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Ethical Challenges in Construction Procurement Ensuring Transparency in Subcontractor Selection

Discuss how modern tools and methodologies can help maintain fairness and transparency in procurement.

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Abstract

The construction industry faces persistent ethical challenges in procurement, including issues like favoritism, bribery, and hidden agreements, which compromise fairness, inflate costs, and erode trust. This article emphasizes the crucial importance of transparency in subcontractor selection, a key issue that needs urgent attention. It also highlights modern tools and methodologies that can address these challenges. E-tendering platforms, blockchain, and AI-powered decision-making systems provide structured and impartial frameworks for evaluating bids, ensuring accountability and fairness. By leveraging these innovative practices and overcoming barriers like resistance to change and confidentiality concerns, the construction sector can move toward a more ethical and efficient procurement system. The article also envisions a future where emerging technologies, such as smart contracts and IoT integration, create an equitable and transparent procurement ecosystem.

Keywords— *Construction Procurement, Ethical Challenges, Transparency, Subcontractor Selection, Blockchain Technology, AI in Construction, E-Tendering Platforms, Smart Contracts, Sustainability, Accountability in Procurement.*

I. INTRODUCTION TO ETHICAL CHALLENGES IN CONSTRUCTION PROCUREMENT

Many people see the construction industry as prone to dishonesty, especially when choosing suppliers and subcontractors. Problems like bribery, secret deals, and favoritism often lead to higher project costs, lower quality, and lost trust among those involved. A new study shows that construction workers usually face dishonest actions, such as fake high prices and secret payments, which damage the fairness of the buying process [1].

The complicated and scattered nature of construction projects makes these ethical problems worse. Many people with different goals participate, creating situations where dishonest actions might grow. Watts et al. [2] say that construction projects' unique and short-term nature often leads to ethical problems requiring strong rules to guide behavior.

Solving these ethical problems is very important for the long-term success and image of the construction industry. Using open and fair buying practices keeps up with legal rules while building a culture of honesty and responsibility. Zhao et al. [3] suggest that changing buying systems and finding the proper selection criteria can raise ethical standards in construction.

This article will examine how ethical buying failures affect the industry, discuss the rules of honest buying, and review modern tools and methods that help ensure fairness and transparency in subcontractor selection.

II. IMPACT OF ETHICAL LAPSES IN PROCUREMENT

Unethical actions in buying construction materials and services create big problems affecting many project parts. These wrongdoings damage the honesty of the process and hurt the project's success and long-lasting quality. The harmful effects of such actions fall into three groups: financial, operational, and reputational impacts.

a. Financial Consequences

One big problem caused by unethical buying actions is losing money for everyone involved. Tricks like rigging bids, working secretly together, and charging too much make projects cost more, stretching budgets and cutting profits. Amoah and Steyn [1] say that unfair practices like rewards for tenders or showing favoritism add extra costs for builders and clients, causing long-term financial liabilities [1]. These money risks worsen when harmful materials or services are used to save money after unfair deals.

b. Operational Challenges

Unethical actions also profoundly affect how projects run. Choosing favorites or biased subcontractors means picking unqualified vendors, lowering work quality, and causing delays. Zhao et al. [3] stress that bad buying choices lead to inefficiencies, arguments, and redoing work, all hurting project timelines [3]. Work challenges spread, making it hard for people to work together and creating a harmful work atmosphere.

c. Reputation Damage

Besides financial and operational problems, unethical actions harm the reputation of construction companies and their partners. Bad news from unfair buying practices reduces trust among clients, investors, and the public. Watts et al. [2] point out that reputation is a valuable asset for construction firms, and bad behavior can seriously damage this trust, affecting future business chances [2]. In severe cases, companies might face legal troubles, bans from government contracts, and loss of professional licenses.

d. Legal and Rule Problems

Unethical actions often attract the attention of lawmakers and might lead to legal issues. Breaking buying laws and rules can result in lawsuits, fines, and punishments. Companies must navigate different legal systems that stress fair buying practices as construction grows worldwide. Following rules is now seen as an essential duty of construction firms to keep things clear and honest [3].

Given these problems, construction companies need to build strong ethical systems that focus on clarity and responsibility in buying. Using new tools and methods, discussed later, helps reduce these ethical risks while making buying more efficient and fairer.

III. SUBCONTRACTOR COMPETITIVENESS

The strength of subcontractors matters significantly in keeping things open and fair when buying construction services. Honest buying methods help subcontractors compete equally, picking based on skill, ability, and meeting project needs, not on favoritism or bad influence. Intense competition among subcontractors brings new ideas, saves money, and keeps quality high, which are key to project success. When honesty is lacking, subcontractor strength weakens. For example, favoritism or secret deals during bidding might lead to choosing subcontractors who are not right for the job. This affects work quality and stops other good subcontractors from trying in future bids, lowering market strength. Zhao et al. [3] say that a fair and open bidding process is needed to keep subcontractors competing fairly and to build trust in the industry.

Making subcontractors stronger needs clear and set standards during buying. Amoah and Steyn [1] stress that clear evaluation criteria like technical skill, safety records, and past performance remove bias and give all subcontractors

a fair shot at contracts. These methods push subcontractors to get better and meet industry standards. A few favored subcontractors might take over if competition is weak, cutting diversity and new ideas. This not only limits project choices but might also raise costs due to less bargaining power. Honest buying systems try to stop such takeovers by making the picking process competitive, open, and free from conflicts.

By strengthening subcontractors, construction companies can improve project quality, spark new ideas, and build trust across the industry. Using new buying tools and technologies, discussed later, further helps these goals by making the evaluation process automatic and standard, lowering bias chances, and maintaining a fair field for all subcontractors.

IV. PRINCIPLES OF ETHICAL PROCUREMENT

In construction, Ethical Procurement depends on three fundamental ideas: Transparency, accountability, and fairness. Following these ideas helps pre-construction managers choose subcontractors and make buying decisions using clear guidelines without unfair pressure. These ideas build trust among the people involved and reduce the chances of dishonest actions, like favoritism and corruption.

a. Transparency:
   Transparency in buying supplies is essential for maintaining honesty and fairness when picking subcontractors. It means giving everyone involved, like subcontractors, precise and easy-to-find details about how selections are made, evaluations happen, and decisions are reached. Open buying habits lower the chances of arguments and build a trusting space where subcontractors feel sure their offers get a fair look. Using online tendering tools and buying software makes things more straightforward by ensuring all offers are received, noted, and checked in an organized way [4].
b. Accountability:
   Accountability means everyone buying goods or services takes responsibility for their choices and actions. Ethical buying rules stress the need to write down each process step, from early checks to final deals, to create a clear record. Accountability tools like outside audits and frequent rule checks stop bad behavior and encourage following buying rules. Clear responsibility helps fix arguments and ensures buying choices match project aims [4].
c. Fairness:
   Fairness in procurement means giving all subcontractors the same chances to compete and be judged based on skill. Clear rules like technical skills, financial health, and safety history help construction companies remove bias and choose subcontractors reasonably. Fairness raises the quality of selecting subcontractors and makes the market more competitive by inviting different and skilled vendors. Fairness must deal with hidden decision bias through AI tools and decision support systems [5].

V. MODERN TOOLS FOR ETHICAL PROCUREMENT

Technology's growth has dramatically improved buying in construction, offering tools and systems that make subcontractor choice more transparent, fairer, and faster. Construction companies use new tools to follow ethical rules, reduce mistakes, and remove unfairness.

a. Procurement Management Software:
   Procurement management software changes how construction companies pick subcontractors and manage bidding. Tools like Procore, Oracle Aconex, and Autodesk Build simplify everything from RFPs to contract handling. These tools allow real-time tracking of buying activities. Every step gets recorded, making an audit trail that supports accountability. Automated bid checks reduce bias, standardizing how subcontractor skills and proposals get reviewed [6].
b. E-Tendering Platforms:
   E-tendering platforms play a significant role in making bidding very clear. These platforms provide one safe

place for subcontractors to send bids online. Every submission gets a timestamp and encryption, which lowers tampering or favoritism. Zhao et al. [3] show that E-tendering platforms probably attract more subcontractors, which means more competition and fair chances for all vendors. Platforms also let decision-makers compare bids using set rules that support fairness.

c. Blockchain Technology:
Blockchain technology is a new tool in construction procurement that keeps records safe and unchanged. It makes a shared book of buying actions blocking fake changes to bid papers or deals. Blockchain's openness gives everyone the same data, building trust and cutting fights. Smart contracts, self-working deals with set terms, can handle payments automatically and keep buying rules [7].

d. AI Powered Decision Making:
AI grows more common in finding patterns and oddities in buying data. AI tools study past data to foresee possible troubles – e.g., subcontractor failures or cost jumps. AI might also remove hidden bias in bid checks by offering fair advice using numbers. This way, choices rest only on worth and match moral rules.

e. Collaboration and Document Sharing Platforms
Collaboration tools like Microsoft Teams and Asana allow people to talk quickly and share documents with others. These tools put all project information in one place, so everyone buying things gets the correct and current information. These platforms make things clear and responsible; they lower the chances of misunderstandings or unequal information.

VI. CASE STUDY - LEVERAGING E-TENDERING SYSTEMS FOR TRANSPARENT PROCUREMENT IN A LARGE-SCALE MULTIFAMILY PROJECT

A compelling example of the effective use of modern tools in construction procurement is the 3800 Acqua project, a large-scale multifamily development in Suffolk, VA. This project demonstrated how adopting an e-tendering system could streamline the subcontractor selection, ensuring transparency, fairness, and operational efficiency.

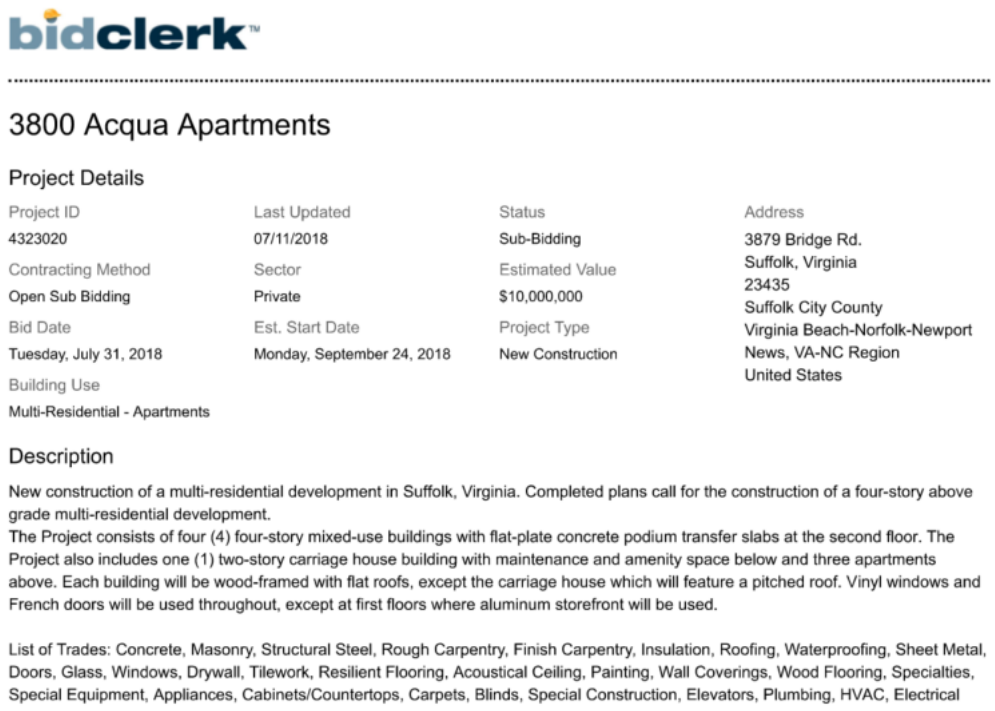
The project team used an e-tendering platform to manage bids from over 50 subcontractors, fostering a competitive and open selection process. The platform allowed for seamless distribution of standardized Request for Proposal (RFP) forms, which outlined all critical details required for accurate bid submissions. These RFP included essential project information, such as a link to the complete set of drawings, the project schedule, bid due dates, and specific project requirements. Additionally, the forms included a clearly defined scope of work for subcontractors to price, along with sections for unit pricing and value engineering suggestions. This structure allowed subcontractors to propose cost-saving measures and provided a framework for pricing any additional work that might arise during construction.

The RFP for the 3800 Acqua project was meticulously structured to ensure clarity and strict adherence to project requirements. Key elements included comprehensive payment terms, which specified that payments would be made on monthly draws based on work inspection and completion. Notably, payment for on-site materials was excluded to encourage steady work progress. A 10% retainage was held on all draws until the project's completion, ensuring subcontractor accountability and maintaining high-quality standards throughout the project lifecycle.

Additionally, subcontractors were required to provide a one-year warranty for their work following acceptance by the Owner, Owner's Lender, and Contractor. Compliance with the construction plans and specifications was strictly enforced, with no deviations or substitutions permitted unless prior written approval was obtained from the Owner. To promote pricing transparency, the RFP required lump-sum bids, with bidders expected to adhere to all applicable local, state, and federal building ordinances and regulations.

The RFP also outlined operational expectations. Subcontractors were required to maintain a clean and organized worksite, with trash removal mandated daily. They were also responsible for unloading materials provided by the contractor and ensuring proper traffic control for all material and equipment deliveries. These detailed requirements streamlined the bidding process and set clear expectations, promoting a fair, efficient, and transparent procurement process aligned with the project's objectives.

To expand the pool of competitive bids, the RFPs were distributed to subcontractors from the contractor's database and uploaded to widely used bidding platforms such as PlanHub, ConstructConnect, Bid Clerk, Blue Book Bid Network, Builders and Contractors Exchange, Dodge Report and BidNet. These platforms allowed for greater exposure to qualified subcontractors, ensuring a more extensive and diverse pool of bidders.



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3800 Acqua Apartments

Project Details

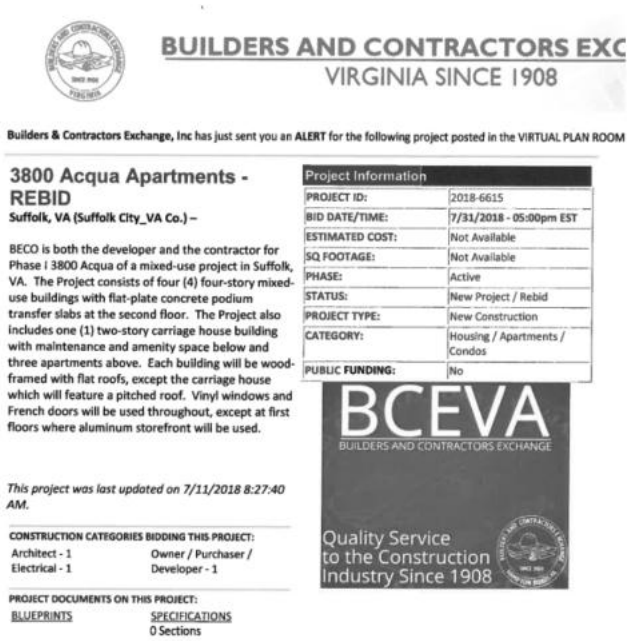
Project ID	Last Updated	Status	Address
4323020	07/11/2018	Sub-Bidding	3879 Bridge Rd. Suffolk, Virginia 23435 Suffolk City County Virginia Beach-Norfolk-Newport News, VA-NC Region United States
Contracting Method	**Sector**	**Estimated Value**	
Open Sub Bidding	Private	$10,000,000	
Bid Date	**Est. Start Date**	**Project Type**	
Tuesday, July 31, 2018	Monday, September 24, 2018	New Construction	
Building Use			
Multi-Residential - Apartments			

Description

New construction of a multi-residential development in Suffolk, Virginia. Completed plans call for the construction of a four-story above grade multi-residential development.
The Project consists of four (4) four-story mixed-use buildings with flat-plate concrete podium transfer slabs at the second floor. The Project also includes one (1) two-story carriage house building with maintenance and amenity space below and three apartments above. Each building will be wood-framed with flat roofs, except the carriage house which will feature a pitched roof. Vinyl windows and French doors will be used throughout, except at first floors where aluminum storefront will be used.

List of Trades: Concrete, Masonry, Structural Steel, Rough Carpentry, Finish Carpentry, Insulation, Roofing, Waterproofing, Sheet Metal, Doors, Glass, Windows, Drywall, Tilework, Resilient Flooring, Acoustical Ceiling, Painting, Wall Coverings, Wood Flooring, Specialties, Special Equipment, Appliances, Cabinets/Countertops, Carpets, Blinds, Special Construction, Elevators, Plumbing, HVAC, Electrical

Figure 1: 3800 Acqua Lifestyle Apartments "Bid Clerk" listing



BUILDERS AND CONTRACTORS EXC
VIRGINIA SINCE 1908

Builders & Contractors Exchange, Inc has just sent you an **ALERT** for the following project posted in the VIRTUAL PLAN ROOM

3800 Acqua Apartments - REBID
Suffolk, VA (Suffolk City_VA Co.) –

BECO is both the developer and the contractor for Phase I 3800 Acqua of a mixed-use project in Suffolk, VA. The Project consists of four (4) four-story mixed-use buildings with flat-plate concrete podium transfer slabs at the second floor. The Project also includes one (1) two-story carriage house building with maintenance and amenity space below and three apartments above. Each building will be wood-framed with flat roofs, except the carriage house which will feature a pitched roof. Vinyl windows and French doors will be used throughout, except at first floors where aluminum storefront will be used.

This project was last updated on 7/11/2018 8:27:40 AM.

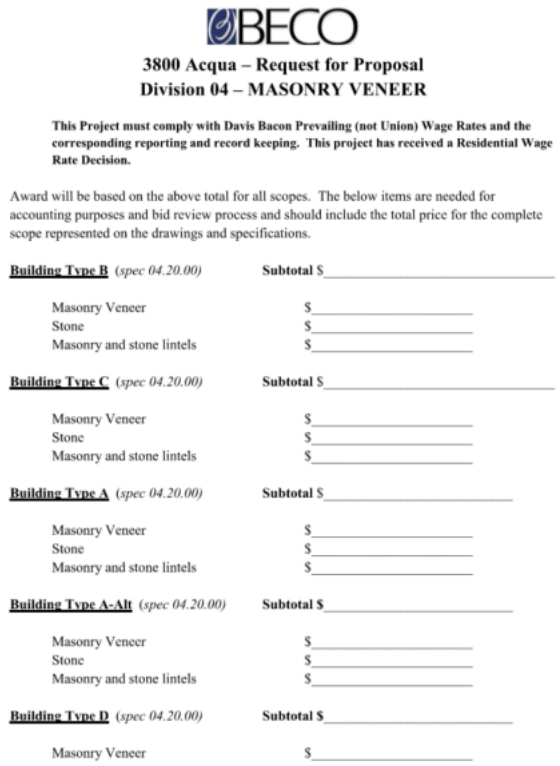
CONSTRUCTION CATEGORIES BIDDING THIS PROJECT:
Architect - 1
Electrical - 1
Owner / Purchaser / Developer - 1

PROJECT DOCUMENTS ON THIS PROJECT:
BLUEPRINTS
SPECIFICATIONS
0 Sections

Project Information	
PROJECT ID:	2018-6615
BID DATE/TIME:	7/31/2018 - 05:00pm EST
ESTIMATED COST:	Not Available
SQ FOOTAGE:	Not Available
PHASE:	Active
STATUS:	New Project / Rebid
PROJECT TYPE:	New Construction
CATEGORY:	Housing / Apartments / Condos
PUBLIC FUNDING:	No

BCEVA
BUILDERS AND CONTRACTORS EXCHANGE
Quality Service to the Construction Industry Since 1908

Figure 2: 3800 Acqua Lifestyle Apartments "Builders and Contractors Exchange" listing



BECO

3800 Acqua – Request for Proposal
Division 04 – MASONRY VENEER

This Project must comply with Davis Bacon Prevailing (not Union) Wage Rates and the corresponding reporting and record keeping. This project has received a Residential Wage Rate Decision.

Award will be based on the above total for all scopes. The below items are needed for accounting purposes and bid review process and should include the total price for the complete scope represented on the drawings and specifications.

Building Type B *(spec 04.20.00)* **Subtotal** $_____

Masonry Veneer $_____
Stone $_____
Masonry and stone lintels $_____

Building Type C *(spec 04.20.00)* **Subtotal** $_____

Masonry Veneer $_____
Stone $_____
Masonry and stone lintels $_____

Building Type A *(spec 04.20.00)* **Subtotal** $_____

Masonry Veneer $_____
Stone $_____
Masonry and stone lintels $_____

Building Type A-Alt *(spec 04.20.00)* **Subtotal** $_____

Masonry Veneer $_____
Stone $_____
Masonry and stone lintels $_____

Building Type D *(spec 04.20.00)* **Subtotal** $_____

Masonry Veneer $_____

Figure 3: Typical example of BECO Construction's RFP sheet

Using e-tendering tools and standardized RFPs enhanced the transparency of the subcontractor selection process and reduced administrative overhead, saving the project team time and resources. According to London et al. [4], integrating digital tools into procurement processes is critical to eliminating traditional inefficiencies and fostering ethical behavior in construction projects.

The 3800 Acqua project team set a benchmark for ethical procurement practices by incorporating such tools. The adoption of e-tendering, combined with clear project guidelines and competitive bidding practices, ensured the successful execution of the project while upholding transparency and fairness. This case study highlights the transformative potential of modern tools in streamlining procurement processes, ensuring compliance, and delivering value to all stakeholders.

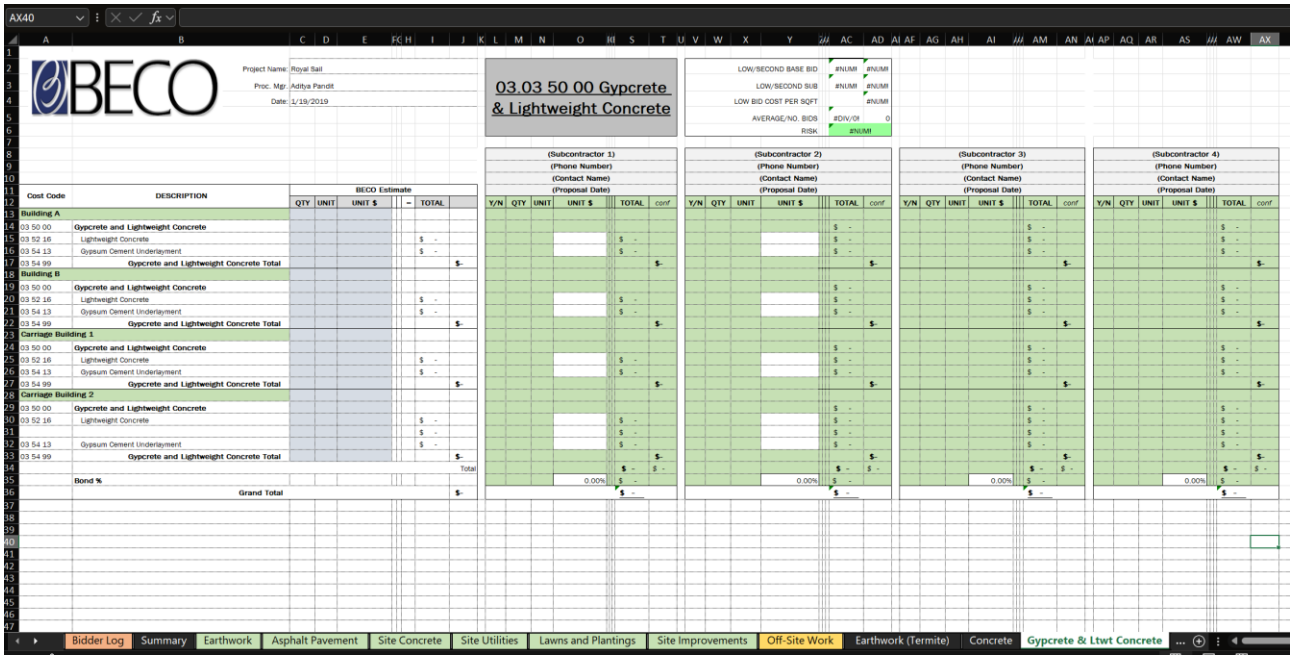


Figure 4: BECO Construction's Bid Tracking sheet

All received bids were organized and recorded in a tracking sheet, enabling the team to compare each subcontractor's scope of work on an "apples-to-apples" basis. If subcontractors omitted any line items, they were contacted to revise their bid to include the missing components. Once all bids were complete, a final decision was made on the lowest bidder. After this initial evaluation, shortlisted subcontractors were asked to present their portfolios and recommendation letters to facilitate the final selection.

Subcontractors with prior experience working with the contractor were given preference if their pricing was competitive and their performance on previous projects met expectations. Factors such as safety records, adherence to timelines, and overall ease of collaboration were carefully considered. Once selected, subcontractors were required to submit proof of meeting the necessary insurance requirements. Following this, they were issued a Subcontract Agreement for review and signature. Upon execution of the agreement, subcontractors were granted access to the job site and authorized to begin their work. This thorough and structured process ensured transparency, fairness, and quality in the subcontractor selection and onboarding.

All subcontractors who submitted bids but were not selected for the project were sent a personalized thank-you letter and constructive feedback. The feedback included comparing their bid to the winning bidder and indicating their ranking in the selection process. In cases where the bid amounts were very close, subcontractors were assured they would be strongly considered for future projects. This approach promoted transparency in the bidding process and demonstrated respect for the time and effort invested by all bidders.

In specific scenarios, multiple subcontractors were selected to expedite the project timeline. For example, two contractors were engaged during the concrete phase, each assigned two buildings. This strategy enabled simultaneous work on multiple buildings, allowing concrete to be poured concurrently, significantly accelerating the schedule and reducing the overall project duration. This collaborative and transparent approach fostered goodwill among subcontractors and optimized project efficiency.

VII. Methodologies for Transparent Subcontractor Selection

Implementing transparent subcontractor selection methodologies is critical to fostering fairness, efficiency, and trust in construction procurement. An excellent way to clarify things is by setting standard rules for choosing subcontractors. These rules include technical skills, financial health, safety history, and past work performance. Using clear rules helps construction managers judge subcontractors' abilities fairly, and everyone gets judged the same way. S. Patil et al. [9] highlight that clearly defined prequalification standards improve the quality of contractors selected and significantly enhance project success rates by reducing risks associated with unqualified bidders.

People often use weighted scoring systems to judge bids, remove unfairness, and support fair decisions. This method gives different importance to parts of the bid – e.g., cost, technical skills, proposed timelines, and following project rules. Khosa and Yusof [10] say weighted scoring systems offer a straightforward way to choose contractors, letting decision-makers focus on important things while keeping the judging process open. Initially, a fair bidding contest is crucial for openly selecting subcontractors. Open contests attract many possible subcontractors and inspire fresh ideas and cost-saving methods. Sharing clear RFPs (Request for Proposals) with all needed project details helps subcontractors give correct bids. Using digital platforms for submitting and checking bids makes things more open by removing manual mistakes and reducing chances for favoritism [9].

Adding third-party checks during buying steps helps ensure fairness and ethical rules are followed. Independent reviewers look at the bidding and picking process to find mistakes or possible unfair actions. Olawumi et al. [11] say third-party checks add another level of responsibility – making dishonesty or bias in picking contractors less likely [11]. Construction project leaders create a transparent and fair buying atmosphere using these ways. Standard rules, fair judging systems, competitive offers, and outside watching not only follow ethical rules but also build trust with stakeholders and improve project results.

VIII. CHALLENGES IN IMPLEMENTING TRANSPARENT PRACTICES

Clear buying practices are essential for fairness and speed, but using them brings many problems. These problems often come from not wanting change, complex new systems, and the need to balance different needs. One big problem is not wanting to change in groups that are used to old buying ways. Old habits often miss the openness and honesty seen in transparent systems. Workers and partners might not want new tools or rules, worrying about more checks or messing up old ways. Khoso and Yusof [10] say this is very common in fields like building, where top-down systems and old ways are strong.

Using new procurement tools like blockchain systems, online bidding, or AI checking tools often requires a lot of money and is very hard. Teaching staff to mix new systems with old ways and keep systems safe needs time, skill, and money. Small companies, especially, might find it hard to find the needed resources to make a difference in tech use in the field. While openness is essential, it must mix with secret keeping, especially when checking bids. Sharing private info, like price plans or unique methods, could hurt subcontractors and fair play. Finding the right mix between openness and keeping bidders' secrets needs careful planning of buying systems and following moral rules.

IX. FUTURE OF ETHICAL PROCUREMENT IN CONSTRUCTION

The future of fair buying in buildings uses new tech and creates a more equitable buying system. Using new ideas and caring about fairness, the field can fix current problems and develop new rules for fair actions. New tech is ready to change buying in buildings. For example, it provides unchangeable records and precise ways to cut the chance of cheating and ensure honesty. Smart contracts let deals happen automatically, making payments and checks easier. The Internet of Things (IoT) can make buying better by providing real-time information on material use and gear work, helping better choices. Olawumi et al. [11] say these techs have tremendous power to change buying ways by making them faster and more honest.

The future buying system in building dreams of more fairness and openness. This means making digital tools easy to get, helping teamwork among partners, and making places that care about fair actions with cost and speed. Rules and field standards must change to help these changes make sure everyone is treated fairly. Openness plans must go beyond tech, bringing changes in groups to care about honesty, fairness, and truth. By following these trends and fixing use problems, the building field can have a new and morally strong buying system, making a new level of greatness.

X. CONCLUSION

The ethical challenges in construction procurement underscore the need for transformative practices and tools to ensure transparency, fairness, and accountability in subcontractor selection. Implementing structured methodologies, such as standardized prequalification criteria, weighted scoring systems, and third-party audits, mitigates bias and unethical practices risks. Furthermore, adopting emerging technologies like blockchain, AI, and IoT fosters a more efficient and transparent procurement process. While challenges such as resistance to change and balancing confidentiality remain, these can be addressed through stakeholder education, resource allocation, and robust legal frameworks. By embracing innovative solutions and prioritizing ethical standards, the construction industry can improve operational efficiency, enhance stakeholder trust, and set a benchmark for sustainable growth. The future of procurement lies in the seamless integration of technology and ethical practices, paving the way for a fairer and more accountable construction ecosystem.

REFERENCES

[1] C. Amoah and D. Steyn, "Barriers to unethical and corrupt practices avoidance in the construction industry," *International Journal of Building Pathology and Adaptation*, vol. 41, no. 6, pp. 85–101, 2022.

[2] G. Watts, J. Challender, A. Higham, and P. McDermott, *Professional Ethics in Construction and Surveying*. Routledge, 2021.

[3] N. Zhao, F. J. Ying, and J. Tookey, "Construction Procurement Selection Criteria: A Review and Research Agenda," *Sustainability*, vol. 14, no. 22, p. 15242, 2022.

[4] K. London, J. Oliver, and P. Everingham, "Ethical Behaviour in the Construction Procurement Process," *Cooperative Research Centre for Construction Innovation*, 2006.

[5] D. Luu and W. Sher, "Construction Tender Subcontract Selection Using Case-Based Reasoning," *Construction Economics and Building*, vol. 6, no. 2, pp. 32–43, 2006.

[6] S. H. Khahro, S. Hassan, N. Y. Zainun, and Y. Javed, "Digital transformation and e-commerce in the construction industry: A prospective assessment," *Academy of Strategic Management Journal*, vol. 20, no. 1, pp. 1–8, 2021.

[7] H. Wu, P. Zhang, H. Li, B. Zhong, I. W. Fung, and Y. Y. R. Lee, "Blockchain technology in the construction industry: Current status, challenges, and future directions," *Journal of Construction Engineering and Management*, vol. 148, no. 10, p. 03122007, 2022.

[8] S. O. Abioye, L. O. Oyedele, L. Akanbi, A. Ajayi, J. M. D. Delgado, M. Bilal, and A. Ahmed, "Artificial intelligence in the construction industry: A review of present status, opportunities, and future challenges," *Journal of Building Engineering*, vol. 44, p. 103299, 2021.

[9] S. Patil, B. Konnur, P. Devthanekar, and K. Patil, "Review of Contractor Prequalification Criteria and their Impact on Project Success Factors," *International Journal of Research in Engineering, Science, and Management (IJRESM)*, vol. 3, no. 7, pp. 298–302, Jul. 2020.

[10] A. R. Khoso and A. M. Yusof, "Extended review of contractor selection in construction projects," *Canadian Journal of Civil Engineering*, vol. 47, no. 7, pp. 771–789, 2020. Available: https://doi.org/10.1139/cjce-2019-0258.

[11] T. Olawumi, S. Ojo, D. Chan, and M. Yam, "Factors Influencing the Adoption of Blockchain Technology in the Construction Industry: A System Dynamics Approach," in *Proceedings of the International Conference on Construction Engineering and Management*, 2021, pp. 84–97. Available: https://doi.org/10.1007/978-981-16-3587-8_84.