

# Construction and Practice of a Technical and Vocational Training System for Overseas Civil Engineering Projects

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**Abstract:** To address the shortage of local talents and mismatched training systems faced by Chinese enterprises in overseas infrastructure projects, this paper takes the technical and vocational training system for overseas civil engineering personnel as the research object. Based on a review of domestic and international research and practices, it systematically analyzes key challenges in developing such a system, including large gaps between Chinese and foreign standards, misalignment between local talent supply and project demand, fragmented and unintegrated resources, and difficulties in cross-cultural adaptation. Following the research framework of “theoretical method – case practice”, this study proposes four practical pathways: aligning standards, optimizing models, integrating resources, and improving mechanisms. The effectiveness of these pathways is verified using cases from the China–Laos Railway and Jakarta–Bandung High-Speed Railway projects. The findings provide theoretical support and replicable practical models for high-quality localized skills training in overseas civil engineering projects and for enhancing the international competitiveness of enterprises.

**Keywords:** Overseas projects; Civil engineering; Skills training; Practical research

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## 1. Introduction

With the deepening of the Belt and Road Initiative, global demand for infrastructure investment has continued to grow. An increasing number of Chinese enterprises are participating in overseas civil engineering and infrastructure projects, promoting the export of Chinese technologies and production capacity. However, such expansion is accompanied by problems such as a shortage of localized talents and incompatible training systems.

Currently, the global infrastructure sector faces a serious imbalance between supply and demand for skilled workers. Overseas civil engineering projects impose increasingly high requirements on professional skills, cross-cultural adaptation, and alignment with international standards. Most existing training programs

simply copy domestic models and lack systematic design, making them unable to meet on-site operational needs or support localized development. Although attempts such as “Field Colleges” and “Luban Workshops” have emerged, a standardized and systematic training system has not yet been formed.

Against this background, constructing a training system that fits the overseas civil engineering environment, connects Chinese and international standards, and integrates technical skills with localization has become critical to overcoming talent bottlenecks, ensuring project quality, and advancing international industrial capacity cooperation. This gives the study practical necessity and application orientation <sup>[1]</sup>.

## **2. Significance of constructing and implementing an overseas civil engineering skills training system**

Establishing and implementing a technical skills training system for overseas civil engineering projects carries important theoretical and practical significance.

In practical terms, the system effectively solves the shortage of localized talents and skill mismatches for Chinese enterprises in overseas projects. Through standardized and systematic training, it improves the professional competence of local skilled workers, aligns with international civil engineering standards and on-site operational requirements, and ensures construction quality, safety, and efficiency. It helps Chinese enterprises deepen their presence in overseas markets, enhance international competitiveness, and support high-quality infrastructure cooperation under the Belt and Road Initiative.

Theoretically, the development and application of the system enrich the theoretical framework of overseas vocational skills training, fill research gaps in targeted training for civil engineering, and provide a replicable practical model for similar overseas skills training programs. It also offers theoretical support and guidance for innovating talent development models in the context of international industrial capacity cooperation <sup>[2]</sup>.

## **3. Difficulties in constructing and implementing the training system**

### **3.1. Difficulty in adapting differences between Chinese and foreign civil engineering standards**

Countries and regions hosting overseas civil engineering projects have their own industrial standards. Requirements for construction techniques, quality acceptance, and safety regulations vary significantly across economies. Some countries have unique technical codes and operational rules that differ substantially from current Chinese standards in parameters and procedures <sup>[3]</sup>. The training system must accommodate major requirements of national standards, integrating mature Chinese civil engineering technologies while accurately aligning with local norms to avoid disconnects between training content and project practice. In addition, some countries update standards frequently, requiring continuous revision of training content, which raises the cost and difficulty of dynamic adaptation. Errors in standard alignment directly affect the suitability of training outcomes for real-world construction <sup>[4]</sup>.

### **3.2. Misalignment Between Local Talent Supply–Demand and Training Positioning**

Talent demand for overseas civil engineering projects is localized and differentiated. The skill levels and knowledge structures of the local labor market often deviate from actual project needs. The training system must precisely match local talent supply and job requirements. However, in some regions, the overall skill

level is low, and receptivity to training is strongly influenced by local culture and educational background. Training positioning often deviates: it may overemphasize theoretical instruction at the expense of practical ability, or focus only on single-post skills without improving comprehensive literacy. As a result, trained personnel cannot quickly adapt to positions or fill talent gaps, reducing the practical value and targeting of the training system <sup>[5]</sup>.

### **3.3. Insufficient integration of training resources and support capacity**

Overseas civil engineering training requires integrated resources, including instructors, textbooks, venues, and equipment. However, resources are unevenly distributed overseas. Some project locations lack professional trainers and standardized textbooks. Most trainers are part-time on-site technical staff without systematic teaching capacity. Training venues and practical equipment are constrained by local economic and industrial conditions. Suitable practical facilities are often unavailable, and equipment lags behind construction technologies, failing to meet hands-on training needs. In addition, training funding is limited by project budgets, restricting investment in instructor development, textbook updates, and equipment maintenance, which hinders the stable operation and effectiveness of the training system <sup>[6]</sup>.

### **3.4. Poor adaptation between cross-cultural communication and training delivery**

Cultural differences create significant communication barriers in overseas civil engineering training. Differences in language, values, and work habits easily lead to miscommunication between trainers and local trainees, resulting in inaccurate delivery of content and poor comprehension. Some training materials ignore local cultural backgrounds and use uniform teaching methods and languages, which do not match trainees' cognitive habits and learning characteristics, reducing motivation and participation <sup>[7]</sup>. Cultural differences also affect training organization and management. A one-size-fits-all model cannot adapt to individual learning speeds and styles, weakening training effectiveness and increasing implementation difficulties.

## **4. Construction and practical paths for the overseas civil engineering skills training system**

### **4.1. Align Chinese and foreign standards and build a differentiated training content system**

Researchers and practitioners fully collect civil engineering industry standards, safety codes, and technical requirements of the host country, then combine the advantages of Chinese civil engineering technology to identify priorities for training content. They clarify skill demands for each project position, decompose core skill modules, remove content that conflicts with local standards or is irrelevant to positions, and form a content framework that meets local realities and connects Chinese and foreign standards. A dynamic updating mechanism is established to respond to revisions of local standards and technological improvements, ensuring timely adjustment of training content <sup>[8]</sup>.

Take the civil engineering skills training project for the China-Laos Railway as an example. The staff needs to fully understand the construction quality acceptance standards and safety operation procedures of the civil engineering industry in Laos. They should particularly analyze the differences between China's railway civil engineering standards and the norms of Laos in aspects such as subgrade compaction degree, bridge concrete strength indicators, and steel bar binding techniques. They should identify the special requirements

of Laos for railway civil engineering construction, and in connection with the main construction links of the China-Laos Railway project, break down the skill modules of each position, eliminate the operation processes that conflict with the norms of Laos in the Chinese standards, and integrate them into differentiated training content that includes standard interpretation, skill practice, safety protection, etc. At the same time, assign dedicated personnel to connect with the construction department of Laos, keep track of the revision of local civil engineering standards in real time, promptly incorporate the latest norms into the training content, compile a standard comparison manual, help trainees quickly master the core requirements of both standards, and supplement special training contents such as roadbed anti-sinking and bridge anti-corrosion for tropical regions based on the local geological conditions, to ensure that the training content is highly consistent with the actual construction of the project, effectively solve the problem of incompatibility between Chinese and foreign standards, and cultivate technical and skilled personnel who meet the requirements of both standards for the project.

#### **4.2. Adapt to local realities and optimize training modes and teaching methods**

Research is conducted on local talent supply, learning habits, and cultural characteristics. Based on the results, the training model is optimized away from pure theoretical instruction to an integrated model combining theory and practice, online and offline. Teaching methods are improved according to local cognitive characteristics, using modular and tiered instruction to meet learners with different foundations<sup>[9]</sup>. An online training platform is built with practical videos and standard interpretation materials for flexible learning, while offline sessions focus on hands-on training to strengthen operational abilities, achieving precise matching between training modes and local needs.

In the local skills training program for infrastructure construction of the Yawat-Vietnam high-speed railway in Indonesia, the staff first conducted research on the skill levels, learning habits and cultural backgrounds of the local workforce in Indonesia. They learned that local trainees placed greater emphasis on practical skills, had a low acceptance of theoretical knowledge, and most needed to balance on-site work and thus could not attend centralized training. Therefore, a combined training model was formed, which included online intensive teaching, offline practical training, and nighttime supplementary training. An online multi-language training platform was set up, uploading practical teaching videos, standard interpretation courseware, and knowledge point question banks, supporting trainees to study in fragmented time during their spare hours, setting up online Q&A channels to promptly answer trainees' learning questions; offline, the practical training venue for the Yawat-Vietnam high-speed railway construction site was established, dividing areas for roadbed construction, bridge pouring, and steel bar processing, equipped with professional practical equipment, and arranging senior project technicians for on-site guidance, correcting behavioral deviations step by step. According to the different skill bases of the trainees, stratified teaching was carried out. Trainees with zero skills mainly received basic skills training, and those with certain skills received on-site specialized skills training. In combination with the local language habits in Indonesia, bilingual teaching in Indonesian and Chinese was used to avoid language communication barriers, which was in line with the learning characteristics of local trainees and improved the participation rate and learning effect of the training, enabling the training content to be quickly transformed into on-site practical skills.

#### **4.3. Integrate high-quality resources and strengthen training support**

Project, local educational, and industrial resources are coordinated to establish a multi-stakeholder integration

mechanism. Professional instructors are recruited and provided specialized training in teaching and cross-cultural communication. Training funds are allocated rationally, prioritizing instructor development, textbook compilation, and practical equipment. Standardized training venues are constructed, suitable equipment is provided, and localized textbooks are developed. Supporting services are improved to offer all-round resource support for the training system<sup>[10]</sup>.

In the “Civil Engineering Training Project for Metro in Riyadh, Saudi Arabia”, the staff need to integrate the technical resources of Chinese-funded enterprises, the educational resources of local vocational colleges, and the resources of industry associations. They will form a training teaching team consisting of senior technical experts from Chinese-funded enterprises, professional teachers from local vocational colleges, and industry technical backbone members. Specialized training will be provided for the teachers, including cross-cultural teaching and updates in civil engineering skills, to enhance the teaching ability and cross-cultural communication skills of the teachers, and to ensure the quality of the training. The training funds will be reasonably allocated, with the majority of the funds used to purchase the practical equipment and the compilation of teaching materials. Standardized training venues will be constructed, and practical equipment such as steel bar processing machines and concrete mixers will be configured. In combination with the local civil engineering standards and the construction requirements of the Riyadh Metro project, Arabic and Chinese bilingual training materials will be compiled. The content of the materials includes theoretical knowledge, practical operation procedures, and safety regulations. Comprehensive services, such as answering questions, assessment, and logistical support, will be improved to create a favorable learning environment for the trainees. In addition, efforts will be made to connect with the local construction department, seek policy support, enrich training resources, and solve the problem of resource shortage during the training process, providing guarantees for the orderly conduct of the training work.

#### **4.4. Improve management and control mechanisms for sustainable implementation**

A full-process training management and control system is established to clarify responsible persons and operating rules for planning, delivery, and assessment. A scientific evaluation system is set up using skill mastery and job suitability as indicators, with regular assessments to identify and resolve problems promptly. A feedback mechanism tracks post-training job placement and collects input to continuously refine content, format, and support, promoting long-term and standardized operation.

In the infrastructure training program for the Mombasa-Nairobi Railway in Kenya, the staff needs to determine the planners of the training plan, the coordinators of the teaching staff, the organizers of practical training, the evaluators of the assessment and evaluation, and the supervisors of the effect tracking. They should standardize the management of the entire training process and ensure that each link proceeds in an orderly manner. Establish a comprehensive evaluation system including theoretical assessment, practical assessment, and job fit assessment. The theoretical assessment focuses on the interpretation of standards and the mastery of professional knowledge, the practical assessment emphasizes the detection of the standardization and proficiency of the trainees’ job skills operations, and the job fit assessment pays attention to the trainees’ performance in the project after training. The assessment results are directly linked to the trainees’ job recruitment and skill promotion, and implement regular assessment and irregular spot checks. For trainees who fail the assessment, they will receive supplementary training and examinations to ensure the quality of the training. Designated personnel are responsible for tracking and managing the job matching situation of the trainees after training. Regularly collect feedback from trainees and project managers. Timely

make improvements and adjustments to training problems such as overly difficult training content, inadequate practical training, and teaching methods not suitable for local trainees. Also, improve the management system of the training system, formulate management regulations for training updates, teacher management, and fund usage, and promote the long-term operation of the training system. Thus, qualified technical and skilled talents will be continuously provided to the Mombasa-Nairobi Railway project, ensuring the construction quality and efficiency of the project.

## 5. Conclusion

This paper focuses on the construction and practice of a technical skills training system for overseas civil engineering projects. It clarifies the significance of the system, analyzes four major practical difficulties: standard alignment, talent supply, demand mismatch, resource shortage, and cross-cultural adaptation, and proposes targeted implementation pathways, whose feasibility and effectiveness are verified using real overseas project cases. Based on the needs of Chinese enterprises “going global” and global infrastructure cooperation, this research solves key problems in overseas civil engineering training, enriches relevant theories and practical models, and provides theoretical support and operational guidance for localized talent development, improved international competitiveness, and high-quality infrastructure cooperation under the Belt and Road Initiative.

## Disclosure statement

The author declares no conflict of interest.

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