www.ijecs.in
International Journal Of Engineering And Computer Science ISSN:2319-7242
Volume – 4 Issue - 12 December, 2015 Page No. 15368-15372

Decision Forecast Modelling For Effective Execution Of Research Projects In R&D Labs Through Bi Models

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***Abstract*—**Research institutions adopting Enterprise Resource Planning packages for their day to day operations generate enormous data. Effective methodology for analysis these data will add value to the research and provide in the decision making process for the management using Business Intelligence (BI) models. For accomplishing this task, specific rules, techniques and algorithms needs to be developed in order to make the ERP system intelligent. These rules will bring out the hidden Business Intelligence in the ERP data and thereby will improve the outcome and deliverables of the project apart from providing support to the scientist. This forms a cyclic structure by again analyzing the outcome of the intelligence found, as this intelligence is incorporated with the ERP database itself. BI has been found used extensively in manufacturing sector and business houses and seldom used in R&D institutions and laboratories. This research work envisages to use BI model to improve the performance and provide support to large R&D labs like Council of Scientific and Industrial Research (CSIR).

Keywords: *Business Intelligence, ERP, Data mining*

I. INTRODUCTION

A. ERP

ERP is an acronym for Enterprise Resource Planning. At its most basic level, ERP software integrates the various functions (like inventory and order management, accounting, human resources, customer relationship management (CRM)) into one complete system to streamline processes and information across the entire organization. ERP systems use a shared database which supports multiple functions used by different organizational units. In practice, this means that various stake holders working in different units can rely on the same information for their specific needs.

ERP software offers some degree of synchronized reporting and automation. For instance, purchase orders, appointment orders, etc automatically flow into the financial system without any manual re-keying and therefore finance division or HR division can process related transactions more quickly and accurately thereby avoiding errors and discrepancies that usually arises out of data entry being made multiple times.

B. BUSINESS INTELLIGENCE

Business Intelligence (BI) systems combine data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision makers. Implicit in this definition is the idea that business intelligence systems provide actionable

information delivered at the right time, at the right location, and in the right form to assist decision makers. The objective is to improve the timeliness and quality of inputs to the decision process, hence facilitating managerial work [2].

A BI system includes the rules (architecture) providing a framework for the organization of the technologies, platforms, databases, gateways, people and processes. To implement architecture the Business Intelligence architect must implement an infrastructure. Technical infrastructures are the technologies, platforms, databases, gateways, people and processes necessary to make the architecture functional within the corporation [3].

"The processes, technologies and tools needed to turn data into information and information into knowledge and knowledge into plans that drive profitable business action. BI encompasses data warehousing, business analytics and knowledge management [4]."

BI pulls information from many other systems. Business Intelligence is referred as a "data refinery [5]." BI environment takes raw material—data from respected ERP —and processes it into a multiplicity of information products.

II. LITERATURE REVIEW

Enterprise resource planning (ERP) is business management software—typically a suite of integrated applications—that an organization can use to collect, store, manage and interpret data from many business activities. This includes (1) Product planning, cost, (2) Manufacturing or service delivery, (3) Marketing and sales, (4) Inventory management and (5) Shipping and payment.

ERP provides an integrated view of core business processes, often in real-time, using common databases maintained by a database management system. ERP systems track business resources—cash, raw materials, production capacity—and the status of business commitments: orders, purchase orders, and payroll. The applications that make up the system share data across the various departments (manufacturing, purchasing, sales, accounting, etc.) that provide the data.

For small and medium enterprise or R&D lab implementing BI require large investment. There is lot of BI tools available in the market. They are divided into 3 major groups as: (1) Query and reporting; (2) Online analytical digesting (OLAP); (3) Data mining. As per the author [6] some of the popular tools are popular one are. SAP Business Objects, IBM Cognos, ProClarity, and QlikView. To overcome this, web based support system is developed. For small enterprises these tools are difficult to work with. In this system the authors proposed a web support system for business intelligence which provides automated data mapping and loading from user application. The web support system is user friendly and very less time to understand the process. User friendly means the pages are menu driven; even non-technical user can use this web support system. The results are displayed as charts and dashboards [6].

Lot of data resides in the ERP database. In order to transform these existing data into knowledge, and help the enterprise to make the wise decisions of operation management. To transform the data into knowledge, it needs to use the data warehouse, on-line analysis processing (OLAP) technologies, data mining and so on tools. The BI system software is costly, also the development and maintenance cycle is long, and the expense is expensive, generally, it's difficult for the Small and medium-sized enterprises and R&D organization to introduce BI. To overcome this, BIaaS is developed. BIaaS is BI as a Service. Here BI is implemented as a service and it is used by multiple Organizations. This BIaaS is easy to implement and the result will be utilized by all the organization and labs. BIaaS is user friendly and very less time to understand the process. The data for each lab or enterprise is kept separate. BIaaS provides a scalable environment [7].

When there is an economic downturn or recession, BI is becoming an important factor in enterprise core competence. Li. Xingsen et al. [8] use formalized models based and give an information cube for collecting the integrated information from the web or other data sources. This helps us to collect systematic proper data for BI and useful in finding more knowledge. By implementing this BI, the revenue of the enterprise will increase. Also they describe information with matter element, affair-element, and relation-element; they did more research on information processing to wisdom with extension reasoning, extension transformation, and intelligent knowledge management method.

Feng et al. [9] have conducted interview with senior managers in enterprises. There are two main conclusions; First is the Influence Diagrams, it is not obvious that a common pattern emerges across all

cases given the different contexts. However, from the comparison of the decision-making processes and detailed information, it is possible to identify similarities and insights about decision-making environments that lend themselves to effective decision-modeling. Second it is possible through an interview process to model the decision-making framework of managers. Decisions involving quantifiable data are more likely to be useful for BI design than decisions involving less quantifiable data. Accordingly, not all roles within an organization would be amenable to decision-modeling. The outcome of the interview is that "Decision-making involves multiple disciplines including mathematics, sociology; psychology different technologies have been Said". BI is one of the promising areas. For a Business Analyst they must possess rich analytical knowledge. The outcome of the interview suggest that decisions featuring less uncertainty with measurable outcomes are more amenable to the use of decision models as a precursor to a decision-centric BI-mediated information delivery.

ZHU Min et al. [10] in their work analyzed the problem of data redundancy and data discord. According to them traditional data bases and data warehouse have lot of redundant data and unwanted data. For BI all this data need to preprocessed and cleaned. All this data need to process by using specific algorithm. For that they proposed an Equipment support management. They proposed equipment support management system based on BI technology to conform face-transaction procession database platform and face-analysis procession data warehouse platform.

Ying Wang et al. [11] in their work discussed about BI System combined with BPM. Business performance management (BPM) is 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. The port BI system combined with BPM, which enables port enterprises to perform an in depth historical analysis of the monitored metrics in order to detect any abnormal pattern or opportunities. Also for a BI System three things are important. They are Data Management, Data Analysis, and Knowledge Discovery.

In the research work done by Sohail Asghar et al. [12], they stated that companies are lack of standardization of procedures in cultivating BI for improving the performance of the organization at all levels. For this they developed a model for link dimensions of BI and processes together. They proposed an architecture which is divided into two main parts i.e. BI dimension and BI process. BI dimension includes the concept of knowledge, functionality, technology, business and organization whereas the BI process includes the activities of operational data sources, ETL, data warehouse, OLAPS, data mining and visualization tools. As a holistic approach, they linked the BI dimension with the BI process as a whole model which is essential during the complete life cycle of BI system development.

Xu Hongfeng et al. [13] in their research work used some standardization for BI System integration based on SaaS. Standardization is an important means for information processing, exchanging, managing and clearing up technical bulwark more effectively. Their innovation includes one version for one platform, multi-tenancy, cost-effectiveness, and open source. By using the standardization, Enterprises can respond quickly to changes in business conditions by delivering all relevant data at the right time to stakeholders across the enterprise.

Jan et al. [14] in their work used an Interface for BI. The capturing and exploitation of user data within a Business Intelligence (BI) lifecycle involves the interaction between the human user – respectively teams – and systems. Their work plays an important role in todays and future BI-lifecycle. Their hypothesis is, that working with a digital pen together with the specially designed graphical elements and forms can enhance work in the healthcare domain, because of the on the fly digitalization of the contents. The investigations were done in the context of a Business Intelligence (BI) lifecycle, where content is captured, analyzed, utilized, and renovated e.g. on paper printouts.

III. PROBLEM FORMULATION

The proposed system aimed to predict the BI from the ERP modules used in research labs. We have identified few challenges that are critical for the successful implementation of BI solutions in small and medium enterprises are: The BI is done at Organization level, it is analyzed that the user details need to be populated. This needs to be changed; and BI is implemented as a separate framework.

DOI: 10.18535/Ijecs/v4i12.45

The BI while implementing in the Research labs need to increase the revenue, reduce time for a process and need to bring lot of new visions and horizons to the Industrial research. As of the starting of this 21st century globalization is the key mantra for all the industry. So surviving in this world economy, it is important for any industry to update by it. For this updating, an organization needs lot of knowledge. The main scope of this project is to find the hidden intelligence, by processing the data in the organization's database. After this it is important for any organization to check if this intelligence increases the company's revenue and opens new door for innovations. The organization's need to be achieved through this intelligence as well as the revenue also increases simultaneously.

Currently the data about the intelligence will be stored in simple tables and files. After gaining lot of intelligence the storage will be moved to large databases. Currently the BI will be choosing through different decision forecast modelling. Later rules and patterns will be found to choose the BI.

IV. PROPOSED SYSTEM

The 21st century smart business depends mainly on the BI on how the organization implements the intelligence it found during the years and how fast it implemented the BI. The objective varies from industry to industry. The objective of the system is to find Business Intelligence from the ERP System. This BI while implementing in the research labs need to increase the revenue, reduce time for a process and need to bring lot of new visions and new horizons to the Industrial research.

The data resides in the database without any information and knowledge. So first this data need to be analyzed. After analyzing the data the information will be gained. After gaining the information, these information need to be checked for its any hidden rule in it. This rule on planning and implementing will give results. This results need to be analyzed. There are two main impacts with these rules.

First the rule will provide positive things like reducing the revenue and founding new values form the rule will benefit the organization. On the other side we may get negative results. So before implementing the rules, the Intelligence must be analyzed thoroughly to find if the intelligence gives only positive results. Since positive results will only help the organization to improve to a new heights.

Since the BI is found using the ERP System application, it will easy to change whenever the environment changes. Only little bit of change needs to done in the BI application.

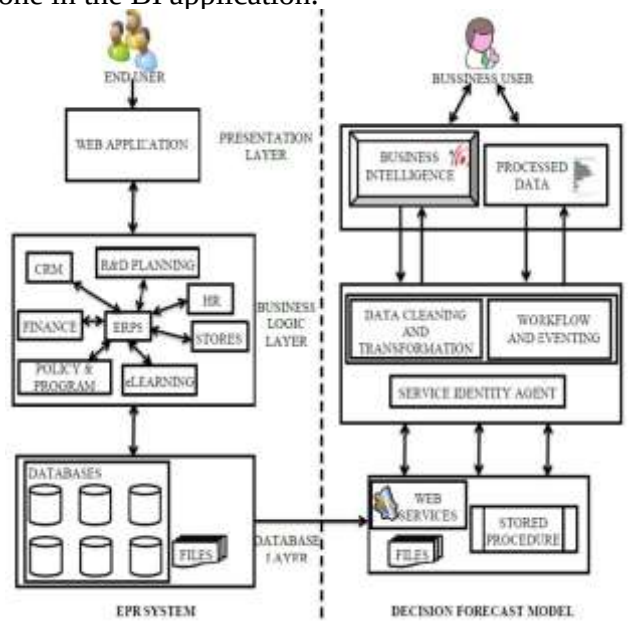

Fig 1 Architecture diagram

Web Application is the front end of the system where the user accesses the application. This is basically the presentation layer of the system.

ERP is the business logic layer of the given system. The business logic are written and implemented in the system. For an ERP there is lot of business logic need to be communicated. For an enterprise the different aspects are CRM, Financial, Marketing, HR, Production and Suppliers.

The Database layer is the layer where all the data are stored. An ERP system will have lot of databases for each domain and will be do communication based on the user request from presentation layer through business logic layer. The data will update in the database layer whenever the user changes or adds data in the presentation layer.

Analysis layer is the back end of the Decision forecast model. This layer is source of data that provide stored or processed data as "raw materials." Sources can include web services, stored procedure and different file sources.

The raw data is aggregated and provided to the user in a new, unified form. Its function is to transform data into business information and process intelligence. The inputs from different sources are combined to form a single source of input. The missing values and other improper data are removed at

this step. The data are fine-tuned and loaded to a separate database.

Decision Making Layer presents the composite data to the user in a central, integrated, task-focused user interface that provides both information for decision-making and functionality for taking action. This layer combines the best aspects of any number of applications and different data sources into a single application that is focused on the needs of the user, instead of on the capabilities and limitations of any one system. Thus from the generated sheets and charts the business intelligence are found.

V. EXPERIMENTAL RESULTS

The database used in the ERP modules is analyzed for writing queries and web services. The user requirements are analyzed and queries for different input are written and checked. Sample analyzing of the entire database is done and simple queries are written to get the output. Basic reports are generated. The reports are exported to database. The data are normalized. Next different algorithms such as linear regression algorithm for time series are used. Then depending on the requirement different mathematical functions are applied. Based on this algorithm data will behave differently. From this different forms of output are received. They are in the form of excel sheets / charts or other visual forms. From the charts / excel sheets business intelligence in them are found. Based on the requirements this can be implemented.

VI. CONCLUSION AND FUTURE WORK

Analysis of data generated in the research institutions can improve the understanding of the researchers and provide deep insight into their area of research by collaborations and networking. Forecast on the investment to be made in a specific research area can provide lot of value to the decision making process for the management. New thrust areas can be identified by analyzing the large interest of researchers, etc.

The business intelligence that emerges out of ERP implementation need to be effectively implemented in large R&D organizations. The outcome of the research and research utilization data analysis can be done using this Business Intelligent models.

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