Integration of Business Intelligence in Modern Retail System

[1] Mayank Kumar Panda   [2] Dr. Mahua Banerjee

[1] Student, Master in Business Administration, Birla Institute of Technology, Mesra, (Lalpur Off-Campus), Jharkhand, India

[2] Assistant Professor, Department of Management, Birla Institute of Technology, Mesra, (Lalpur Off-Campus), Jharkhand, India

Abstract

A wide range of data in the retail industry is constantly being collected, ranging from emerging trends to sales data. This data collection, measurement, and reporting is a significant challenge for retailers, yet it is essential. By implementing a robust BI system, companies can efficiently store and process this data to ensure they are adapting to the changing retail landscape as quickly as the industry. The primary objective of any BI tool is to provide greater visibility into daily operations. When used correctly, BI tools can help retail sectors to increase sales per visit by gaining a better understanding of their customers' needs, optimising prices to match current trends, increasing margins by analyzing and predicting upcoming trends, and improving the shopping experience for customers. This paper provides an overview of BI with a comparative analysis of BI tools in order to successfully integrate BI in the retail industry process. The paper further describes the functioning of retail processes integrated with BI.

Keywords: business-intelligence, Software-as-a-Service, online-analytical-processing, omnichannel-analytics

I. INTRODUCTION

Over the past few years, the ability to store large volumes of data in the memory of a computer, even in a virtual machine that can be remotely accessed, and to retrieve these stored data in real-time, has made it possible for companies to quickly combine data. This is the need of the hour as it comprises historic data along with real time data which the managers at different levels share for making data driven decisions. For this reason, decision support systems have been developed. However, due to the challenges of using the decision support system, visual issues and the fact that the system was not compatible with all applications, it was necessary to design a new system known as Business Intelligence Systems [1].

The importance of Business Intelligence (BI) in the retail industry cannot be overstated. BI tools provide retailers with a comprehensive overview of their business operations, allowing them to identify areas of inefficiency and make informed decisions regarding pricing, promotional activities, and product offerings. Additionally, BI enables retailers to tailor their marketing strategies to their customers by examining customer data, including purchase histories and browsing patterns, to create campaigns that are tailored to their customers [13 – 15].

The integration of Business Intelligence into retail companies presents a number of challenges. One of the most prominent is the need to integrate multiple data sources, such as point-of-sales (POS) systems, customer information, inventory and supply chain information, into a single data repository. This necessitates the development of comprehensive data management strategies, such as extraction, transformation and loading. Additionally, the development of analytical models capable of extracting insights from the large volumes of data generated by retail operations is a key challenge. These models must be adapted to the specific requirements of the retail sector, taking into account factors such as seasonal patterns, consumer trends and cost-effective pricing strategies. Furthermore, the BI system must be easily accessible and user-friendly for non-technical personnel, including store management and merchandiser, who can benefit from the insights generated.

This paper aims to provide an overview of Business Intelligence as software which caters to the data driven decision making to the tactical and strategic level. In order to generate awareness about the importance and relevance of BI, the paper provides key statistics on business intelligence software that illustrate how organizations around the world utilize BI to their benefit. It further explains the way BI can be integrated in a retail industry process to leverage the benefits of data driven activities.

II. Background

Hans Peter Luhn, a researcher at IBM who coined the term "BI," defined it as "the ability to understand the relationships between existing information in order to reach a desired outcome" [2]. According to the work of Sabanovic & Soilen, Business Intelligence refers to a set of tools and processes that make it easier and faster for businesses to make decisions [3]. BI is a combination of data collection, data cleaning, and data integration. It's the process of turning raw data into actionable insights for decision support in a fraction of the time [4]. This is the practice of gathering accurate data in the appropriate format at the appropriate time that has a positive effect on business processes and strategies for decision making [5]. Wherever business data is stored, it is essential to be able to quickly access the data, process it, and make timely predictions for managers [6]. Business intelligence technology allows one to analyze data across multiple dimensions in situations where multiple elements need to be considered at the same time [7]. By allowing qualified information to be searched, data to be integrated, and meaningful insights to be obtained with multi-dimensional analysis across a data set composed of multiple sources, it can transform into actionable, aggregated reports that can feed into decision-making processes [8 – 9].

The BI enabled retail system is the need of the hour. The intelligent retail model has several advantages. It enables retailers to create comprehensive, customer-centric experiences at all stages of the customer journey, from back-office operations to on-the-ground innovation. By utilizing data-driven strategies, retailers can convert data into revenue by attracting customers through tailored messaging, products they desire, knowledgeable support personnel, and a highly responsive retail experience that is supported by the strength of data aggregation and analysis. In order to cater this intelligent retail system, it is required to know about the different aspects of the BI Software which are given in the next section.

III. BI AS A SOFTWARE

A software which is a collection of tools that facilitate the extraction, classification, consolidation, analysis, and presentation of intricate information into comprehensible reports for the purpose of generating insights is known as to be a Business Intelligence Software. It is used by organizations to gather, organize, process, measure, visualize and disseminate business intelligence.

Business intelligence software has been instrumental in bridging a wide range of business automation gaps over the past few decades; but that does not mean that there is no more room for it to innovate. The very idea of data analytics is revolutionary, and it works quite well in reacting to new trends and opportunities, responding to the expected growth as well as the unexpected changes in various sectors. The primary purpose of Business Intelligence (BI) is to transform data and enable businesses to analyze it in the most appropriate, tailored way. The advantage of BI is that it eliminates the need for complex installations and lengthy learning processes, and instead provides a user-friendly Software-as-a-Service (SaaS) and self-managed platform where users only need to know which button to use to analyze data.

3.1 ROLE OF BI IN COMPANIES

Business intelligence (BI) is a strategic tool used by companies to:

- Investigate Key Performance Indicators
- Handling resources in a cost-efficient manner
- Finding relationships between datasets for better decision-making
- Analysing business status across the total goals
- Obtaining insights for comprehensive decision-making

Another benefit of BI software is the easy deployment, use and integration of BI practices across different departments. BI software can be used as a standalone application, as well as can be integrated with the organization's digital portals.

The last one decade in the market there is a transition in the analytics from IT-driven to business-driven analytics. This is responsible for the expansion in Business Intelligence (BI) software. Today, BI software is primarily used by business owners, high-level executives, managers, and front-line personnel such as sales, support, and purchasing personnel. The cross-functional nature of BI software makes it not only a strategic tool but also a tactical tool.

IV. CATEGORIES OF BI SOFTWARE

The different categories of a Business Intelligence Software can be better explained in the way it works for different functions. The basic three functions are:

1) Data Management   2) Data Discovery   3) Visualization Platform

4.1 Data Management

One of the major functions of a Business Intelligence (BI) software is to facilitate the purification of existing data sets. The original data obtained from different sources are most likely to be disorganized and inconsistent. It must be prepared for analysis, report generation etc. This component of BI software utilizes a standardized methodology for storing data. This function ensures that raw data is processed in a clean, precise manner and that an apples-to-apples comparison is conducted. Moreover, BI software uses ETL (Extract, Transform, Load) processes in order to collect data from multiple sources and load it into a suitable repository like spreadsheets, data container and data warehouse. This is a key feature of most leading BI software solutions.

4.2 Data Discovery

When most people think of Business Intelligence (BI) software, the first thing that comes to mind is the pattern finding capability. This is where BI comes in, with its cognitive skills for uncovering patterns and insights from massive information.

A data mining tool that connects with numerous business systems and data sources, such as spreadsheets, email lists, reports, and website content, is the most prevalent sort of BI solution. BI software sends data to a central platform, where it is processed and output is produced.

OLAP (Online Analytical Processing) is a feature included in the majority of BI packages. However, OLAP is a subset of the larger data discovery spectrum, and therefore requires the use of additional technologies to develop intelligent assets. Relational databases, predictive analytics, and other techniques are among these.

4.3 Visualization Platform

Some BI systems been favourite with some users, like top management teams, because to their intuitive visualizations, dashboards that emphasize key performance indicators (KPIs), report writers etc. It allows users to personalize results, and performance measures that exhibit firm wellbeing with a perceptible specific number.

V.   FEATURES OF BI SOFTWARE

The BI features are important to know the functioning of the BI Software. The BI functions have different features. Some common functions are:

- Evaluate multiple variables to identify any association among them
- Predict results through statistical techniques to predict future behaviour
- Get awareness from datasets on trends
- Present cause and effect scenarios

When conducting a comparison, it is essential to compare the fundamental features of a Business Intelligence software that encompasses all or a subset of the following:

1) OLAP

The practice of online business analytics (OLAP) involves the collection, analysis, and publication of data. Business intelligence (BI) solutions are based on tools that facilitate the real-time analysis of multilevel data, either on its own or in conjunction with other analytics tools. A BI software should enable users to carry out three operations: consolidating or aggregating data from various sources, drilling down into detail, and slicing. The more ways a dataset can be isolated and viewed (an OLAP cube), the more easily it can be interpreted.

2) Reporting and querying

Business intelligence (BI) software is characterized by its ability to generate reports and queries. These reports and queries are responsible for the classification and creation of complex data. Integration is essential for accessing external sources, and mobile access to these queries and reports allows for the flexibility of the cloud and the real-time availability of data. There are two main types of BI reporting: customised and ad hoc. Customised reports can be presented in the form of a quick search, while ad hoc reports can be distributed across the entire organization. Additionally, modern BI solutions provide intuitive query capabilities, eliminating the need for SQL or coding expertise. This allows companies to access BI tools across the entire organization, rather than just within the IT department.

3) **Data Visualization**

Data visualization is the last stage of reporting and is, in fact, one of the most common characteristics of BI solutions. Executives and non-executives alike view BI from this perspective and can create charts, graphs and dashboard widgets. Advanced visualizations like geospatial reports, heat maps, funnels and more are also available. In many ways, visual dashboards are the sum of the parts of a BI solution. Beyond a chart or graph, you can have many other features at your disposal, such as sharing and commenting, reporting-querying, integration, customization, and more. Most BI solutions have visual dashboards that vary in terms of colour, location, cluster and other metrics.

4) **Integration**

One of the most important things to consider when buying a BI software is how well it integrates with other business applications. It can be native (with the software vendor's own applications), pre-built (with third party applications), or API (with the software's own apps). There are many BI software solutions available, some with open API support (Ruby, Java, JavaScript) and others with API integration (for developers).

VI. COMPARATIVE ANALYSIS OF DIFFERENT BUSINESS INTELLIGENCE TOOLS

Companies' need for business intelligence has become increasingly significant in terms of extracting insights from visual reports and envisioning their future strategies and plans. As a result, the sophistication, range and usability of BI tools have grown significantly, making it increasingly challenging to decide which BI tool to use [10]. As a result, this section places some comparative analysis of different Business Intelligence tools on several aspects like top BI software vendors, top IAAS platforms etc. The report has been prepared by Finances Online based on a survey. According to the analysis, the best 3 Business Intelligence statistics one should know are:
1) Top Business Intelligence Software in the world
2) Importance of Data Preparation according to companies
3) Top IAAS platforms preferred by BI vendors.

The following visualizations were made by the Finances Online on its survey [11]:


Source: financesonline.com

VII. BUSINESS INTELLIGENCE IN RETAIL SECTOR

As it has been found that BI has become a very efficient tool to data-driven decision making hence this paper reflects the necessity of BI in retail sector. This section, will explore how business intelligence can be leveraged to provide retailing insights to guide a business towards growth, including the use of interactive data visualization software. Additionally, it will reflect at how the retail industry would benefit from the use of business intelligence and what strategies can be employed to maximize its potential for business growth.

The following onion layer diagram depicts the entire business process of retail sector integrated with BI.
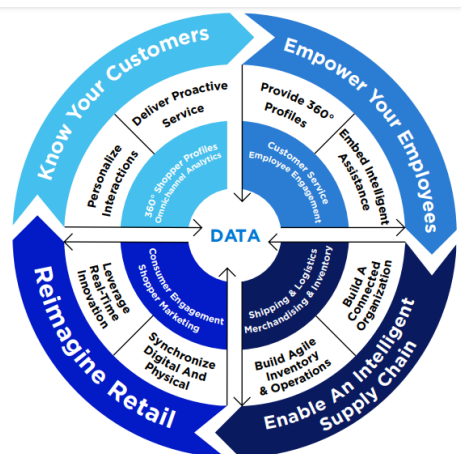
source: https://www.datatobiz.com [12]

This onion layer diagram shows the following:

- The DATA is at the centre
- The four basic functions like Shoppers Profile, Customer Service, Shipping & logistics and Consumer Engagement are data centric operations. This means that the data generated from these activities must be utilised by BI software to achieve the required objectives.

- Third layer of The Business Intelligence (BI) in retail suggests :

  - Personalize interactions using customer data.
  - Offers proactive service by spotting trends.
  - Creates holistic buyer personas from various data.
  - BI harmonized cross – channel customer behaviour.
  - Integrates AI for efficient customer support.
  - Aligns departments, inventory optimization, and acclimate in real time**.**

- Fourth layer of The Business Intelligence (BI) in retail suggests:

  - BI assists merchants in understanding client preferences and behavior in order to provide customised marketing.
  - BI delivers real-time data to employees to help them make better decisions.
  - Business intelligence improves inventories and discovers supply chain improvements.
  - In retail, BI enables fast changes, creativity, and data-driven decision-making.

Explanation of 1st Quadrant:

 "Know Your Customers" in retail management by building "360-Degree Shopper Profiles." This data-driven strategy enables merchants to provide "Personalized Interactions" in which they personalize experiences to specific consumers. Retailers must also "Deliver Proactive Service" by anticipating demands in order to flourish. All of this is made possible by "Omnichannel Analytics," which uses data from many touchpoints to provide consistent, individualized consumer experiences, resulting in improved loyalty and company success.

Explanation of 2nd Quadrant:

Retail management success focuses about rethinking retail experiences, harnessing real-time innovation, and synchronizing the digital and physical domains. To do this, merchants must prioritize customer connection and shopper marketing.

Consider Amazon, the retailing behemoth. They've revolutionized retail by offering cashier-less shops (Amazon Go), which use real-time innovation and smart technology to seamlessly integrate digital and physical purchases. This reinvented retail experience increases customer engagement by making shopping faster and more comfortable, as well as providing targeted incentives and tailored shopper marketing based on individual tastes and habits.

Explanation of 3rd Quadrant:

- Retail management thrives on interconnected elements:

- Connected Organization: Seamless communication enables an "Intelligent Supply Chain."

- Agile Inventory and Operations: Swiftly respond to demand and market trends.

- Shipping and Logistics: Efficiently move products from warehouses to customers.

- Merchandising and Inventory: Tailor displays and stock to enhance the shopping experience.

For example, a retail giant uses real-time data to predict demand, optimize inventory, and offer flexible delivery options, ensuring competitiveness and customer satisfaction.

Explanation of 4th Quadrant:

- In the context of retail management, success is achieved by creating an interconnected ecosystem:

- Empower Your Employees: Retailers should invest in their workforce to enhance customer service and employee engagement.

- Provide 360-Degree Profiles: Utilize comprehensive customer profiles to understand and serve customers better.

- Embed Intelligent Assistance: Leverage technology to provide employees with real-time insights and support.

For instance, a retail chain equips its staff with mobile apps that access customer profiles, allowing for personalized assistance. This not only improves customer service but also boosts employee engagement, creating a win-win scenario for both the business and its workforce.

VIII. CONCLUSIONS

In today's data-driven business world, the integration of BI into the retail sector has become a necessity. Collecting, analyzing, and visualizing large volumes of data is essential for retail businesses in order to make smart decisions and remain competitive. In this paper, we have covered the importance of BI in retail, highlighting its role in turning raw data into useful insights for support decision making. Business Intelligence software is a set of tools that make it easier to extract, classify, consolidate, analyze, present, and generate insights. BI software has adapted to the needs of different industries, providing easy-to-use SaaS platforms that don't require complicated installations or complex training. Investigating key performance indicators, effectively managing resources, identifying data linkages, assessing the state of the business, and collecting insights for thorough decision-making are some of the crucial roles that BI plays in organizations. Furthermore, BI techniques are a strategic and tactical tool because to how simple they are to adopt, use, and integrate across several departments.

In-depth analyses of several BI software categories, including as data management, data discovery, and visualization platforms, were also included in the report. Particular emphasis was placed on each category's function in data cleansing, pattern recognition, and data presentation. It also emphasized the core capabilities of BI tools, including OLAP, reporting and querying, data visualization, and integration, all of which are essential for evaluating and contrasting BI solutions.

Additionally, the comparative examination of different BI tools demonstrated their growing complexity and adaptability, making the selection of the best BI software a difficult process. The possibilities for tailored interactions, proactive service, omnichannel analytics, and a linked retail environment were highlighted as the role of BI in the retail industry was investigated. In the retail industry, where data-driven decision-making and customer-centric strategies are crucial for sustained development and success, this research has highlighted the significance of business intelligence.

REFERENCES

[1] H. Ates "Karar Vermede İş Zekasının Önemi: Tekstil Sektöründe Bir Araştırma",T.C. Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı Üretim Yönetimi ve Endüstri İşletmeciliği Programı Yüksek Lisans Tezi, 2008

[2] Luhn, Hans P. "The Automatic Creation of Literature Abstracts." IBM Journal of Research and Development, 159-165 (1958).

[3] Sabanovic, Adis, Klaus Solberg Søilen. "Customers' Expectations and Needs in the Business Intelligence Software Market." Journal of Intelligence Studies in Business 2.1 (2012).

[4] KARIM, Akram Jalal. The value of competitive business intelligence system (CBIS) to stimulate competitiveness in global market. International Journal of Business and Social Science, 2.19 , (2011). [5] Zeng L., Li L., Duan L. "Business intelligence in enterprise computing environment. Information Technology and Management." 13 (4):297- 310 (2012).

[6] Akçetin E., Çelik U., Takçı H. "Lojistik ve Denizcilik Sektörü Açısından Veri Madenciliği Uygulamalarının Önemi". Journal of ETA Maritime Science, 1(2): 73-80 (2013).

[7] Yılmaz E. "İş Zekası Araçları Ve Ormancılık". İstanbul Üniversitesi Orman Fakültesi Dergisi, 55(1):135-146 (2005).

[8] Dursun T., Kaya S. "İş Zekası Ve Sosyal Medya Uygulamaları". Maltepe Üniversitesi İktisadi Ve İdari Bilimler Fakültesi Ekonomik, Toplumsal Ve Siyasal Analiz Dergisi, 2015/II(6):174-198 (2015).

[9] M. Damar, G. Özdağoğlu, A. Özdağoğlu. "İş Zekasını ve İlgili Teknolojileri Konu Alan Araştırmalara Küresel Ölçekte Bilimetrik Bakış", BEYDER / 2018, 13:2 (197-218)(2018).

[10] K. Gowthami, M.R. Pavan Kumar. "Study on Business Intelligence Tools for Enterprise Dashboard Development", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 04 , (2017).

[11] 36 Best Business Intelligence Software Statistics: 2023 Market Share & Data Analysis - Financesonline.com

[12] https://www.datatobiz.com

[13] Gaol, F.L., Abdillah, L. and Matsuo, T., 2020. Adoption of business intelligence to support cost accounting based financial systems—case study of XYZ company. Open Engineering, 11(1), pp.14-28.

[14] Gunasekaran, A., Yusuf, Y.Y., Adeleye, E.O. and Papadopoulos, T., 2018. Agile manufacturing practices: the role of big data and business analytics with multiple case studies. International Journal of Production Research, 56(1-2), pp.385-397.

[15] Kraus, Mathias, Stefan Feuerriegel, and Asil Oztekin. "Deep learning in business analytics and operations research: Models, applications and managerial implications." European Journal of Operational Research 281, no. 3 (2020): 628-641.