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# Project Management Practices and Performance Outcomes in China–Ethiopia Infrastructure Development Projects: Empirical Evidence from Addis Ababa, Ethiopia

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Statement on Participant Consent: Informed consent was obtained from all participants involved in the study. Participants were informed about the purpose of the research, and their participation was voluntary. Their confidentiality and anonymity were maintained throughout the research process.

# Project Management Practices and Performance Outcomes in China–Ethiopia Infrastructure Development Projects: Empirical Evidence from Addis Ababa, Ethiopia

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## Abstract

China–Africa infrastructure cooperation has become an important driver of infrastructure development in Ethiopia, creating opportunities for technological advancement, knowledge transfer, and improved construction project management. However, the effectiveness of these partnerships remains influenced by institutional, cultural, regulatory, and managerial challenges. This study examines the prospects and implications of China–Africa infrastructure cooperation for construction project management in Addis Ababa, Ethiopia. A mixed-methods research design was employed, incorporating structured questionnaires administered to 85 construction professionals and semi-structured interviews with 10 key informants. Quantitative data were analyzed using descriptive statistics, including frequencies, percentages, means, and standard deviations, while qualitative information was examined through thematic analysis. The findings indicate that cooperation creates substantial opportunities for construction management improvement, with an overall opportunities mean of 4.23, followed by project management practices (4.08) and challenges (4.01) on a five-point Likert scale. Advanced project management practices recorded the highest practice score (M = 4.32, SD = 0.74), while local technical skills development achieved the highest opportunity score (M = 4.30, SD = 0.71). Nevertheless, cultural and language barriers remained the most significant challenge (M = 4.21, SD = 0.82). Knowledge transfer received a comparatively lower score (M = 3.86, SD = 0.95). The study concludes that China–Africa infrastructure cooperation positively supports construction project management and local capacity development, but sustainable benefits require stronger institutional coordination, structured knowledge-sharing mechanisms, and effective cross-cultural communication.

**Keywords:** China–Africa cooperation; infrastructure development; construction project management; technology transfer; stakeholder coordination.

## 1. Introduction

Infrastructure development is a fundamental driver of economic growth, industrialization, urban transformation, and socioeconomic development. Transportation networks, roads, railways, bridges, energy facilities, industrial parks, and water supply systems provide essential foundations for economic productivity, investment, and regional connectivity [1-3]. However, developing countries frequently encounter financial, technological, institutional, and managerial constraints that limit their ability to implement large-scale infrastructure projects effectively. Consequently, international infrastructure cooperation has become an important mechanism for mobilizing investment, accessing advanced construction technologies, strengthening institutional capabilities, and improving project delivery performance.

China–Africa infrastructure cooperation has emerged as a significant component of development partnerships across the African continent. Through bilateral agreements, development financing, foreign direct investment, engineering, procurement and construction (EPC) contracts, and the Belt and Road Initiative (BRI), Chinese financial institutions and construction companies have contributed to developing roads, railways, bridges, industrial parks, and urban infrastructure. The Forum on China–Africa Cooperation (FOCAC) Beijing Action Plan (2025–2027) further emphasizes infrastructure connectivity, industrialization, investment, and technical cooperation as key priorities for strengthening China–Africa relations [4]. These partnerships provide opportunities not only for physical infrastructure development but also for technology transfer, professional skills development, knowledge exchange, and institutional capacity building [5, 6].

Ethiopia provides an important context for examining China–Africa infrastructure cooperation because of its extensive engagement with Chinese construction companies and financial institutions over the past two decades. Addis Ababa, as the country's political, economic, and administrative center, has experienced substantial infrastructure expansion through international construction partnerships. Major developments, including the Addis Ababa Light Rail Transit (LRT), road corridors, bridges, housing projects, drainage systems, and urban transportation facilities, demonstrate the contribution of international cooperation to urban development. Nevertheless, challenges associated with infrastructure operation, maintenance, integration, and long-term sustainability remain significant. For instance, the [7] reported a joint Ethiopian–

Chinese technical review of the Addis Ababa LRT aimed at identifying operational difficulties and improving maintenance and integration with ongoing urban development [8, 9].

Construction project management involves the systematic planning, organization, coordination, implementation, monitoring, and control of project activities to achieve predetermined objectives within specified time, cost, quality, scope, and safety requirements. International infrastructure projects are particularly complex because they involve stakeholders operating under different institutional, regulatory, technical, cultural, and organizational environments [10, 11]. Differences in communication practices, contractual arrangements, construction standards, procurement procedures, and management approaches can influence project implementation and performance. Therefore, effective collaboration between Chinese contractors and Ethiopian stakeholders is essential for strengthening project planning, scheduling, resource allocation, quality assurance, occupational safety, stakeholder coordination, and overall project delivery [12].

Despite the opportunities associated with international partnerships, infrastructure projects in Ethiopia continue to experience challenges related to delays, cost escalation, procurement inefficiencies, material shortages, administrative procedures, and inadequate stakeholder coordination. A 2024 study of Ethiopian construction projects identified owner and contractor competence, bureaucratic procedures, payment difficulties, material shortages, and low productivity as important project failure factors [13]. Similarly, [14] identified delayed approvals, inaccurate contract duration estimates, slow labor mobilization, and inadequate decision-making as significant contributors to construction time overruns in Addis Ababa. These challenges highlight the importance of improving project management practices, institutional coordination, contractual administration, and communication among international and domestic project participants [15].

Technology transfer and local capacity development are equally important dimensions of China–Africa infrastructure cooperation. Although Chinese construction companies introduce engineering expertise, modern construction technologies, and management systems, their participation does not automatically guarantee sustainable knowledge transfer or stronger domestic capabilities. [16], Examining the Addis Ababa–Djibouti and Awash–Weldiya railway projects highlights the potential of infrastructure investment to facilitate technical learning while

identifying persistent barriers to long-term capacity development. Similarly, [17] emphasizes that skills development within China–Africa economic and trade cooperation zones depends on employment conditions, workplace arrangements, and access to meaningful training opportunities. [18] also identifies limited technical awareness, inadequate training, the absence of Building Information Modeling (BIM) standards, and insufficient institutional support as barriers to BIM adoption in Ethiopia's construction industry. Furthermore, [19] demonstrates that the local development contributions of Chinese construction companies depend on domestic industrial capabilities, institutional conditions, employment opportunities, subcontracting arrangements, and effective technology transfer.

Although previous studies have examined China–Africa economic relations, infrastructure financing, technology transfer, and local development, limited empirical research has investigated their influence on construction project management performance in Addis Ababa. In particular, the relationships among international management practices, stakeholder coordination, project implementation challenges, technology transfer, and local institutional capacity remain insufficiently explored. Addressing these gaps is important for improving collaborative infrastructure delivery and maximizing the benefits of international partnerships [20].

Therefore, this study aims to examine the prospects and implications of China–Africa infrastructure cooperation for construction project management performance in Addis Ababa, Ethiopia. Specifically, it evaluates existing cooperation arrangements and their influence on project management practices, identifies major implementation challenges, assesses contributions to local skills development, technology transfer, and institutional capacity building, and proposes strategies for improving project performance and sustainability [21].

The study is expected to contribute empirical evidence to international construction management literature while providing practical recommendations for policymakers, government institutions, contractors, consultants, and project managers. Ultimately, it seeks to strengthen stakeholder coordination, project implementation, knowledge exchange, and institutional collaboration to promote sustainable infrastructure development and long-term benefits for Ethiopia's construction industry [22].

## 2. Materials and Methods

### 2.1 Description of the Study Area

The study was conducted in Addis Ababa, the capital city of Ethiopia, which serves as a major hub for infrastructure development, international investment, construction activities, and institutional administration. The research focused on infrastructure projects involving Chinese contractors and Ethiopian stakeholders, including road corridor development, ring road expansion, Light Rail Transit (LRT) improvement works, water supply and sewerage systems, urban drainage infrastructure, housing developments, and bridge construction. These projects provided a relevant context for examining the influence of international infrastructure cooperation on construction project management performance. The study considered the perspectives of key stakeholders, including contractors, consultants, client organizations, government agencies, utility institutions, and Chinese project management teams, to understand their experiences, collaborative practices, implementation challenges, and contributions to sustainable infrastructure development in Addis Ababa, as shown in Figure 1.

### 2.2 Research Design

The study employed a descriptive and explanatory mixed-methods research design, supported by a case-study approach. The descriptive component examined infrastructure cooperation characteristics, project management practices, opportunities, and implementation challenges, while the explanatory component investigated their relationships with project management performance, technical capacity development, and stakeholder coordination. Quantitative and qualitative data were integrated to provide comprehensive insights into respondents' perceptions and key informants' experiences. The research process followed a systematic sequence of stages, beginning with the identification of the research problem and objectives, followed by a review of relevant theoretical and empirical literature. Subsequently, the target population and respondents were identified, and data were collected through questionnaires and semi-structured interviews. Quantitative and qualitative data were then analyzed, integrated, and interpreted to develop the study findings, conclusions, and recommendations, as shown in Figure 2.

### 2.3 Target Population and Sampling

The study targeted professionals involved in China–Africa infrastructure projects in Addis Ababa, selected through purposive sampling based on their relevant experience and project

involvement. Data were collected from 85 questionnaire respondents and 10 key informants through semi-structured interviews, representing 95 participation instances in total. The participant distribution is presented in Table 1.

Table 1. Summary of the research participants

| **Participant category** | **Number** |
|---|---|
| Questionnaire respondents | 85 |
| Semi-structured interview participants | 10 |
| **Total participation instances** | **95** |

The organizational distribution of the 85 questionnaire respondents, presented in Table 2, indicates that contractors constituted the largest group (32.9%), followed by consultants (18.8%), client organizations (17.6%), government agencies (14.1%), utility organizations (9.4%), and Chinese project teams (7.1%). Regarding professional experience, most respondents had over five years of experience (85.9%). Academically, bachelor's degree holders represented the largest proportion (49.4%), followed by master's degree holders (32.9%), demonstrating relevant professional and educational backgrounds.

Table 2. Organizational distribution of questionnaire respondents

| **Organization type** | **Frequency** | **Percentage (%)** |
|---|---|---|
| Contractors | 28 | 32.9 |
| Consultants | 16 | 18.8 |
| Client organizations | 15 | 17.6 |
| Government agencies | 12 | 14.1 |
| Utility organizations | 8 | 9.4 |
| Chinese project teams | 6 | 7.1 |
| **Total** | **85** | **99.9** |

### 2.4 Data Collection Instruments

Two primary data collection instruments were employed: structured questionnaires and semi-structured interviews. These instruments facilitated the collection of quantitative and qualitative data from professionals involved in China–Africa infrastructure projects.

### 2.4.1 Structured questionnaire

Structured questionnaires were administered to 85 professionals using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to assess perceptions of China–Africa infrastructure cooperation. The questionnaire covered three major dimensions: construction project management practices, challenges affecting collaborative infrastructure project implementation, and the opportunities and implications of international cooperation, including technology transfer, skills development, and institutional capacity building, using Equation 1.

$$n_{adj} = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} = 85 \quad (1)$$

### 2.4.2 Semi-structured interviews

Semi-structured interviews were conducted with 10 key informants representing relevant construction and infrastructure stakeholders. The interviews examined project management systems, professional development, technology and knowledge transfer, cultural and language barriers, regulatory and contractual challenges, and strategies for improving project delivery. The qualitative information provided deeper insights into the experiences of project stakeholders, helped explain the quantitative findings, and identified practical challenges affecting effective collaboration in China–Africa infrastructure projects in Addis Ababa.

## 2.5 Data Analysis Methods

### 2.5.1 Quantitative analysis

Quantitative data collected from 85 questionnaire respondents were analyzed using descriptive statistics, including frequencies, percentages, means, and standard deviations. These techniques summarized respondents' demographic characteristics and assessed their perceptions of China–Africa infrastructure cooperation. Likert-scale responses were analyzed to evaluate project management practices, opportunities, and implementation challenges. The findings indicated positive perceptions of Chinese project management practices (M = 4.32, SD = 0.74), while cultural and language barriers remained significant challenges (M = 4.21). Overall, opportunities ranked highest (M = 4.23), followed by project management practices (M = 4.08) and challenges (M = 4.01). This statistical approach provided a clear ranking of variables and helped identify the

dominant factors influencing infrastructure project performance frequency/percentage using equation 2, mean using equation 3, and standard deviation using equation 4.

$$\% = \frac{f}{N} \times 100 \tag{2}$$

$$M = \frac{\sum x}{n} \tag{3}$$

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} \tag{4}$$

Therefore, the coefficient of variation was used to compare the relative dispersion of responses across different indicators. A lower CV indicates greater consistency among respondents, whereas a higher CV indicates greater variability in their responses. A lower CV generally indicates greater relative consistency among observations. However, CV values should be interpreted cautiously when applied to five-point Likert-scale data because the scale is ordinal and has a non-zero arbitrary origin, using Equation 5.

$$CV = \frac{SD}{M} \times 100 \tag{5}$$

Moreover, the principal findings of the study were derived from descriptive statistical analysis of the questionnaire responses. The analysis focused on summarizing respondents' perceptions, identifying key trends, and comparing the major dimensions of China–Africa infrastructure cooperation. However, the original research report did not include the complete respondent-level dataset required for independently verifying or recalculating all statistical indicators. Therefore, the reported statistical results were retained as presented in the original analysis.

### 2.5.2 Qualitative analysis

Qualitative data from 10 key informants were analyzed using thematic analysis through transcription, coding, categorization, and interpretation. Five major themes emerged: project management systems, knowledge transfer and capacity building, communication and cultural barriers, regulatory and contractual challenges, and project delivery performance. The findings

complemented quantitative results by explaining key implementation issues. Manual coding ensured detailed analysis of interview responses, while SPSS was used for quantitative data analysis and reliability testing.

### 2.5.3 Reliability, validity and triangulation

The study ensured reliability, validity, and credibility through systematic quantitative and qualitative procedures. Reliability was assessed using Cronbach's Alpha to determine the internal consistency of questionnaire items, with a coefficient of $\alpha \geq 0.70$ considered acceptable (Equation 6). Validity was established through content, face, and construct validity, supported by expert evaluation and alignment with the theoretical framework. The Content Validity Ratio (CVR) was calculated using Equation 7, while the acceptable validity condition was assessed using Equation 8. Triangulation integrated questionnaire responses from 85 respondents and interviews with 10 key informants to verify findings. The consistency of evidence strengthened credibility, particularly for project management practices (M = 4.08), opportunities (M = 4.23), and challenges (M = 4.01), as presented in Equation 9.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_T^2}\right) \tag{6}$$

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \tag{7}$$

$$CVR \geq CVR_{\text{critical}} \tag{8}$$

$$T = \frac{Q + I}{2} \tag{9}$$

## 3. Results and Discussion

### 3.1 Profile of Respondents

The questionnaire survey involved 85 professionals representing diverse organizational backgrounds, educational qualifications, and levels of professional experience. Contractors constituted the largest group (32.9%), followed by consultants (18.8%), client organizations (17.6%), government agencies (14.1%), utility organizations (9.4%), and Chinese project

management teams (7.1%). Regarding professional experience, 85.9% of respondents had more than five years of experience, indicating substantial practical knowledge of infrastructure project implementation. Furthermore, 88.2% held bachelor's degrees or higher qualifications. Overall, the respondents' professional and educational backgrounds provided a relevant foundation for assessing China–Africa infrastructure cooperation and construction project management performance in Addis Ababa, as shown in Figure 3.

### 3.2 Influence of China–Africa Cooperation on Project Management Practices

The overall mean score for project management practices was 4.08, indicating a positive perception of China's contribution to construction project management. Advanced project management practices received the highest rating (M = 4.32, SD = 0.74), followed by scheduling and resource planning (M = 4.18, SD = 0.81) and safety and quality standards (M = 4.09, SD = 0.79). Communication and coordination recorded a mean of 3.97 (SD = 0.91), while knowledge transfer received the lowest score (M = 3.86, SD = 0.95). These findings highlight strong management practices but indicate the need for improved knowledge-sharing mechanisms and local capacity development, as shown in Figure 4.

### 3.3 Challenges Affecting China–Africa Infrastructure Cooperation

The overall mean score for challenges affecting China–Africa infrastructure cooperation was 4.01, indicating significant implementation constraints. Cultural and language differences ranked highest (M = 4.21, SD = 0.82), highlighting communication barriers, differences in workplace practices, and coordination difficulties among international project stakeholders. This finding is consistent with studies that emphasized the importance of cultural awareness, effective communication, trust, and organizational adaptability among Chinese contractors in Ethiopia.

Contractual and regulatory differences ranked second (M = 4.06, SD = 0.87), reflecting complexities associated with procurement procedures, contract administration, and institutional requirements. Differences in construction standards recorded a mean of 3.95 (SD = 0.89), indicating challenges in technical specifications and quality assurance. Limited local capacity received the lowest score (M = 3.81, SD = 0.93), highlighting the need for stronger professional development, technology transfer, and institutional capacity-building mechanisms to ensure sustainable infrastructure cooperation, as shown in Figure 5.

### 3.4 Opportunities and Implications of China–Africa Cooperation

The overall mean score for opportunities was 4.23, representing the highest-rated dimension of China–Africa infrastructure cooperation. Local technical skills development received the highest rating (M = 4.30, SD = 0.71), indicating strong contributions to professional learning and workforce development. Enhanced project management capacity followed (M = 4.25, SD = 0.76), while improved efficiency and cost management recorded a mean of 4.13 (SD = 0.83). These findings highlight the potential of international partnerships to strengthen local expertise and organizational capabilities. However, the relatively lower knowledge-transfer score (M = 3.86) emphasizes the need for structured training and institutionalized knowledge-sharing mechanisms, as shown in Figure 6.

### 3.5 Comparative Analysis of Research Dimensions

The comparative analysis revealed that opportunities recorded the highest mean score (4.23), followed by project management practices (4.08) and implementation challenges (4.01). This indicates that respondents generally recognized the positive contributions of China–Africa infrastructure cooperation to technical skills development, managerial capacity, construction efficiency, and improved project management practices.

However, the relatively high challenges score demonstrates that significant implementation constraints persist alongside these benefits. The findings suggest that international cooperation offers considerable development opportunities, but improvements in communication, institutional coordination, and knowledge transfer remain necessary. These results reflect respondents' perceptions rather than independently measured project-level performance outcomes, as shown in Figure 7.

### 3.6 Qualitative Findings from Key Informant Interviews

Interviews with 10 key informants identified five major themes: advanced project management systems, knowledge transfer and capacity building, communication and cultural barriers, regulatory and contractual challenges, and project delivery performance. The findings supported questionnaire results, highlighting improved management practices alongside persistent coordination and institutional challenges. However, these findings reflect stakeholder experiences rather than independently measured project-level performance improvements.

## 4. Conclusions

This study examines the prospects and implications of China–Africa infrastructure project cooperation on construction project management, with a specific focus on Addis Ababa, Ethiopia. Based on the analysis of both quantitative and qualitative findings, this section presents the main conclusions drawn from the study as follows;

1. China–Africa infrastructure cooperation positively influences project management practices (M = 4.08), particularly planning, scheduling, and performance monitoring.

2. The findings confirm that cooperation contributes significantly to capacity development and skill enhancement, as reflected in the high rating for opportunities (M = 4.23), particularly where local teams gain technical skills (M = 4.30, SD = 0.71).

3. The study concludes that project management systems introduced through Chinese involvement are perceived as effective, particularly advanced project management practices (M = 4.32, SD = 0.74) and improved collaboration in scheduling and resource planning (M = 4.18, SD = 0.81).

4. Despite the positive outcomes, significant challenges remain, especially communication barriers due to cultural and language differences, which ranked highest among constraints (M = 4.21, SD = 0.82).

5. The overall comparative analysis indicates that opportunities recorded the highest mean score (M = 4.23), followed by project management practices (M = 4.08) and implementation challenges (M = 4.01), suggesting an overall positive assessment of the cooperation's impact.

## Acknowledgment

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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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# List of Figures

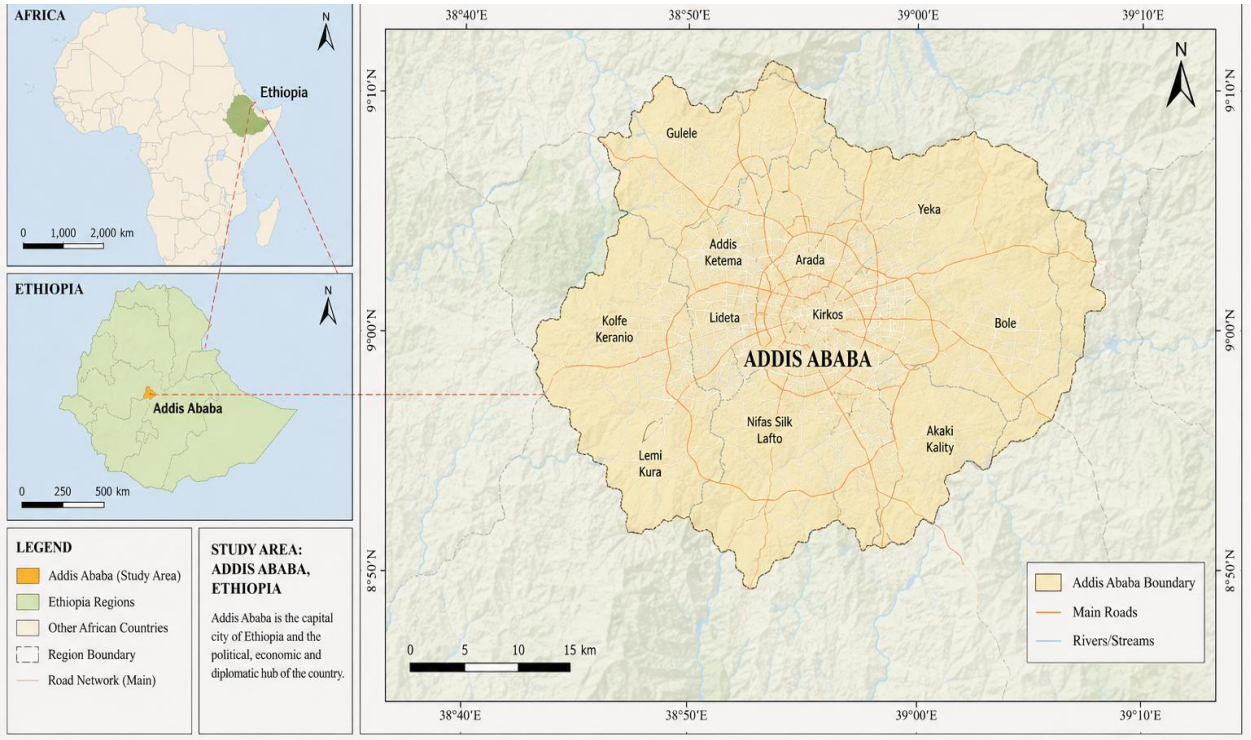



Figure 1. Study area location map

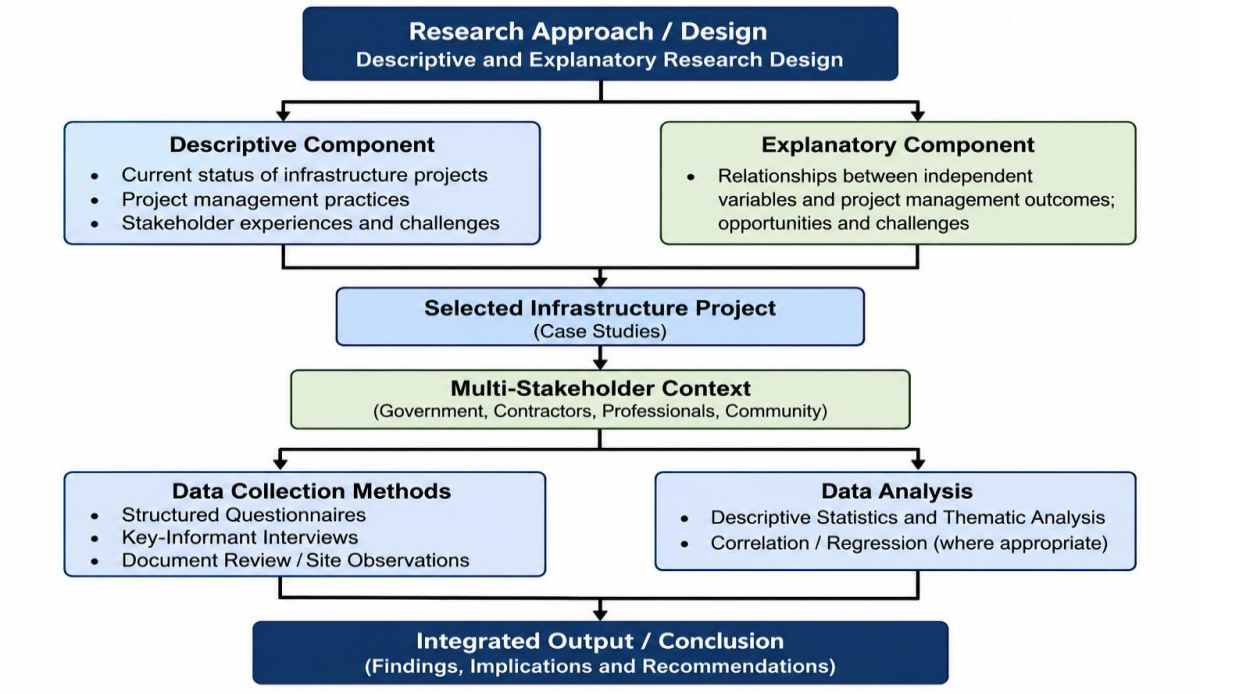



Figure 2. Mixed-methods research framework.

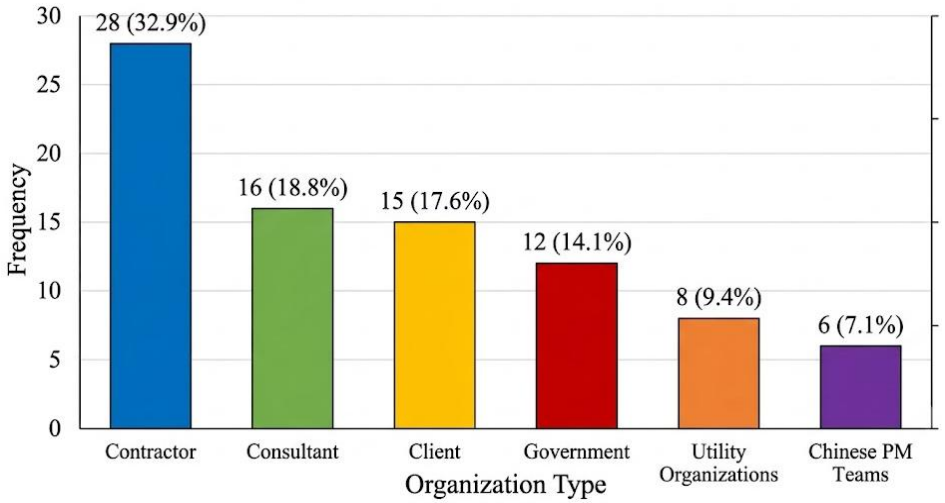



Figure 3. Distribution of respondents by organization type

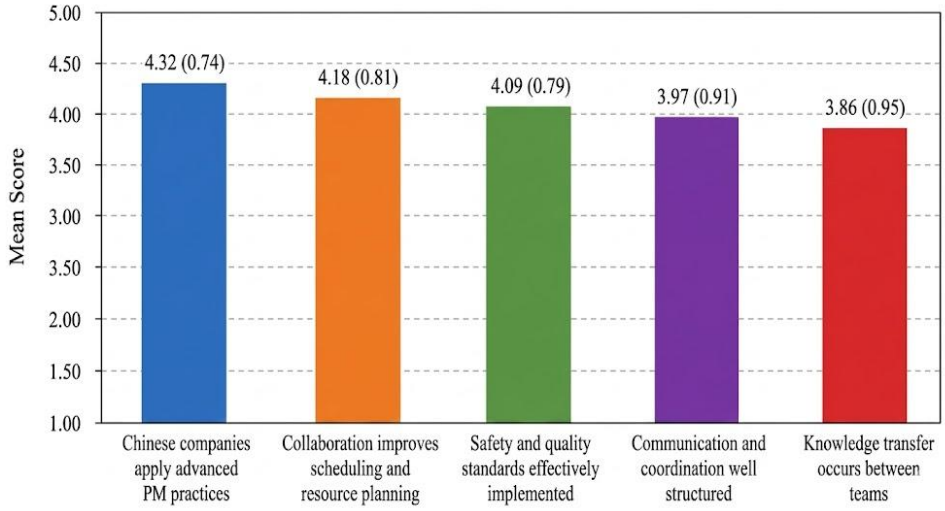



Figure 4. Project management practices

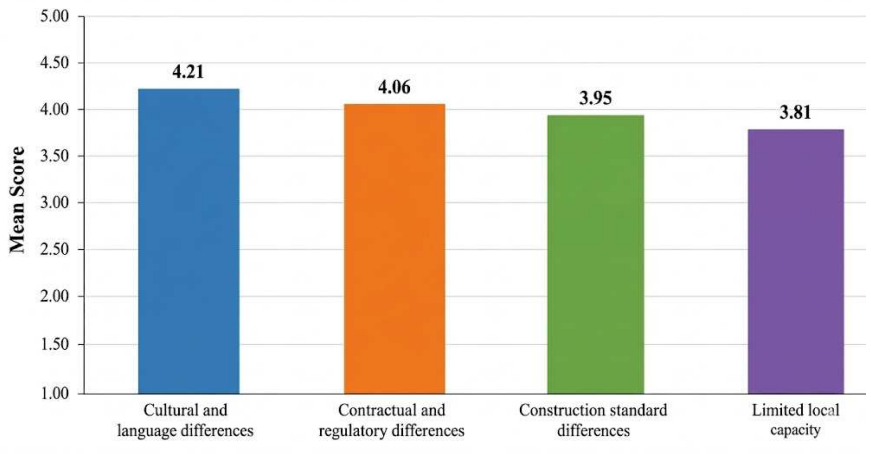



Figure 5. Challenges in China–Africa Cooperation Construction Projects

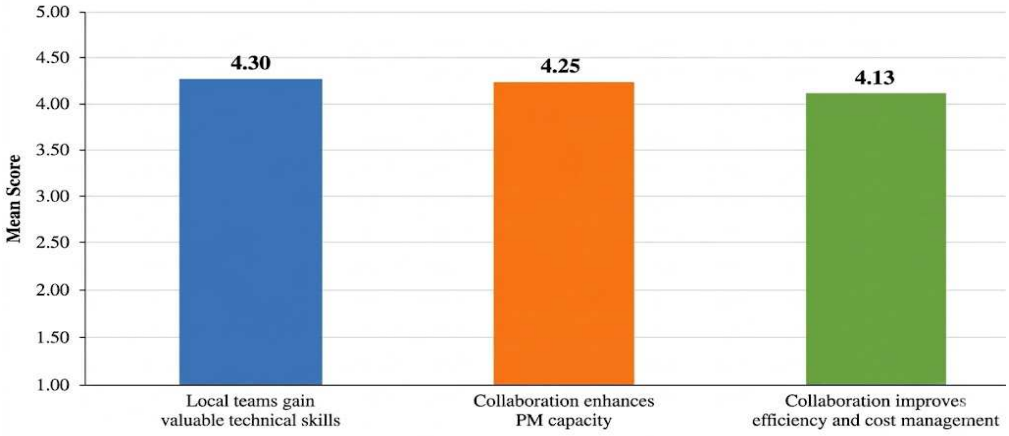



Figure 6. Benefits of China–Africa Cooperation Construction Projects

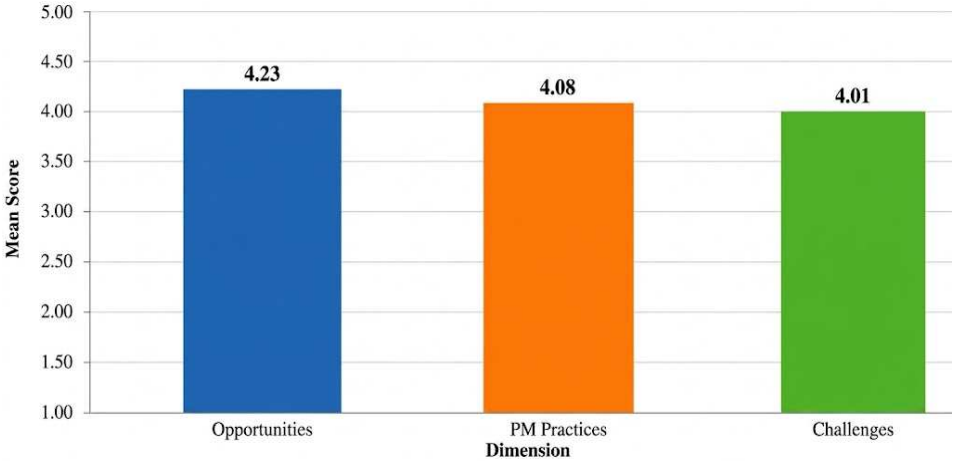



Figure 7. Comparative analysis of dimensions