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Evaluating the Effects of Duty-Free Incentives on Cost and Schedule Performance of Construction Projects in Ethiopia: Evidence from Addis Tomorrow Special Economic Zone

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Evaluating the Effects of Duty-Free Incentives on Cost and Schedule Performance of Construction Projects in Ethiopia: Evidence from Addis Tomorrow Special Economic Zone

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Abstract

Special Economic Zones (SEZs) use fiscal and administrative incentives to attract investment, yet the extent to which duty-free provisions improve construction delivery depends on how efficiently they are implemented. This study assessed the perceived effects of SEZ duty-free incentives on construction cost and project duration at Addis Tomorrow Special Economic Zone (ATSEZ), Addis Ababa, Ethiopia. A convergent mixed-methods case-study design combined a five-point Likert questionnaire completed by 98 stakeholders with 13 semi-structured key-informant interviews. Quantitative analysis included descriptive statistics, reliability and validity testing, Pearson correlation, multiple regression, mediation analysis using 5,000 bootstrap resamples, and robustness checks; interview evidence was analyzed thematically. Positive cost benefit recorded the highest mean (4.173), while execution cost pressure averaged 3.694. External constraint intensity was high (4.036), whereas positive schedule benefit and net schedule benefit were lower, at 3.201 and 2.949, respectively. The positive schedule model explained 50.0% of outcome variance (adjusted $R^2 = 0.479$), and the net schedule model explained 46.5% (adjusted $R^2 = 0.442$). Policy implementation efficiency was a significant predictor of positive cost benefit ($\beta = 0.335$, $p = 0.023$), net cost benefit ($\beta = 0.421$, $p = 0.005$), positive schedule benefit ($\beta = 0.399$, $p = 0.003$), and net schedule benefit ($\beta = 0.389$, $p = 0.005$). Coordination influenced outcomes mainly through implementation efficiency. The findings indicate that duty-free incentives are associated with stronger perceived cost savings than schedule gains; their practical value depends on coordinated approvals, reliable documentation, procurement readiness, and supply-chain support.

Keywords: Special Economic Zones; Duty-Free Incentives; Construction Cost; Duration; Policy Implementation Efficiency; Trade Facilitation.

1. Introduction

Special Economic Zones (SEZs) are geographically defined areas in which governments provide a distinct package of regulatory, fiscal, infrastructure, and administrative arrangements to encourage investment and economic activity. Their policy rationale commonly includes attracting domestic and foreign direct investment, supporting industrialization, expanding exports, and strengthening regional development. In practice, however, the performance of zones varies considerably because incentives operate within wider institutional, infrastructure, and market conditions. Research on SEZs has therefore moved beyond the presence of tax advantages to consider governance, institutional capacity, local linkages, and the quality of implementation [1-4].

In construction-intensive SEZ development, duty-free treatment can be especially important because projects may require imported machinery, specialist equipment, electrical and mechanical systems, finishing products, and materials that are unavailable or insufficient locally. Exemptions from customs duties and related import charges can lower landed costs and reduce initial capital requirements. Ethiopia's SEZ framework expressly includes customs-related incentives for eligible imports, including construction materials, making implementation processes relevant to developers and contractors [5, 6]. Nevertheless, the existence of an exemption does not ensure that the intended savings are realized. Applications, eligibility confirmation, BOQ preparation, material classification, import documentation, customs verification, foreign-exchange arrangements, and inland transport all affect the time and cost of obtaining goods [7-10].

Construction performance is generally assessed through cost, time, quality, and scope. For imported inputs, a fiscal saving may coexist with administrative and logistics costs. Repeated document submissions, inconsistent material descriptions, delayed approvals, foreign-exchange shortages, letter-of-credit constraints, port congestion, shipping uncertainty, and inland transport interruptions can increase procurement lead times and project overhead [11-13]. The World Trade Organization's Trade Facilitation Agreement emphasizes transparent procedures and cooperation among border agencies, while the World Bank's Logistics Performance Index identifies customs clearance, infrastructure, logistics competence, tracking, and timeliness as key

elements of supply-chain performance. These mechanisms are directly relevant to landlocked Ethiopia, where imported construction inputs depend on international corridors [14-17].

Although previous studies on Special Economic Zones (SEZs) have extensively examined investment promotion, export performance, employment generation, and regional economic development, limited attention has been given to the operational effects of duty-free incentives during the construction phase. This gap is significant because infrastructure development establishes the foundation for subsequent industrial operations, directly influencing investment readiness, project costs, and completion schedules [18, 19]. Addressing this gap, the present study investigates the implementation and perceived effects of duty-free incentives on construction project performance at Addis Tomorrow Special Economic Zone (ATSEZ) in Addis Ababa, Ethiopia. Specifically, it examines the relationship between duty-free incentives and project cost and schedule performance, considering four key implementation dimensions: policy implementation efficiency, institutional coordination and support, external constraints, and project preparedness and procurement alignment. By integrating these dimensions, the study provides project-level evidence on how fiscal incentives translate into practical construction benefits and identifies institutional and operational factors that may influence their effectiveness in the Ethiopian SEZ context [20].

The study asks whether duty-free incentives are perceived to reduce construction costs, whether they improve project duration, and how institutional and project-level conditions shape these outcomes. It contributes by integrating SEZ policy analysis with construction management concerns, particularly BOQ governance, procurement alignment, document consistency, and customs clearance [21]. The analysis also distinguishes positive cost benefit from execution cost pressure and schedule benefit, avoiding the assumption that a tax exemption automatically produces a net project benefit. This distinction is important in interpreting the results: the survey captures stakeholder perceptions and statistical associations rather than audited project-level savings or causal effects. The study is a single-case, cross-sectional investigation, and its findings should therefore be interpreted within the ATSEZ context [16].

2. Materials and Methods

2.1 Study Area and Case Selection

The study was conducted at Addis Tomorrow Special Economic Zone (ATSEZ), located in the Gotera area of Addis Ababa, Ethiopia, at approximately 9.03° N latitude and 38.75° E longitude, with an average elevation of 2,355 metres above sea level. ATSEZ was purposively selected as the study area because of its strategic importance in promoting industrial development and attracting investment through special economic zone incentives. The project involves multiple institutional stakeholders and private-sector participants, providing a suitable context for examining construction procurement processes. In particular, its duty-free arrangements for importing construction materials, machinery, equipment, and industrial inputs offer an opportunity to investigate how incentive administration influences procurement planning, implementation, coordination, and overall efficiency within large-scale construction projects, as shown in Figure 1.

2.2 Research Design

A convergent mixed-methods case-study design was adopted. Quantitative and qualitative evidence was collected during the same research period, analyzed separately, and integrated during interpretation. The questionnaire measured stakeholder perceptions of policy implementation efficiency, coordination and institutional support, external constraints, project preparedness and procurement alignment, cost outcomes, and schedule outcomes. Semi-structured interviews explored how applications, approvals, customs clearance, documentation, procurement, and logistics functioned in practice. Integration enabled statistical patterns to be interpreted alongside operational explanations rather than treating either data stream as sufficient on its own, as shown in Figure 2.

2.3 Population, Sampling, and Sample Size

The target population comprised stakeholders directly involved in the implementation or use of SEZ duty-free incentives in ATSEZ construction activities. These included government institutions responsible for investment approvals, customs and tax administration; SEZ developers; contractors; supervising consultants; tenant enterprises; and coordination-related actors. Purposive sampling was used for the questionnaire to reach participants with relevant experience in SEZ projects, procurement, duty-free procedures, and project management. Key-

informant purposive sampling was used for interviews based on decision-making responsibility, technical expertise, and direct implementation experience. The study involved 111 participants: 98 questionnaire respondents and 13 interviewees. The questionnaire sample included tenant enterprises, contractors, SEZ developers, consultants/supervisors, government institutions, and coordination actors using Equation (1).

$$n_{adj} = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} = 98 \quad (1)$$

2.4 Data Collection Instruments

Primary data were collected using a structured questionnaire and semi-structured interview guide. The questionnaire used a five-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. It contained construct items grouped as follows: policy implementation efficiency (B1–B4), coordination and institutional support (C1–C4), external constraints (D1–D4), project preparedness and procurement alignment (E1–E4), cost outcomes (F1–F4), and schedule outcomes (G1–G4).

The interviews examined duty-free application procedures, approval and verification, customs clearance, document requirements, procurement and BOQ alignment, logistics barriers, and implications for cost and schedule. Secondary sources included SEZ regulations, customs directives, national investment laws, project documents, BOQs, procurement records, WTO trade facilitation materials, OECD indicators, World Bank logistics reports, and relevant academic literature. The document does not provide audited item-level project savings or actual schedule delay records; consequently, the principal outcome measures are stakeholder perceptions.

2.5 Quantitative Data Analysis

Questionnaire data were analyzed using SPSS. Descriptive statistics summarized means, standard deviations, frequencies, and percentages. Internal consistency was assessed using Cronbach's alpha. Construct suitability was examined using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. Pearson correlation assessed bivariate associations.

Variance inflation factors (VIFs) were examined before regression. Multiple linear regression was used to estimate the relationships between the explanatory constructs and five outcomes: positive cost benefit, execution cost pressure, exploratory net cost, net schedule benefit, and positive schedule benefit.

2.6 Qualitative Analysis and Integration

Interview data were transcribed and analyzed thematically. The procedure involved repeated reading, generation of initial codes, grouping of codes into themes, review and refinement of themes, and interpretation against the study objectives. Themes included direct cost reduction, administrative execution burden, customs and approval delays, inter-agency coordination, project preparedness, external supply-chain constraints, and differences in stakeholder perceptions. Quantitative and qualitative results were integrated through methodological, data-source, and stakeholder triangulation.

2.7 Reliability, Validity, and Triangulation

Reliability refers to the degree to which a measurement instrument produces consistent and stable results over time. In this study, internal consistency reliability was assessed using Cronbach's Alpha coefficient. The reliability of the constructs was evaluated using the standard formula in Equation (2).

$$\alpha = \left(\frac{k}{k-1}\right) \times \left[1 - \left(\frac{\sum \sigma_i^2}{\sigma_t^2}\right)\right] \qquad (2)$$

where k represents the number of items, $\Sigma\sigma_i^2$ is the sum of item variances, and σ_t^2 is the total variance of the scale. The computed Cronbach's Alpha values for all major constructs exceeded the accepted threshold of 0.70, indicating satisfactory internal consistency and reliability of the measurement instruments used in the study.

Validity refers to the extent to which the research instrument accurately measures the intended constructs. In this study, multiple forms of validity were assessed, including content validity, construct validity, and face validity, to ensure the robustness of the measurement tool. Content validity was established through a comprehensive development process in which questionnaire items were derived from previous empirical studies, relevant trade facilitation literature, and SEZ policy frameworks. In addition, expert consultation was conducted to ensure that all items

adequately captured the dimensions of policy implementation efficiency, coordination, constraints, preparedness, and project outcomes. Construct validity was tested using statistical measures. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was computed in Equation (3).

$$KMO = \frac{\sum r_{ij}^2}{\sum r_{ij}^2 + \sum q_{ij}^2} \quad (3)$$

where r^2ij represents the correlation coefficients, and q^2ij represents partial correlations. The resulting KMO value was 0.768, which is considered acceptable for factor analysis. Bartlett's Test of Sphericity was also significant ($p < 0.001$), indicating that the correlation matrix was suitable for structure detection and that variables were sufficiently related for factor analysis. Face validity was further ensured through expert review by academic researchers, industry practitioners, and research supervisors before field administration. These experts evaluated the clarity, relevance, and appropriateness of all questionnaire items, ensuring that the instrument was both meaningful and contextually appropriate for SEZ stakeholders.

Triangulation was achieved by gathering information from diverse groups, including government institutions, SEZ developers, construction contractors, consultants, and tenant enterprises. This allowed the study to capture multiple institutional perspectives on duty-free incentive implementation. Third, methodological triangulation was implemented by combining quantitative and qualitative research methods. The integration of both approaches can be expressed conceptually in Equation 4.

$$T = (Q_1 \cap Q_2 \cap Q_3) \quad (4)$$

where T represents triangulated findings, Q_1 represents quantitative survey results, Q_2 represents qualitative interview evidence, and Q_3 represents documentary analysis. The intersection of these datasets strengthens the reliability of the conclusions. The convergence of findings reinforced the study's conclusions. For instance, the questionnaire results indicated a positive cost-benefit perception with a mean value of 4.173. This was strongly supported by interview data, which consistently highlighted substantial customs duty and VAT savings. Furthermore, regression analysis identified policy implementation efficiency as the most significant predictor of both cost and schedule outcomes, while qualitative findings explained how administrative efficiency and

procedural effectiveness directly influence project performance.

3. Results and Discussion

3.1 Respondent Profile

The 98 respondents represented diverse SEZ stakeholders, including tenant enterprises (29.6%), contractors (25.5%), developers (23.5%), supervision and consulting organizations (10.2%), government institutions (10.2%), and coordination actors (1.0%). Regarding professional experience, 77 respondents (78.6%) had over five years of experience, while 21 (21.4%) had five years or less. This distribution demonstrates substantial professional exposure among participants, strengthening the credibility of their assessments of duty-free incentive implementation. Educational qualifications were not collected and were excluded from the analysis, as shown in Figure 3.

3.2 Descriptive Statistical Analysis

The descriptive statistics indicate that positive cost-benefit recorded the highest mean (4.173), demonstrating strong agreement that duty-free incentives reduce customs duties, VAT, and imported construction costs. Execution cost pressure (3.694) reflects considerable administrative and compliance burdens. External constraint intensity (4.036), alongside low reverse-coded environmental convenience (1.964), highlights persistent foreign exchange, customs, transportation, and policy interpretation challenges. Conversely, positive schedule benefit (3.201) and net schedule benefit (2.949) indicate limited time-related improvements. Overall, incentives provide greater financial benefits than schedule improvements due to persistent procedural and institutional bottlenecks, as shown in Figure 4.

Further analysis shows that F1, F2, and F4 recorded mean scores above 4.1, with high proportions of ratings (4–5). Notably, F2 achieved 86.7% agreement, confirming strong recognition of reduced imported material and equipment costs. Conversely, G1 recorded a lower mean of 2.908, with only 39.8% agreement, while G3 reached 3.806 (62.2%). These findings demonstrate stronger cost benefits than schedule improvements, which remain dependent on approvals, customs clearance, documentation, and logistics efficiency, as shown in Figure 5.

3.3 Reliability and Validity

Cronbach's Alpha confirmed good reliability for most constructs ($\alpha > 0.80$), while external constraints (0.711) and procurement alignment (0.767) demonstrated acceptable consistency. D1–D4 were retained, with D1–D3 used for robustness testing. Similarly, F3 was analyzed separately as execution cost pressure because including it reduced the positive cost-benefit scale reliability to 0.672, as shown in Table 1.

Table 1. Reliability test results

Variable	Items	Cronbach's Alpha
Policy implementation efficiency B	B1–B4	0.893
Coordination and institutional support C	C1–C4	0.869
External constraint intensity D	D1–D4	0.711
Core external constraints	D1–D3	0.800
Project preparedness and procurement alignment E	E1–E4	0.767
Positive cost benefit	F1, F2, and F4	0.810
Exploratory net cost scale	F1, F2, F3_R, F4	0.672
Positive schedule benefit	G1, G2, and G4	0.869
Net schedule benefit	G1, G2, G3_R, and G4	0.848
All core items	B1-G4	0.881

For structural validity, this study uses KMO and Bartlett's test of sphericity. The KMO value for the 24 core items is 0.768, and Bartlett's test result is χ^2 (276) =1845.417, $p < 0.001$. The KMO value reaches a good level, and Bartlett's test is significant, indicating that the items have a sufficiently strong correlation structure and are suitable for subsequent correlation and regression analyses, as shown in Table 2.

Table 2. KMO and Bartlett's test results

Test Indicator	Result
KMO	0.768
Bartlett's χ^2	1845.417
df	276
p-value	<0.001

3.4 Correlation Analysis

Correlation analysis revealed that policy implementation efficiency, coordination support, and project preparedness were positively associated with cost and schedule benefits. Implementation efficiency showed the strongest schedule correlations ($r = 0.653–0.665$, $p < 0.001$). Conversely, execution cost pressure was negatively correlated ($r = −0.421$). External environmental convenience showed a negative association with positive cost benefits, requiring cautious interpretation without implying improved project performance.

3.5 Multiple Regression Results

The positive cost benefit model was statistically significant ($R^2 = 0.381$; adjusted $R^2 = 0.354$; overall $p < 0.001$). Policy implementation efficiency had a positive significant association with cost-benefit ($\beta = 0.335$, $p = 0.023$). External environmental convenience had a negative significant coefficient ($\beta = −0.401$, $p < 0.001$), while coordination and project preparedness were not significant at the 5% level. The result reinforces the importance of efficient approvals and predictable documentation, while the negative external-convenience coefficient should be interpreted in light of import exposure and the difference between gross savings and net performance, as shown in Table 3.

Table 3. Multicollinearity test results

Independent Variable	VIF
Policy implementation efficiency B	3.162
Coordination and institutional support C	3.534
External environmental convenience D_R / external constraint intensity D	1.196
Project preparedness and procurement alignment E	1.781

3.6 Mediation Analysis

Mediation analysis demonstrated that coordination support significantly improved implementation efficiency ($a = 0.877$, $p < 0.001$), generating significant indirect effects across four cost and schedule outcomes. However, execution cost pressure was insignificant. The findings influence project performance primarily through improved approvals, documentation, customs clearance, and institutional problem-solving, as shown in Table 4.

Table 4. Mediation analysis

Outcome	Indirect effect (a×b)	Bootstrap 95% CI	Interpretation
Positive cost benefit	0.202	[0.031, 0.418]	Significant indirect effect
Exploratory net cost	0.504	[0.136, 0.958]	Significant indirect effect
Net schedule benefit	0.283	[0.033, 0.631]	Significant indirect effect
Positive schedule benefit	0.330	[0.034, 0.733]	Significant indirect effect
Execution cost pressure	−0.306	[−0.694, 0.003]	Not significant; CI includes zero

3.7 Robustness and Stakeholder Differences

Robustness tests confirmed stable coefficient directions after excluding invalid responses, modifying constraint measures, and analyzing 77 implementation actors. ANOVA revealed substantial stakeholder differences: government reported higher implementation efficiency (M = 4.325), while contractors reported lower efficiency (M = 2.440) and greater cost pressure (M = 4.040), highlighting the need for shared performance standards and objective monitoring.

3.8 Integrated Discussion and Implications

The findings reveal an imbalance between cost and schedule benefits of duty-free incentives. Although tax exemptions substantially reduce imported material and equipment costs, administrative procedures, foreign-exchange shortages, customs clearance, and logistics constraints limit schedule improvements. Policy implementation efficiency emerged as the strongest predictor of project outcomes, highlighting the importance of coordinated approvals, accurate BOQ documentation, procurement alignment, and effective customs procedures.

Project preparedness also improved schedule performance by reducing documentation mismatches and verification delays. These findings suggest four priorities: phase-based approvals, dedicated inter-agency coordination, standardized digital documentation, and transparent processing timelines.

Furthermore, stakeholder differences highlight the need for institutional dialogue and contractor participation. Performance monitoring should incorporate approval duration, customs release, delivery time, demurrage, and actual tax savings. Overall, effective implementation requires integrating fiscal incentives with administrative efficiency and reliable logistics systems.

4. Conclusions

This study examined how duty-free incentives are experienced during the construction of Addis Tomorrow Special Economic Zone. The findings show that fiscal exemptions are perceived to reduce import-related construction costs, but their contribution to project duration is weaker and depends on implementation conditions. The conclusions are summarized as follows:

1. The study involved 98 stakeholders, of whom 78.6% had more than five years of professional experience, providing substantial practical insights into SEZ duty-free incentive implementation.
2. Duty-free incentives generated stronger financial benefits than schedule improvements, with positive cost-benefit recording the highest mean (4.173). Notably, 86.7% recognized reduced imported material and equipment costs.
3. Implementation constraints: External constraints recorded a high mean of 4.036, while execution cost pressure reached 3.694, highlighting persistent foreign-exchange, customs, documentation, and logistics challenges.
4. Institutional efficiency: Policy implementation efficiency significantly predicted positive cost benefits ($\beta = 0.335$, $p = 0.023$), while its schedule correlations reached 0.665 ($p < 0.001$).
5. Coordination and mediation: Coordination support significantly improved implementation efficiency ($a = 0.877$, $p < 0.001$), with significant indirect effects across four principal cost and schedule outcomes.
6. Policy implications: Stakeholder differences, particularly government implementation efficiency ($M = 4.325$) and contractor perceptions ($M = 2.440$), emphasize the need for coordinated approvals, standardized digital documentation, transparent procedures, and measurable service timelines.

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Declaration of Competing Interest

The authors declare that they have no competing interests.

Availability of Data

This article outlines research that has not used any data.

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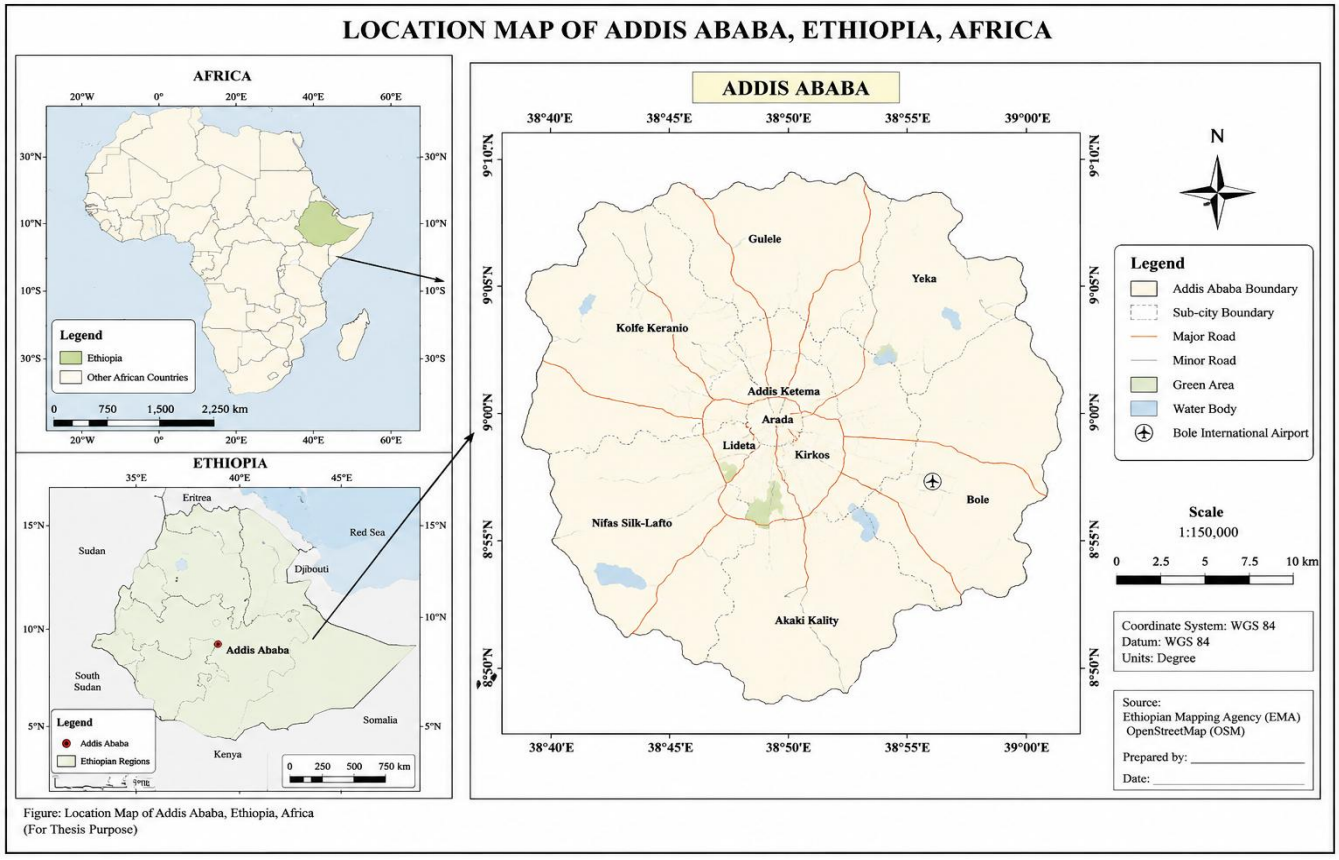

Figure: Location Map of Addis Ababa, Ethiopia, Africa
(For Thesis Purpose)

Figure 1. Location map of the study

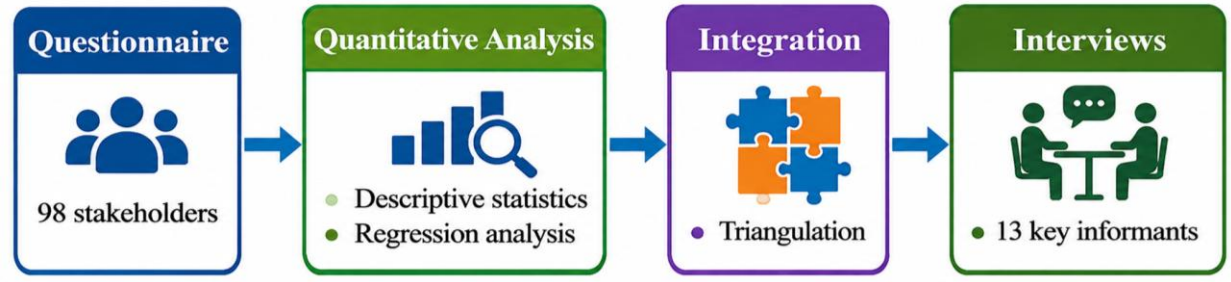

Figure 2. Mixed-methods research and integration sequence

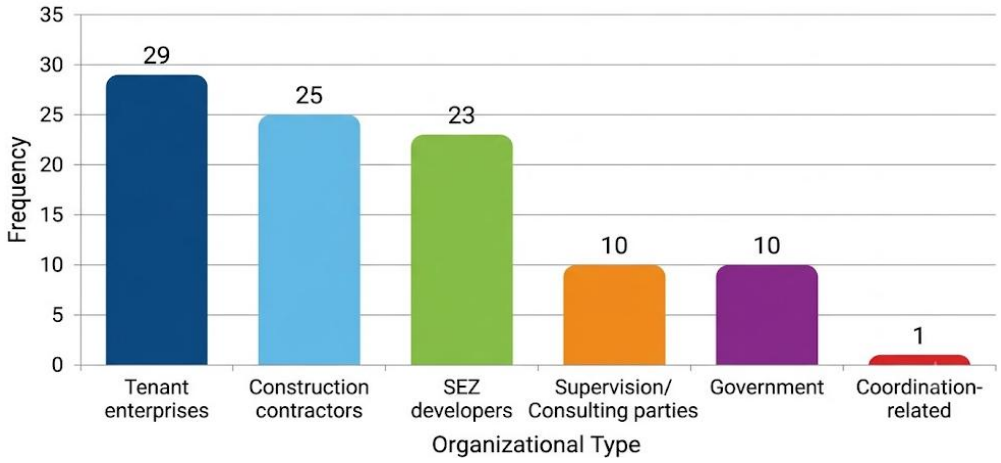

Figure 3. Distribution of respondents by organizational type

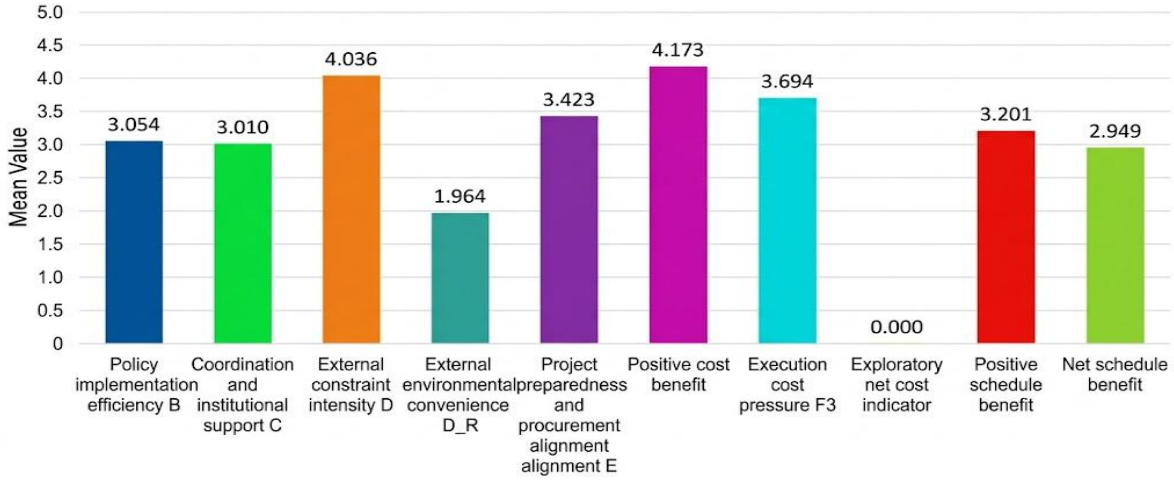

Figure 4. Descriptive statistics of main variables

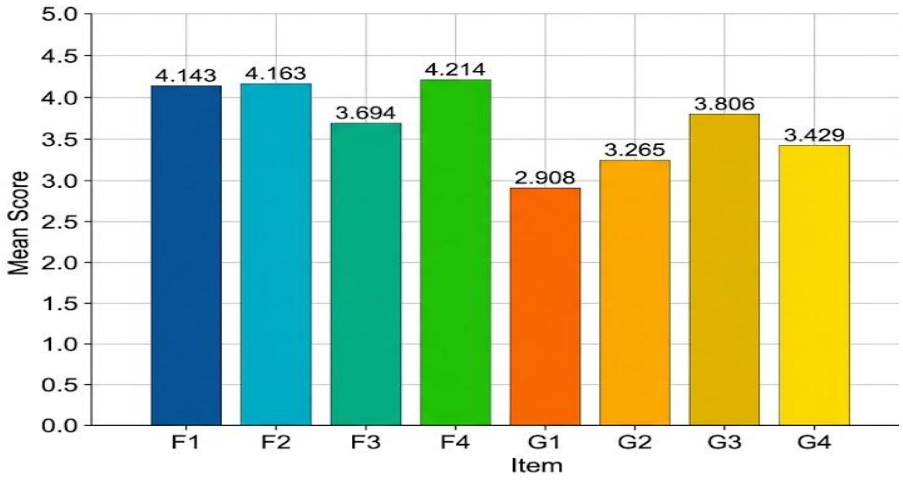

Figure 5. Descriptive statistics of key cost and schedule items