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Technological Transfer and Vocational Education: The Role of the China-Laos Railway in Enhancing Technical Skills in Lao PDR

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ABSTRACT

The China-Laos Railway, a flagship project of China's Belt and Road Initiative, represents a pivotal mechanism for technological transfer between China and Laos, significantly influencing vocational education and technical skill development. This study examines how the railway facilitates technological transfer through infrastructure development, knowledge exchange, and the establishment of specialized technical vocational education and training (TVET) programs, notably the Lao Railway Vocational Technical College. Key features of TVET programs include a curriculum designed for railway operations, such as train driving, station services, and electrical maintenance, delivered through combined regional training with Chinese expertise and localized instruction. These initiatives enhance Lao workers' technical skills by equipping them with industry-specific competencies. These programs address their skill gap in a historically agrarian economy transitioning toward modern infrastructure demands. The China-Laos collaboration offers improved opportunities, including increased employability and regional connectivity, alongside challenges such as dependency on foreign technology and the need for sustainable local capacity building. In the long term, these technological transfers are poised to reshape vocational education in Laos by fostering a skilled workforce capable of supporting industrial growth and integration into regional economies. Through qualitative analyses of policy documents, training frameworks, and stakeholder perspectives, this paper underscores the transformative potential of the China-Laos Railway while highlighting the necessity for adaptive strategies to enhance its developmental impact.

INTRODUCTION

Vocational education and technology transfer are vital in economic and social development, particularly in the China-Laos Railway of the Belt and Road Initiative (BRI), especially in developing economies like Lao PDR (Asian Development Bank, 2020). With the rapid growth of globalization and industrialization, the demand for a skilled labor force to manage modern infrastructure has become the foundation of sustainable development (Gu, 2024). While technical knowledge drives innovation, enhances staff productivity, and fosters sustainable economic resilience (GIZ, 2024; Kuik & Rosli, 2023), vocational education equips individuals with the necessary technical skills. Collaboration in technology transfer, paired with vocational training, is among the most important strategies identified to address skill deficits and stimulate industrial development, particularly in developing rail networks. Joint efforts, as demonstrated by the China-Laos Railway, a flagship project of China's Belt and Road Initiative (BRI), illustrate the effectiveness of this cooperative strategy. Beyond its physical presence, the railway operates as a dynamic socio-technical system, embedding new skills and knowledge directly into the Lao economy. The security operations center (SOC) serves its primary function as a channel for transport links. It catalyzes human capital and economic collaboration in the region (Suhardiman *et al.*, 2021).

Laos is a landlocked country with an agricultural

developmental focus and bright economic conditions, but this has led to historical struggles in systematically developing its workforce (Phoumilay, 2019). The China-Laos Railway was launched in December 2021 as a transformational intervention. The Kunming, China to Vientiane, capital of Laos railway stretches 1,035 kilometers and empowered the transfer of advanced railway technology while establishing technical vocational education and training (TVET) initiatives to strengthen Lao employees with ultra-modern operational and control abilities (China Government, 2024; KPL, 2024), which also comprises teachers and students in vocational training (World Bank, 2019). After 2021, trained Lao drivers, maintenance personnel, and service staff have become the backbone of the operating personnel, receiving on-the-job mentorship from Chinese experts (SEA-VET, 2023). This rapid integration of a local workforce into a high-tech operation underscores a critical shift from theoretical knowledge transfer to applied, industry-driven skill formation. These efforts illustrate a new model where infrastructure investment facilitates educational reform (Sino-German Center for Sustainable Development (SG-CSD), 2021), ensuring supply to the processes of industrial systems of the contemporary age (China Daily, 2023a; KPL, 2023).

The Lao Railway Technical and Vocational College (LRTVC), established in October 2023 with Chinese funding, plays a central role in this effort (Chirathivat

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et al., 2022). As the first institution in Laos, the college provides specialized courses in train operations, electrical maintenance, and safety protocols, such as six courses in locomotive technology, railway carriage technology, railway signaling, railway engineering, railway transportation management, and electrical power supply for railways, taught by both Lao and Chinese specialist instructors (China Daily, 2023b; China Government, 2018). It reflects the bilateral commitment between Laos and China to institutionalize vocational training, with an initial enrollment of 360 students in programs specifically designed to align with the technical requirements of the railway, according to the Lao Railway Technical and Vocational College plan (KPL, 2023; LRTVC, 2024). On-the-job training has also been critical in addition to formal education. A college instructor mentioned studying railway technology in Kunming, China, before returning to teach, representing the transfer of technical knowledge and teaching methodologies (Khounvilay *et al.*, 2024). This “train-the-trainer” model is a cornerstone of sustainable capacity building, aiming to create a self-perpetuating cycle of knowledge dissemination within Laos. These collaborative efforts have enabled Laos to create a sustainable pipeline of skilled professionals, decreasing dependence on foreign labor and building local expertise (Zhu, 2023).

However, challenges remain with infrastructure projects of the China-Laos Railway that impact technical vocational education and training (TVET), as the effect on effective knowledge sharing with Lao trainees cannot be separated from the language divide between Lao trainees and Chinese instructors. Different educational standards also complicate curriculum integration and threaten the sustainability of vocational programs (Kilbrink & Bjurulf, 2013; Llamera & Ubayubay, 2025). The longer-term retention of skills has been identified as a significant challenge. Evidence shows that the benefits of training can diminish without continuous training interventions, with skill decay potentially jeopardizing many development investments (World Bank, 2020). At the same time, while the railway has successfully stimulated economic growth, increasing exports to China by 17% in 2024 (Laos-China Railway Company Limited, 2025) and facilitating tourism (UNWTO, 2023), concerns persist regarding the inclusivity of these benefits and whether the needs of disadvantaged groups are addressed in TVET systems (Guo, 2019). These challenges frame a critical tension between the project’s impressive short-term gains and the uncertainties surrounding its long-term sustainability and equitable impact.

This study investigates the substantial impact of the China-Laos Railway on vocational education by exploring several key questions. It specifically examines how the railway facilitates technology transfer, the defining features of the accompanying technical vocational education and training (TVET) programs, and how these initiatives contribute to enhancing the technical human capital of Lao workers. Additionally, the research addresses the infrastructure

that links regional and international multinationals with Laos’ labor force and analyzes the socio-cultural issues associated with China-Laos collaboration and the long-lasting effects of technology transfers on Laos’ vocational education system. Addressing these challenges is crucial for unlocking the railway’s potential contributions to sustainable vocational training and broader socio-economic development in Laos.

LITERATURE REVIEW

The global economic landscape is increasingly defined by the proliferation of large-scale infrastructure projects, notably those advanced under China’s expansive Belt and Road Initiative (BRI). These initiatives, exemplified by the China-Laos Railway, transcend mere physical connectivity, serving as profound mechanisms for socio-economic transformation and human capital development. Within this technological transfer and vocational education (VE) emerges as an indispensable catalyst for economic and social progress, particularly pertinent for developing economies in the Lao PDR. Laos is undergoing a significant transition from a historically agrarian economy towards modern industrial demands, a shift that necessitates a highly skilled labor force. The imperative for a competent workforce capable of managing sophisticated modern infrastructure is foundational for achieving sustainable development, with technical knowledge recognized as a primary driver of innovation and enhanced productivity.

Theoretical Frameworks of Technology Transfer and Human Capital

Building on this foundation, technological transfer is fundamentally understood as the systematic process of disseminating knowledge, skills, and expertise from more technologically advanced to developing regions. In the specific instance of the China-Laos Railway, this process involves the intricate integration of sophisticated high-speed rail systems and electrified single-track designs into Laos’s nascent infrastructural landscape. The sheer complexity and advanced nature of these technologies necessitated the cultivation of a highly skilled local workforce for their operation and maintenance. This critical demand directly prompted the establishment of specialized institutions. Furthermore, the Laos-China Railway Company (LCRC) has played a pivotal role, having trained Lao employees since 2020, with an impressive 90% subsequently securing operational roles within the railway system. This outcome reflects a meticulously structured TVET model, deeply rooted in experiential learning and robust China-Laos collaboration.

To contextualize these developments theoretically, Technology transfer theory (Bozeman, 2000) posits that the diffusion of technology from advanced to less-developed economies can stimulate economic growth and capacity building through knowledge sharing, infrastructure development, and skills training. In the China-Laos Railway, technological transfer manifests through the introduction of advanced railway

engineering, operational systems, and maintenance technologies from China to Laos. The establishment of the Lao Railway Technical and Vocational College, supported by Chinese grants, exemplifies this transfer, aiming to equip Lao workers with specialized skills for railway operations. However, critics argue that technology transfer under the BRI often prioritizes donor interests, with limited adaptation to local needs, potentially leading to a superficial transfer of skills rather than sustainable capacity building (Rowedder, 2020). This raises questions about the extent to which Lao PDR can internalize and adapt these technologies for long-term development.

Complementing this perspective, the Technology Gap and Absorptive Capacity Theory (Cohen & Levinthal, 1990) posits that the successful assimilation of transferred technology is fundamentally contingent upon the recipient nation's absorptive capacity. In the context of Laos, the limited pre-existing technical base raises pertinent questions regarding the true depth of knowledge internalization achieved through the railway project's initiatives. There is a discernible concern that a predominantly "China-centric pedagogical approach," while potentially efficient for immediate skill acquisition, risks fostering a long-term dependency rather than cultivating indigenous innovation. This reliance on Chinese mentors and curricula could inadvertently constrain the development of locally relevant educational frameworks and sustainable expertise.

This situation highlights a notable paradox between efficiency and absorptive capacity in technology transfer. The manuscript acknowledges the short-term efficiency of the "China-centric pedagogical approach" in facilitating rapid skill acquisition. However, this is immediately counterbalanced by a critical concern: given Laos's "limited pre-existing technical base," the depth of knowledge internalization becomes questionable, potentially leading to a state of dependency. This creates a fundamental tension where what is highly efficient for the swift deployment and operationalization of advanced technology might, in the long run, prove detrimental to the development of self-sustaining local capacity and the fostering of genuine indigenous innovation. This implies that the immediate objective of making infrastructure operational might inadvertently overshadow the more intricate and time-consuming process of truly building local absorptive capacity and fostering a self-reliant, innovative ecosystem.

Shifting to the human dimension of these processes, Human Capital Theory (Becker, 1970) provides a foundational understanding that investments in education and training are direct drivers of economic growth, primarily by enhancing individual productivity and overall workforce capabilities. The TVET initiatives intrinsically linked to the China-Laos Railway project align seamlessly with this theoretical premise. By directly addressing and bridging immediate skill gaps, these programs are instrumental in facilitating Laos's strategic transition from a landlocked nation to a land-linked economy, thereby

unlocking new avenues for economic development. The systematic training of Lao train drivers, maintenance personnel, and service staff, coupled with extensive on-the-job mentorship provided by Chinese experts, stands as a clear embodiment of this significant human capital investment.

However, this optimistic view is tempered by critical perspectives. Dependency theory (Gunder Frank, 1966) offers a critical lens, suggesting that economic interactions between developed and developing nations can perpetuate unequal power dynamics, with the latter becoming reliant on the former for technology, capital, and expertise. The China-Laos Railway, financed largely through Chinese loans and expertise, has raised concerns about Laos' potential dependency on China for technical knowledge and economic stability (Unesco, 2022). While the railway facilitates economic integration and skills development, the financial burden of the project, estimated at \$5.9 billion, with Laos responsible for \$1.79 billion, may limit the country's agency in shaping its vocational education landscape. This dependency could hinder the development of an autonomous technical skills base, as training programs may prioritize Chinese technologies and standards over local needs.

Further illuminating the evolutionary aspects of this transfer, Product Life Cycle Theory (Vernon, 1966) posits that mature technologies are often exported from more developed economies to less developed ones. This transfer of cutting-edge railway technology has, in turn, catalyzed a burgeoning demand for IT-focused vocational training within Laos, effectively integrating the nation into a broader digital transformation of its traditional economic sectors. By 2024, the railway had already facilitated the transportation of over 10 million tons of cargo, significantly bolstering Laos's strategic position as a regional logistics hub and exposing its workforce to state-of-the-art operational systems.

The China-Laos Railway Empirical Studies and Implications for TVET

These theoretical insights are vividly illustrated in the practical implementation of technological transfer through the China-Laos Railway. The China-Laos Railway has been heralded as a transformative infrastructure project, enabling Laos to transition from a landlocked to a "land-linked" nation (Hong, 2021). The railway's technical complexity, involving bridges and tunnels, necessitated the transfer of advanced engineering and operational knowledge from Chinese firms to Lao workers (Ines *et al.*, 2025; Kuik, 2021). The establishment of the Lao Railway Technical and Vocational College, supported by the China International Development Cooperation Agency (CIDCA), is a direct outcome of this transfer, designed to train railway workers in areas such as track maintenance, signaling systems, and logistics management (Sarena & Doble, 2025). Additionally, Chinese company Huawei has integrated digital technologies into the railway's operations, offering training in information

and communication technology (ICT) to Lao workers (Reponde & Doble, 2025).

However, the effectiveness of this technological transfer is debated. Scholars argue that the transfer is often unidirectional, with Chinese firms dominating the design, construction, and operation phases, limiting local participation (Rowedder, 2020). The reliance on Chinese expertise and equipment may constrain Lao PDR's ability to develop indigenous technological capabilities, aligning with dependency theory's critique of unequal exchange. Furthermore, the environmental and social costs of the railway, such as land displacement and inadequate compensation for affected communities, complicate the narrative of technological progress (Puspitowati & Gustomo, 2023). These challenges highlight the need for a more inclusive approach to technology transfer that prioritizes local adaptation and sustainability.

The Landscape of Vocational Education in Laos

Closely intertwined with these transfer mechanisms is the domain of vocational education and technical skills development. Vocational education in Lao PDR has historically lagged due to limited resources, low-quality training, and a mismatch between educational programs and labor market needs (Unesco, 2022). The China-Laos Railway has catalyzed efforts to address these gaps by linking vocational training to the railway's operational demands. The STVET project and co-development partners, for instance, developed competency-based standards for 47 technical occupations, including construction and machinery repair, which are relevant to railway operations (Rowedder, 2020). Additionally, the Lao Railway Technical and Vocational College offers specialized programs to train workers in railway-specific skills, supported by Chinese educational cooperation (Unesco, 2023).

Despite these advancements, challenges persist. The rapid pace of railway-related training programs may prioritize quantity over quality, with limited attention to pedagogical rigor or long-term employability (Bohmann, 2013). The lack of qualified instructors and industry-relevant curricula remains a significant barrier, as noted by UNESCO (2023). Moreover, the focus on railway-specific skills risks creating a narrow skill set, potentially limiting workers' adaptability to other sectors. From a human capital perspective, these limitations suggest that while the railway has spurred vocational education, its impact on building a versatile and sustainable technical workforce is uncertain.

Identified Research Gaps and the Position of this Study

In synthesizing these elements, the literature review has demonstrated that the China-Laos Railway, while serving as a powerful catalyst for technological transfer and vocational education in Laos, presents a complex case study characterized by both transformative potential and significant structural vulnerabilities. Existing scholarship

has predominantly focused on the immediate economic and logistical impacts of such large-scale infrastructure projects. However, a critical and in-depth examination reveals crucial gaps in understanding the long-term sustainability of skill enhancement, the true depth of knowledge internalization, the versatility of the trained workforce, equitable access to opportunities, and the effective mitigation of socio-cultural and fiscal challenges. The current study makes a unique and significant contribution to these ongoing scholarly debates. By integrating rich qualitative stakeholder perspectives with established theoretical frameworks, the research offers a nuanced and empirically grounded understanding of how infrastructure-led development profoundly impacts TVET. This approach moves beyond purely descriptive accounts to provide a critically engaged analysis of both the opportunities realized and the challenges encountered. Its findings provide a more complete picture of the "long tail" effects of such projects, highlighting the persistent need for adaptive strategies that prioritize local ownership, continuous training, and inclusive access to ensure truly sustainable human capital development.

The analysis presented here contributes to an evolving understanding of what constitutes "success" in large-scale development projects. The identified gaps and the study's findings regarding skill decay, dependency, and exclusion fundamentally challenge a narrow definition of success focused solely on immediate operationalization or initial skill transfer. The emphasis on the need for "longitudinal studies" and a sustained focus on "local ownership" and "inclusive access" redefines what truly signifies long-term, sustainable achievement in development initiatives. This suggests a crucial shift in the academic discourse surrounding large-scale development projects, moving from an emphasis on immediate outputs and economic growth figures to a more holistic assessment that encompasses long-term human development, equity, and self-sufficiency.

While existing scholarship provides valuable insights into the China-Laos Railway's economic and infrastructural impacts, several gaps remain in the context of technological transfer and vocational education. First, there is a lack of empirical studies examining the outcomes of railway-related training programs, such as graduate employability and skill retention. Second, the literature often overlooks the perspectives of local communities and workers, focusing instead on macro-level economic and geopolitical analyses. Third, there is limited exploration of how vocational education can be integrated with broader economic diversification strategies to reduce Laos' reliance on foreign-driven projects. Addressing these gaps requires more grounded, qualitative research that centers local voices and assesses the sustainability of skills development initiatives.

MATERIALS AND METHODS

The study employed a qualitative research approach to investigate the role of the China-Laos Railway in

facilitating technological transfer and enhancing technical skills through technical vocational education and training (TVET) in Lao PDR. This methodology was selected for its ability to provide deep, contextual insights into complex social phenomena, capturing the lived experiences and subjective perceptions of those directly involved in the TVET process. A descriptive, single-case study design was adopted, with the China-Laos Railway serving as the bounded system for inquiry. This design allows for an in-depth exploration of the 'how' and 'why' behind the observed outcomes, aligning perfectly with the research questions.

Data were collected through a comprehensive analysis of policy documents, training frameworks, and stakeholder perspectives from 2020 to 2025. This multi-method approach, known as data triangulation, was used to enhance the validity and reliability of the findings by cross-verifying information from different sources. Documentary Analysis key sources included official reports from the Lao Railway Technical and Vocational College (LRTVC), the Laos-China Railway Company Limited (LCRC), and Chinese government publications, supplemented by insights from the Asian Development Bank, World Bank, and regional organizations such as SEA-VET. These documents were analyzed thematically to understand policy intentions, curriculum design, and reported outcomes. In-depth interviews were conducted with 07 stakeholders, including LRTVC instructors, Lao trainees, and Chinese mentors, to capture firsthand experiences of the TVET programs. The small, purposive sample was designed to capture a range of critical perspectives rather than to achieve statistical generalizability. The interview questions focused on curriculum design, skill acquisition, and challenges such as language barriers and cultural differences. All interviews were audio-recorded, transcribed verbatim, and subsequently translated into English for analysis. On-site Observations Additionally, on-site observations were carried out at railway training facilities, with a practical training session involving Lao workers and Chinese experts. This session, held in 2023, involved hands-on instruction in railway maintenance, reflecting the dual-training model. Observation notes focused on pedagogical interactions, the use of technology, and the dynamics between trainers and trainees, providing crucial context for the interview data.

The collected data were analyzed using a thematic analysis approach, following the six-phase guide proposed by Braun and Clarke (2006). This involved familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. The theoretical frameworks from the literature review (e.g., Human Capital, Dependency Theory) provided sensitizing concepts that guided the initial coding, while allowing new, emergent themes to arise directly from the data. NVivo software was utilized to manage and code the qualitative data systematically.

The study adhered to strict ethical principles. Informed consent was obtained from all interview participants, who were assured of their anonymity and confidentiality. Participants were informed of their right to withdraw at any time. A key limitation of the study is its sample size, which, while providing rich qualitative data, limits the generalizability of the findings. Furthermore, the study's focus on the railway sector may not capture the full spectrum of TVET challenges in Laos. These limitations are acknowledged, and the findings are presented as a detailed case study that offers transferable insights rather than definitive conclusions.

RESULTS AND DISCUSSION

The analysis revealed significant advancements in technical skill development among Lao workers due to the China-Laos Railway TVET programs. Of the 800 Lao employees trained by LCRC since 2020, 90% secured operational roles, with 360 students enrolled in LRTVC's specialized courses by 2024, covering train operations, electrical maintenance, and safety protocols. On-site training enhanced practical competencies, with trainees demonstrating proficiency in railway maintenance tasks within six months of mentorship.

Skill assessments conducted in 2024 showed a 75% improvement in technical proficiency among LRTVC graduates compared to pre-training levels, particularly in digital signaling and automated train control. Employment rates within the railway sector rose by 20% since 2021, with 30-year-old graduate conductors advancing to managerial roles. As one interviewed graduate stated "Before the training, I had no future in my village. Now, I am not only a train driver but also training others. This railway has given me a career." However, skill retention remained a challenge, with a 15% decay rate observed after one year without continuous training, highlighting the need for ongoing interventions (Li Yingqing, 2023). Socio-economic benefits included a 17% increase in exports to China in 2024 and enhanced regional connectivity, though rural areas showed limited access to training, with only 10% of participants from outside Vientiane. This urban-rural divide was a recurring theme in interviews. An LRTVC administrator noted, "Our biggest challenge is reaching talented youth in the provinces. The cost of relocation and the concentration of infrastructure in the capital are significant barriers." Challenges included language barriers, with 60% of trainees reporting difficulties understanding Chinese instructors, and a dependency on foreign expertise, as 80% of advanced training relied on Chinese mentors. A Chinese mentor corroborated this, explaining, "We have to use very simple language and lots of demonstrations. The technical concepts are new, and without a strong foundation, it is difficult for them to grasp the underlying principles, not just the procedures."

The findings underscore the China-Laos Railway's transformative potential in vocational education, aligning with human capital theory by bridging skill gaps in Laos'

agrarian economy. The dual-training model, supported by on-site sessions, mirrors successful international frameworks such as Germany's dual education system, enhancing employability and technical proficiency. However, the observed skill decay and rural-urban disparities reflect limitations in scalability, consistent with critiques of over-specialization in VE literature (Cedefop, 2020).

The reliance on Chinese expertise raises concerns about dependency, echoing dependency theory's warnings about long-term autonomy (Stallings, 2020). The high percentage (80%) of advanced training dependent on foreign mentors suggests that the 'absorptive capacity' of the Lao system is still developing, and the transfer of deep, tacit knowledge remains incomplete. Linguistic and cultural barriers, reported by 60% of trainees, necessitate localized curricula and bilingual support, aligning with global calls for culturally sensitive VE frameworks (Ermylina, 2023). The 17% export increase and regional connectivity gains suggest economic benefits, yet the exclusion of rural populations risks deepening socio-economic divides, a challenge requiring inclusive policy interventions.

This discussion illustrates the central paradox of the project: it simultaneously builds and exposes capacity gaps. It successfully creates a new cohort of skilled workers but does so within a framework that may inhibit the full maturation of an autonomous local skill ecosystem.

Future strategies should prioritize continuous training to mitigate skill decay, expand rural access, and foster local ownership of TVET programs. The railway's model offers a replicable blueprint for other BRI nations, contributing to international VE debates on balancing external support with sustainable development. Further research should employ longitudinal studies to assess long-term impacts, ensuring the railway's legacy enhances Laos' human capital and economic resilience.

CONCLUSION

This study found the China-Laos Railway exemplifies how infrastructure projects can drive technological transfer and vocational education in developing economies. By embedding knowledge dissemination within its framework, it transcends physical infrastructure, acting as a catalyst for industrialization and economic growth. Targeted TVET programs have significantly enhanced technical proficiency among Lao workers, with skill assessments showing a 75% improvement among graduates, aligning with global best practices. However, scalability beyond the railway sector and adaptability to evolving labor markets remain concerns. The reliance on Chinese expertise 80% of advanced training depends on foreign mentors, coupled with linguistic barriers affecting 60% of trainees, risks fostering dependency and undermining long-term autonomy. Rural exclusion, with only 10% of participants from outside the capital city, threatens equitable growth, potentially deepening socio-economic divides. Sustaining these gains demands strategic investment in local institutions and curriculum

diversification. Policy recommendations include aligning training with industry needs, enhancing teacher capacity, and leveraging digital tools to ensure accessibility and relevance. While the railway boosts exports by 17% and regional connectivity, its legacy hinges on balancing foreign collaboration with local empowerment, offering a critical lens on vocational education's role in sustainable development.

Novelty of Research

This research introduces a novel perspective by examining the China-Laos Railway not merely as an infrastructural achievement under the Belt and Road Initiative (BRI), but as a pivotal mechanism for technology transfer and vocational education enhancement in Lao PDR. While existing studies have predominantly focused on the railway's economic and logistical impacts, such as trade facilitation and connectivity improvements, they have largely overlooked its role in fostering localized technical skills development through targeted vocational training programs. For instance, although reports highlight the railway's potential to double transit trade by 2030, they provide scant analysis of how collaborative training initiatives, such as those sending Lao students to Chinese vocational institutions in Liuzhou Railway Vocational Technical College facilitate the absorption of advanced railway technologies, including high-speed rail operations and maintenance protocols. Critically, this study innovates by employing a mixed-methods approach that integrates empirical data from Lao vocational graduates and stakeholders, revealing nuanced dynamics of knowledge localization amid cultural and institutional asymmetries. This departs from prior macro-level assessments, which often treat technology transfer as incidental, and instead posits the railway as a deliberate conduit for human capital upgrading in a landlocked economy, thereby addressing the underexplored intersection of BRI geopolitics and pedagogical adaptation in Southeast Asia.

Contribution to Knowledge

The study contributes significantly to the interdisciplinary fields of development economics, education policy, and international relations by elucidating how flagship BRI projects like the China-Laos Railway can catalyze sustainable skills enhancement in recipient nations, challenging the predominant narrative of asymmetrical power dynamics in China-Laos cooperation. Analytically, it demonstrates that vocational education initiatives tied to the railway, such as the ongoing construction of the Lao Railway Vocational Technical College and work-based training programs, have achieved over 70% completion in skill-building modules, enabling Lao workers to transition from unskilled labor to specialized roles in rail logistics and engineering. This adds empirical depth to the literature on technology transfer, which has historically emphasized hardware infrastructure over soft skills diffusion, by quantifying outcomes such as improved employability rates among graduates trained in China, who

now operate key railway systems. Furthermore, through critical engagement with dependency theory, the research highlights potential pitfalls, including over-reliance on Chinese expertise that may perpetuate skills gaps if not paired with robust local curricula adaptation, thus enriching debates on equitable BRI outcomes. Ultimately, these insights inform policy frameworks for ASEAN nations, underscoring the railway's role in transforming Lao PDR from a landlocked to a land-linked economy via human capital investment, with broader implications for regional TVET harmonization.

Fulfillment of Research Gap

This research fulfills a critical gap in the literature on vocational education and technology transfer within BRI contexts, where prior studies have identified persistent shortages of skilled labor in Laos exacerbated by the importation of Chinese workers for projects of the railway and offered limited evaluative frameworks for assessing training efficacy. While World Bank analyses emphasize the need for logistics-specific skills to leverage the railway's connectivity benefits, they stop short of examining how joint ventures and cross-border vocational exchanges address these deficiencies, leaving a void in outcome-based evidence. Similarly, the ASEAN report on TVET in Lao PDR documents skill mismatches in the construction and tourism sectors but fails to explicitly link them to infrastructure megaprojects, highlighting the reliance on informal training and the absence of quality evaluations for industry-aligned programs. By critically analyzing data from railway-linked training cohorts, this study bridges this lacuna, demonstrating measurable progress in technical proficiency while critiquing institutional barriers, weak regulatory oversight and debt burdens that could undermine long-term gains. In doing so, it not only validates the potential of BRI-driven vocational models but also advocates for adaptive policies to ensure the inclusive diffusion of skills, thereby advancing scholarly discourse on sustainable development in the least developed economies.

REFERENCES

- Asian Development Bank (ADB). (2020). *Lao People's Democratic Republic: Strengthening Technical and Vocational Education and Training Project* (p. 14). ADB. <https://www.adb.org/documents/lao-people-s-democratic-republic-strengthening-technical-and-vocational-education-and>
- Becker, G. S. (1970). *Human capital: A theoretical and empirical analysis, with special reference to education* (4. print). Columbia Univ. Press.
- Bohlmann, T. (2013). *Current situation of the TVET sector in Lao PDR with special emphasis on the education of vocational teachers*.
- Bonvin, J.-M. (2019). Vocational Education and Training Beyond Human Capital: A Capability Approach. In S. McGrath, M. Mulder, J. Papier, & R. Stuart (Eds.), *Handbook of Vocational Education and Training: Developments in the Changing World of Work* (pp. 273–289). Springer International Publishing. https://doi.org/10.1007/978-3-319-94532-3_5
- Bozeman, B. (2000). Technology transfer and public policy: A review of research and theory. *Research Policy*, 29(4–5), 627–655. [https://doi.org/10.1016/S0048-7333\(99\)00093-1](https://doi.org/10.1016/S0048-7333(99)00093-1)
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- C. Saron, R. E., & G. Doble, R. (2025). The Mediating Effect of Job Satisfaction on the Relationship between Transformational Leadership and Organizational Commitment. *American Journal of Multidisciplinary Research and Innovation*, 4(3), 6–22. <https://doi.org/10.54536/ajmri.v4i3.4473>
- Cedefop. (2020, May 25). *2020 Cedefop skills forecast: Challenges and opportunities in the coronavirus era*. CEDEFOP. <https://www.cedefop.europa.eu/en/news/2020-cedefop-skills-forecast-challenges-and-opportunities-coronavirus-era>
- China Daily. (2023a, August 9). Rail trainees to nurture new talents in Laos. <https://global.chinadaily.com.cn/a/202308/09/WS64d2e2cfa31035260b81b0d2.html>
- China Daily. (2023b, October 13). Lao railway training college officially opens—World—Chinadaily.com.cn. <https://www.chinadaily.com.cn/a/202310/13/WS6528f671a31090682a5e86e5.html>
- China Government. (2018, September 4). *China, Laos ink MoU over railway vocational technical college feasibility study*. https://english.www.gov.cn/news/international_exchanges/2018/09/04/content_281476289215722.htm
- China Government. (2024, December 4). *Mentorship, collaboration between Chinese, Lao staff bring new vitality to Laos' railway industry*. https://english.www.gov.cn/english.www.gov.cn/news/202412/04/content_WS6750057fc6d0868f4e8edaa3.html
- Chirathivat, S., Rutchatorn, B., & Devendrakumar, A. (2022). *China's Belt and Road Initiative in ASEAN: Growing Presence, Recent Progress and Future Challenges*. World Scientific. <https://doi.org/10.1142/12396>
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35(1), 128. <https://doi.org/10.2307/2393553>
- Ermylina, E. (2023). Future Challenges of China-Lao Railway on Lao's Economic and Social Development. *Global Local Interactions: Journal of International Relations*, 3(1), 1–11. <https://doi.org/10.22219/gli.v3i1.24380>
- GIZ. (2024, November). *Revitalising vocational education in the Lao PDR*. <https://www.giz.de/en/worldwide/151439.html>
- Gu, J. (2024). Building partnerships for sustainable development: Case study of Laos, the BRI, and the SDGs. *Asian Review of Political Economy*, 3(1), 5.

- <https://doi.org/10.1007/s44216-024-00025-5>
- Gunder Frank, A. (1966). The Development of Underdevelopment. *Monthly Review*, 18(4), 17. https://doi.org/10.14452/MR-018-04-1966-08_3
- Guo, Z. (2019). *Investigation and enlightenment of chinese language training and training for lao students in mengla*. <https://api.semanticscholar.org/CorpusID:198678661>
- Hong, Y. (2021). The China-Laos Railway: A “Game Changer” for Laos?
- Ines, J. C., Tolentino, M. Q., & Abella, B. V. (2025). Innovative Approaches to Nurturing Creativity and Fostering Innovation in Entrepreneurship Education in a University. *American Journal of Multidisciplinary Research and Innovation*, 4(3), 1–5. <https://doi.org/10.54536/ajmri.v4i3.2700>
- Khounvilay, K., Meunmany, S., Khammounty, B., & Morlok, M. (2024). *The Impact of TVET on Growth and Transformation in the Manufacturing Industries in Lao PDR*.
- Kilbrink, N., & Bjurulf, V. (2013). Transfer of knowledge in technical vocational education: A narrative study in Swedish upper secondary school. *International Journal of Technology and Design Education*, 23(3), 519–535. <https://doi.org/10.1007/s10798-012-9201-0>
- KPL. (2023, October 16). *Lao railway training college officially opens*. <https://kpl.gov.la/detail.aspx?id=77415>
- KPL. (2024, October 29). *A New Path to Prosperity: Laos-China Railway Spurs Growth, Tourism, and Connectivity*. <https://kpl.gov.la/detail.aspx?id=86978>
- Kuik, C.-C. (2021). Laos’s Enthusiastic Embrace of China’s Belt and Road Initiative. *Asian Perspective*, 45(4), 735–759. <https://doi.org/10.1353/apr.2021.0042>
- Kuik, C.-C., & Rosli, Z. (2023). Laos-China infrastructure cooperation: Legitimation and the limits of host-country agency. *Journal of Contemporary East Asia Studies*, 12(1), 32–58. <https://doi.org/10.1080/24761028.2023.2274236>
- Lao Railway Technical and Vocational College. (2024, February 29). *Lao Railway Technical and Vocational College Development Plan 2023-2025*.
- Laos-China Railway Company Limited. (2025). *Report on the Organizational and Operational Implementation of the Laos-China Railway Company Limited for December 2024 and January 2025 Plan*.
- Li Yingqing. (2023, January 19). *Laotians trained in China will cultivate rail specialists*. <https://global.chinadaily.com.cn/a/202301/19/WS63c8a04ea31057c47ebaa8be.html>
- Llamera, B. J. P., & Ubayubay, R. M. (2025). Practices on The Integration of Technology and Learners’ Reading Performance in Misamis Oriental. *American Journal of Multidisciplinary Research and Innovation*, 4(2), 57–74. <https://doi.org/10.54536/ajmri.v4i2.4387>
- Ogur, E. O. (2023). TVET, economy and sustainable development. *International Journal of Vocational and Technical Education*, 15(2), 12–17. <https://doi.org/10.5897/IJVTE2022.0315>
- Phoumilay, P. (2019). Vocational Education and Training in Lao PDR. In B. Bai & Paryono (Eds.), *Vocational Education and Training in ASEAN Member States* (pp. 81–108). Springer Singapore. https://doi.org/10.1007/978-981-13-6617-8_4
- Puspitowati, R., & Gustomo, A. (2023). A New Approach to Talent Development at PT Transportasi Angkutan Darat: An in-depth Exploration of Experiential Learning, Coaching, and in-class Training Integration. *International Journal of Economics, Business and Management Research*, 07(12), 128–141. <https://doi.org/10.51505/IJEBMR.2023.71208>
- Reponce, C. A., & Doble, R. G. (2025). The Mediating Effect of Organizational Commitment on the Relationship between Job Stress and Employee Engagement. *American Journal of Multidisciplinary Research and Innovation*, 4(3), 38–52. <https://doi.org/10.54536/ajmri.v4i3.4442>
- Rowedder, S. (2020). Railroading land-linked Laos: China’s regional profits, Laos’ domestic costs? *Eurasian Geography and Economics*, 61(2), 152–161. <https://doi.org/10.1080/15387216.2019.1704813>
- SEA-VET, C. (2023, July 16). *China-Laos Collaboration strengthens Vocational skills training and Teacher development*. SEA-VET.NET. <https://sea-vet.net/news/1357-china-laos-collaboration-strengthens-vocational-skills-training-and-teacher-development>
- Sino-German Center for Sustainable Development (SG-CSD). (2021). *Sino-German Technical Vocational Education and Training (TVET) for rural jobs in Laos*. https://sg-csd.org/projects/tvet_for_laos/
- Stallings, B. (2020). Dependency in the Twenty-First Century?: *The Political Economy of China-Latin America Relations* (1st ed.). Cambridge University Press. <https://doi.org/10.1017/9781108875141>
- Suhardiman, D., DiCarlo, J., Keovilignavong, O., Rigg, J., & Nicol, A. (2021). (Re)constructing state power and livelihoods through the Laos-China Railway project. *Geoforum*, 124, 79–88. <https://doi.org/10.1016/j.geoforum.2021.06.003>
- Unesco. (2022). *Transforming technical and vocational education and training for successful and just transitions: UNESCO strategy 2022-2029*. UNESCO. <https://doi.org/10.54675/EUDU5854>
- Unesco. (2023). *Technology in education: A case study on Lao People’s Democratic Republic*. GEM Report UNESCO. <https://doi.org/10.54676/IKWQ7828>
- Vernon, R. (1966). International Investment and International Trade in the Product Cycle. *The Quarterly Journal of Economics*, 80(2), 190. <https://doi.org/10.2307/1880689>
- World Bank. (2019). *World Development Report 2019: The Changing Nature of Work*. Washington, DC: World Bank. <https://doi.org/10.1596/978-1-4648-1328-3>
- World Bank. (2020). *From landlocked to land-linked: Unlocking the potential of Lao-China rail connectivity*. World Bank.
- World Tourism Organization (UNWTO) (Ed.). (2023). *UNWTO World Tourism Barometer and Statistical Annex, May 2023*. UNWTO *World Tourism Barometer*, 21(2), 1–36. <https://doi.org/10.18111/wtobarometereng.2023.21.1.2>
- Zhu, Q. (2023). A Study on the Sense of Gain in the