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# Big Data and Analytical Strategies for Cloud ERP Systems with Business Simulation

**Lea Masnec**
University of Zagreb

**Ruben Picek**
University of Zagreb

**Abstract**: In the changing landscape of the business world, the rapid pace of change has led to an increasing demand for innovative approaches to problem-solving and optimization. With the ongoing advancement of ERP (Enterprise Resource Planning) systems, which now incorporate predictive analytics, cloud computing, and business analysis through simulations, businesses have new opportunities to enhance their operations. This paper explores a business analysis framework within the context of cloud ERP systems using test data of one company as a case study. Such a business-oriented approach, driven by the adoption of innovative practices, empowers companies to adapt swiftly to the changing dynamics of the market. This paper primarily offers insights into the possibilities unlocked by ERP systems using predictive analytics and business analysis via simulations. These insights encompass a combination of various factors that impact business operations, such as pricing strategies, market segmentation, resource allocation, and other critical components. Furthermore, leveraging a myriad of today's tools, this research demonstrates that after constructing a data model, operations like classification and time series forecasting can be executed on the dataset, all of which significantly influence the final business decisions. This research seeks to provide a broader perspective on problem-solving within the context of ERP systems and how they enable data-driven decision-making for enhanced business performance.

**Keywords:** Big data, Business intelligence, Cloud ERP systems

## Introduction

With the advancement of new technologies, ERP systems have become increasingly prevalent across various industries. This paper is based on the development of a decision-making model through graphical analytical representation, aimed at facilitating business decision-making for companies. For businesses, it is crucial to plan their resources and make timely business decisions. As Rabia and Bellabdaoui (2022) point out, a decision made late is equivalent to lost business, whereas a decision made on time is akin to gained business. Through the application of predictive analytics and simulations, businesses can analyze extensive sets of historical data, recognizing underlying patterns and trends. This capability enables them to make precise predictions about future outcomes (Bharadiya, 2023). It is well-known that data holds significant value when well-structured and utilized for in-depth business analysis. The increase in data sources has provided many businesses with the capability to make faster, fact-based decisions and leverage operational opportunities (Aliahmadi et al., 2022). The paper consists of sections on related work, scientific methods, and a core section titled "Business Intelligence in ERP Systems." This section covers problem classification, model development, and what-if simulation for resolving business issues. Results of case study and discussion that elaborate resarch question are also present. In last section authors provide conslusions. The research question to be answered in this paper is:

*How can the integration of predictive analytics and 'what-if' simulations into ERP systems enhance overall system efficiency and unlock their potential for strategic business planning?*

### Related Work

Several pivotal contributions have shaped the discourse surrounding predictive analytics, business intelligence, and ERP system integration. The research by Rabia and Bellabdaoui (2022) explores the domain of simulation-based analytics, which holds particular significance when discussing the dynamics of intricate systems. Rabia & Bellabdaoui provide an overview of simulation techniques that are vital in business analysis, and this importance becomes evident when considering the topic of this research in the context of cloud ERP systems, where a substantial volume of data and complexity exists. Bakhshi and Bates (2018) provided comprehensive insights into the potential of predictive analytics across diverse domains. Their work laid the groundwork for subsequent research, including the exploration of statistical, learning, and ensemble methods for predictive analytics as exemplified by Budgaga et al. (2016). In parallel, Deka (2014) emphasized the critical role of predictive and predictive analytics within the realm of Big data, highlighting its significance in enabling data-driven decision-making in contemporary business operations. This foundational understanding has been further complemented by the insights provided by Gartner (2019) regarding the broader landscape of artificial intelligence and its integration, including predictive analytics, into business systems. Also, Paulino (2022) in his study explores how business analytics implementation in the retail industry can enhance organizational performance, drawing from the established principles of data mining and predictive analytics. Paulino's research also emphasizes concepts that affect a company's bottom line and its long-term operations.

Himeur et al. (2023), in their research, emphasize the benefits of Big data analytics and prediction while also highlighting the challenges that businesses face when it comes to gaining a competitive edge in the market through predictions. According to Himeur et al. (2023), additional research and initiatives related to Big data should be made a primary goal to demonstrate the market potential that Big data technology can achieve. Hsieh (2017) provided a forward-looking perspective of ERP systems, shedding light on the next generation of these systems and their convergence with predictive analytics and business intelligence. This work contributes to a broader understanding of how ERP systems are advancing to incorporate advanced analytics capabilities. Additionally, Nazarov et al. (2020) conducted a tangible case study, scrutinizing the application of SAP Analytics Cloud for intellectual analysis of business activities. This case study provides actionable insights into the integration of analytics tools within ERP systems, showcasing practical implications for real-world applications. In a complementary vein, Park and Kim (2017) conducted a comprehensive review focused on predictive analytics within ERP systems. Jafari et al. (2023) also emphasize the importance of business intelligence through integration and agility in supply chain performance.

Through their research across various industries, they have confirmed that BI and integration play a crucial role in achieving improved business performance, particularly in the context of supply chain planning. Aliahmadi et al. (2022) corroborate the hypothesis that technologies can serve as potent enablers, particularly in the distribution of fast-acting pharmaceutical products, which will also be demonstrated in this research within the context of Big data. This claim is also confirmed by the research of Žagar and Miletić (2022), who, in their study, analyzed the application of Big data collection for product quality prediction, further emphasizing the utility of predictive methods in the industry.

## Method

This research employed various research and writing methods to address the theoretical aspects and practical implementation. Firstly, a descriptive research method was utilized to provide a comprehensive description and analysis. Qualitative literature analysis was conducted to identify trends and techniques within the domains of business intelligence, predictive analytics, and "what-if" simulation. An experimental research method was employed to construct a data model using SAP Analytics Cloud tools and to test various scenarios through predictive analytics and "what-if" simulation. Additionally, qualitative data analysis was applied to scrutinize the results and draw conclusions. Finally, statistical data analysis methods were employed to ascertain correlations and associations among different factors and their impact on business operations.

### Business Intelligence in ERP Systems

In today's business environment, with the increasing volume of data generated from various sources such as social media, IoT *(Internet of Things*) devices, and other applications, there is a growing need for the development of tools for analyzing large datasets. According to Deka (2014) and Li et al. (2022), big data analytics is employed for predictive analysis, enabling organizations to forecast future events and recommend

appropriate strategies. Data management is a crucial component of business intelligence. The development of BI tools capable of collecting, processing, and analyzing vast amounts of data is becoming pivotal in achieving business objectives. In this regard, BI tools assist organizations in gathering and processing extensive data, transforming it into valuable insights that enable informed business decision-making.

An essential capability of business intelligence within ERP systems is "what-if" simulation. This technique empowers organizations to simulate various scenarios based on different variables and parameters, allowing them to predict potential outcomes and impacts on their operations. Implementing this technique enables organizations to assess the effects of changes in production, pricing, marketing strategies, and other factors on their business efficiency. In the process of implementing predictive analytics, it is crucial to ensure that the system has an adequate volume of data, well-defined models and algorithms, and suitable infrastructure for data analysis and visualization. Furthermore, employee education is necessary to empower them to utilize these techniques effectively for achieving the best results.

## Model Development

In this chapter, the development of a data model simulating a business scenario is presented through a business problem-solving approach. In the context of the pharmaceutical sector, which plays a pivotal role in both human health and the global economy, the role of ERP systems has taken on even greater significance. This is precisely why, as a practical illustration in the context of implementing predictive analytics, a dataset from a pharmaceutical company (Farseer, 2022) was selected to create a model for further analysis. During the model creation process aimed at addressing the business problem, the following steps were taken:

1. Data set analysis;
2. Data set editing and interconnection using a business analytics tool;
3. Defining the business objective;
4. Training classification and regression models;
5. Developing an analytical application using integrated JavaScript, application design, and mathematical calculations (base discount, gross margin, scenario price, scenario discount, net revenue, etc.);
6. Adding items to the application based on categories and operational areas;
7. Testing the application and analyzing potential improvements to company operations;
8. Formulating the final conclusion for the company.

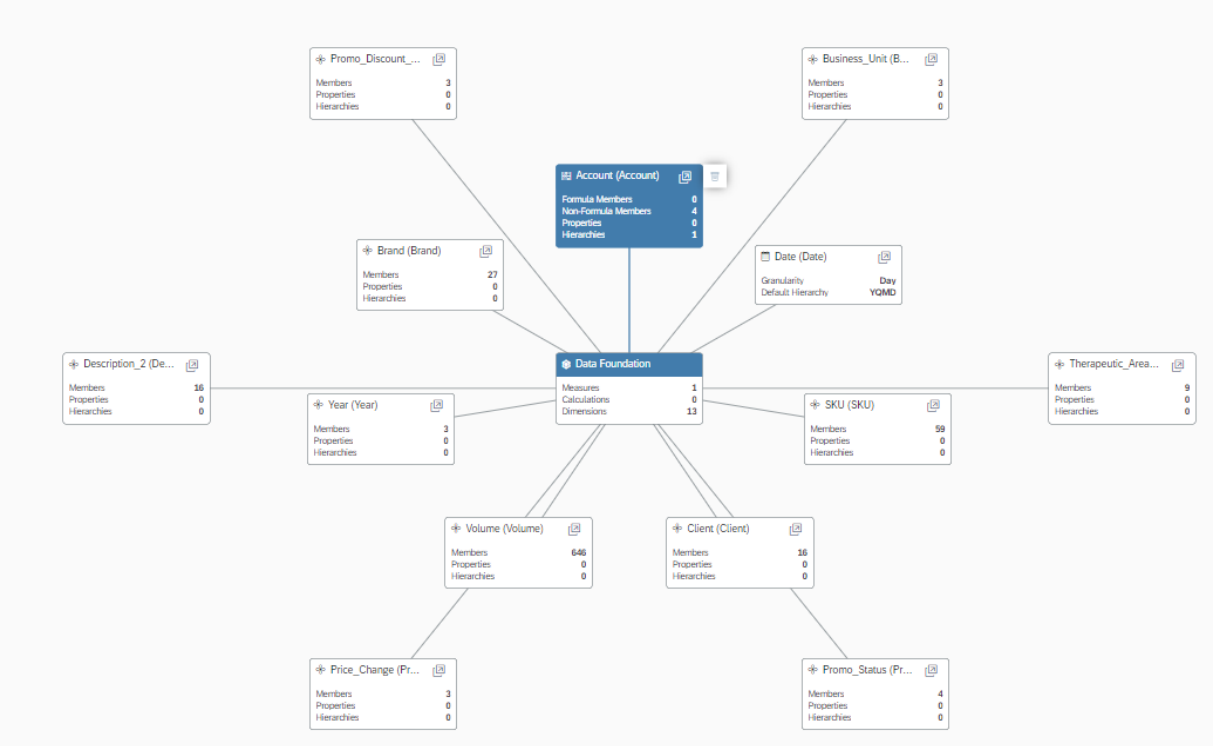


Figure 1. Data model generated in SAP analytics cloud

In the process of creating the data model, it was necessary to first organize the data model and link specific dimensions' data from one dataset to another using the "Combine Data" option. Based on the collected sales data of the pharmaceutical company, a model was created encompassing information about SKUs (*Stock Keeping Units*), clients, sales volumes, prices, discounts, and other relevant indicators. The modeling process involved various steps, such as data integration, establishing connections between entities, defining dimensions and measures, and implementing necessary data transformations. Figure 1 illustrates the model generated after refining the final dataset, which will serve as the foundation for further analysis.

A review of the pharmaceutical company's operations is a crucial step in understanding its functioning, successes, and challenges. Analyzing the financial results of the pharmaceutical company, including revenues, expenses, profits, and balance sheets, enables an assessment of the financial stability and profitability of the company. It is also important to examine trends in financial indicators to identify strengths, weaknesses, and potential opportunities for improvement.

**Business Operations and Enhancement Oppportunities through Analytics Tools**

Setting a goal in a clear and measurable way allows the organization to have a clear vision of the desired outcome and directs all activities towards achieving that outcome. In the business problem described, the company did not achieve a profit in the year 2021, as the total gross revenue was negative. This also resulted in a negative net income, meaning the company actually lost money that year. The company's sales amounted to 2.44 million units, generating gross revenue of 144.241 million. However, the company applied 10.039 million in basic discounts. Up to that point, the company was profitable. However, an additional 9.045,375 million kuna was spent on promotions, resulting in an actual financial loss.

Setting a goal in this case would be to achieve profitability for the company. By reducing promotional discounts to achieve a positive net income and avoid losses, the company will create a sustainable business model and increase overall profitability. Goal setting allows for a focus on a specific outcome and the necessary decision-making and actions to achieve that goal. Figure 2 depicts the developed analytical application for addressing the business problem, showing the initial state of the company in 2021 before any changes were made.

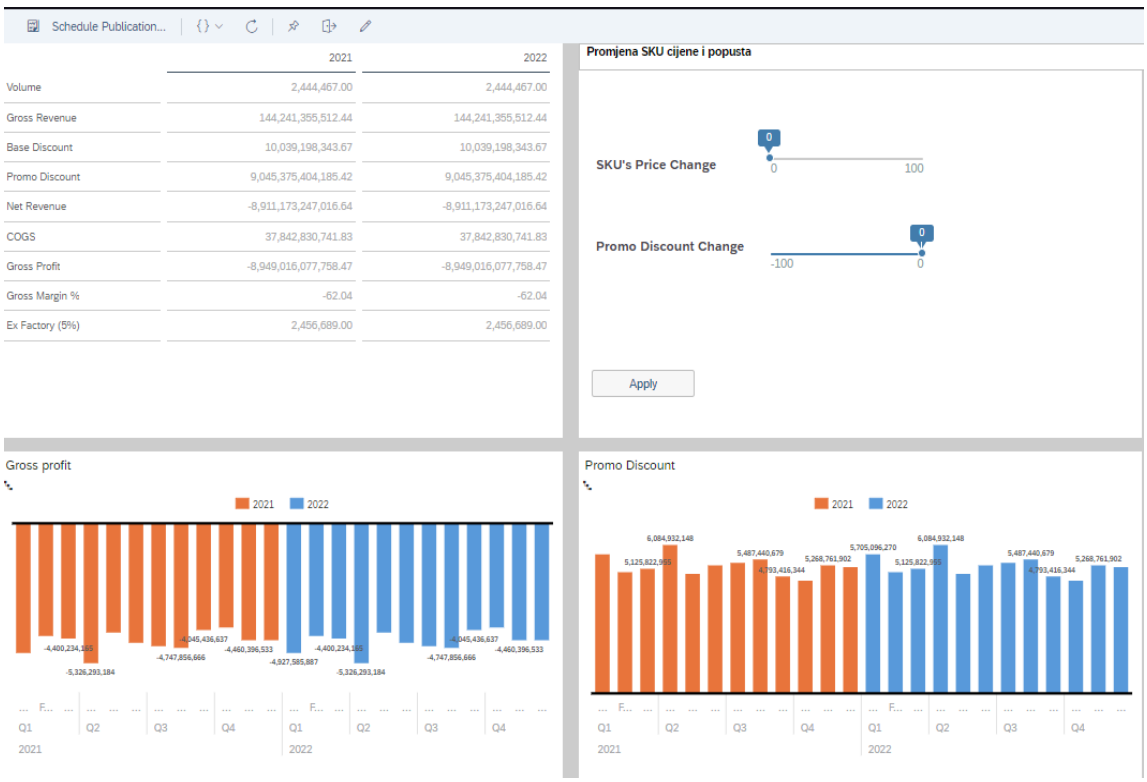


Figure 2. Overview of the initial state of the company in 2022

The strategy is depicted in Figure 3, and it is now clearly visible in the table that Net Revenue, and consequently Gross Profit, is now positive, as evident in Figure 1 at the end.

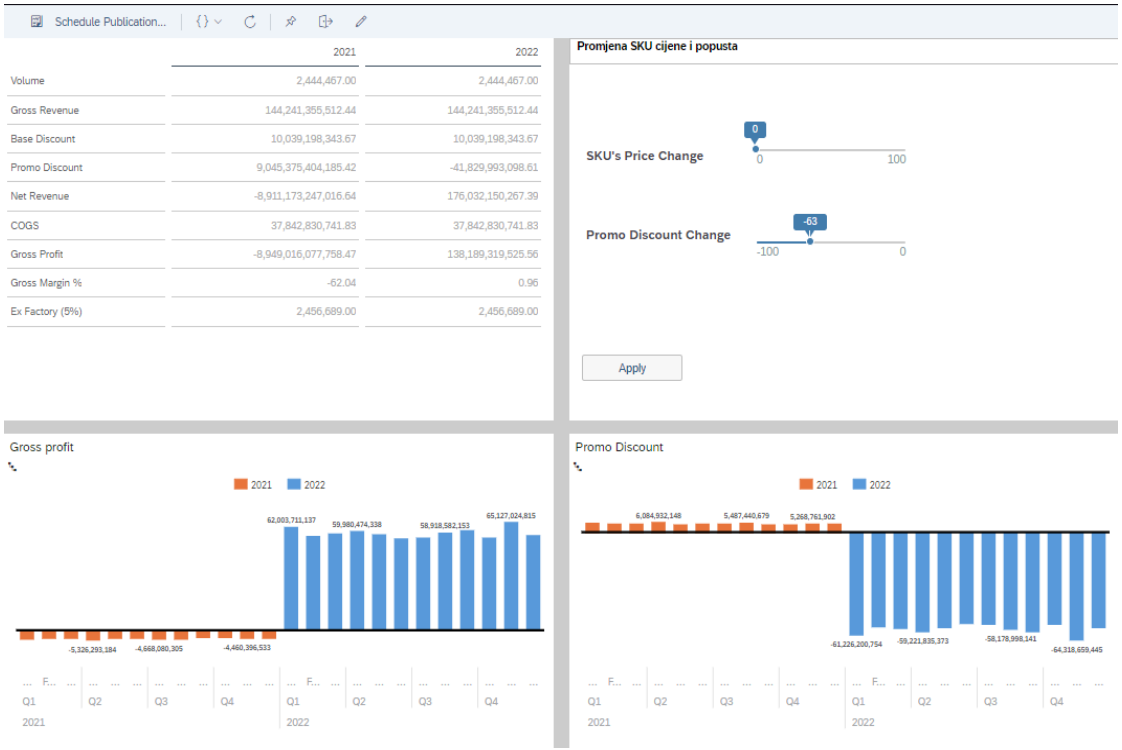


Figure 3. Analytical application depicting the post-change state

As a solution, based on the change in Figure 3, the possibility of increasing SKU prices is considered to address the issue. However, such an approach may further exacerbate the situation since promotions are price-dependent. Therefore, the only remaining option is to reduce promotional discounts. Reducing discounts allows the company to achieve higher margins and greater profitability. By using the "Promo Discount Change" slider, it is possible to determine the maximum discount amount that the company can apply, which is -63. Any discount greater than this will not result in profitability. This strategy enables the company to maintain profitability, secure revenues, and ensure business stability.

## Results and Discussion

The combination of predictive analytics and "what-if" simulations provides tools for a more profound comprehension of business dynamics, the identification of potential challenges, and the discovery of optimal solutions. The introduction of analytical approaches into pharmaceutical company processes enables quicker and more informed decision-making, securing a competitive advantage in the market, as demonstrated in the practical example within this thesis.

The research question introduced in the paper's introduction was: *How can the integration of predictive analytics and 'what-if' simulations into ERP systems enhance overall system efficiency and unlock their potential for strategic business planning?*. Based on the research question, the following conclusions have been dicuss and analyzed:

1. **How can predictive analytics enhance the efficiency of ERP systems?** Predictive analytics can improve ERP system efficiency by enabling more accurate forecasting of future trends and business needs. ERP systems can utilize predictive analytics to forecast future product and service demand, optimize manufacturing processes, and manage inventory effectively. Additionally, predictive analytics can assist in recognizing customer behavior trends and adapting marketing campaigns to boost sales.
2. **What are the key advantages of implementing "what-if" simulations in ERP systems?** Predictive analytics and "what-if" simulations can be instrumental in business planning by allowing users to test different scenarios and predict outcomes before making final decisions. This approach aids users in making better-informed decisions based on real data. "What-if" simulations are valuable for business future planning, process and resource optimization, and risk reduction.
3. **How can predictive analytics and "what-if" simulations be employed in business planning?** The primary benefits of implementing "what-if" simulations in ERP systems include enabling users to test

various scenarios and predict outcomes before making final decisions. This way, users can make better-informed decisions based on real data. "What-if" simulations support future business planning, process and resource optimization, and risk management.

4. **What are the possibilities for implementing predictive analytics in ERP systems?** Opportunities for implementing predictive analytics in ERP systems include integrating external predictive analytics tools, such as machine learning and data analysis tools. This integration allows the utilization of machine learning algorithms to predict future trends and customer behavior. Additionally, ERP data can be leveraged for predictive analytics. For instance, sales data can be used to forecast future sales trends. Automation of predictive analytics can also be achieved, where the system is programmed to automatically generate predictive models based on input data. This automation can be useful for generating predictions without the need for manual analysis.

Based on the conclusions presented, it is evident that this research further reinforces the significance of analytical methods and simulations in organizing business operations within companies by leveraging new technologies, significantly reducing potential business risks.

## Conclusion

This research provides insights into analyzing business operations from the perspective of utilizing Big data analytics and reporting tools. This solution is applicable across various sectors and provides room for considering similar solutions in other industries. Specifically, this paper discusses the use of Big data analytics and market event simulation in businesses. In the case study presented in the research paper, we can observe how a change in the discount amount can significantly impact a company's annual profit, resulting in better outcomes compared to the previous year. Such analysis is becoming almost essential for every business today to eliminate potential market errors and manage resources more effectively. The paper showcases just one possibility for improving business operations, but this data model and analytical application offer a multitude of opportunities depending on the company's goals, which should be clearly defined before creating an analytical simulation. The primary aim of this paper was to demonstrate how to manage a company and make proactive business decisions, both in the pharmaceutical industry in this research example and in other industries.

The theoretical part of this paper addressed current trends and research in the field of Big data analytics, prediction, and simulation. Meanwhile, the practical part of the paper focused on a specific issue, namely, the operations of a company with multiple product groups and corresponding discounts for each of them. In the practical part, the company's final profit was observed as the main indicator of its success. In the further course of the research, we would focus on the impact of simulations on business decisions and the development of more advanced simulation models that will simulate specific business scenarios in the market defined by external influences, particularly for individual products within companies.

## Recommendations

This research is recommended for all BI consultants, especially those working with more complex reporting tools that combine programming code with user interfaces, interface design, and analytics through classification and regression. This study can be valuable not only for academic purposes but also for businesses aiming to enhance their operations through optimization using Big data analytics. Recommended areas for further research include:

1. Cost-benefit analysis;
2. Advanced predictive models;
3. Integration of predictive analytics with ERP systems.

## Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the authors.

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## Author Information

**Lea Masnec**
University of Zagreb, Faculty of Organization and Informatics, Pavlinska 2, 42000, Varaždin, Croatia
Contact e-mail: *lmasnec@foi.hr*

**Ruben Picek**
University of Zagreb, Faculty of Organization and Informatics, Pavlinska 2, 42000, Varaždin, Croatia

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