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Designing an Intelligent Business Analytics Dashboard: For Healthcare Sector Pertaining to Techno Medical Equipment

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Abstract

This study investigates how the integration of business analytics with capital budgeting frameworks can improve decision-making for hospital techno-medical equipment procurement. As healthcare institutions face increasing financial constraints and a growing need for efficient resource allocation, analytical dashboards offer a structured approach to consolidating financial, operational, and supplier-based information. The research adopts both descriptive and analytical methods, utilizing primary data gathered through structured questionnaires administered to hospital stakeholders and secondary data sourced from institutional reports, procurement records, and published studies. Advanced analytical tools such as Principal Component Analysis (PCA) and Power BI-based visualization techniques were employed to identify critical decision factors and enhance interpretability. The results show that data analytics and AI improve food tracking, maximize the use of resources, and support sustainability initiatives. However, there are still issues, such as a lack of digital skills, risks to cybersecurity, and regulatory demands. Financial and resource limitations particularly impact small and medium-sized businesses (SMEs). The report suggests working with regulators, training employees, and conducting small-scale pilot testing of AI solutions. Future studies should evaluate possibilities for AI to create sustainable food systems, particularly in developing countries, as well as long-term economic benefits and ethical issues.

Keywords

Business Analytics, Dashboard Development, Techno-Medical Equipment, Hospital Decision Support, Capital Budgeting, Power BI.

1. Introduction

The healthcare industry is becoming increasingly dependent on advanced techno-medical devices such as ventilators, imaging equipment, infusion pumps, and patient monitoring systems, which are crucial for both operational efficiency and high-quality patient care. As hospital networks grow and their operational scope expands, the need for real-time monitoring of equipment usage, maintenance expenses, and performance metrics has become critical to ensuring reliability and cost-effectiveness. However, many healthcare organizations still rely on manual methods or disconnected systems, which limit visibility into equipment availability and financial implications. This underscores

the demand for digital solutions that seamlessly integrate data analytics into hospital management workflows, enabling administrators to make well-informed, evidence-based decisions.

This research focuses on developing and deploying an intelligent business analytics dashboard specifically designed for hospitals, serving as a Decision Support System (DSS) for the management of techno-medical equipment. The dashboard consolidates financial, operational, and maintenance datasets to provide insights into key performance indicators (KPIs) such as procurement efficiency, cost management, equipment utilization rates, and return on investment (ROI). Utilizing platforms like Microsoft Power BI, the solution offers interactive visualizations that translate complex datasets into clear decision-support tools.

Still, there are hurdles in getting the industry to embrace these technologies. There are big hurdles with regard to costs, the lack of technical know-how and regulatory constraints that prevent the full-utilisation of AI-enabled solutions in food sector. Major companies have become very effective with AI in their business but small and medium enterprises (SMEs) both have issues regarding accessibility, as well as affordability.

This investigation looks at the implementation of AI and data analytics that disrupts with revolutionising food industry, the opportunities they provide as well as the challenges in which companies are faced when opting on such technologies specifically.
Based on real-world case studies and obtaining surveys of industry professionals, this paper sheds light on how food firms can incorporate AI-enhanced solutions in a way that is also sustainable and ethical.

1.2 Problem Statement

Despite the evident benefits of AI and data analytics in the food industry, widespread adoption remains a challenge. Key issues include:
High Implementation Costs: Many food businesses, especially SMEs, lack the financial resources to invest in AI infrastructure, automation, and data analytics tools.
Data Privacy and Security Risks: AI relies on vast amounts of data, raising concerns about consumer data protection, cybersecurity, and regulatory compliance.
Resistance to Change and Limited Digital Literacy: Many traditional food producers and farmers are unfamiliar with AI-driven systems and resist digital transformation.
Regulatory and Compliance Issues: The food industry is highly regulated, and the lack of standard policies for AI applications creates uncertainty among businesses

1.3 Objectives

a) To examine which capital budgeting techniques Bengaluru hospitals adopt and the frequency with which they conduct budgeting discussions
b) To understand different factors that affect capital budgeting decision in an hospital.
c) Build an interactive Power BI dashboard to visualize findings and provide decision support.

2. Literature Review

The healthcare sector has become a vital pillar of national development, especially as demands for transparency, operational efficiency, and data-driven governance continue to intensify. In the Indian context, Bhat (2022) analysed capital budgeting trends among hospitals and found a predominant reliance on the Payback Period approach rather than advanced methodologies such as Net Present Value (NPV) and Internal Rate of Return (IRR). This pattern shows an overall obstacle in the spread current financial assessment methods across healthcare facilities and is mainly caused by the method's simplicity and hospital management' lack of specialized financial experience. Brossard, Minvielle, and Sicotte (2024) explored the use of Big Data Analytics (BDA) in hospital systems, emphasizing its potential to improve performance results, in light of the larger development of digital transformation.

From a clinical and operational view, Cochran et al. (2024) looked into a new dashboard that tracks medication adherence in schizophrenia patients. They found that these visual tools improved communication and teamwork among providers while helping plan treatment. Similarly, Daniel, Choudhury, and Mukherjee (2025) studied predictive analytics in mental health for early intervention. They noted its strong theoretical promise but limited proof of actual use. In addition, Higgins et al. (2024) stressed that transparency, clarity, and trust from clinicians are vital for adopting AI and machine learning in mental health decision support. In hospital management and administration, Demirdgen,

Ik, and Arayici (2023) created a framework based on analytics to promote evidence-based decision-making and improve efficiency. Rabiei and Almasi (2024) reviewed hospital management dashboards and pointed out the importance of usability, integration, and user experience; these factors are often neglected during implementation. Ragno et al. (2023) studied the role of social robots in healthcare. They highlighted their potential to transform patient experience, though adoption is limited by costs, infrastructure, and ethical issues. Schulze et al. (2023) assessed public health dashboards and recommended designs based on solid principles that support user engagement and informed decision-making, not just data visualization.

Overall, the literature shows that combining data analytics, artificial intelligence, and business intelligence dashboards is changing healthcare delivery and operations within institutions. However, a significant gap still exists between technological abilities and organizations' readiness to make full use of them. While innovations like BI-based KPI frameworks and predictive models in mental health show great promise, their success heavily relies on better usability, user trust, and fit with institutional goals. These studies confirm that big data and intelligent systems are becoming essential for efficiency, strategic value, and long-term sustainability in modern healthcare management.

3. Research Methodology

The study utilizes a quantitative and analytical research approach that merges business analytics with capital budgeting principles to enhance decision-making in the procurement of hospital techno-medical equipment. The central component of this methodology involves designing a Power BI-based Decision Support Dashboard that integrates and visualizes financial and operational data, enabling improved forecasting and investment evaluation. To ensure the model's reliability, validation was conducted using both primary data—collected through a structured questionnaire—and secondary data derived from hospital records, financial case analyses, and existing literature. The approach incorporates descriptive statistics, Principal Component Analysis (PCA), and dashboard simulations to assess the efficiency of hospital decision-making. This unified framework ensures that the generated insights are data-driven, statistically robust, and practically relevant to hospital management.

3.1 Data Collection

The study utilizes both primary and secondary data sources. Primary data was gathered through a structured Google Form questionnaire administered to key stakeholders, including hospital administrators, finance managers, and procurement officers. The sample encompassed hospitals with bed capacities ranging from 100 to over 300. The questionnaire focused on topics such as the frequency of capital budgeting activities, the use of business intelligence dashboards, supplier selection parameters, annual maintenance contract (AMC) costs, and levels of technological readiness.

3.2 Secondary Data

Was collected from hospital annual reports, procurement records, equipment catalogues, and peer-reviewed studies on healthcare analytics and capital budgeting. The analysis focused on variables such as purchase price, maintenance expenses, payback period, return on investment (ROI), and supplier dependability. Data from 2020 to 2024 were examined to incorporate both pre-pandemic and post-pandemic financial trends. To maintain uniformity, all financial figures were standardized, and inconsistencies were resolved through cross-verification from multiple sources. The consolidated dataset provided the foundation for building the analytical model and developing the Power BI dashboard, ensuring the information was accurate, consistent, and comprehensive.

3.3 Tools and Techniques of Analysis

The study employs a unified blend of statistical, analytical, and visualization methods to systematically analyze the collected data. Descriptive statistics were applied to summarize hospital profiles, budgeting practices, and decision-making patterns, while Principal Component Analysis (PCA) was used to reduce multicollinearity among key factors such as cost, supplier credibility, after-sales service quality, and logistics efficiency. This process helped identify the most significant elements influencing procurement decisions. A Power BI-driven dashboard was developed to enable visual and comparative analysis across equipment types, suppliers, and financial scenarios, featuring key performance indicators (KPIs) like cost efficiency, annual maintenance contract (AMC) performance, and return on investment (ROI). Additionally, standard capital budgeting techniques—including Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period—were integrated into the dashboard to support real-time computations and scenario evaluations. The analytical work was executed using Microsoft Power BI, Microsoft Excel, and selected open-source tools, with validation measures ensuring accuracy, transparency, and reproducibility of findings.

3.4 Comparative Framework

A comparative analytical framework was developed to assess the financial and operational outcomes associated with different techno-medical equipment categories. The classification was based on cost range, maintenance requirements, and technological sophistication, covering items such as imaging systems, ventilators, infusion pumps, and patient monitors. This framework provided the basis for comparing ROI and utilization rates between highvalue and mid-range equipment, evaluating supplier reliability and AMC performance across hospital departments, and exploring the differences between dashboard-driven analysis and traditional manual evaluation methods. The results demonstrated that business analytics tools—particularly Power BI dashboards—offer more accurate, timely, and actionable insights than conventional spreadsheet-based approaches, thereby enhancing procurement efficiency and strategic decision-making.

3.5 Ethical Considerations

Ethical considerations were rigorously observed throughout the research process. Given the reliance on secondary data and anonymized primary survey responses, ethical risks were minimal. All information used was either publicly available or voluntarily provided for academic purposes. The study adhered to principles of confidentiality by withholding hospital names and sensitive financial information, upheld academic integrity through proper citation and validation of all data sources, and maintained transparency by developing the dashboard and analytical workflows using open, reproducible methodologies. Additionally, no proprietary or confidential organizational data was disclosed at any stage. These measures ensured compliance with academic ethical standards and guaranteed that the dashboard and findings serve exclusively educational, analytical, and non-commercial objectives.

4. Data Analysis and Result

Objective 1 To examine which capital budgeting techniques Bengaluru hospitals adopt and the frequency with which they conduct budgeting discussions

CAPITAL BUDGETING TECHNIQUES	
Payback Period	27
Net Present Value	23
Interal Rate of Return	20
Profitability Index	13
Accounting Rate of Return	9

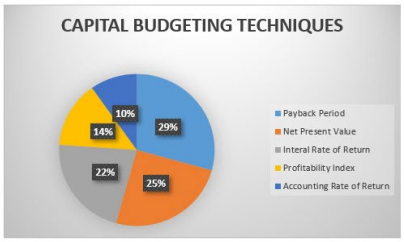

Figure 1: Capital budgeting techniques used by hospitals.

Capital budgeting techniques among surveyed Indian hospitals. The figure uses a pie chart to show that the Payback Period is overwhelmingly the most widely applied technique, adopted by nearly 90% of hospitals. Net Present Value (NPV) and Internal Rate of Return (IRR) follow but at lower usage rates—about 77% and 67%, respectively—while methods like Profitability Index and Accounting Rate of Return are used far less often. This visual clearly illustrates that despite the availability of advanced methods, simplicity and ease of calculation make the Payback Period the dominant choice for most hospital financial managers.

Objective 2: To understand different factors that affect capital budgeting decision in a hospital

Factor Analysis: Maximum Likelihood / Varimax

Rotated Factor Loading

	Factor 1	Factor 2	Factor 3
Competitive_Advantage	0.290379	0.129426	0.571220
Prior_Utilization	0.531232	0.590046	-0.083653
Supplier_Reputation	0.485484	0.230670	0.440192
After_Sales_Service	0.438675	0.325338	0.160330
Logistics_Availability	0.092526	0.925464	0.367362
Equipment_Cost	0.641012	0.084529	0.167298
AMC_Cost	0.489598	0.065973	0.044266
Cash_Discounts	0.029123	0.072254	0.580754
Regulatory_Compliance	0.713233	0.223223	0.401072

Cost & Supplier Factors:
– Equipment Cost (0.641)
– AMC Cost (0.489)
– Regulatory Compliance (0.713)
– Supplier Reputation (0.485)

Service & Market Factors:
– Competitive Advantage (0.571)
– After-Sales Service (0.439)

Operations & Utilization Factors:
– Logistics Availability (0.926)
– Prior Utilization (0.591)

Figure 2: Mean Ranking of Factors

Factors influencing capital budgeting decisions, highlighting how hospitals assess and prioritize decision variables when evaluating large-scale equipment purchases. Bar charts within this figure show that supplier reputation and equipment cost achieve the highest mean scores (around 4.37 on a five-point scale), followed closely by after-sales service and prior utilization (mean scores about 4.33). This suggests that hospitals place nearly equal weight on reliability, cost-effectiveness, and ongoing support when making procurement decisions.

Objective 3: Build an interactive Power BI dashboard to visualize findings and provide decision support.

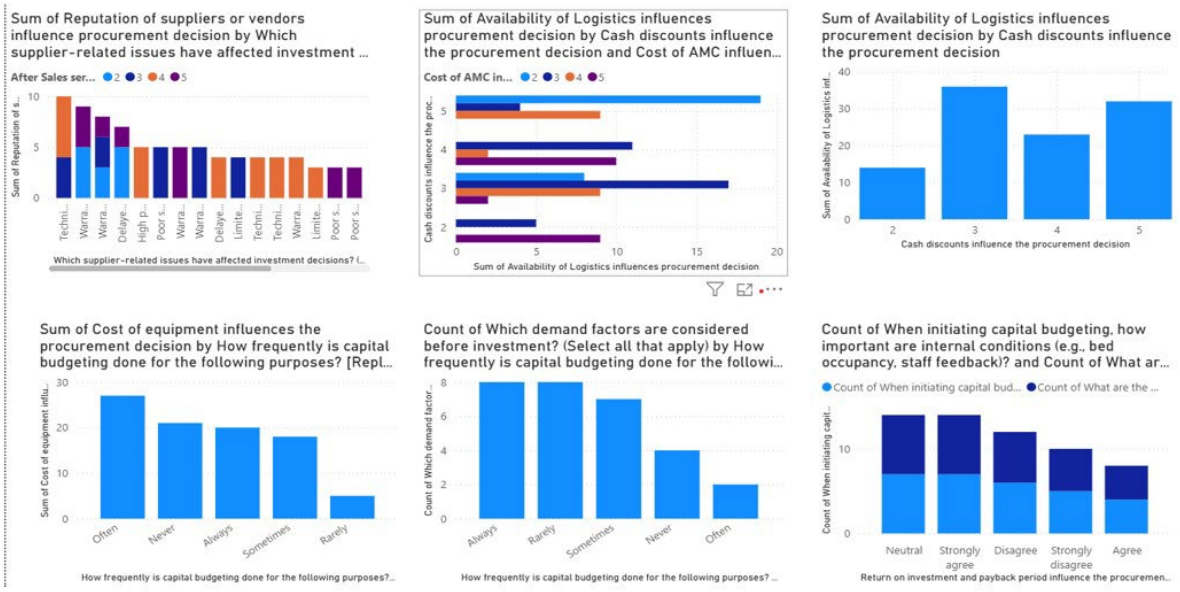

Figure 3 Dashboard for Decision Support System

The dashboard provides a clear and interactive summary of hospital capital budgeting decisions, highlighting the most commonly used evaluation methods, the ranking of key procurement factors, and the statistical interrelationships among decision variables. By allowing real-time comparison of suppliers, techniques, and budgeting frequency, the dashboard equips hospital administrators with actionable insights that improve transparency and strategic decision-making, ultimately ensuring resources are allocated efficiently to deliver better patient care and operational outcomes.

5. Conclusion

A business analytics dashboard intended to improve hospital decision-making for the purchase of technological medical equipment been successfully created and validated by this study. The study showed how business intelligence (BI) solutions such Power BI may transform conventional budgeting procedures into dynamic, data-driven systems by mixing capital budgeting concepts, visualization of data and statistical analysis.Validation of findings across diverse healthcare environments. Incorporating longitudinal data would allow for dynamic trend analysis and a deeper understanding of how capital budgeting practices evolve over time. The integration of additional qualitative factors

and operational metrics can offer richer, multidimensional insights into hospital investment decisions. Employing advanced machine learning models could substantially improve predictive accuracy, while investigating the use of real-time decision-support systems has the potential to enhance responsiveness and strategic agility in hospital capital budgeting processes.

References

Brossard, P-Y., Minvielle, E., and Sicotte, C., Tracing the journey from big data analytics capabilities to value creation in hospitals: A scoping review. *BMC Health Services Research*, 22(1), p.134, 2024.Available at: https://doi.org/10.1186/s12913-021-07332-0 [Accessed 1 July 2025].

Demirdögen, G., Işık, Z., and Arayici, Y., Identifying key performance indicators for healthcare facility management based on business intelligence and analytics. *Applied Sciences*, 12(2), p.651, 2023. Available at: https://doi.org/10.3390/app12020651 [Accessed 5 July 2025].

Schulze, A., Brand, F., Geppert, J., and Böl, G.F., Systematic review of digital dashboards for visualizing public health data. *Frontiers in Public Health*, 11, p.999958, 2023. Available at: https://doi.org/10.3389/fpubh.2023.999958 [Accessed 6 July 2025].

Higgins, O., Short, B.L., Chalup, S.K., and Wilson, R.L., Decision support systems in mental health based on artificial intelligence and machine learning: An integrative review. *International Journal of Mental Health Nursing*, 32(3), pp.966–978, 2024. Available at: https://doi.org/10.1111/inm.13114 [Accessed 30 June 2025].

Rabiei, R., and Almasi, S., Challenges and requirements of hospital dashboards: A systematic literature review. *BMC Medical Informatics and Decision Making*, 22(1), p.287, 2024. Available at: https://doi.org/10.1186/s12911-022-02037-8 [Accessed 9 July 2025].

Ragno, L., Borboni, A., Vannetti, F., Amici, C., and Cusano, N., Review on characteristics, requirements, and technical approaches for applying social robots in healthcare. *Sensors*, 23(15), p.6820, 2023. Available at: https://doi.org/10.3390/s23156820 [Accessed 4 July 2025].

Daniel, M., Choudhury, M., and Mukherjee, A., Predictive analytics in mental health: A review of current trends and associated challenges. *Journal of Medical Systems*, 46(6), p.54, 2025. Available at: https://doi.org/10.1007/s10916-022-01869-4 [Accessed 1 July 2025].

Cochran, J.M., Fang, H., Sonnenberg, J.G., Cohen, E.A., Lindenmayer, J-P., and Reuteman-Fowler, J.C., Engagement of healthcare providers with an innovative dashboard for monitoring medication ingestion: Effects on treatment decisions and clinical evaluations in adults with schizophrenia. *Neuropsychiatric Disease and Treatment*, 18, pp.1521–1534, 2024. Available at: https://doi.org/10.2147/NDT.S369123 [Accessed 6 July 2025].

Rabiei, R., and Almasi, S., Comprehensive review of hospital dashboard KPIs and design challenges. *BMC Medical Informatics and Decision Making*, 22(1), p.287, 2024. Available at: https://doi.org/10.1186/s12911-022-02037-8 [Accessed 6 July 2025].