

# Online Submission and Automated Evaluation Framework for Public Procurement under Uttarakhand SBD System

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**Abstract:** *Procurement is an essential process for infrastructure and service provision; however, the current tendering processes governed by the Uttarakhand Standard Bidding Document guidelines are all manual, unintegrated, and inefficient processes that are inefficient, lack transparency, accuracy, and auditability. A proposal aims to overcome these challenges of the current tendering processes to create an efficient and automated e-procurement system that is transparent in its operations. The framework aims to encompass all aspects of the procurement process, from the preparation of the tender to the reporting of the awarded contract to the government of Uttarakhand. The implementation of a rule-based evaluation engine enforces consistent evaluation based on the SBD criteria, and AI-based anomaly detection improves risk management and governance. The system was tested in an infrastructure procurement use case, reducing the bid evaluation time from 4-5 hours to 10-15 minutes (94% efficiency gain). The framework achieved high accuracy, repeatability, and auditability through automation, real-time analytics and audit trails - offering a scalable platform for smart public procurement.*

**Keywords:** E-Procurement; Automated Bid Evaluation; Public Procurement; Decision Support System; Transparency; AI-based Evaluation

## 1. Introduction

One of the most important functions of government administration is public procurement since it deals with the procurement of goods, works, and services needed in the welfare of the people, development of infrastructure, and efficient execution of governance (Panayiotou et al., 2004). Governments incur high expenses in the procurement to construct roads, bridges, schools, hospitals, water supply systems and other developmental projects using large sums of public money (Croom & Brandon-Jones, 2007). Thus, a proper procurement system is the key to value-based money, transparency, accountability and prompt implementation of the state projects. Public procurement in terms of governance is strategic in fostering economic growth, healthy competition, local industries and optimum use of the state resources (Das, 2025). When properly organized procurement system assists in reducing corruption, minimizing of fund wastage and enhancing trust between government departments and contractors as well as the citizens (Agrell et al., 2004). It also makes sure that the procurement decision is taken in accordance to the laid down rules, regulations, and technical standards (Negi et al., 2024).

Conventionally, many government departments used to conduct tendering processes manually via paper-based systems. These traditional ways include physical delivery of bids, paperwork examination, time-consuming processes of approval, human-based processes (Aguiar Costa & Grilo, 2015). A number of challenges are common with such systems, which include delays in processing of bids, lack of transparency, excessive administrative expenses, errors in document handling, poor participation of bidders and chances of manipulation or favouritism (Omweri, 2025). The digital transformation in procurement incorporates e-tendering, electronic bid submission, automated document verification,

online bid evaluation and real time monitoring of procurement activities (Gulati & Shama, 2024). These systems help increase efficiency, lower processing time, increase transparency, and make the environment more competitive to the bidders (Uwimpeta & Akims, 2025).

Standard Bidding Document (SBD) systems and e-procurement portals have been implemented in India in different states to modernize the procurement practice. One such project is the Uttarakhand SBD System which is an initiative to standardize tender processes, compliance and encourage fairness in public procurement (Bai & Qiu, 2023). Nevertheless, a more integrated model that integrates online submission systems with automated bid evaluation methods are still necessary. This structure can considerably minimize manual interventions, enhance the accuracy of decision-making, and reinforce governance results (Gao et al., 2026).

Therefore, the study aims at establishing an Online Submission and Automated Evaluation Framework of Public Procurement under Uttarakhand SBD System to solve the current problem areas and help in transforming procurement to a smarter, quicker and more transparent environment (Croom & Brandon-Jones, 2007).

The Standard Bidding Document (SBD) System has been implemented by the Government of Uttarakhand as a significant move towards enhancement of consistency, transparency, and accountability in government procurement (Thai, 2001). A Standard Bidding Document refers to an organized format, terms, eligibility criteria, technical requirements, contractual terms and conditions, and evaluation processes adopted by government departments during the invitation of tenders to public works, goods, and services (Panda & Sahu, 2012).

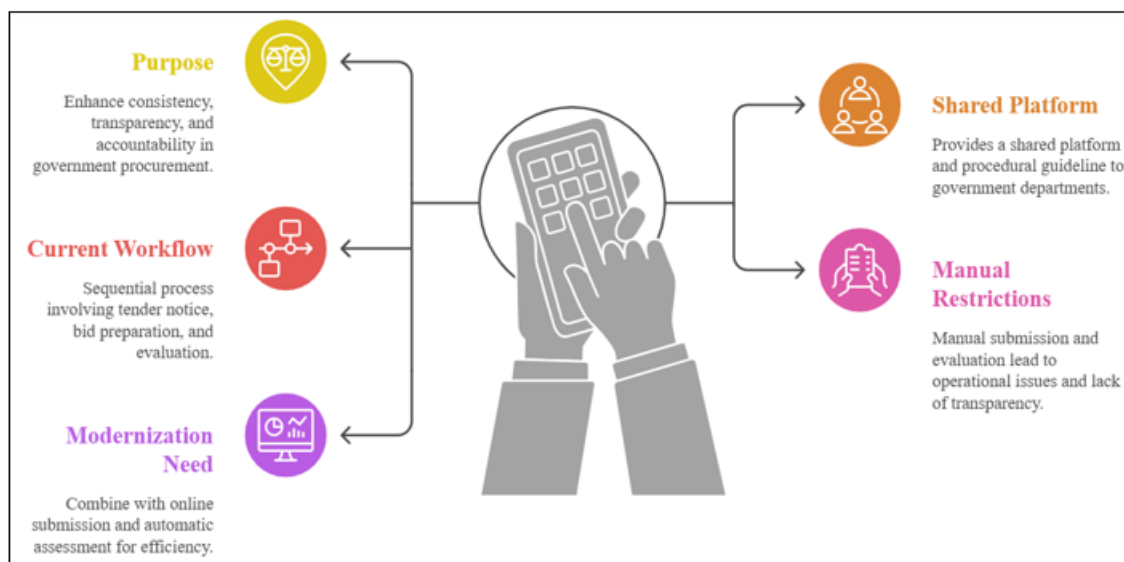
The Uttarakhand SBD System offers a shared platform and procedural guideline to a number of government departments including Public Works, Irrigation, Rural Development, Urban Development, Energy as well as other government agencies (Davila et al., 2003). This standardization will assist the procurement officials as well as the bidders in knowing their roles and responsibilities effectively and reduce differences in tender practice between different departments (Croom & Brandon-Jones, 2007).

Currently, procurement process under the Uttarakhand SBD System is typically in a sequential manner. The involved department, first, determines the project requirement and draws the tender notice and technical specifications, estimated cost, eligibility criterion and the conditions of the contract (Khanh, 2014). Once competent authorities approve the tender, it is published to be participated by the people. Interested contractors/suppliers obtain/download tender documents and prepare the necessary technical and financial bids and submit them within the stipulated deadline (Afolabi et al., 2019). The assessment procedure typically starts by examining obligatory documents like registration certificates, experience records, financial reports, earnest money deposit,

affidavits and compliance statements (Hossain Saad, 2025). Successful bidders move to financial assessment phase where the price quoted is compared and a successful bidder or most appropriate bidder is selected based on the rules. Lastly, a contract is awarded and the approval is given (Gulati & Shama, 2024).

Despite the advancement in procedural consistency by the SBD framework, a large number of procurement activities remain based on manual or semi-digital, which poses a number of operational issues (Tiwari et al., 2023). Remote contractors might experience problems with the timely submission because of the restrictions imposed on traveling to the office, printing documents, and because of reliance on office hours (Gujar & Narahari, 2010).

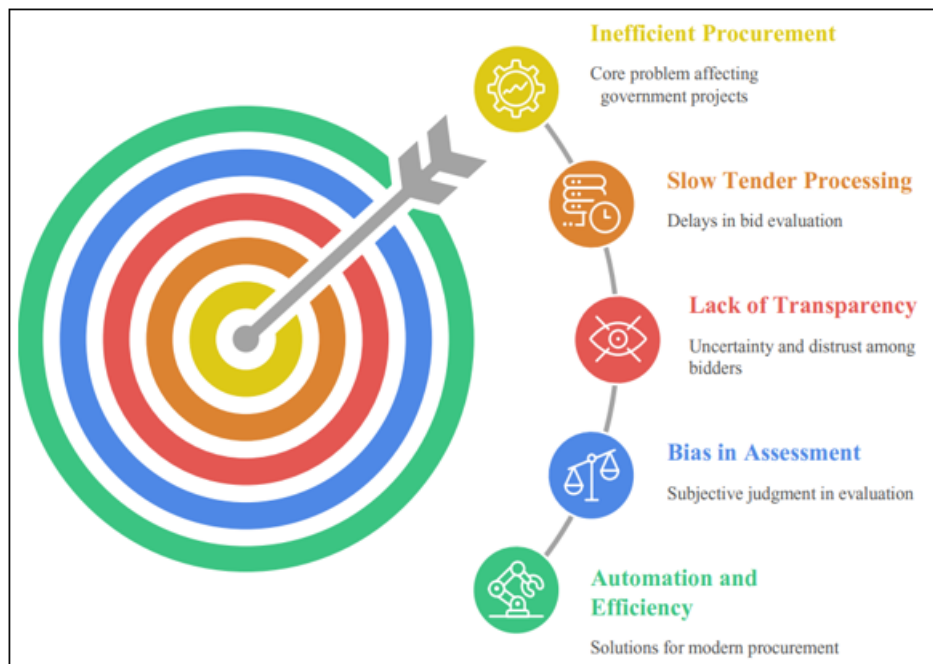
When a lot of tenders is handled manually, record management is also cumbersome and retrieval, auditing and monitoring difficult (Neupane et al., 2012). Figure 1 presents the overall rationale for transforming the existing manual procurement system into a transparent, efficient, and digitally integrated online tender management framework.



**Figure 1:** Conceptual framework under the Uttarakhand SBD procurement process

These challenges bring about a great demand on research to come up with a new technology-advanced platform of online submission and automated bid assessment. Figure 2 shows the

key obstacles in the public procurement process, such as delays, lack of transparency, manual inefficiencies, compliance problems, and administrative complexity.



**Figure 2:** Public procurement challenges

Delay in processing of tender is one of the big issues in the current procurement systems. The time spent in traditional or semi-manual processes is considerable to submit documents, open bids, check eligibility requirements, technical evaluation, financial analysis, approvals, and final award. The process is very slow as each stage requires handling of records manually, checking again and again, inter-departmental communication (Panayiotou et al., 2004). These delays may delay the start of projects, raise administrative expenses and have an implication on the completion of the public infrastructure works on time. The delayed procurement in areas like road, water supply, medical facilities and education infrastructure directly affects the delivery of the services to the people. Thus, minimizing processing time has become a critical research agenda (Davila et al., 2003).

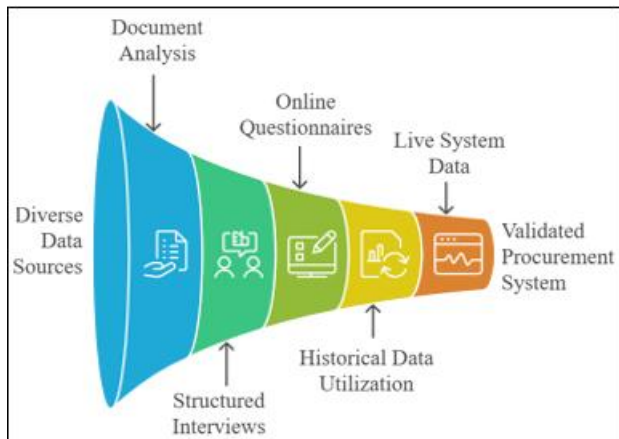
Thus, the main issue to be discussed within this study is a lack of an integrated digital system that will merge online tender submission with automated bid evaluation within the framework of the Uttarakhand SBD. The urgency is to find a strong, transparent and efficient solution that reduces human input, speed of the tender process, objective assessment, and enhances responsibility in government procurement. The research problem addressed in this study is the design, development and assessment of an integrated Online Submission and Automated Evaluation Framework on Public Procurement within the Uttarakhand SBD System. The key element of the research is the creation of an automated bid evaluation model related to the predetermined eligibility criteria, technical compliance parameters, and financial comparison rules in accordance with the SBD provisions. The framework will minimize the human intervention in routine activities and ensure fairness, consistency and regulatory adherence.

## 2. Methodology

This research employed a hybrid research approach (Figure 3), combining exploratory, design and validation studies, for creating an automated public procurement system under

Uttarakhand Standard Bidding Document (SBD) system. The exploration phase included procurement policy analysis, review of SBD tender documents, past tender data, and consultations with key stakeholders to identify the key issues of procurement process delays, paperwork, lack of transparency, manual verification, and subjective evaluation of bids. In-depth interviews with procurement officials, evaluators, and administrators, and surveys among bidders, were conducted to understand operational challenges and expectations. The TenderEval Automated Bid Evaluation System was designed and developed based on the above insights as a secure web-based application with user registration, tender publication, online bid submission with guidance, automated document verification, integration with digital signatures, eligibility check, turnover and experience check, financial bid analysis, L1 determination and AI-based flagging of risks. Algorithms for GST verification, PAN card validation, EMD verification, compliance and bid ranking were developed to automate a fair and transparent bid evaluation. It was tested using live data and pilot studies to compare manual and automated procurement. Evaluation metrics like accuracy, speed, transparency, compliance and user acceptance validated substantial gains in efficiency, consistency, fairness and speed of procurement processes.

The system has a secure user registration and authentication system with distinct access rights among various user types including administrators, evaluators and bidders. All the users receive credentials and permissions based on their role in the procurement process. Administrators manage system configurations and users, evaluators assess bids and evaluate submitted bids, and bidders participate in tenders and track the status of their applications. Password-protected log-ons ensure access to non-public procurement information.



**Figure 3:** Research methodology framework illustrating the integration for developing a validated procurement system

Figure 4 presents the core operational modules of the proposed digital procurement platform designed to ensure secure access, efficient tender management, systematic bid submission, and compliance control.



**Figure 4:** Functional modules of the proposed procurement system

### 3. Results and Discussions

The findings suggest that the suggested platform can effectively combine both administrative control, bidders, automated compliance verification, transparent evaluation logic, and digital reporting into one online platform. The framework had proven itself to minimize manual effort, enhance processing speed, ensure record of decisions that can be traced, and produce the objective result determined by predefined rules. The results of this chapter are drawn in sections and with reference to the outputs of generated systems, interface functions, validation indicators and operating observations. These findings give an indication on the viability and success of the suggested automated procurement model.

#### 3.1 Overall System Performance

The TenderEval system was tested in a fictional infrastructure procurement exercise that covered the entire tender process. The system demonstrated seamless data collection, processing, validation and decision-making in an integrated process. From a systems engineering perspective, the system

provided functional cohesion and modular interoperability whereby each module (submission, validation, evaluation, reporting) was able to operate independently and in a synchronised fashion. This removed inter-process and data duplication lags. Our research shows that automation not only reduced the manual effort but also resulted in deterministic decision-making, in which the decision-making process is based on rules rather than interpretation. This is critical for public procurement systems to be repeatable and compliant.

#### 3.2 Role-Based Access Control

The system's Role-Based Access Control (RBAC) ensured secure data access. Technically, the system uses user-role mapping and permission tables for access control, which checks every operation (read/write/update) before they are executed. This helps prevent data leaks and privilege escalation, particularly during sensitive operations such as financial bid opening. The duty segregation ensures the principle of least privilege and good system design, essential for e-governance systems integrity. Further, session management and authentication checks avoid unauthorised access, adhering to digital security practices.

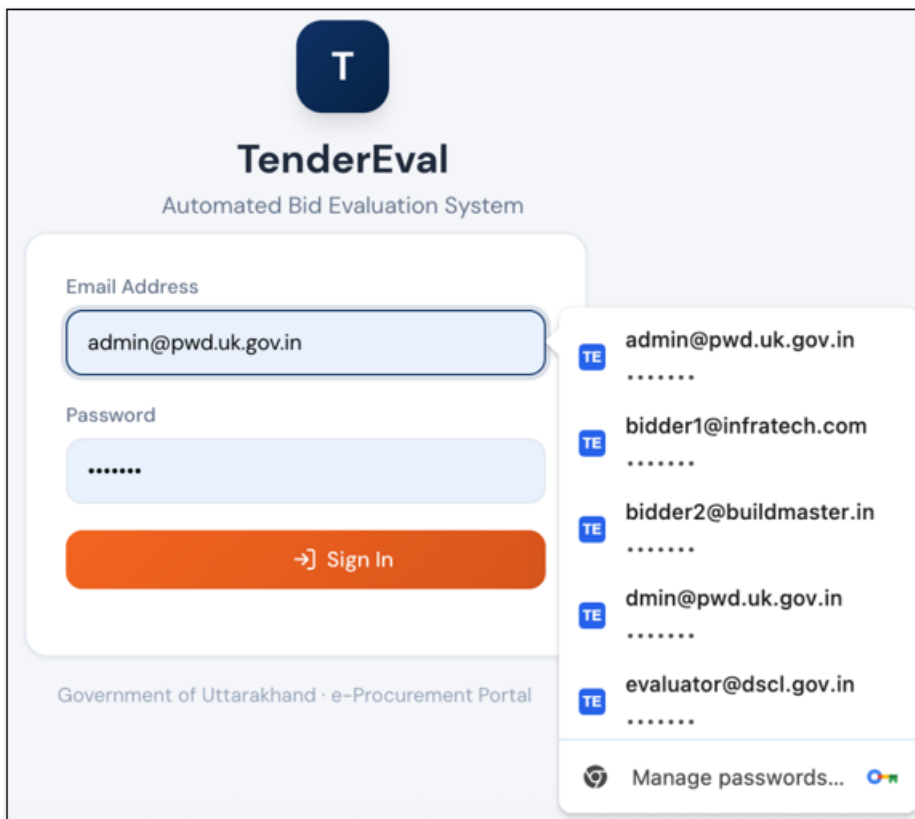


Figure 1: Secure user interface displaying user authentication and role-based access control

### 3.3 Administrator Dashboard and Analytics

The administrator dashboard is a type of real-time decision support system (DSS) that combines database queries with visual components. The KPIs are dynamically loaded via queries to the back-end and visualised using graphic elements, simplifying the process of analysing complex data. In terms of data mining, the dashboard converts raw procurement data into meaningful information using

aggregation operations and data visualisation (charts, indicators). This enables:

- Process monitoring (tender lifecycle tracking)
- Cost analysis (bid vs estimate)
- Operational diagnosis (delay or bottleneck identification)

The real-time update capability provides data integrity and timeliness, essential for time-critical procurement activities.

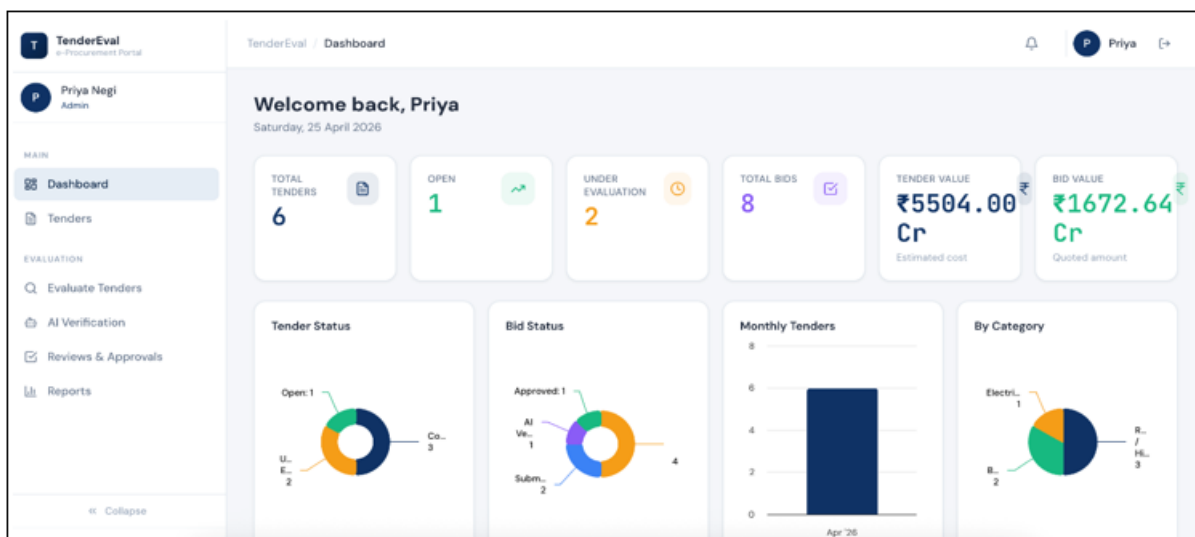


Figure 2: Administrator dashboard illustrating real-time procurement analytics

### 3.4 Listing, Search and Filter Tender

The module offers fast searching through indexed database queries and efficient search algorithms. Unlike conventional systems that use manual search, our system uses dynamic

queries and filtering, simplifying the search process from linear to close to constant time. Multidimensional filtering provides a decision-making tool, enabling users to filter tenders by cost, time and category. This enhances information availability and speeds up decision-making. In terms of

system design, options such as pagination and lazy loading enable scalability, enabling the system to work with large amounts of data without compromises.

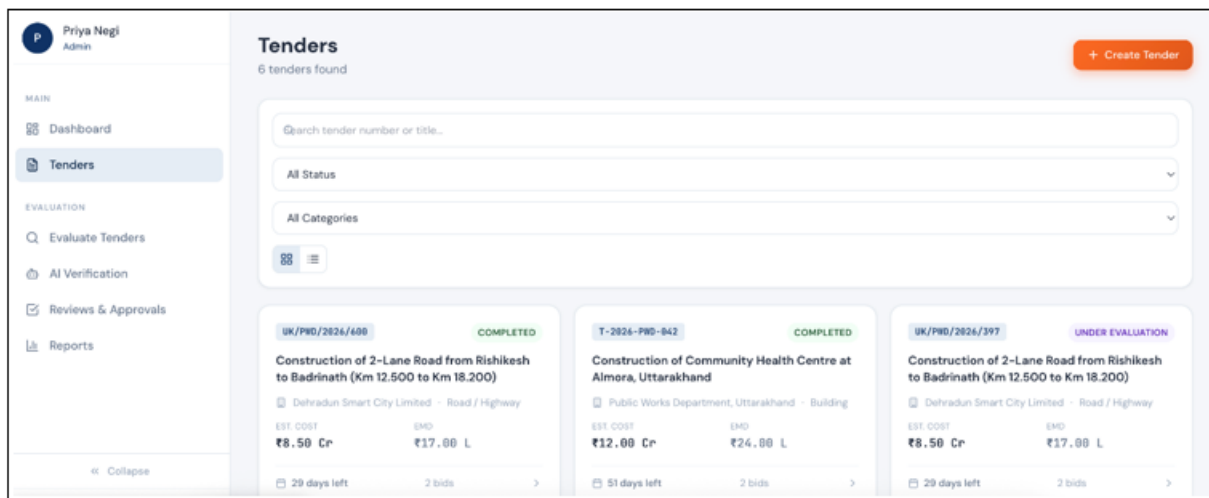


Figure 3: Tender listing, search, and filtering interface

### 3.5 Tender Creation and Management

The tender creation feature enforces data standardization and schema consistency with structured data entry forms and validation. This guarantees a standardised format for tenders, critical for subsequent processing. Data validation (e.g.,

number checks, required fields) provides an integrity layer, ensuring incorrect or incomplete data is not entered. In terms of process control, lifecycle-based controls ensure that operations adhere to a state transition (draft → published → evaluation) approach, preventing unauthorized changes and enforcing process integrity.

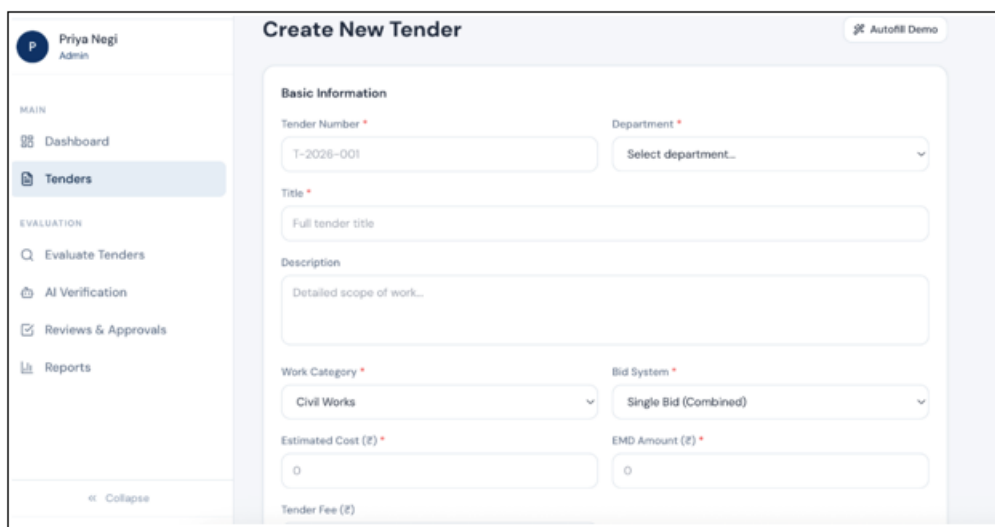


Figure 4: Tender creation interface illustrating the structured form-based input system

### 3.6 Tender Detail and Lifecycle Control

The module combines the data visualization with the control functions to give users a view into the tender process. Furthermore, the addition of temporal tracking provides users

with a time-based aspect to the tender processing. Additionally, the module acts as an intermediary between the data and the users to enable the synchronization of the various tasks related to the tenders.

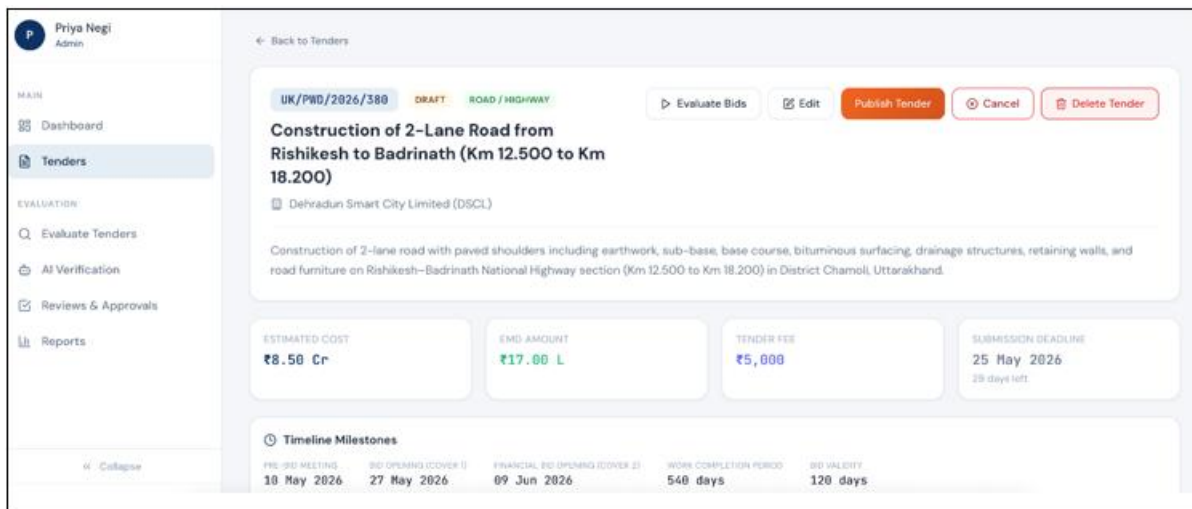


Figure 5: Tender detail and management interface

### 3.7 Bid Submission Workflow

By guaranteeing that each bid is validated in this way, the system will minimise the risk of missing or invalid bids. The workflow will be implemented in a way that each stage of the validation process meets certain criteria in order to continue forward to the next step. This will ensure that the bids are:

- Improved data integrity
- Reduced error propagation
- Consistent format for evaluation

The ability to provide feedback regarding the progress and validation of each bid will allow for human-computer interaction (HCI) to provide the optimal user experience to each user while still meeting the compliance standards of the process.

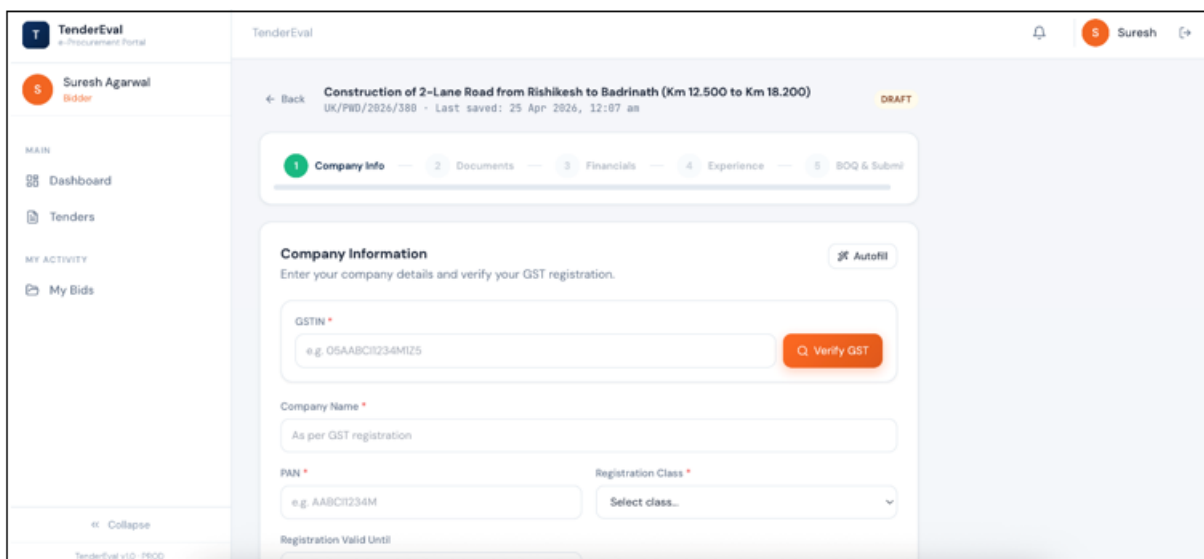


Figure 6: Sequential bid submission workflow

### 3.8 AI-Based Bid Evaluation

The evaluation module is the main computational intelligence component. It combines rule-based and statistical techniques for automated decision-making. The eligibility condition is based on a binary decision rule, allowing only qualified bids. The scoring system adopts a multi-criteria decision-making

(MCDM) model to assess bidders. The outlier detection mechanism based on statistical measures (e.g., Z-score) improves governance by detecting anomalies in bid values. This introduces risk intelligence, allowing fraud prevention. The automatic L1 calculation guarantees impartial financial analysis, avoiding human bias and arithmetical errors.

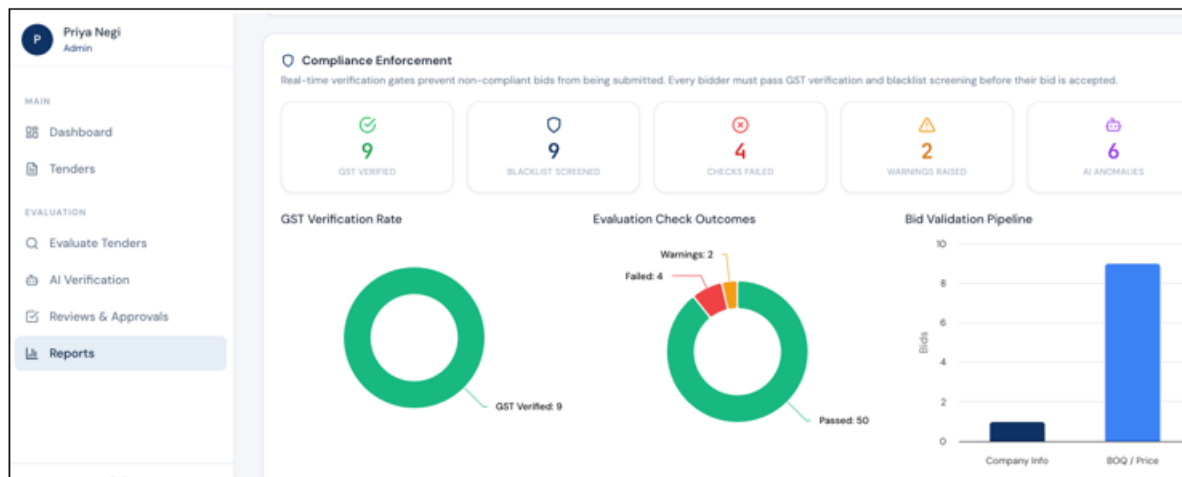


Figure 7: AI-based bid evaluation results interface

#### 4. Performance Evaluation and Discussion

The analysis of the TenderEval system reveals significant gains in efficiency, accuracy, transparency and analytical power over the traditional manual procurement processes. The system decreased time spent on evaluating bids from around 4-5 hours to 10-15 minutes per bid, resulting in 94% efficiency gain, largely because of rule execution automation, parallel processing for eligibility criteria validity and removal of duplicate manual processes. The rule-based evaluation system achieved 100% accuracy in terms of computational error-free results and consistent application of Standard Bidding Document (SBD) evaluation criteria for all bidders, thus removing subjective biases and human inconsistencies. Moreover, the system improved transparency and auditability by showing the results of each criterion, decision logic, and audit logs with time-stamped activities, allowing complete decision history and preventing disputes. In terms of analysis, the integrated reporting dashboard offered real-time analytics view of procurement patterns, bidder engagement and cost variations, in which the difference between estimated and bid values reflected market competition and opportunities for cost reduction. Moreover, the lifecycle analysis showed a well-cultivated process with limited bottlenecks, and the system proved to be capable of real-time procurement operations. In summary, the outcomes confirm that the proposed system converts traditional bid evaluation to a quick, accurate, and data-driven process that meets current e-governance needs.

#### 5. Conclusions

This research shows the potential of the proposed TenderEval - Automated Bid Evaluation System to enhance the effectiveness, transparency, precision, and impartiality of public procurement under the Uttarakhand Standard Bidding Document (SBD) system. Online tendering, automated vendor qualification, technical bid review, financial bid assessment, and L1 selection in a digital platform have effectively reduced human intervention, paperwork and administrative lag in the procurement process as well as any possible biases in decision-making. The validation results confirm the speed improvements, auditability, compliance and trust, and the proposed framework is a viable solution to the digital transformation of government tendering. However, as any digital governance system, further effort is required to

design the current validated framework into a smart and scalable procurement system. Subsequent actions should involve pilot testing in government departments to determine how effective it is in actual procurement situations and identify institutional impediments to implementation. Techniques, such as artificial intelligence, machine learning, Natural Language Processing (NLP), Optical Character Recognition (OCR), blockchain and predictive analytics can be used to improve bid evaluation, anti-fraud, document processing and audit security. Connection and compliance checks can be enhanced by linking with national digital platforms such as GST, PAN, and Government e-Marketplace (GeM). Other improvements, including mobile compatibility, vendor rating, multi-lingual interfaces, and national scalability will make the framework more accessible and scalable across states and industries. These enhancements will support the development of TenderEval as a state-based procurement system to a single national e-procurement system that can be used to assist in transparent, accountable, and efficient procurement in India.

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