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Enhancing Government Procurement: Utilizing Business Intelligence for Deep Data Analytics in Electronic Procurement

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***Abstract*—** Government procurement processes can be made more effective, transparent, and accountable by using electronic procurement systems, which have attracted a lot of attention in the public sector. To comprehend and evaluate the usage and effects of the government's electronic procurement system, this research article conducts an analytical analysis. The paper evaluates the primary characteristics, advantages, difficulties, and success factors related to the deployment of electronic procurement systems, drawing knowledge from prior research and actual case studies. The paper also suggests a framework for evaluating the effectiveness of electronic procurement systems based on several criteria, including process effectiveness, cost-effectiveness, vendor engagement, and governance. The study's findings aid in understanding the function and potential of the Electronic Procurement System in modernizing government procurement.

Keywords*— *Electronic Procurement System, Public Procurement, e-Procurement, Tenders, Vendors, Bidders, Government Departments, Goods, Services, Contracts.

I. INTRODUCTION

The government is largely responsible for providing citizens with essential amenities like infrastructure, health care, and education. Along with time constraints, the effectiveness of citizen-centred services has an impact on economic growth through its effects on poverty reduction, human capital development, and corruption. The delivery of effective and efficient public services is of the highest importance and is the key goal of any modern government. Public procurement must be prioritized and treated seriously if effective delivery is to be achieved.

II. BACKGROUND

The government is using public e-procurement more and more as a tool to advance the people's quality of life and economic prosperity, which highlights the significance of procurement. Government/ public procurement is the official procedure through which government agencies acquire the materials they require for carrying out their duties, particularly the provision of public services of the requisite caliber and within the allotted time frame. It entails tasks like determining the need for procurement, awarding contracts, and making the last payment. Any proposed procurement must receive appropriate publicity, commensurate with its size and character, to encourage the greatest possible participation and competition, according to the core concept of effective procurement. A robust government procurement system is important for both ethical and economic reasons.

III. ELECTRONIC PROCUREMENT SYSTEM: CONCEPTS AND FEATURES

The government has started implementing e-governance solutions, including the electronic procurement (e-Procurement) system, in response to the development of ICTs and the fast expansion of the Internet.

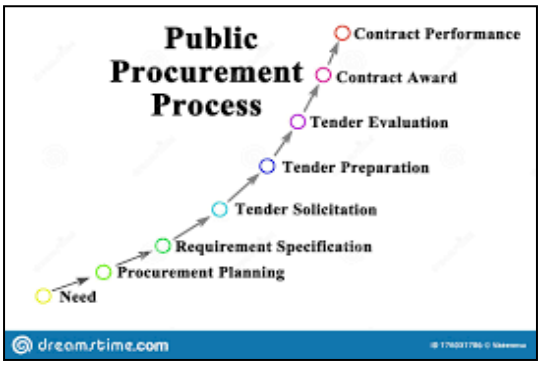

Fig. 1. Public Procurement Process

Government e-procurement offers centralized access to data on state-wide tendering for various public purchases undertaken by different government agencies.

Electronic procurement, also known as e-procurement, refers to the method of obtaining goods, services, and works through electronic means, with the Internet being the most commonly utilized channel. This approach encompasses the utilization of electronic data interchange, extranets, online marketplaces, and/or dedicated e-procurement systems for tasks such as ordering, bidding, and service delivery.

A. Prime Objectives of Electronic Procurement System

- Establishing a comprehensive hub for all government procurement services.
- Enhancing efficiency while reducing procurement cycle time and costs.
- Advancing transparency in government procurement practices.
- Enforcing procurement reform uniformly across government entities.
- Ensuring equitable opportunities for all bidders and the effective implementation of tendering procedures.

B. Salient Features of the Electronic Procurement System

The following are some of the key characteristics:

- Encrypting bids submitted by bidders.
- Offering the flexibility to utilize a single, double, or multi-cover bid system.
- Enabling offline technical evaluations.
- Generating charts for comparison of technical / financial bids.
- Publishing information about the contract award.
- Communicating "Event Alerts" via email or SMS for all available features.

C. Benefits of Electronic Procurement System Adoption

The Adopting an Electronic Procurement System in government can bring numerous benefits. These benefits can positively impact the efficiency, transparency, cost-effectiveness, and overall effectiveness of government procurement processes. Here are some key benefits of e-Procurement adoption:

- **Process Efficiency:** e-Procurement streamlines and automates various procurement activities, leading to improved process efficiency. Manual tasks, such as document preparation, bid evaluation, and contract management, can be automated, reducing administrative burden and saving time. Electronic workflows, notifications, and approvals enhance process speed, accuracy, and responsiveness.
- **Cost Savings:** e-Procurement can contribute to cost savings in government procurement. By automating processes, reducing paperwork, and minimizing manual errors, e-Procurement reduces administrative and operational costs. Electronic bidding and online vendor registration processes can increase competition and drive cost savings through transparent and competitive procurement practices. Additionally, e-Procurement enables effective spending analysis and strategic sourcing, allowing governments to negotiate better terms and achieve cost efficiencies.
- **Transparency and Accountability:** e-Procurement enhances transparency and accountability in government procurement. Electronic systems provide audit trails, ensuring a transparent record of procurement activities, including vendor selection, bid evaluation, and contract award processes. This transparency reduces the potential for corruption, favoritism, and irregularities, promoting fair and ethical procurement practices. Stakeholders, including vendors and citizens, can have increased visibility into the procurement process, fostering trust and confidence.
- **Vendor Access and Participation:** e-Procurement expands vendor access and participation in government procurement. By providing an online platform, e-Procurement enables vendors, to easily access procurement opportunities. This increases competition, diversifies the vendor pool, and encourages broader vendor participation. E-Procurement also provides equal opportunities for vendors, ensuring fair and non-discriminatory access to procurement information and bidding processes.
- **Data-driven Decision Making:** e-Procurement generates valuable procurement data that can be leveraged for data-driven decision-making. Governments can analyze data on vendor performance, pricing trends, market dynamics, and procurement patterns to inform strategic decision-making. This data-driven approach helps optimize procurement strategies, identify potential cost savings, and improve overall procurement outcomes.
- **Enhanced Contract Management:** e-Procurement facilitates effective contract management throughout the procurement lifecycle. Electronic systems enable centralized contract repositories, automated contract renewals, and tracking of contract milestones, deliverables, and performance indicators. This reduces the risk of contract breaches, improves compliance, and ensures efficient contract administration.
- **Improved Document Management and Accessibility:** e-Procurement eliminates the need for physical paperwork and enables electronic document management. Electronic storage, retrieval, and sharing of procurement documents improve accessibility and reduce the risk of document loss or damage. This ensures that procurement information is readily available to authorized stakeholders, enabling efficient collaboration, communication, and decision-making.
- **Standardization and Consistency:** e-Procurement facilitates standardization and consistency in procurement processes. It allows governments to establish and enforce standardized procurement policies, procedures, and templates. This reduces ad hoc decision-making, promotes adherence to regulations, and ensures consistency across procurement activities.

By adopting e-Procurement, government organizations can realize these benefits, transforming procurement practices and achieving greater efficiency, transparency, and value for money. However, successful implementation requires careful planning, stakeholder engagement, capacity building, and ongoing monitoring and evaluation to ensure the system's effectiveness and sustainability.

D. Challenges in Implementing Electronic Procurement System in Government

- **Resistance to Change:** One of the major challenges in implementing an Electronic Procurement System in

government is the resistance to change from stakeholders involved in the procurement process. Government organizations often have established traditional procurement methods and a reluctance to adopt new technology-driven systems. Resistance can arise due to concerns about job security, or fear of unfamiliarity with the new system.

• **Complex Regulatory Environment:** Government procurement is subject to a complex regulatory environment, including legal frameworks, procurement rules and regulations, and compliance requirements. Ensuring that the electronic system aligns with legal requirements, maintains transparency, and prevents fraudulent activities can be demanding.

• **Capacity and Skill Gaps:** Implementing e-Procurement requires a certain level of technical expertise and capacity within government organizations. However, there may be skill gaps in terms of IT infrastructure, software development, data management, and cyber security. Building the necessary capacity and providing training to personnel involved in the procurement process can be a significant challenge.

• **Data Security and Privacy:** Electronic procurement involves the exchange and storage of sensitive information, including vendor details, contract terms, and financial data. Ensuring robust data security measures, protecting against unauthorized access or data breaches, and maintaining privacy can be a significant challenge for government agencies. The implementation of strong encryption protocols, access controls, and compliance with data protection regulations are critical considerations.

• **Vendor Participation and Readiness:** Procurement relies on the active participation of vendors and suppliers. However, vendors may face challenges in adopting and adapting to e-Procurement. Issues such as limited access to technology, lack of awareness about the system, or resistance to change may hinder vendor participation. Government agencies must actively engage with vendors, provide training and support, and address their concerns to encourage broader participation.

• **Financial Constraints:** Implementing e-Procurement requires investments in technology infrastructure, software development, training, and ongoing maintenance. Limited financial resources or competing budget priorities can pose challenges for government agencies seeking to implement e-Procurement. Securing adequate funding and ensuring a sustainable financial model for the system can be a significant hurdle.

• **Stakeholder Collaboration and Coordination:** Successful implementation of e-Procurement necessitates collaboration and coordination among multiple stakeholders, including government departments, procurement officials, IT teams, vendors, and end-users. Aligning the interests, expectations, and roles of these diverse stakeholders can be challenging. Effective communication, stakeholder engagement, and change management strategies are essential to address these challenges.

By acknowledging these challenges, government agencies can develop strategies to mitigate them and ensure a smoother implementation of Electronic Procurement Systems. Addressing resistance to change, enhancing technical capabilities, ensuring data security, fostering vendor participation, and facilitating stakeholder collaboration are crucial steps toward successful e-Procurement implementation in the government sector.

IV. RESEARCH OBJECTIVES

This research endeavor sought to comprehensively assess the data produced throughout the e-Procurement lifecycle to facilitate its efficient deployment. The primary objectives encompassed:

1. Examination of E-Procurement Stages: Investigating the distinct phases of e-procurement relative to procurement categories, including goods, services, and works.
2. In-Depth Data Analysis: Delving deeply into the data generated by electronic procurement systems to extract valuable insights.
3. Issue Identification and Remediation: Identifying gaps and challenges within the e-procurement process and formulating recommendations to resolve them effectively.

V. STUDY METHODOLOGY

Government e-Procurement has long been in use. The overall number of tenders published through e-procurement is 65,281, and the sum of their declared values is Rs. 93,528 crores. 140 government departments and affiliated organizations have signed up, and there are 25,199 registered bidders on the e-procurement system. Data generated at various stages of the e-procurement process was examined as part of this analytical assessment to facilitate value-added services for the users and ensure effective deployment. The visibility of purchase trends can be improved with the use of these analytics. It is possible to use data analytics to get important insights that will improve the current e-procurement process.

A.Data Collection

Extensive data analysis of various e-procurement functions based on procurement activities such as products, services, and works was carried out. Key stakeholders had challenges, which were identified and given appropriate advice for solutions. The Data Analytic Lifecycle provided the foundation for the technique used to develop the research study. Both secondary and primary data were found. Information regarding the publicly announced tender, including details about the tender type, contract types, category, coverage, technical and financial opening, evaluation procedures, contract award, tender cancellation, corrigendum updates, and re-tendering specifics, was also collected.

The study used a cross-sectional descriptive survey to gather data and demonstrate the effects of e-procurement adoption on both bidders and user departments. Four structured questionnaires that were framed as interview schedules were used to gather primary data from the important stakeholders. For a better knowledge interviews were conducted with nodal officers of the user government

departments/ organizations and registered bidders. The experiences of bidders about the registration procedure, utilization of the services offered and any issues they encountered while using the service were documented.

B. Data Analytics

Extensive Using data analytics approaches, we have taken raw data and found patterns to gain insightful knowledge from it. A stronger data analytics platform is being worked on to enable strategic choices for process improvement and success optimization.

The executive dashboard for the process performance summary has been produced using the Data Analytics tool, which has been used to evaluate the e-procurement data. The view of a corporate information management tool known as a dashboard aids in real-time monitoring and tracking of Key Performance Indicators, measurements, and events pertinent to activities.

The dashboard is purposefully crafted to:

- Present essential information regarding different Key Performance Indicators (KPIs).
- Offer valuable insights into the procurement workflow.
- Provide a quick overview of the progress of various departments.
- Ensure user-friendliness and ease of comprehension.
- Deliver real-time data visualization.
- Facilitate informed decision-making.
- Monitor critical day-to-day operational details.
- Display a concise summary of the entire process.

VI. KEY FINDINGS AND RECOMMENDATIONS

- Work Work Tenders Dominate: Work tenders constitute the largest portion (83.28%) of e-procurement traffic.
- Promoting Transparency: An overwhelming majority (98.87%) of tenders are "open tenders".
- Optimizing Notifications: To enhance efficiency, economy, and effectiveness, tender notifications should be published in one national-level and two state-level newspapers, in accordance with Store Purchase and Service Procurement Rules, and also in the Indian Trade Journal.
- User-Friendly Interface: While most user departments and bidders find the e-procurement platform easy to use, there's consensus that the interface needs simplification to reduce reliance on operators.
- Streamlining Tender Creation: Users suggest simplifying the lengthy process of tender document creation, providing standardized templates, and improving customization options for Bill of Quantity (BOQ)/price bid templates.
- EMD and Payment: Recommendations include flexible EMD amounts, a mandatory "online mode" for tender fee payment with minimal documentation, and acceptance of multiple payment methods.
- Optimal Tender Timing: Analysis indicates a peak in tender publication in January-February. To improve cash flow management, it's proposed that most works tenders be published and awarded during the monsoon season.
- Bilingual Interface: Bidders highlight the need for a bilingual interface with features like "save draft" and "modify" during bid submission.
- Online Submission: To streamline the process, online bid submission should be made mandatory, eliminating the need for physical submissions.
- Bid Evaluation: User departments recommend generating the BOQ summary in non-editable PDF format to prevent manipulation post-financial bid opening.
- Rate Contract Offers: An option for bidder-wise multiple-item rates is suggested to facilitate Rate Contract Offers.
- Bid Validity Period: The majority of tenders are awarded within their bid validity period.
- EMD Handling: Provisions for forfeiting EMD amounts are recommended to address the current lack of such provisions.
- Payment Gateway: Incorporating a unified payment interface (UPI) is suggested to expand payment options, reducing difficulties faced by bidders.
- Tender Cancellations: A substantial portion of tenders (14%) are cancelled, with the highest frequency at the end of the financial year. Proper training, careful tender document creation, and wider circulation of NIT and tender documents are proposed to mitigate these issues.
- Alerts and Notifications: Users receive SMS/email alerts during the tender cycle. Registered bidders advocate for customized alerts based on their work preferences to promote fair competition.
- Standardized Templates: User departments request standardized tender templates for frequently issued tenders.
- Success Ratio: Achieving a cent-percent success ratio hinges on minimizing tender cancellations through meticulous attention to the e-procurement process by user departments.

VII. CONCLUSION

Government organizations are implementing e-procurement systems for a variety of reasons, but the main ones are decreased purchasing costs, increased productivity, and efficiency. The goal of the research study is to present a thorough review of government sector electronic procurement systems. The research adds to the body of information already available on this subject by looking at the characteristics, advantages, difficulties, and success factors related to the implementation of electronic procurement systems.

Policymakers and practitioners can assess the impact of implementing electronic procurement systems and decide on future initiatives with the help of the proposed analytical framework, which provides a structured method for assessing the effectiveness of electronic procurement systems in government procurement. A comprehensive strategy that includes organizational readiness assessments, stakeholder engagement, change management methods, capacity-building programs, and effective project planning and execution is

needed to address the obstacles. Government organizations can increase the likelihood of successful adoption and realize the rewards of electronic procurement systems by proactively addressing these issues.

REFERENCES

[1] Ministry of Defence. (n.d.). eProcurement System of Ministry of Defence. Retrieved from https://defproc.gov.in

[2] Indian Railways. (n.d.). eProcurement System of Indian Railways. Retrieved from https://www.ireps.gov.in

[3] Centre for Public Impact. (n.d.). Government eProcurement System Singapore. Retrieved from https://www.centreforpublicimpact.org

[4] ACM Digital Library. (n.d.). A Case Study of eProcurement. Retrieved from https://dl.acm.org

[5] Transparency in Public Procurement through e-Procurement in India. Retrieved from http://www.icommercecentral.com

[6] Das, R. K., Patra, M. R., & Panda, S. K. (2010). An e-governance project monitoring initiative in India: A case study of e-procurement. In Proceedings of the International Conference on Theory and Practice of Electronic Governance (ICEGOV '10), Computer Science.

[7] Bikshapathi, K., & Raghuveer, P. (n.d.). Implementation of eProcurement in the Government of Andhra Pradesh: A case study. Retrieved from https://procurementobservatoryraj.in

[8] Ramanujam, P. G. (n.d.). eGovernment: Strategies for successful eProcurement. Retrieved from http://scienceandnature.org

[9] Somasundaram, R. (n.d.). INDIA: Case study on e-Government Procurement Development. Asian Development Bank. Retrieved from https://www.adb.org

[10] Patel, P. H. (n.d.). A study of eProcurement practices in selected organizations in Gujarat. Retrieved from https://www.gtu.ac.in

[11] National Institute of Government Purchasing (NIGP). (n.d.). The Value of eProcurement/ERP Solutions: A case study. Retrieved from www.naspo.org

[12] Central Public Procurement Portal (CPPP). (2020, January). CPPP Newsletter.

[13] Central Public Procurement Portal (CPPP). (2020, January). Tender Statistics for the Organizations Using eProcurement.

[14] Central Public Procurement Portal (CPPP). (2017-18). Annual report on Central Public Procurement Portal (CPPP) based on the usage.

[15] Gupta, M., & Narain, R. (n.d.). A survey on adoption of e-procurement in Indian organizations. Motilal Nehru National Institute of Technology, Allahabad.

[16] Angeles, R., & Nath, R. (n.d.). Business-to-business e-procurement: Success factors and challenges to implementation. Supply Chain Management: An International Journal, 12(2), 104–115.

[17] Hardy, C. A., & Williams, S. P. (n.d.). E-government policy and practice: A theoretical and empirical exploration of public e-procurement. Government Information Quarterly, 25(2), 155–180.

[18] Lee, J., Oh, K., & Kwon, H. Y. (n.d.). Striving for transparency and efficiency in e-government: Procurement reform through e-procurement. In Proceedings of the 2nd International Conference on Theory and Practice of Electronic Governance, Egypt.

[19] Padhi, S. S., & Mohapatra, P. K. J. (n.d.). Adoption of e-procurement in government departments. Electronic Government: An International Journal, 7(1/2), 41–59