 Cloud computing

Another, increasingly popular web-based solution is cloud computing. Cloud computing provides access to large amounts of data and computational resources through a variety of interfaces. It is provided as services via cloud (Internet). These services delivered through data centres are accessible anywhere. Besides, they allow the rise of cloud analytics.

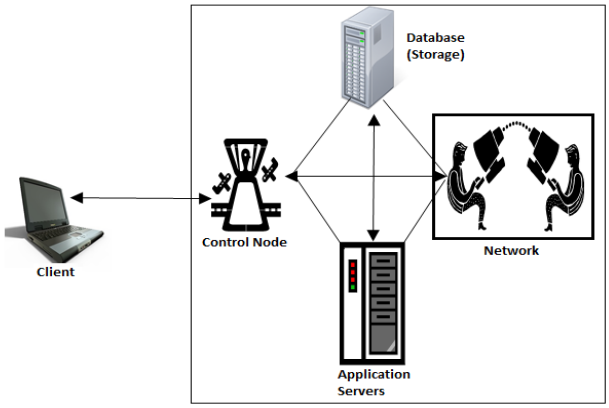
The main consumers of cloud computing are small enterprises and start-ups that do not have a legacy of IT investments to manage. Cloud computing based BI tools are rather cheap for small and middle-sized enterprises, because they provide no need of hardware and software maintenance and their prices increase according to required data storages. Contrariwise, cloud computing does not allow users to physically possess their data storage. It causes user dependence on the cloud computing provider, loss of data control and data security. In conclusion, most cloud computing-based BI tools do not fit enterprise requirements yet, researchers still finding new approaches on clouds to adopt Business Intelligence system in to the Enterprise market tis can shows the more benefits to Small and Mid Sized Enterprises in upcoming days.

5.2.1 How Cloud Computing Works

Let's say you're an executive at a large corporation. Your particular responsibilities include making sure that all of your employees have the right hardware and software they need to do their jobs. Buying computers for everyone isn't enough, you also have to purchase software or software licenses to give employees the tools they require. Whenever you have a new hire, you have to buy more software or make sure your current software license allows another user. It's so stressful that you find it difficult to go to sleep on your huge pile of money every night.

Soon, there may be an alternative for executives like you. Instead of installing a suite of software for each computer, you'd only have to load one application. That application would allow workers to log into a Web-based service which hosts all the programs the user would need for his or her job. Remote machines owned by another company would run everything from e-mail to word processing to complex data analysis programs. It's called cloud computing, and it could change the entire computer industry.

Fig. 1. How Cloud Computing Works



In a cloud computing system, there's a significant workload shift. Local computers no longer have to do all the heavy lifting when it comes to running applications. The network of computers that make up the cloud handles them instead. Hardware and software demands on the user's side decrease. The only thing the user's computer needs to be able to run is the cloud computing systems interface software, which can be as simple as a Web browser, and the cloud's network takes care of the rest.

There's a good chance you've already used some form of cloud computing. If you have an e-mail account with a Web-based e-mail service like Hotmail, Yahoo! Mail or Gmail, then you've had some experience with cloud computing. Instead of running an e-mail program on your computer, you log in to a Web e-mail account remotely. The software and storage for your account doesn't exist on your computer it's on the service's computer cloud.

5.3 Web-based open source software

In this section, we focus on ETL (Extraction Transformation Loading) tools, OLAP servers and OLAP clients. Their characteristics are summarized in Table 1.

TABLE I
WEB-BASED OPEN SOURCE SOFTWARE

		Tools	Platform	License
ETL	ROLAP	Clover ETL	Java	LGPL
		JasperETL	Java	GPL
	MOLAP	Palo ETL Server	Java	GPL
OLAP	Server	Mondrian	Java	CPL
		Palo	Java	GPL
	Clients	Free Analysis	Java	MPL
		JPalo	Java	GPL
		PoeOLPAP	Java	LGPL

5.3.1 ETL

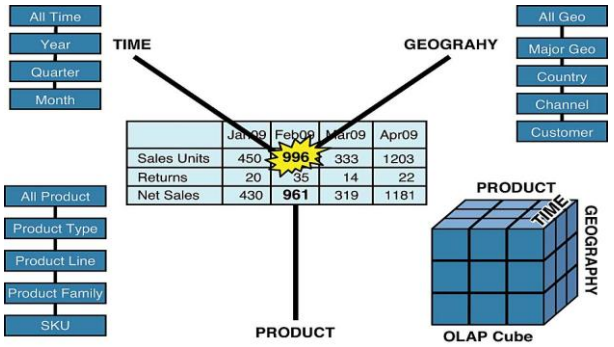
Web-based free ETL tools are in most cases ROLAP (Relational OLAP)- oriented. ROLAP-oriented ETL tools allow user to define and create data transformations in Java (JasperETL) or in TL (Clover.ETL)1. SingularMOLAP (Multidimensional OLAP)-oriented ETL Palo defines the ETL process either via web interfaces or via XML structures for experts. All studied ETL tools configure heterogeneous data sources and complex file formats. They interact with different DBMSs (DataBase ManagementSystems). Some of the tools can also extract data from ERP (Enterprise Resource Planning) and CRM (Customer Relationship Management) systems.

5.3.2 On-Line Analytical Processing (OLAP) Systems

Today, on-line analytical processing (**OLAP**) centres on systems that focus on asking and answering "what happened" to operations. A most important part of OLAP systems is their multidimensional analysis capabilities, that is, analysis that goes beyond the traditional two-dimensional analysis. Essentially, multidimensional analysis represents an important method for leveraging the contents of an organization's production data and other data stored in company databases and data warehouses because it allows users to look at different dimensions of the same data, say by business units, geographical areas, product levels, market segments, and distribution channels. As such, OLAP makes it easier to do analyse that cross departmental and even corporate boundaries. Another way of viewing OLAP is

getting a typical company out of the custom report-writing business and into the data-cube-server-building business. An OLAP data structure can be thought of as a Rubik's cube of data that users can twist and twirl in different ways to work through "what happened" scenarios to get at the real issues of the situation.

Fig. 2. Example of an OLAP Cube image



Current OLAP tools have proven their value in providing a multidimensional view of summarized data. Some of these tools are available within a business intelligence operating mode to further enhance a better understanding of a company's operations today as well as in the future. Although OLAP tools meet many needs, they do not allow for the analysis and understanding of individual customer behaviour at the transaction level. The reason is that OLAP tools, both those implemented on top of relational databases (ROLAP) and those implemented on top of multidimensional databases (MOLAP), centre on aggregating and summarizing data.

Although aggregated data can provide trend analysis information, it is not actionable at an individual level. For example, knowing that 5,000 products were sold does not help a company's decision makers to focus on individual customers. It knows who those 5,000 customers are that can help decision makers to get at the underlying profiles and possible motivation for buying a company's products or services. From this broader view, knowledge discovery is needed to complement that information found within an OLAP system that decision makers have found by "slicing and dicing" rapidly through reams of data. Overall, OLAP systems can be useful building blocks for the implementation of smart business systems.

In this section we review OLAP servers as well as OLAP clients. All OLAP severs use the MDX (Multi-Dimensional expression) language for aggregating tables. They parse MDX into SQL to retrieve answers to dimensional queries. All OLAP servers exist for Java, but a Palo exists also for .NET, PHP, and C.

CONCLUSION

Nowadays, BI becomes an essential part of any enterprise, even an SME. This necessity is caused by the increasing data volume indispensable for decision making. Existing solutions and tools are mostly aimed at large-scaled enterprises; thereby they are inaccessible or insufficient for SMEs because of high price, redundant functionality, complexity, and high hardware and software requirements. SMEs require solutions with light architectures that, moreover, are cheap and do not require additional hardware and software.

This paper discusses the importance of data warehousing for SMEs, presents the main characteristics and examples of web-based data warehousing, MOLAP systems, security issues in cloud computing systems. In this context, our research objective is to design BI solutions that are suitable for SMEs and avoid the aforementioned disadvantages.

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