

Business Intelligence Solution for Food Industry

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Abstract: Before the 1960's organizations used to calculate figures on speculation. But ever since the demand for data analysis increased, Business Intelligence and Analytics is growing so rapidly that today it has been used for government, non-government, profitable, non profitable as well as the corporate world. The effect and impact on business intelligence system on various aspects of economy are increasing year to year. Recently, it is being used in the food industry as well. Many advanced techniques give rise to efficient methods and ways to provide a robust and effective environment for implementing BI systems in the food manufacturing industry domain; which is one of the most important industries across the globe. Hence this makes quite sense that this area would make use of such BI tools and take advantage in the similar manner as marketing firms and financial departments for understanding their customer needs, increasing efficiency and for keeping track of the rising demands. This paper discusses a BI system on a food manufacturing industry; National Foods Canada along with the characteristics, data, methodology as well as tools used in the system. Also examples with references of the business intelligence systems used in the food manufacturing industries are presented.

Keywords: Business intelligence, data warehouse, foods industry.

INTRODUCTION

By reviewing related work done in the field of Business Intelligence, authors have constructed business intelligence (BI) system. It not only includes dashboards, reporting tool and analysis but also give performance management to give smarter decisions to company and a mean to understand business.

BI has two meanings with respect to the term 'intelligence'. The first meaning refers to the human knowledge that is being implemented or to what level human intelligence is applied to the Business activities. It is an investigation of an application with respect to the technologies and human cognitive faculties applied to decision support to solve various business problems.

The second meaning is associated with the intelligence as information is valued for its currency and relevance. It is platform integrating applications and technologies that provides access and becomes a source for analyzing data to help enterprise users and make strong decisions for the business. The term focuses on holding a vast vision in this regard and about the factors that has a strong impact on business. BI includes deep knowledge about important factors for instance, competitors, customers, economic environment, business partnerships, internal activities and good quality business decisions. Business Intelligence assists firms to make such decisions. A

specialized field of business Intelligence known as Competitive Intelligence strongly focuses on external competitive environment. Data is collected on the basis of actions and activities of competitors, Analysis and decisions are made on this information. In today's world changes are taking place dramatically resulting in modern businesses, rising standards, automation and advance technologies have enabled availability of large amount of data [1].

Data warehouses have been set up that comprises repositories to store data. ETL is tool for extraction, transformation and loading respectively. Also Enterprise application integration tools are available. Online Analytical Processing tools are also available that allow fast creation of reports that perform quantitative analysis on the data.

Business Intelligence facilitates gathering and sorting large amount of data, extraction of relevant information, On the basis of that information decisions are made and actions are performed [2]. The business Intelligence helps company to cope up with the rising market and its competitors, makes confident in making decisions, gaining experience in data discovery to make better decisions [3]. In a recent study, a group of researchers have explored use of Support vector machines [4] in K-means clustering on real-time business intelligence systems [5]. Other Business Intelligence softwares also provides substantial decision making but are costly in market and need technical implementation of requirements [6-7]. Business Intelligence solution specifically for big data is crucial and need high analytical and technical skills for

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implementation [8]. Weka tool is an open source platform that provide interface to develop analytical solutions using different machine learning techniques [9].

Other BI systems related specifically to food industry are as follows; Silvo-Stratum has allowed hundreds of food companies to take their data analysis and reporting to a next level by involving BI techniques. Stratum BI system suite allow food companies to achieve better planning, alignment, optimization and monitoring by importing and aligning data and storing it in a central repository which is accessible to end users [10]. BOARD has been chosen by many European food industries to optimize sales, plan costs, monitor channels, create dashboards and report and do analysis. It is a solution for the management, support and control of such core processes [11].

Another food industry ERP solution is MAX FOOD SOFTWARE that provides stress on food safety and works for reducing risks and costs and allows business growth [12]. "BIG IMPACT" is also a food manufacturing Business Intelligence solution that provides analysis in the sales, products and promotions areas [13].

This study also explored the complete concepts of BI technology, requirements, design and implementation in food industry. Authors believe that it would be helpful for researchers working in the field of BI to understand any concepts and idea of BI in food industry.

BACKGROUND

In this study, authors have developed Business Intelligence System for food industry. The data used in this research was taken from a well-known industry. This data was used to build decision support system. The data is collected from National Foods, Canada. Pak National Foods (Pakistan National Foods) has been an importer and distributor of branded food products for over 15 years. During this period they have managed to expand their operations to include retail outlets in Canada, United States and the United Arab Emirates. The current CEO is the initiator, owner of this business. Pakistan National Foods has managed to distinguish itself from its competitors through its wonderful relationship management techniques and a 24 hour delivery guarantee. In order to meet this guarantee, Pakistan National Foods invests heavily in inventory and in a responsive

logistics network. The investment in inventory is required because currently no innovative and technical manner of predicting demand exists for Pakistan National Foods's product portfolio or product categories. For this reasons we saw greatest value in improving Pakistan National Foods's current forecasting methodology. With a greater understanding of product demand, historical trend, seasonality and available statistical techniques, Pakistan National Foods can streamline its inventory levels and better cater to its customers and suppliers needs.

BUSINESS DESCRIPTION

Project Goal

The goal of this project is to help the Company reduce Pakistan National Foods's inventory levels by improving its current forecasting methodology. We have used the all products categories to design a forecasting technique that can be implemented for any product category. In this manner, the Company can use this forecasting technique to help Pakistan National Foods predict its future demand more accurately thus reducing the requirement of a buffer inventory stock.

Product Portfolio

Pakistan National Foods's product portfolio contains over 1,500 items that scope the broad category of branded foods. This category includes various brands and types of readymade frozen meals, rice, naans, spices, pickles, juices, tea etc. For the purpose of this project we will be focusing all products and their sales.

Customers

Pakistan National Foods's customers fall in one of two main categories:

1. Big Box Retailers

This category of customers includes various national and international grocery chain stores like: Sobeys, Walmart, Loblaw's, Metro, FreshCo, Price Chopper etc. These customers are responsible for their own forecasting and promotional activity; hence, they already provide Pakistan National Foods with a fairly detailed and accurate sales forecast.

2. Ethnic Grocery Stores

This category of customers includes grocery/convenience stores of various ethnicities and sizes. This customer category does not provide

Pakistan National Foods with a sales forecast. Pakistan National Foods's sales team is responsible for communicating with the customer and predicting their future product demand. For this reason, an update in Pakistan National Foods's forecasting model will be most useful in predicting demand for these customers.

3. Suppliers

Currently Pakistan National Foods imports products from various suppliers in India, Pakistan, and Dubai and they also purchase products from various local manufacturers. Pakistan National Foods takes great pride in its ability of creating long term relationships with its suppliers. An updated forecasting model will allow Pakistan National Foods to improve its relationships with its suppliers by making its ordering more uniform and predictable. If Pakistan National Foods is to share its improved forecast with its suppliers, this will allow the supplier to incorporate a lean production system. Specifically, a system where products are produced only when demand for them exists (a pull system). This collaboration of information should further improve Pakistan National Foods's relationships with its suppliers, while aiding both financially. For the purpose of this project we will be focusing on one of Pakistan National Foods's main suppliers, namely 'National Foods'.

DATA DESCRIPTION

As discussed earlier, this is provided by National Foods Industry, Canada. This data contains information about customer Sales, customer lists, list of items and sales inventory. Following are the features that each of mentioned lists contains.

List of Customers contains information about customer demographics including customer name, contact details (address street 1, address Street 2), city, province and postal Code.

Customer Sales contains of following attributes: customer name, item number, description, quantity, revenue and profit.

Inventory Sales contains following attributes: item number, description, quantity, unit, revenue and profit.

Item Lists contains following attributes: item number, description, quantity and value.

The presented system is not only able to facilitate decision makers and policy makers to make business decisions for their company but will also be able to support individuals in making relevant decisions. This system will provide benefit for industry in analyzing critical factors in their datasets. The generated model will be able to assist higher management to understand slowly changing dimensions and methodologies associated with the company business.

METHODOLOGY

Data is collected from National Foods Industry, Pakistan and details of data set have been discussed in earlier section. On the basis of that data a decision support system was built. This Business Intelligence System is comprised of following four servers working at the backend as shown in Figure 1; a) User interface, b) Application server, c) Database server, d) Informatica server. Informatica is widely used ETL tool which provides strong data integration if data resides on different platforms.

Application server is basically web application that will allow main application to be used from desktop system/ laptop. Then the application server that contains user interface will prompt user to enter user id and password. On the successful login, the user will be redirected to another page. Database will hold the data in application database and also store the reports and queries entered by user.

At the end, Informatica server will be used for Extraction, Transformation and Loading processes and will also be used to create system workflows.

Other than these servers microstrategy tool reporting tool will also be used that will generate reports.

Firstly, the system involves the installations of Informatica 9.6.1 (along with Powercenter tools), Apache tomcat, Microstrategy reporting tool, Visual studio and SQL server Management Studio. Then,

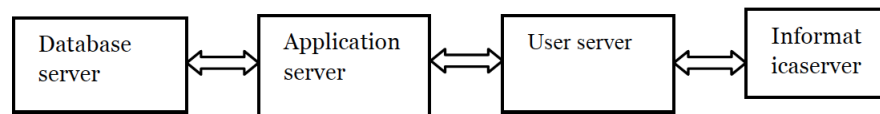


Figure 1: Servers of BI system.

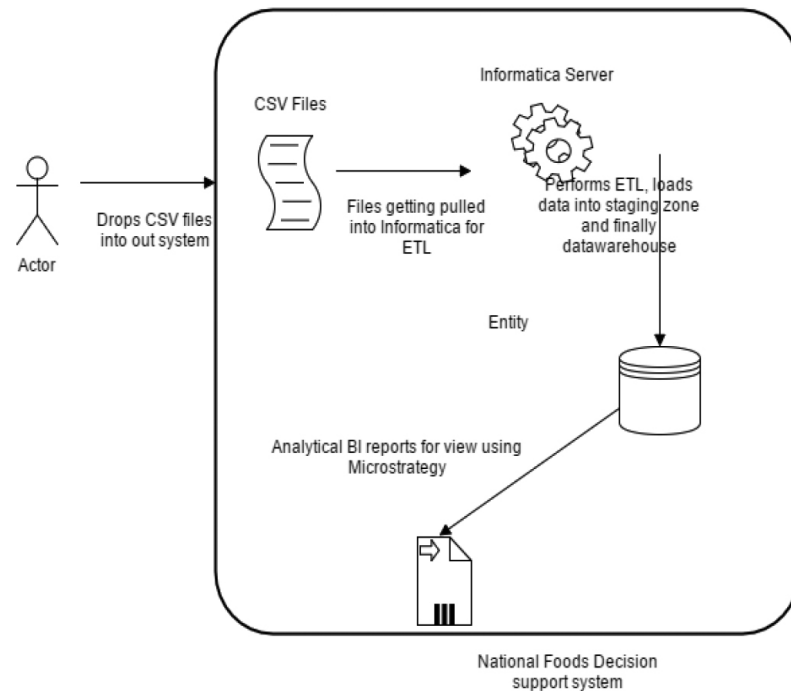


Figure 2: System Architecture of BI system.

following steps are required to implement the complete decision support system as shown in Figure 2.

Step#1: Setting up database (creating tables, writing read and write SQL procedures to extract and load data into the database tables)

Step#2: Setting up UI that is User Interface.

Step#3: Creating up backendlogic Business Layer

Step#4: Writing Informatica Workflows.

Step#5: Automating the Informatica Execution from UI and integration.

Step#6: Writing Batch or shell scripts to call informatica workflows.

Step#7: Setting up Micro strategy Project

Step#8: Setting up Micro strategy Schema Objects

Step#9: Creation of Reports

Step#10: Visualization in Micro strategy

Step#11: Creation of Dashboards

Step#12: Integration of Micro strategy reports with our UI.

After successful login the user will be asked to drop or upload relevant files. These files contain data about inventory sales, customer sales, and items sale and

customer demographics. After submission of files, the processing will start at the backend and will be uploaded on the server.

This uploaded data will then be moved to informatica server where major processes (ETL) of constructing a data warehouse will be carried out. The workflows will be generated for this data set and on successful completion of these workflows, execution will be completed. The generated reports are compiled according to the data stored in data warehouse through microstrategy reporting tool. On successful login, the user will be redirected to next page on which he/she will be able to upload zip files of their dataset. The server will extract the contents of zip files in a folder and trigger informatica workflow. These workflows will be directly triggered from user interface. This server will only accept zip files and will not accept any other file type.

It is a Business Intelligence System in which user interface is set up for user to interact with the system and Informatica server is set up to for extraction of data set then its transformation to appropriate data structures and finally to perform loading process to data warehouse and to create workflows. Micro strategy reporting tool is set up to generate report and graphs and Database server is set up to store data entered by user. Finally, Dashboards are used to represent the results in user friendly format. This dashboard was created using Google API [].

In the mentioned four servers used in the presented system, Informatica Power Center is used for extraction, transformation and loading (ETL) and is widely used in building enterprise data warehouses. The components within Informatica Power Center aid in extracting source components from any internal, external or archived resources, then transforming its naming conventions and data structures as per business requirements. Finally data loading was done into a target data warehouse. The Informatica scope was used for ETL and micro-strategy tool reporting tool was also used to create workflows. The Informatica Power Center consists of 3 main components; Informatica Power Center Client Tools for the development of transformation processes also known as mappings (Designer), define run-time properties for a mapping that are known as sessions (Workflow Manager) and monitoring execution of sessions (Workflow Monitor). It is also used for managing repository for administrators.

Repository is a data inventory where all the data related to mappings, sources, targets, etc. is kept. This is the place where all the metadata for an application is stored. All the client tools and Informatica Server fetch data from Repository.

Informatica Power Center Server was used as the Server where all the executions take place. Server makes physical connections to sources/ targets, fetches data, applies the transformations mentioned in the mapping and loads the data in the target system. Then, Ms SQL Server Management Studio refers to application database that was used to hold the data and also store the reports and queries entered by user. Another tool, Visual Studio MVC was used to develop the application that contains User interface. It will prompt user to enter ID and password. On the successful login the user will be redirected to another page. Web Application Server is used which is a web application that allows application to be used from any PC or laptop. Finally, data warehouse is setup to store data and to structure data model using methodologies. Reports and graphs of the system were generated by using "Micro strategy reporting" tool.

RESULTS AND DISCUSSION

Our Business Intelligence System basically functions by triggering the Informatica workflows with the application User Interface (UI) i.e. when the user uploads his zip files on our UI.

The end result of our system will be a report generated using the effective report generating tool; Micro strategy enterprise platform. This will be a Business Intelligence report for National Foods Canada.

CONCLUSION

This paper presents a business intelligence system for foods industry and was developed using real-time data set from National Foods Industry Pakistan. In these industries, data is growing rapidly on the daily basis but not getting utilized by decision makers and policy makers.

By developing business intelligence solution, authors provided a reliable decision support system that can be used by management and administrators to analyze data more efficiently by using dashboard feature which gives overall performance representation at a glance. This feature has reduced time significantly as data is not needed to be analyzed by analyst and system is playing a role of business analyst avoiding paper work.

Another achievement of this study is that big data is handled by implementing data warehouse using latest technology. This data handling provided flexibility in accommodating large data set and also made this system scalable for other domains.

REFERENCES

- [1] Trieu V-H. Getting value from Business Intelligence systems: A review and research agenda. *Decision Support Systems* 2017; 93: 111-24. <https://doi.org/10.1016/j.dss.2016.09.019>
- [2] Visinescu LL, Jones MC, Sidorova A. Improving Decision Quality: The Role of Business Intelligence. *Journal of Computer Information Systems* 2017; 57(1): 58-66. <https://doi.org/10.1080/08874417.2016.1181494>
- [3] Yang J, Pinsonneault A, Hsieh J, Eds. Understanding Intention to Explore Business Intelligence Systems: The Role of Fit and Engagement. *Proceedings of the 50th Hawaii International Conference on System Sciences* 2017.
- [4] Suykens JA, Vandewalle J. Least squares support vector machine classifiers. *Neural Processing Letters* 1999; 9(3): 293-300. <https://doi.org/10.1023/A:1018628609742>
- [5] Wang J, Wu X, Zhang C. Support vector machines based on K-means clustering for real-time business intelligence systems. *International Journal of Business Intelligence and Data Mining* 2005; 1(1): 54-64. <https://doi.org/10.1504/IJBIDM.2005.007318>
- [6] Chaudhuri S, Dayal U, Narasayya V. An overview of business intelligence technology. *Communications of the ACM* 2011; 54(8): 88-98. <https://doi.org/10.1145/1978542.1978562>
- [7] White C.J. The IBM business intelligence software solution. Data Base Associates, Version 2000; 4.

- [8] Chen H, Chiang RH, Storey VC. Business intelligence and analytics: From big data to big impact. *MIS quarterly*. 2012; 36(4): 1165-88.
- [9] Hall M, Frank E, Holmes G, Pfahringer B, Reutemann P, Witten IH. The WEKA data mining software: an update. *ACM SIGKDD Explorations Newsletter* 2009; 11(1): 10-8. <https://doi.org/10.1145/1656274.1656278>
- [10] Inc. SS. Silvon: Driving the Intelligence Enterprise. 2016 [cited 2016 05-04-2016]; Available from: <https://www.silvon.com/food-beverage-cpg.php>
- [11] International B. Board International-Business Intelligence Software Solutions. 2017 [cited 2016 04-05-2016]; Available from: <http://www.board.com/en/bi-solutions-food-beverage-industry>
- [12] Solutions Ms. MAXFood's Food Safety Portal, Incident Management, and Recall Management Capabilities. Wheaton, IL 2017 [cited 2016 05-04-2016]; Available from: <http://www.maxfoodsoftware.com/index.html>
- [13] Impact B. Business Impact. 07-06-2016; 2017 [cited 2016]; Available from: <http://businessimpactinc.com/industries/food-manufacturing/>

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