Adaptive Business Intelligence model for Cross Functional Integration for Manufacturing Industry

Sumaiya Khan
Student, M.E. Computer
Sardar Patel Institute of Technology
Mumbai, India

D.R. Kalbande, Ph.D
Asso. Professor, Computer
Sardar Patel Institute of Technology
Mumbai, India

ABSTRACT
As international competition intensifies, more and more organizations are finding themselves under the mounting pressure to improve productivity and marketing strategy. Decision making is considered as one of the important factor in this task. The emphasis is mostly given towards the use of IT for individual functions. However, in the last few years, there has been an increasing recognition of the potential of Information System in improving productivity through organizational redesign and integrating cross functions. The purpose of this study is to develop an Adaptive Business Intelligence model for manufacturing industry which integrates cross functions. During the past few decades, organizations have strived to improve their decision – making capability by collecting and storing more and more data. The Business Intelligent (BI) tool is responsible for converting this data to usable knowledge. But having the knowledge is not sufficient for the managers to take right decision. Adaptive Business Intelligence (ABI) is a tool which helps managers to take right decisions. Assigning meaning to data, deriving knowledge from data, building the appropriate model from and about the data, and deriving optimal management decision support are the key activities to support manufacturing industries in business process from all fields of the process chain, including R&D, technical design, control, production, quality control and strategic management. This set of key activities are summarized under the term Adaptive Business Intelligence (ABI).

In this research we will propose an Adaptive Business Intelligence (ABI) model for manufacturing industries which will help the managers to take business decisions correctly by considering cross functional view of the system. The proposed model will mask the heterogeneity in different functions and provides a single view to its users of the manufacturing industry.

General Terms
Machine Learning, Soft Computing

Keywords
Business Intelligence (BI), Adaptive Business Intelligence (ABI), Cross Functional Integration (CFI)

1. INTRODUCTION
In last few decades, it has been observed that decision making is considered as very vital factor in getting an edge in the intensified international competition. For this reason organizations have collected and stored more and more data from the various operational sources. The need to convert this raw data to useful knowledge has fueled the growth of Business Intelligence Industry which provides Business Intelligence tools. The Business Intelligence tools convert the raw data to useful knowledge, which helps the decision makers to take the correct decisions. But having knowledge does not imply correct decision. The Adaptive Business Intelligence goes one step ahead; it helps decision makers in taking right decision. The Adaptive Business Intelligence is a tool which uses Business Intelligence (to convert raw data to knowledge), Prediction, and Optimization and Adaptability units.

2. Business Intelligence (BI)
Business Intelligence is a software tool which converts the raw data into useful knowledge by retrieving, summarizing and interpreting data for end users.

Most of the BI can perform the following tasks: [7]

- Access data from a variety of sources,
- Provide mechanism to transform data into knowledge, and
- Display this knowledge to users in a variety of graphical reports.

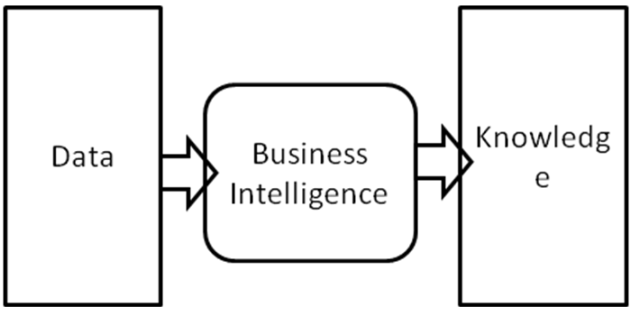

Figure 1Task of Business Intelligence

BI systems are becoming increasingly more critical to the daily operation of organizations. [1]

2.1 Goal of BI
The major goal of BI is to help managers make faster and smarter decisions by converting the raw data from various sources to knowledge and represent it in a various graphical formats like chars or graphs.

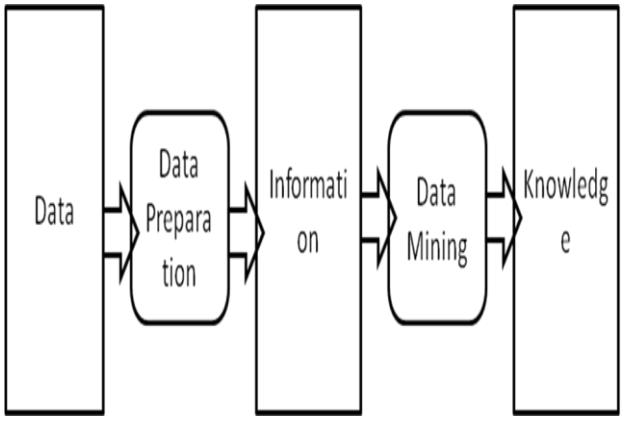

Figure 2 Business Intelligence [6]

Vast gulf exists between having the "right knowledge" and making the "right decision". To answer questions such as "What should be done to increase profits? Reduce costs? And increase market share?" business managers need more than graphs, charts, and numerical reports. They need systems that can predict the future and recommend the best course of action. For this reason the future of BI industry lies in systems that can predict, optimize and adapt – put another way, the future of the industry lies in Adaptive Business Intelligence. [7]

3. Adaptive Business Intelligence

The power and appeal of ABI systems reside in their ability to answer the two fundamental questions behind all business decisions:

- What is likely to happen in the future? and
- What is the best decision right now?

Without a doubt, organization that can accurately answer these questions on a consistent basis will have a competitive advantage over those that cannot. By combining prediction (What is likely to happen in the future?) and Optimization (what is the best decision right now?) into one system, business managers can reach new heights in their decision – making efficiency.

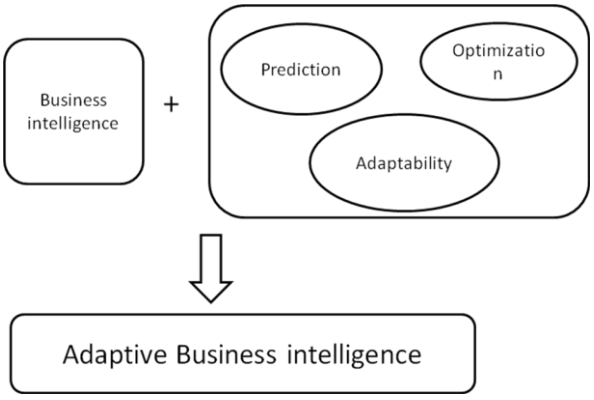

Figure 3 Components of Adaptive Business Intelligence system

3.1 **Prediction** [7]

A prediction is a statement about future based on previous experience and knowledge. A prediction will state about the way things will happen in future. A prediction is a statement where some outcome is expected. For some problems, there are only two possible expected outputs: "yes" or "no", "true" or "false", "buy" or "sell", etc. These are classic classification problems, because they assign new cases to a class. A classification problem may have, however, more than two outputs, in fact, the number of possible classes (i.e., expected outputs) might be quite significant (e.g., different types of diseases).

A prediction model uses the data mining technique to produce the expected output from past historical data. In general, the more data the better, as data mining can produce better results when performed on large data sets, and the resulting predictions models are more accurate.

3.1.1 Prediction Model Building:

The prediction model building consists of following three steps:

3.1.1.1 Data Preparation

The organizations collect and store more and more data to make their prediction model more accurate. But all the collected and stored data is not relevant to the problem at hand.

The data preparation step performs the data cleansing work by removing the garbage data and retaining only the required data. This step is the most laborious step in the prediction model process. 80% of data mining efforts are used in this step.

This step includes:

- Data transformation
- Normalization
- Creation of derived attributes
- Variable selection
- Elimination of noisy data
- Supplying missing values
- Data cleaning.

3.1.1.2 Model Building

This step includes a complete analysis of the data (i.e., the data mining stage), the selection of the best prediction method on the basis of:

a. Explaining the variability in question and

b. Producing consistent results , and the development of one or more prediction models

3.1.1.3 Deployment and Evaluation

Once the best model for the given problem is selected, the next step is to implement the model and test it on new data items and generate the prediction.

Since new data comes on regular and continuous basis, it is necessary to regularly check the accuracy of the prediction model and accordingly tune it.

3.2 **Optimization** [7]

Optimization is an act, process, or methodology of making something (as a design, system, or decision) as fully perfect, functional, or effective as possible. In optimization process, we make our Adaptive Business System more accurate in such a way that it gives correct and accurate prediction irrespective of environment changes. Optimization techniques are often called as "classic" techniques. The best examples are linear programming, dynamic programming and network flow programming. A new class of optimization technique called as "modern heuristics" has been emerged in last decade which include simulated annealing, evolutionary programming and tabu search.

3.3 **Adaptability** [7]

Unfortunately most prediction models lose its accuracy over time due to sudden or gradual changes in the underlying patterns and trends. For this reason, "adaptability" or "self validation" is required by all the prediction systems.

Adaptability is the ability to change (or be changed) to fit changed circumstances. Adaptability is the most important component of any intelligent system. This process allows a prediction model to compare predicted values against actual outcomes and automatically adjust.

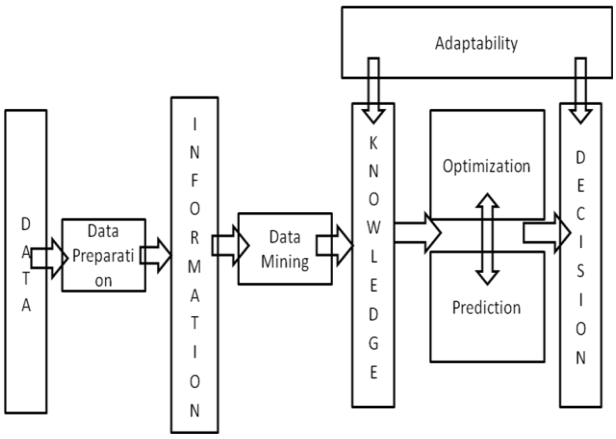

Figure 4 Adaptive Business Intelligence [6]

4. Cross Functional Integration

Cross Functional Integration (CFI) is the establishment of mechanism that provide functions to ensure that various functions work together effectively to achieve the overall objective of the organization. [5]

CFI issues have been considered important at the intra-organization as well as the inter-organizational level. [5]

5. Data Transformation Layer

The data of various functions are stored in their respective operational database. To provide a single view across the functions, data from all the functions are collected and stored in a single data ware house. Various functions operational data bases may be implemented on various platforms and they all may follow different notations to represent same real world entities. In such scenario, collecting and storing information from heterogeneous systems into one data ware house is not simple. To perform this crucial task, a middle layer called Data Transformation Layer has been introduced. The function of Data Transformation Layer is to collect the data from various heterogeneous sources and load it into a single data ware house. Diagram 5 shows this concept graphically.

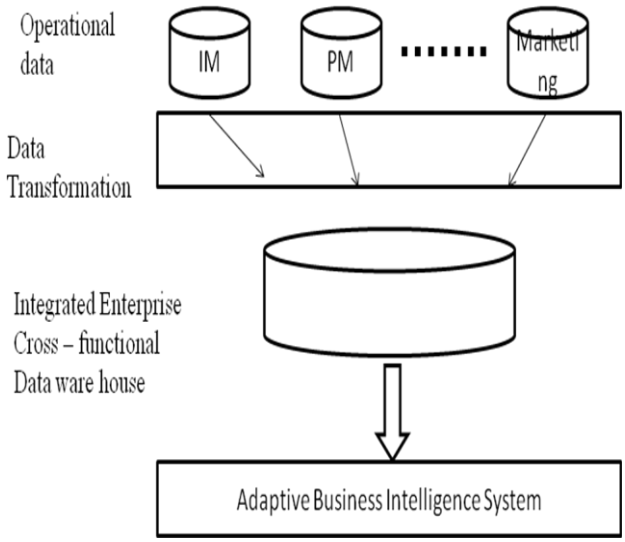

Figure 5 Data Transformation Layer

The Data Transformation Layer can be implemented using ETL tool. ETL stand for Extraction, Translation and Loading, are three major functions of database combined in one tool. ETL tools are able to extract data from external data sources and put into one data base or data ware house.

The major steps of ETL tool are as follows:

- Extracting data from outside sources
- Transforming extracted data to fit operational needs (which can include quality levels)
- Loading transformed data into the target (database, operational data store, data mart or data warehouse).

5.1 Extract

Extraction involves extracting data from source database. This step is most challenging step of ETL because the success subsequent steps depend on the correctness of Extract step. The extract step in our proposed system will extract the data from different sources and transform all into a single format for the transformation phase.

5.2 Transformation

The data is now available on one platform and one database. The data is transformed to meet the business requirements. Various transformation operations are performed based on the extracted data from the operational sources. Different databases may use different term to represent same entity; the transformation phase will map all such data into a single representation. In the stage we can check for data quality and perform data cleansing.

5.3 Loading

Finally, data is loaded into a data warehouse, usually into fact and dimension tables.

6. Proposed Model

Most manufacturing and supply chain management professionals are driven by make-to-stock decisions. In an

ideal world we could all "scan one, make one," but the realities of manufacturing requirements, long lead times, lot sizes, distribution channels, geographical restrictions, and limited views of retail sales can cause complex stocking situations.

Manufacturing industries require very strong and stable forecasting and decision making system. The proposed model will help the manufacturing industry in this situation.

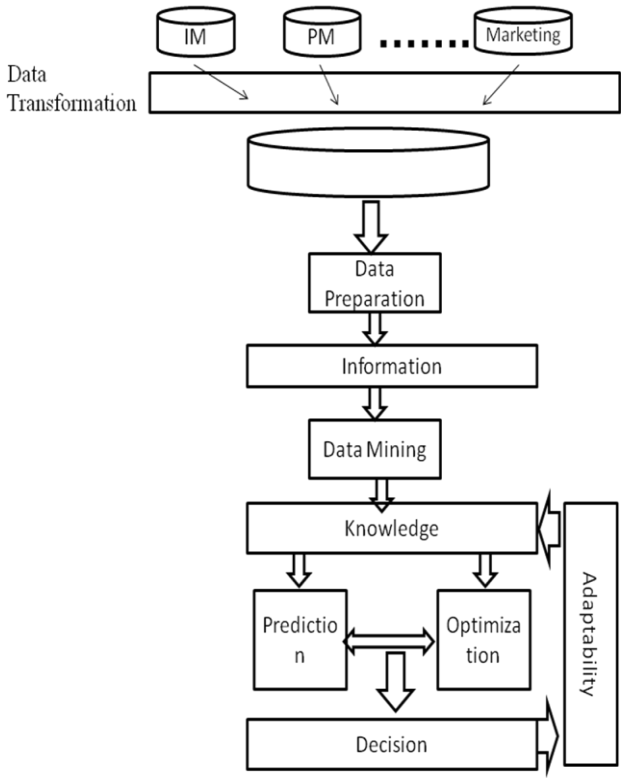

Figure 6 Proposed Model

6.1 Implementation of ABI in Supply Chain Network

The key supply chain problem is that the delivery time of products to the customer must be considerably shorter than the production or the lead time. In order to realize this and to guarantee a high delivery service, inventory and safety stock must be built up at component or finished product level in plants or distribution centers.

- In the proposed ABI system, you base forecasts on aggregated historical data from the Productive Systems and Business Information Warehouse (BW) system (such as sales quantities from past sales orders, lead time for sourcing an item, cost price and sales price of an item).
- Using this system managers can generate planned independent requirements based on these historical data collected from BW and can release these forecast back to productive system.
- In Proposed ABI model different forecasting models will be available to do the forecast as per the product characteristic.
- Managers can also plan for short term or mid-term horizon for the entire supply chain that means requirements at each plant, distribution, center and supplier.

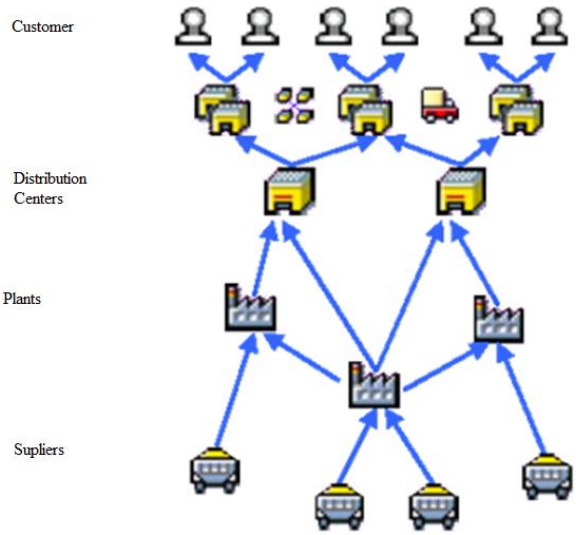

Figure 7 Supply Chain Network

The ABI system will integrate purchasing, manufacturing, distribution and transportation so that comprehensive tactical planning and sourcing decisions can be simulated and implemented on the basis of single global consistent model .Going a step ahead the transactional and historical data derived from BW and Productive system can be used for production planning and scheduling at manufacturing plant from the ABI system itself.

7. Limitation

Research work: The data collected from research can be inappropriate or insufficient for proper working of model.

Platform testing: As the model has not yet been tested on any of the platform, it yet has to be seen how well the model can be implemented and how well it moulds to the requirement and constraints of manufacturing industry.

8. Conclusion

In this research we have proposed an Adaptive Business Intelligence (ABI) model for manufacturing industries which will help the managers to take business decisions correctly by considering cross functional view of the system. The proposed model will mask the heterogeneity in different functions and provides a single view to its users of the manufacturing industry. The model yet has to be implemented and tested on various plateforms.

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