THE APPLICATION OF BUSINESS ANALYTICS
IN COST REDUCTION

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Purpose: The purpose of this publication is to present the applications of usage of business analytics in cost reduction.

Design/methodology/approach: Critical literature analysis. Analysis of international literature from main databases and polish literature and legal acts connecting with researched topic.

Findings: The application of business analytics in cost reduction is paramount in today's fiercely competitive business landscape. This article highlights the pivotal role of business analytics in optimizing financial performance by identifying inefficiencies and areas for cost reduction. By harnessing the power of data, business analytics enables data-driven decision-making, differentiates between cost drivers, streamlines processes, and optimizes inventory and pricing strategies. Various methodologies and techniques, along with a diverse range of software solutions, support organizations in their cost reduction endeavors. Leveraging analytics not only provides a competitive edge but also enhances customer satisfaction, mitigates financial risks, and optimizes supplier relationships. This multifaceted approach empowers organizations to achieve cost reduction goals and secure long-term financial success.

Keywords: business analytics, Industry 4.0, digitalization, artificial intelligence, real-time monitoring; cost, cost reduction.

Category of the paper: literature review.

1. Introduction

The application of business analytics in cost reduction has emerged as a crucial strategy for organizations across various industries. In today's competitive business landscape, companies are constantly seeking ways to enhance their profitability and sustainability, and business analytics plays a pivotal role in achieving these goals. This article delves into the importance of business analytics in cost reduction, the methodologies involved, and the benefits it offers to

organizations (Wolniak, 2016; Czerwińska-Lubszczyk et al., 2022; Drozd, Wolniak, 2021; Gajdzik, Wolniak, 2021, 2022; Gębczyńska, Wolniak, 2018, 2023; Grabowska et al., 2019, 2020, 2021; Wolniak et al., 2023; Wolniak, Grebski, 2023; Wolniak, Skotnicka-Zasadzień, 2023; Jonek-Kowalska,Wolniak, 2023).

Cost reduction is a fundamental objective for businesses, as it directly impacts the bottom line. By implementing business analytics, organizations can gain valuable insights into their operations, uncover inefficiencies, and identify opportunities to optimize costs.

The purpose of this publication is to present the applications of usage of business analytics in cost reduction.

2. Cost reduction and business analytics usage

Business analytics harnesses the power of data and turns it into actionable insights. By analyzing historical and real-time data, organizations can make informed decisions that drive cost reduction strategies. Data-driven decisions are more accurate and precise compared to traditional, gut-feel approaches. Analytics allows organizations to identify the primary drivers of their costs. It helps in distinguishing between fixed and variable costs, understanding cost allocation, and pinpointing areas with the highest cost impact. This knowledge is essential for cost optimization.

Analytics can uncover inefficiencies within business processes. Through process mining and analysis, organizations can identify bottlenecks, redundancies, and waste in their operations. This insight enables them to streamline processes and reduce operational costs (Wolniak, Skotnicka-Zasadzień, 2008, 2010, 2014, 2018, 2019, 2022; Wolniak, 2011, 2013, 2014, 2016, 2017, 2018, 2019, 2020, 2021, 2022; Gajdzik, Wolniak, 2023; Wolniak, 2013, 2016; Hys, Wolniak, 2018). Advanced analytics tools can help in predicting customer demand with a high degree of accuracy. This aids in optimizing inventory levels, reducing carrying costs, and avoiding stockouts or overstock situations, all of which impact costs (Adel, 2022).

Analytics can assist in setting optimal pricing strategies. By analyzing customer behavior and market trends, organizations can determine the right price points for their products and services, maximizing revenue and profitability.

Several methodologies and techniques are employed in the application of business analytics for cost reduction (Du et al., 2023; Fjellström, Osarenkhoe, 2023; Castro et al., 2014; Wang et al., 2023):

- Descriptive Analytics: This involves summarizing historical data to gain a better understanding of past performance and trends, which can help identify areas of cost inefficiency.

- Predictive Analytics: By using statistical and machine learning models, organizations can forecast future costs and identify potential cost-saving opportunities. These include:
- Prescriptive Analytics: This goes beyond prediction to provide recommendations for actions that can reduce costs. It can suggest strategies for optimizing supply chains, procurement, and resource allocation.
- Process Mining: Process mining is a technique used to analyze and visualize business processes, helping to uncover inefficiencies, bottlenecks, and opportunities for improvement.
- Regression Analysis: Regression models can be employed to understand the relationship between various factors and costs. This can assist in cost control and cost reduction strategies.

Table 1 contains descriptions of how business analytics is used cost reduction. This table highlights various facets of how business analytics can be applied to cost reduction, demonstrating its versatility and importance in driving cost-saving strategies for organizations.

Table 1.
The usage of business analytics in cost reduction

Aspect	Description
Data Analysis and Insights	Data analysis is at the heart of business analytics for cost reduction. By meticulously examining historical and real-time data, organizations can extract valuable insights. This process involves uncovering patterns, trends, and anomalies within the data. These insights are essential for identifying areas of inefficiency, understanding the cost structure, and revealing opportunities to optimize costs. It enables organizations to make informed decisions, leading to effective cost reduction strategies.
Predictive Analytics	Predictive analytics takes data analysis a step further by utilizing statistical and machine learning models to forecast future costs. These models are trained on historical data to make predictions about upcoming cost trends. By understanding how costs are likely to evolve, organizations can plan and allocate resources more effectively. This not only allows them to respond to cost challenges proactively but also helps in identifying and mitigating potential areas for cost reduction before they escalate.
Process Optimization	Process optimization is a critical component of business analytics. Through techniques such as process mining, organizations can analyze their internal operations in great detail. Process mining visualizes the entire workflow, highlighting bottlenecks, redundancies, and areas of waste. By identifying these inefficiencies, organizations can streamline their processes, reducing operational costs. This results in better resource utilization, improved productivity, and ultimately, substantial cost savings.
Demand Forecasting	Accurate demand forecasting is vital for cost reduction in various industries. Business analytics leverages historical data, market trends, and customer behavior to predict future demand with precision. Organizations can optimize their inventory levels and supply chain management accordingly. By preventing stockouts and overstock situations, they minimize carrying costs and ensure they meet customer demand, all of which have a direct impact on reducing operational expenses.
Pricing Strategy	Analytics plays a pivotal role in setting the right pricing strategy. By analyzing customer behavior, market dynamics, and competition, organizations can determine the optimal price points for their products or services. This ensures that they maximize revenue while maintaining profitability. Proper pricing strategies can significantly reduce the likelihood of underpricing or overpricing, which can have a substantial influence on overall cost management and financial performance.

Cont. table 1.

Cost Driver Identification	Understanding what drives costs is fundamental to cost reduction. Business analytics helps organizations identify and categorize their cost drivers. It distinguishes between fixed and variable costs, clarifies cost allocation methods, and pinpoints areas with the most significant cost impact. By recognizing these drivers, organizations can target specific areas for cost reduction initiatives, ultimately leading to more efficient cost management and improved financial health.
Resource Allocation	Efficient resource allocation is a key benefit of business analytics. By analyzing data related to resource allocation and utilization, organizations can optimize the allocation of personnel, equipment, and materials. This ensures that resources are used efficiently, reducing waste and unnecessary expenditures. Proper resource allocation contributes significantly to cost reduction by minimizing inefficiencies and streamlining operations.
Data-Driven Decision-Making	Business analytics promotes a culture of data-driven decision-making within organizations. This approach emphasizes using data and evidence to guide choices and actions. By relying on analytics for decision-making, organizations ensure that their strategies and initiatives are based on a sound understanding of their data. Data-driven decisions are typically more accurate, precise, and aligned with organizational goals, resulting in more effective cost reduction strategies and outcomes.
Competitive Advantage	Leveraging analytics for cost reduction provides a significant competitive advantage. Organizations that can offer products or services at more competitive prices or with higher margins have a stronger market position. By optimizing costs and resource utilization, businesses can position themselves more favorably in the market, which can lead to increased market share, customer retention, and overall profitability. A competitive edge in cost management can be a key differentiator in today's competitive business landscape.
Customer Satisfaction	Business analytics has a direct impact on customer satisfaction. By aligning inventory levels, ensuring product availability, and implementing effective pricing strategies, organizations can enhance their ability to meet customer expectations. Satisfied customers are more likely to remain loyal and engage in repeat business, which can lead to long-term financial success. Moreover, customer satisfaction can be closely tied to cost reduction efforts, as efficient operations and pricing strategies contribute to improved customer experiences.
Risk Mitigation	Business analytics is instrumental in identifying and mitigating financial risks. By analyzing historical data and financial trends, organizations can detect potential financial risks early on. This enables them to implement strategies to mitigate or manage these risks effectively, reducing the financial impact and safeguarding the bottom line. Risk mitigation through analytics contributes to overall cost reduction by preventing unexpected financial setbacks.
Supplier and Vendor Optimization	Businesses rely on suppliers and vendors for various goods and services. Business analytics can be used to optimize relationships with suppliers and vendors. It helps in negotiating better terms, managing contracts efficiently, and identifying cost-saving opportunities. Effective supplier and vendor optimization can lead to reduced procurement costs and more favorable terms, directly impacting cost reduction efforts.
Cost Benchmarking	Analytics enables organizations to benchmark their costs against industry standards and competitors. By comparing their cost structure with industry peers, organizations can identify areas where they might be over-spending or underperforming. This helps in setting realistic cost reduction goals and tailoring strategies to align with industry best practices, ultimately resulting in more effective cost management and financial performance.

Source: (Adel, 2022; Akundi et al., 2022; Olsen, 2023; Aslam et al., 2020; Bakir, Dahlan, 2022; Cillo et al., 2022; Ghibakholl et al., 2022, Javaid, Haleem, 2020, Javaid et al., 2020; Cam et al., 2021; Charles et al., 2023; Greasley, 2019; Hurwitz et al., 2015; Nourani, 2021; Peter et al., 2023).

3. Software used in personalized customer experience

In today's highly competitive business environment, organizations are continually seeking ways to optimize their operations and reduce costs while maintaining or even enhancing the quality of their products or services (Wolniak, Grebski, 2018; Wolniak et al., 2019, 2020;

Wolniak, Habek, 2015, 2016; Wolniak, Skotnicka, 2011; Wolniak, Jonek-Kowalska, 2021; 2022). This drive for efficiency and cost reduction has given rise to the widespread adoption of business analytics tools and software. Business analytics software is instrumental in helping organizations analyze their operations, identify inefficiencies, and make data-driven decisions to cut costs and enhance profitability. In this article, we will explore several software solutions commonly used in business analytics for cost reduction (Zeng et al., 2022; Pech, Vrchota, 2022).

Microsoft Excel, while not traditionally considered a dedicated business analytics tool, is a ubiquitous and versatile spreadsheet software used by organizations of all sizes. Excel provides fundamental features for data analysis, visualization, and modeling, making it an accessible entry point for businesses exploring cost reduction through analytics. Users can perform tasks such as data sorting, filtering, pivot tables, and basic financial modeling. While Excel is not as advanced as other dedicated analytics platforms, it can be a cost-effective solution for small to medium-sized businesses or as an initial step toward more advanced tools.

Tableau is a powerful data visualization tool that empowers organizations to create interactive and shareable dashboards. One of its key strengths is the ability to connect to various data sources and quickly transform raw data into insightful visualizations. These visualizations facilitate data exploration, helping organizations identify cost trends, inefficiencies, and opportunities for optimization. Tableau's intuitive interface allows users to create dynamic dashboards that can be used to monitor key performance indicators and track progress toward cost reduction goals (Ghibakholl et al., 2022).

QlikView and Qlik Sense are prominent business intelligence and data visualization tools. These platforms offer in-memory data processing, which enables users to explore data interactively and create dynamic dashboards. Qlik tools are particularly valuable for organizations seeking insights into cost drivers and process optimization. By allowing users to dig deeper into the data and generate real-time insights, QlikView and Qlik Sense support cost reduction efforts by improving operational efficiency.

SAP BusinessObjects is a comprehensive suite of business intelligence tools designed for organizations with complex data requirements. It offers features for data reporting, ad hoc analysis, and dashboard creation. SAP BusinessObjects is invaluable for organizations that want to analyze and optimize costs within the context of their broader enterprise systems and data sources. It provides a centralized platform for accessing and analyzing data, helping organizations make informed decisions about cost reduction strategies (Akundi et al., 2022).

IBM Cognos Analytics is a robust business intelligence platform that offers reporting, dashboarding, and analytics capabilities. It is highly effective for organizations looking to analyze historical and real-time data, create financial models, and explore various cost reduction strategies. Cognos Analytics provides a comprehensive solution for organizations seeking a single platform to support their analytics and cost reduction initiatives (Jonek-Kowalska,

Wolniak, 2021, 2022; Jonek-Kowalska et al., 2022; Kordel, Wolniak, 2021, Orzeł, Wolniak, 2021, 2022, 2023; Rosak-Szyrocka et al., 2023; Gajdzik et al., 2023; Ponomarenko et al., 2016; Stawiarska et al., 2020, 2021; Stecuła, Wolniak, 2022; Olkiewicz et al., 2021).

SAS Analytics is a powerful platform for data analysis, predictive modeling, and advanced analytics. Organizations use SAS to delve into their data and gain insights that help forecast future costs. SAS Analytics is particularly useful in identifying areas where cost savings can be achieved. By using statistical and machine learning models, SAS enables organizations to make informed decisions and execute cost reduction strategies based on data-driven insights (Scappini, 2016).

R is a popular open-source programming language and software environment used for statistical computing and graphics. Organizations with advanced analytics needs often turn to R to build custom cost reduction models and perform in-depth statistical analysis. R provides extensive flexibility and control, making it ideal for organizations with skilled data scientists who can develop tailored cost prediction and optimization models (Cillo et al., 2022).

Python, another open-source language, is widely used for data analysis, modeling, and machine learning. Python's ecosystem of libraries and frameworks makes it well-suited for predictive analytics and machine learning projects related to cost reduction. Organizations can leverage Python to build custom models and algorithms that suit their specific cost reduction goals (Nourani, 2021).

Alteryx is a data blending and advanced analytics platform that empowers organizations to prepare, blend, and analyze data from various sources. It simplifies the data preparation process, allowing users to combine data from disparate sources and generate insights for cost optimization. Alteryx is especially valuable for organizations seeking to streamline their data workflows and reduce manual data manipulation efforts (Charles et al., 2023).

SAP HANA is an in-memory data platform that accelerates data processing and analytics. It is beneficial for organizations dealing with large datasets and complex cost structures. SAP HANA enables real-time analytics, making it easier to analyze costs as they occur. This capability is particularly valuable for identifying inefficiencies and optimizing operations promptly, contributing to cost reduction initiatives (Greasley, 2019).

MicroStrategy is a comprehensive business intelligence and analytics platform. It provides features for data discovery, reporting, and dashboard creation. MicroStrategy's interactive dashboards and data exploration features are beneficial for identifying cost-saving opportunities and monitoring progress toward cost reduction goals. It enables organizations to create customized reports and dashboards tailored to their specific needs (Bakir, Dahlan, 2022).

Table 2 is listing examples of software and applications used in the case of cost reduction. These software tools are widely utilized in business analytics for cost reduction, each offering distinct features and capabilities to support organizations in their efforts to analyze costs, identify inefficiencies, and optimize their operations. The choice of software depends on the specific needs and resources of the organization.

Table 2.

The usage of business analytics in cost reduction

Business Analytics Software	Description
Microsoft Excel	Microsoft Excel is a versatile spreadsheet software widely used for basic data analysis and visualization. It is accessible and provides essential features for cost reduction, such as data sorting, filtering, and basic financial modeling. While it's not as advanced as other tools, it is a cost-effective starting point for small to medium-sized businesses.
Tableau	Tableau is a powerful data visualization tool that enables organizations to create interactive and shareable dashboards. It is valuable for cost reduction initiatives as it allows for in-depth data exploration and visualization, making it easier to identify cost trends, inefficiencies, and opportunities for optimization.
QlikView/Qlik Sense	QlikView and Qlik Sense are business intelligence and data visualization tools that facilitate in-memory data processing. They enable users to explore data and create dynamic dashboards, which are particularly useful for gaining insights into cost drivers and optimizing processes, ultimately reducing operational expenses.
SAP BusinessObjects	SAP BusinessObjects is a comprehensive suite of business intelligence tools. It provides features for data reporting, ad hoc analysis, and dashboard creation. SAP BusinessObjects is valuable for organizations looking to analyze and optimize costs within the context of their broader enterprise systems and data sources.
IBM Cognos Analytics	IBM Cognos Analytics is a business intelligence platform that offers reporting, dashboarding, and analytics capabilities. It is beneficial for cost reduction initiatives by providing tools to analyze historical and real-time data, create financial models, and explore various cost reduction strategies.
SAS Analytics	SAS Analytics is a comprehensive analytics platform that covers data management, advanced analytics, and predictive modeling. It is valuable for cost reduction through predictive analytics, helping organizations forecast future costs and identify areas where savings can be achieved.
R	R is a popular open-source programming language and software environment for statistical computing and graphics. It is ideal for organizations with advanced analytics needs and skilled data scientists. R can be used to build custom cost reduction models and perform in-depth statistical analysis to optimize expenses.
Python	Python, another open-source language, is widely used for data analysis, modeling, and machine learning. It is particularly valuable for predictive analytics and machine learning projects related to cost reduction, allowing organizations to build custom cost prediction and optimization models.
Alteryx	Alteryx is a data blending and advanced analytics platform that empowers organizations to prepare, blend, and analyze data from various sources. It is useful for cost reduction through data preparation, combining data from disparate sources, and generating insights for cost optimization efforts.
SAP HANA	SAP HANA is an in-memory data platform that accelerates data processing and analytics. It is useful for organizations with large datasets and complex cost structures. SAP HANA allows for real-time analytics, making it easier to analyze costs as they occur, identify inefficiencies, and optimize operations promptly.
MicroStrategy	MicroStrategy is a business intelligence and analytics platform that offers robust data discovery and reporting capabilities. It is valuable for cost reduction through its interactive dashboards and data exploration features, which help in identifying cost-saving opportunities and monitoring progress towards cost reduction goals.

Source: (Adel, 2022; Akundi et al., 2022; Olsen, 2023; Aslam et al., 2020; Bakir, Dahlan, 2022; Cillo et al., 2022; Ghibakholl et al., 2022, Javaid, Haleem, 2020, Javaid et al., 2020; Cam et al., 2021; Charles et al., 2023; Greasley, 2019; Hurwitz at al., 2015; Nourani, 2021; Peter et al., 2023; Castro et al., 2014; Wang et al., 2023; Du et al., 2023; Fjellström, Osarenkhoe, 2023; Zeng et al., 2022; Pech, Vrchota, 2022).

4. Conclusion

The application of business analytics in cost reduction is a critical strategy for organizations in today's competitive business landscape. This article has underscored the significance of business analytics in the context of cost reduction, outlining the methodologies and benefits it offers to organizations seeking to optimize their financial performance. Cost reduction is a fundamental goal for businesses as it directly impacts the bottom line. Business analytics is instrumental in providing valuable insights into an organization's operations, helping identify inefficiencies and areas for cost optimization.

Business analytics harnesses the power of data, enabling organizations to make informed, data-driven decisions. This approach is more accurate and precise compared to traditional decision-making, leading to more effective cost reduction strategies. Business analytics helps organizations identify and categorize their cost drivers. It distinguishes between fixed and variable costs, clarifies cost allocation methods, and pinpoints areas with the most significant cost impact. This knowledge is essential for cost optimization.

Through techniques like process mining and analysis, organizations can identify bottlenecks, redundancies, and waste in their operations. This insight empowers them to streamline processes and reduce operational costs, resulting in better resource utilization and substantial cost savings. Accurate demand forecasting is crucial for cost reduction. Business analytics leverages historical data, market trends, and customer behavior to predict future demand with precision. This optimization of inventory levels and supply chain management minimizes carrying costs and ensures timely fulfillment of customer demand.

Analytics plays a pivotal role in setting the right pricing strategy. By analyzing customer behavior and market trends, organizations can determine optimal price points for their products and services, maximizing revenue while preserving profitability. Various methodologies and techniques are employed in the application of business analytics for cost reduction, including descriptive analytics, predictive analytics, prescriptive analytics, process mining, regression analysis, and more.

A range of software solutions is available to support organizations in their cost reduction efforts. These include well-known tools like Microsoft Excel, Tableau, QlikView, SAP BusinessObjects, IBM Cognos Analytics, SAS Analytics, R, Python, Alteryx, SAP HANA, and MicroStrategy, each offering distinct features and capabilities tailored to different organizational needs and levels of expertise. Leveraging analytics for cost reduction provides a significant competitive advantage. It positions organizations favorably in the market, which can lead to increased market share, customer retention, and overall profitability. Efficient operations and pricing strategies also enhance customer satisfaction.

Business analytics assists in identifying and mitigating financial risks, preventing unexpected financial setbacks. It also supports optimizing relationships with suppliers and vendors, helping negotiate better terms and identifying cost-saving opportunities. nalytics enables organizations to benchmark their costs against industry standards and competitors, aiding in setting realistic cost reduction goals and aligning strategies with industry best practices.

The application of business analytics in cost reduction is a multifaceted and indispensable approach for organizations seeking to enhance their financial health and competitiveness. By harnessing data-driven insights, identifying inefficiencies, optimizing processes, and making informed decisions, businesses can embark on a journey toward more efficient operations, improved customer satisfaction, and a stronger competitive position. The choice of software tools and methodologies should align with an organization's specific needs and resources, ultimately contributing to the achievement of cost reduction goals and long-term financial success.

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