

# The Impact of International Technology Transfer on Technology Gap in the Context of Developing Countries

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## Abstract

The study aimed at the effect of International Technology Transfer (ITT) on the technology gap in developing countries. The study investigated the effects of ITT on the policies and strategies that can be implemented to improve ITT in developing countries. The study was anchored on dependency theory. The study employed a qualitative method. The study's narrative review was chosen as it is an evidence-based review that concentrates on previous literature. The study used a search strategy. Previous empirical studies were screened using Prisma Flow-diagram. It was found that the effects of ITTs on the technology gap in developing countries remain a subject of debate and investigation in academic research and that empirical evidence from different studies has shown mixed findings. The study concluded that ITT could positively and negatively affect the technology gap in developing countries. The study recommended that developing countries prioritize investment in education and human capital development to build a skilled workforce capable of utilizing and adapting to new technologies. In addition, they should encourage local innovation and development of indigenous technology to reduce dependency on foreign technology and promote sustainable development.

**Keywords:** globalization, technology gap, technology transfer, technological advancements, technological capabilities

## Introduction

Increased economic integration and the fluidity of globalization have brought about technology transfers. As a result, many industrialized nations have implemented policies that promote technology transfer. International Technology Transfer (ITT) involves transferring technology from developed to developing countries. Osano and Koine (2016) expressed that this transfer can occur through various means, such as foreign direct investment, licensing, joint ventures, and strategic alliances. The goal of technology transfer is to improve the technological capabilities of developing countries and reduce the technology gap that exists between developed and developing countries.

Konstandina and Gachino (2020) argued that ITT has a long, illustrious theoretical and research background. It has become known that Multinational Enterprises (MNEs) use ITT to strategically induce an unabated competitive force for domestic firms in the host nations. They have secured more monopolistic operations or a tendency to dominate the host economies through the ITT to their international affiliates. It is, however exposed from the pragmatic perspective that foreign-owned firms can speed up the transfer of technology and technical know-how. A better application of fundamental technologies may also significantly impact the host economy more than adopting new technologies when the technology gap between industrialized and developing countries is substantial. Zanello et al. (2015) opined that understanding and promoting economic growth and global development, therefore require understanding the transfer, acceptance, and application of knowledge in developing countries.

The technology gap between developed and developing countries is a significant issue. Developed countries have access to the latest technologies and resources, which allows them to be more productive and competitive in the global economy. Developing countries, on the other hand, often lack the technological resources needed to compete in the global market (Hopper et al., 2017; Qalati et al., 2021). This technology gap can lead to economic stagnation and slow growth in developing countries, leading to poverty and other social issues. The problem to be addressed is the impact of ITT on the technology gap in developing countries. Developing countries often lag in technological advancements, hindering their economic growth and limiting their ability to compete in the global market. ITT is seen as a potential solution to help bridge this gap. However, the effectiveness of ITT in narrowing the technology gap remains unclear, as there are a number of factors that can either facilitate or hinder the successful transfer and implementation of new technology in developing countries.

## Review of the Related Literature

### Technology Transfer

There is no consensus as regards the universal conceptual meaning of technology. The most crucial premise for understanding technology is scientific knowledge and advanced equipment. Technology is the systematic integration of organized information into actual tasks. In actuality, technology is the application of scientific knowledge by a specific nation at a particular time to address specific issues affecting its progress.

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Consequently, the definition of technology will change based on the society and development stage. Anything, physical or intellectual, that might support the growth of a nation's economy, industry, or culture will be regarded as technology, regardless of whether the nation currently has access to it. The rationale behind the use of technology is to enhance improved productivity. Konstandina and Gachino (2020) empirical study ascertained that Foreign Direct Investment (FDI) is crucial for technology transfer. Through FDI, the surplus from emerging and transitional nations can be further extracted by transferring knowledge and technology from industrialized nations. Some wealthy nations produce most of the global new technology, and there is now broad acceptance that ITT (ITT) is a significant driver of improved domestic productivity.

According to Gheribi and Voytovych (2018), Technology Transfer is "the term used to describe any procedure whereby a party in one country obtains access to technical knowledge from a foreign party and proficiently incorporates it into its manufacturing process" (p. 551). Transferring technology and expertise between a parent firm and its subsidiaries, affiliates, or other partners in other countries is also referred to as "technology transfer." There are several different pathways used for the transfer of technology. For instance, Halili (2020) posited that a technology package through FDI has been viewed as the primary method for transferring cutting-edge foreign innovations to developing countries. Osano and Koine (2016) added that a nation can transfer technology through license agreements, outright purchases, acquiring capital goods from abroad, and the influx of FDI funds, turnkey projects, and diverse international technical assistance. Patents, trademarks, trade secrets, and other types of intellectual property are transferred by MNEs, along with knowledge and abilities about the creation, manufacture, and marketing of goods and services. Konstandina and Gachino (2020) submitted that both soft and hard technology are transferred in the course of FDI inflow. Physical investments such as machinery, equipment, and plants make up hard technology. Knowledge, organizational structures, and industrial procedures all fall under soft technology. Domestic firms are open to new technology opportunities through technology spillover within and outside the industry. Studies (Konstandina & Gachino, 2020; Noh & Lee, 2019) added that domestic firms benefit via intra-industry spillovers (when the MNEs indirectly release their organizational practices and technology) and inter-industry spillovers (knowledge transfer, information transfer and transferred technology to customers and suppliers).

In most cases, MNEs unconsciously unveiled their technology through their skilled employees who find a better offer with domestic competitors. Based on these, among others, the aggregate

metric of the activity of ITT has become an utmost issue in research. Determining an aggregate metric of ITT's activity and evaluating its benefit to economic growth in both home and host nations is particularly challenging. This is because ITT takes place through a variety of routes. If it was possible to rate the various ITT routes according to their relative relevance, empirical studies could have moved forward by discarding the channels deemed low importance.

Technology gap. It is unclear how productivity or technological disparities between MNEs and domestic firms will affect the transmission of knowledge. However, Wang and Wu (2016) posited that locally inventive business methods used by domestic firms are strengthened by FDI spillover. Technology and knowledge spillovers have their roots in MNEs. According to Buckley and Hashai (2020), one of the main factors leading to the emergence of MNE was the capacity to transfer technological knowledge globally. Recognizing that the mode of knowledge transfers and sharing noted in the existing literature is predicated on inclusivity and mutual benefits, Wang and Wu (2016) expressed that it is important to note that the distinctions between local and foreign firms in terms of technological capability, cognitive structure, and management philosophy can easily impede the success of knowledge spillover.

The term "technology gap" refers to the discrepancy between a firm's existing technological capabilities and what is required to make a product for economical use. Weko and Goldthau (2022) added that the significance of using technologies in local instances is to promote innovation and generate economic value. Foreign-owned firms possess the physical and technological capabilities and have the right volume of intellectual property necessary for technology utilization. Li et al. (2020) expressed that the technology gap describes the knowledge gaps that exist between domestic and foreign-owned businesses at the industry level. The technological capabilities and knowledge has been the brain behind the sustainable competitive advantages of MNEs in developing countries.

### Developing Countries

Ayukekbong et al. (2017) posited that there are varying categorizing developing countries. Most importantly, they are categorized on the basis of economic progress. From other angles, developing countries may be considered fulfilling nomenclature due to shortfalls in the Human Capital Index, standard of living, and overdependence on natural resources. Developing countries are, in most cases, at the receiving end of economic and technological benefits. Table 1 shows the categorization of developing countries by region.

**Table 1**  
Classification of Developing Countries by Continents Region

Africa continent				
Southern Africa	North Africa	Central Africa	West Africa	East Africa
Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe	Algeria, Egypt, Libya, Mauritania, Morocco, Sudan, and Tunisia	African Republic, Cameroon, Central Chad, Congo, Equatorial Guinea, Gabon, and São Tomé and Príncipe	Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo	Burundi, Comoros, Democratic Republic of the Congo, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Somalia, Uganda, and United Republic of Tanzania
Asia continent				
East Asia		South Asia	Western Asia	
Brunei, China, Darussalam, Hong Kong SAR, Indonesia, Malaysia, Myanmar, Papua New Guinea, Philippines, Republic of Korea, Singapore, Taiwan Province of China, Thailand, and Viet Nam		Bangladesh, India, Iran, Nepal, Pakistan, and Sri Lanka	Bahrain, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, and United Arab Emirates	
Latin America and the Caribbean continent				
Caribbean		Mexico and Central America		South America
Barbados, Cuba, Dominican Republic, Guyana, Haiti, Jamaica, Tobago, and Trinidad,		Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Panama		Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela,

Note. Adopted from Prospects of foreign direct investments in technology transfer, by E. Gheribi & N. Voytovych 2018, *Economic and Environmental Studies*, 18(2), p. 555 (<https://doi.org/10.25167/ees.2018.46.5>). Copyright 2018 by the Economic and Environmental Studies.

## Theoretical Underpinning

The study is premised on Dependency Theory. Dependency Theory was propounded by scholars in the 1950s and 1960s, including Raul Prebisch, Fernando Henrique Cardoso, and Enzo Faletto. The theory emerged as a critique of modernization theory, which suggested that developing countries could follow the path of industrialized Western nations by adopting modern technologies and institutions (Agbebi & Virtanen, 2017; Shareiam, 2015). Instead, the theory suggests that the ITT is a mechanism through which developed countries maintain their dominance over developing countries. According to this theory, transferring technology from developed to developing countries is not a neutral process but is shaped by power relations and economic interests.

Dependency theorists argue that MNEs and international organizations are the primary agents of technology transfer (Prasanna *et al.*, 2019; Tülüce & Doğan, 2014). These corporations and organizations are often based in developed countries and have access to advanced technology and capital, which they use to dominate and exploit developing countries. The theory argues that the technology transfer process is often one-sided, with developed countries using their economic and political power to impose their technological standards and practices on developing countries. As a result, developing countries become dependent on developed countries for technological know-how, hindering their ability to develop their technological capabilities. Furthermore, the theory suggests that developed countries often use technology transfer to maintain their economic dominance over developing countries. For example, they may provide outdated or inappropriate technologies that serve their interests and limit the potential for developing new industries in the recipient country. This way, developed countries can ensure that developing countries remain dependent on them for technology and economic growth.

## Technology Transfer to Developing Countries

It is common knowledge that MNEs are drivers of technology transfer. Tülüce and Doğan (2014) expressed that MNEs are widely acknowledged as a mechanism of transferring technology to local firms, notably to the Small and Medium Enterprise (SME) sector, allowing them to modernize their operations to compete globally. Given their enormous expertise and resources in Research and Development, Innovation, and Technology Management, MNEs, and Transnational Corporations (TNCs) are frequently at the forefront of this process (Prasanna *et al.*, 2019). Moreover, by investing in developing countries, these firms can share their knowledge and technology with indigenous firms, creating a ripple effect that could benefit the entire economy.

MNEs participate in technology transfer for various objectives, such as gaining access to new markets, cutting production costs, increasing product quality, and boosting competitiveness. Tang *et al.* (2018) expressed that subsidiaries of MNEs face inherent competitive disadvantages and additional costs when entering international markets. This is primarily due to the considerable differences between the home and host countries regarding technology. The transfer of technology and technical know-how primarily boosts the competitiveness of SMEs because those technologies are tried-and-true and affordable. Garengo (2018) added that improved innovations in SMEs in host countries are favored by technology transfer and knowledge. Therefore, technology transfer and knowledge are critical factors that can significantly improve innovation in SMEs in host countries. When SMEs access new technologies, they can improve their products, services, and processes, increasing efficiency and competitiveness.

On the other hand, knowledge plays a critical role in innovation by providing SMEs with the necessary information and skills to develop new ideas, products, and services. By leveraging knowledge, SMEs can gain a competitive advantage and develop innovative solutions that meet the needs of their customers. However, the transfer of technology can have significant effects on developing countries.

1. **Economic Growth:** Technology transfer can facilitate economic growth by improving productivity, creating new industries, and enhancing competitiveness in the host country.

2. **Job Creation:** Introducing new technology can create job opportunities, including highly skilled and well-paying jobs, which can help reduce unemployment rates in the host country.
3. **Increased Innovation:** Technology transfer can also lead to increased innovation and creativity in the host country as local companies and researchers adapt and build upon the new technologies.
4. **Improved Standard of Living:** The transfer of technology can improve the standard of living in the host country by increasing access to new products and services, improving healthcare outcomes, and reducing poverty levels.

Technology transfer can be advantageous in many ways, but it can also present dangers and obstacles for both the parent firm and its partners. Issues can include safeguarding intellectual property, addressing linguistic and cultural difficulties, and ensuring adherence to regional laws and regulations. Thus, careful planning, open communication, and cooperation between all parties involved are necessary to manage technology transfer effectively. Therefore, there is a need for developing countries to come up with an industrial policy to force technology transfer. Cunningham *et al.* (2019) posited that industrial policy should be effectively implemented to encourage and support successful technology transfer. This signifies that industrial policy is a key tool developing countries can use to promote economic development and facilitate technology transfer. By implementing policies that encourage investment in specific sectors, developing countries can attract foreign firms and encourage them to transfer their technologies to local firms. However, simply implementing an industrial policy may not be sufficient to force technology transfer. Foreign firms may often be reluctant to transfer their technologies due to concerns about intellectual property rights, competitive pressures, etc.

Developing countries should focus on creating an enabling environment that encourages technology transfer. This could include improving education and training programs, investing in research and development, and incentivizing foreign firms to collaborate with local firms. In addition, they should work to strengthen their intellectual property laws and create effective mechanisms for enforcing them. This can help build trust and encourage foreign firms to invest in the country, knowing their intellectual property rights will be protected. While an industrial policy can be an important tool for promoting technology transfer, it should be part of a broader strategy that includes other measures to create an enabling environment for technology transfer and economic development.

## Global Value Chains and Technology Transfer

Global Value Chains (GVCs) refer to the interconnected series of activities involved in producing and delivering goods and services, which can be spread across multiple countries. Ponte *et al.* (2019) and Strange (2020) posited that it describes companies' business operations to move a good or service from conception to usage, recycling, or reuse. There is a strong link between GVCs and technology transfer. GVCs often involve transferring technology from one country to another as companies seek to leverage the skills and expertise of suppliers and partners in different regions. This technology transfer can take many forms, from transferring specific production techniques and processes to licensing intellectual property rights.

Technology transfer occurs in the other direction, as companies in emerging markets develop new technologies and approaches that are then incorporated into global value chains. Although GVC involvement can force developing nations to specialize in low-innovative content, Lema *et al.* (2018) expressed that researchers have found that the potential for transfer of knowledge and spillover effects is greatest when nations are at intermediate stages of development. Participation in GVCs is a possible channel for technology transfer. GVC integration can make it easier for firms to receive non-codified knowledge and technology transfers from abroad, encourage domestic innovation through knowledge spillovers, and increase their ability to absorb new technologies (Branstetter & Maskus, 2022; Piermartini & Rubínová, 2022). The

link between GVCs and technology transfer is an important driver of innovation and economic development as companies and countries seek to leverage the skills and knowledge of partners and suppliers worldwide.

### ITTs and Technology Gap in Developing Countries

ITTs can positively and negatively affect the technology gap in developing countries. Technology transfers can contribute to reducing the technology gap by providing access to advanced technologies that might not otherwise be available. From a different perspective, Bu *et al.* (2019) opined that the technology gap between foreign and domestic firms is what leads to the transfer of technologies through FDI. The bigger the disparity, the more likely regional firms will adopt new technologies and improve efficiency and productivity. Technology transfers allow local firms to upgrade their technology and increase their competitiveness in the global marketplace. Prasanna *et al.* (2019) posited that the transfer of technology primarily improves the competitiveness of domestic firms.

Technology transfers can also contribute to widening the technology gap if they are not accompanied by appropriate support and infrastructure. Prud'homme *et al.* (2018) posited that high technological volatility and strict policy compliance measures precede technology transfer. The transferred technology may not be adequately adopted or used if it is too advanced for the local workforce or the required infrastructure and resources are absent. As a result, developing nations may find it difficult to access and use cutting-edge technologies, which could increase the technology gap. The endeavor of firms or regions to gain knowledge from technology leaders and take advantage of technology spillover is reflected in the technology gap (Pittiglio *et al.*, 2016)

Also, developing countries often face challenges in accessing and acquiring advanced technologies due to inadequate resources, lack of infrastructure, and limited technical expertise. This has created a technology gap, which refers to the disparity between the technological capabilities of developed and developing countries. The technology gap can adversely affect developing countries' economic growth, social development, and competitiveness. Furthermore, the lack of access to advanced technologies can limit the ability to develop countries to innovate and produce goods and services efficiently (Akpan *et al.*, 2020), thus hampering their ability to compete globally. This can result in limited job opportunities, lower standards of living, and a reliance on developed countries for essential goods and services.

Technology transfers can help reduce the technology gap by providing access to advanced technologies, technical expertise, and know-how. Wie (2005), cited in Pratono (2019), exclaimed that technical licensing agreements and FDI are now the main avenues for global technology transfer. For example, a developing country might enter into a licensing agreement with MNEs to use their technology. This would enable the developing country to access advanced technologies and expertise while avoiding the high costs of research and development (Akpan *et al.*, 2020; Pittiglio *et al.*, 2016). With international cooperation, the technology gap can also be closed. Partnerships between academic institutions, research organizations, and private firms can facilitate this. Countries can cooperate, exchange resources, experience, and information, and collectively create new technologies that are advantageous to all parties.

### Technology Gap: Causes and Remedying Strategies

FDI has the potential to introduce new technology and knowledge to developing countries, boosting innovation, production, and efficiency. It is palpable that many firms in developing countries have no access to advanced machinery and equipment, modern production techniques, and management practices. Through technology transfer, domestic firms in developing countries can learn from foreign firms and adopt new technologies, enhancing their competitiveness and performance. With respect to the technology gap in developing countries, the followings are a few causes that require remedying strategies:

1. Limited access to technology: Many developing countries lack the infrastructure and resources necessary for widespread

access. This can include limited access to electricity, internet connectivity, and other necessary resources.

2. Lack of investment: Developing countries often lack the financial resources to invest in technology, research, and development. This can result in a lack of innovation and the inability to keep pace with technological advancements.
3. Weak education systems: Education systems in developing countries may not provide students with the skills necessary to use and innovate with technology. This can limit the development of technological expertise and prevent the country from fully utilizing technology.
4. Political instability: Political instability can discourage foreign investment and create an uncertain business environment, making it difficult for technology companies to establish a presence in developing countries. Political instability and corruption can create an environment not conducive to technological progress and investment.
5. Lack of intellectual property protection: Without strong intellectual property protections, companies may hesitate to invest in developing countries, fearing that their intellectual property will be stolen or otherwise exploited.
6. Limited market size: The relatively small size of many developing country markets can limit the potential profits of technology companies, making it less attractive for them to invest in these countries.
7. Brain drain: Skilled workers and innovators may leave developing countries to pursue better opportunities elsewhere, leading to a shortage of technical expertise within these countries.

The possible consequences are a sharp decline in economic development, productivity, innovation, and competitiveness of countries. Thus, it is imperative to devise policies and strategies to bridge the technology gap between countries, such as technology transfer, investment in education and skills, research and development, institutional and policy reforms, etc. The role of international organizations, such as the United Nations, World Trade Organization, World Bank, and other bilateral and multilateral agencies, in reducing the technology gap between countries is paramount.

### Purpose of the Study

This study aims to examine the effect of ITT on the technology gap in developing countries.

### Objective

This study aims to provide insights into the effectiveness of ITT in reducing the technology gap in developing countries. In addition, the study can inform policymakers and practitioners on the best strategies and policies to promote ITT in developing countries.

### Research Questions

The study explored the following research questions:

1. How does ITT affect the technological capabilities of developing countries?
2. What is the effect of ITT on economic growth in developing countries?
3. What policies and strategies can be implemented to improve ITT in developing countries?

### Methodology

The research employed a qualitative method to deeply understand the subject matter and confirm related information. To draw from the experiences and ideas of others and compare them to the present research issue, the most appropriate approach was to review relevant and scholarly literature. This approach aims to help achieve the research objectives. This study's narrative review was chosen as it is an evidence-based review that concentrates on previous literature. The main focus of a narrative review is to summarize the literature and identify research gaps.

The study used a search strategy related to structured keywords used for searching literature in the database. In addition, a comprehensive search was employed using The Web

of Science and Scopus database. Table 2 shows the reasons for the use of the database.

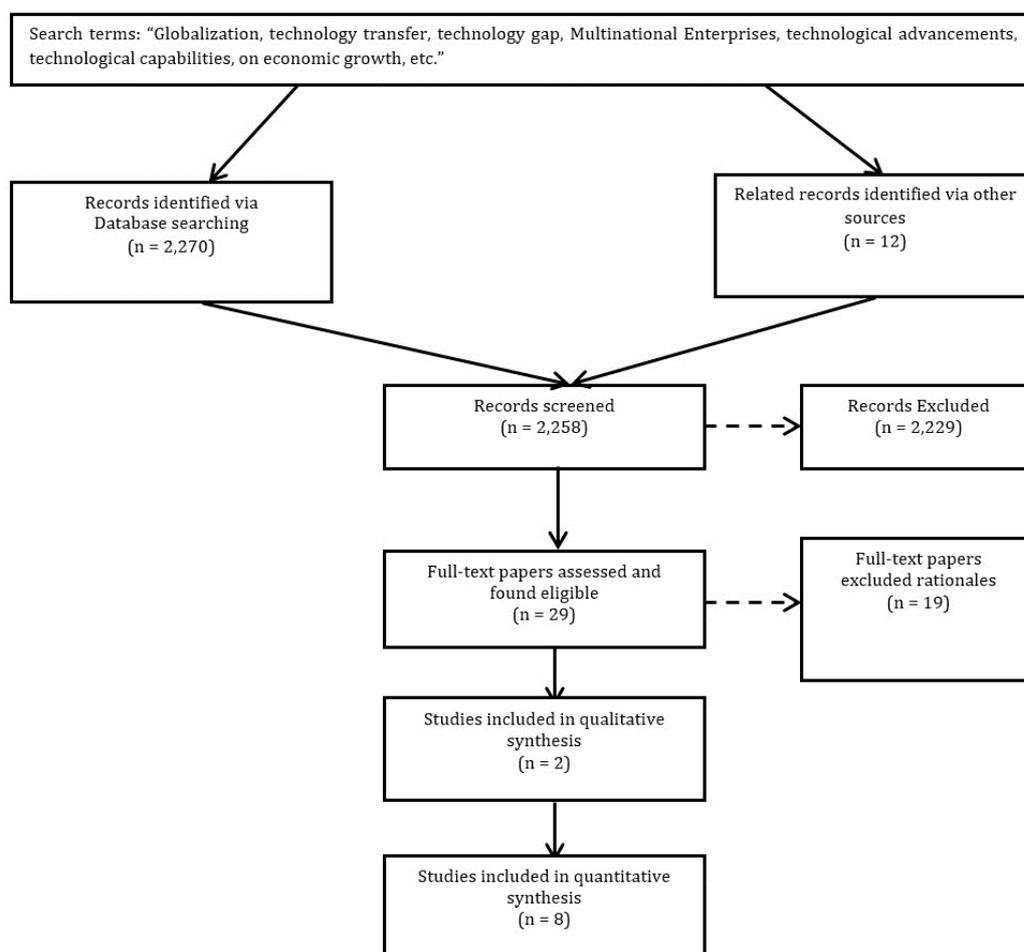
**Table 2**  
Reasons for the Use of Selected Database

Database	Reason for use
Web of Science	The database is widely considered to be reliable and contains top-notch research on the topics of ITT and the Technology Gap.
Scopus	It was chosen because it has records of novel research on ITT and the Technology Gap.

Another technique utilized was forward/backward searching, which involves referencing articles to locate additional relevant research. In order to ensure that all pertinent research had been

identified, hand searches of the most pertinent journals on ITT and Technology Gap, as well as reference lists, were conducted. The flow chart in Figure 1 illustrates the number of studies reviewed.

**Figure 2**  
Prisma Flow-diagram of Relevant Literature Searched



**Results and Discussion**

Researchers concluded that a technology gap between the host and home countries is necessary for FDI-induced technology transfer (Hong et al., 2019). However, the effects of ITTs on the technology gap in developing countries remain a subject of debate and investigation in academic research. Empirical evidence from different studies has shown mixed findings. Some studies have found that ITTs positively affect the technology gap in developing countries. For example, a study by Wong and Chan (2018) found that ITTs positively and significantly impacted technology catch-up in China. Similarly, a study by other studies have found negative effects of ITTs on technology gap in developing countries. For instance, a study by Chakrabarti (2001) found that ITTs led to a widening of the technology gap in India.

Similarly, a study by Aghion et al. (2007) found that ITTs had a negative impact on productivity growth in developing countries.

Some studies have found mixed effects of ITTs on the technology gap in developing countries. For example, a study by Lee and Kim (2010) found that ITTs positively impacted innovation in Korean firms but had a negative impact on the technology gap between Korea and Japan. Many studies have highlighted the importance of contextual factors in determining the effects of ITTs on the technology gap in developing countries. Firms in developing countries (particularly African countries) acquire new technology belatedly due to its high cost. Technology Gap Theory (TGT) explains that MNEs benefit from strong monopolies due to domestic firms' poor absorptive and financial capabilities. Demena and van Bergeijk (2017) added that the vast majority of earlier studies either link high or

low absorptive capacity with low or high technological differences. Although MNEs enjoy temporal monopoly, firms in African countries often struggle to cope with the new market challenge. Technology change has constituted the backdrop of domestic firms in Africa. Therefore, developing nations must quickly adopt new technology to close the gap. To complete this difficult challenge, Gheribi and Voytovych (2018) believe that the roles of both market mechanisms and government regulations are cardinal. A study by Narula and Marin (2003) found that the effects of ITTs on the technology gap depended on the absorptive capacity of the recipient country. Similarly, a study by Kim and Lee (2017) found that the institutional quality of the recipient country moderated the effects of ITTs on the technology gap.

### Summary

The effects of ITTs on the technology gap in developing countries are complex and context-specific. While some studies have found positive effects, others have found negative or mixed effects. The impact of ITTs on the technology gap depends on a range of factors, including the absorptive capacity and institutional quality of the recipient country, as well as the nature and type of the technology being transferred.

### Conclusion

ITT can positively and negatively affect the technology gap in developing countries. It can provide developing countries access to new technologies and knowledge, promoting economic growth and development. It can also widen the technology gap by reinforcing existing inequalities and dependence on developed countries. The effectiveness of technology transfer also depends on factors such as the level of institutional capacity and infrastructure in the recipient country. Therefore, it is important for developing countries to carefully evaluate the costs and benefits of technology transfer and develop appropriate policies and strategies to ensure that technology transfer contributes to their long-term development goals.

### Recommendations

This study recommends the following:

1. Prioritize investment in education and human capital development to build a skilled workforce capable of utilizing and adapting to new technologies.
2. Encourage local innovation and development of indigenous technology to reduce dependency on foreign technology and promote sustainable development.
3. Foster a supportive policy and regulatory environment that promotes technology transfer while protecting local interests and intellectual property rights. Ensure that technology transfer is integrated into broader development strategies and aligns with the country's long-term development goals.

By implementing these recommendations, developing countries can ensure that ITT contributes to their development goals and reduces the technology gap between developed and developing countries.

### References

- Agbebi, M., & Virtanen, P. (2017). Dependency theory – A conceptual lens to understand China's presence in Africa? *Forum for Development Studies*, 44(3), 429–451. <https://doi.org/10.1080/08039410.2017.1281161>
- Aghion, P., Blundell, R., Griffith, R., Howitt, P., & Prantl, S. (2009). The effects of entry on incumbent innovation and productivity. *Review of Economics and Statistics*, 91(1), 20–32. <https://doi.org/10.1162/rest.91.1.20>
- Akpan, I. J., Udoh, E. A. P., & Adebisi, B. (2022). Small business awareness and adoption of state-of-the-art technologies in emerging and developing markets, and lessons from the COVID-19 pandemic. *Journal of Small Business and Entrepreneurship*, 34(2), 123–140. <https://doi.org/10.1080/08276331.2020.1820185>
- Ayukekbong, J. A., Ntemgwa, M., & Atabe, A. N. (2017). The threat of antimicrobial resistance in developing countries: Causes and control strategies. *Antimicrobial Resistance and Infection Control*, 6, 47. <https://doi.org/10.1186/s13756-017-0208-x>
- Branstetter, L., & Maskus, K. E. (2022). Global knowledge flows, absorptive capacity, and capability acquisition: Old ideas, recent evidence, and new approaches. In A. Taubman & J. Watal (Eds.), *Trade in knowledge*. Cambridge University Press.
- Bu, M., Li, S., & Jiang, L. (2019). Foreign direct investment and energy intensity in China: Firm-level evidence. *Energy Economics*, 80, 366–376. <https://doi.org/10.1016/j.eneco.2019.01.003>
- Buckley, P. J., & Hashai, N. (2020). Skepticism toward globalization, technological knowledge flows, and the emergence of a new global system. *Global Strategy Journal*, 10(1), 94–122. <https://doi.org/10.1002/gsj.1372>
- Chakrabarti, A. (2001). The role of intellectual property rights in technology transfer and economic growth: Theory and evidence. *Journal of International Trade and Economic Development*, 10(3), 367–386.
- Cunningham, J. A., Lehmann, E. E., Menter, M., & Seitz, N. (2019). The impact of university focused technology transfer policies on regional innovation and entrepreneurship. *Journal of Technology Transfer*, 44(5), 1451–1475. <https://doi.org/10.1007/s10961-019-09733-0>
- Demena, B. A., & van Bergeijk, P. A. G. (2017). A meta-analysis of Fdi and productivity spillovers in developing countries. *Journal of Economic Surveys*, 31(2), 546–571. <https://doi.org/10.1111/joes.12146>
- Garengo, P. (2018). How bridging organizations manage technology transfer in SMEs: An empirical investigation. *Technology Analysis and Strategic Management*, 31(4), 477–491. <https://doi.org/10.1080/09537325.2018.1520976>
- Gheribi, E., & Voytovych, N. (2018). Prospects of foreign direct investments in technology transfer. *Economic and Environmental Studies*, 18(46), 551–576. <https://doi.org/10.25167/ees.2018.46.5>
- Halili, Z. (2020). Identifying and ranking appropriate strategies for effective technology transfer in the automotive industry: Evidence from Iran. *Technology in Society*, 62, 101264. <https://doi.org/10.1016/j.techsoc.2020.101264>
- Hong, J., Zhou, C., Wu, Y., Wang, R., & Marinova, D. (2019). Technology gap, reverse technology spillover and domestic innovation performance in outward foreign direct investment: Evidence from China. *China and World Economy*, 27(2), 1–23. <https://doi.org/10.1111/cwe.12272>
- Hopper, T., Lassou, P., & Soobaroyen, T. (2017). Globalization, accounting and developing countries. *Critical Perspectives on Accounting*, 43, 125–148. <https://doi.org/10.1016/j.cpa.2016.06.003>
- Kim, Y., & Lee, Y. S. (2017). The impact of ITT on technology gap: An empirical study of developing countries. *Asian Journal of Technology Innovation*, 25(2), 243–257.
- Konstandina, M. S., & Gachino, G. G. (2020). International technology transfer: Evidence on foreign direct investment in Albania. *Journal of Economic Studies*, 47(2), 286–306. <https://doi.org/10.1108/JES-02-2018-0076>
- Lee, Y. S., & Kim, Y. (2010). Effects of technology transfer on innovation in Korean firms. *Asian Journal of Technology Innovation*, 18(2), 99–117.
- Lema, R., Rabellotti, R., & Gehl Sampath, P. (2018). Innovation trajectories in developing countries: Co-evolution of global value chains and innovation systems. *European Journal of Development Research*, 30(3), 345–363. <https://doi.org/10.1057/s41287-018-0149-0>
- Narula, R., & Marin, A. (2003). FDI spillovers, absorptive capacities and human capital development: Evidence from Argentina. *Journal of International Business Studies*, 34(3), 244–262.
- Noh, H., & Lee, S. (2019). Where technology transfer research originated and where it is going: A quantitative analysis of literature published between 1980 and 2015. *Journal of Technology Transfer*, 44(3), 700–740. <https://doi.org/10.1007/s10961-017-9634-4>
- Osano, H. M., & Koine, P. W. (2016). Role of foreign direct investment on technology transfer and economic growth in Kenya: A case of

- the energy sector. *Journal of Innovation and Entrepreneurship*, 5(1). <https://doi.org/10.1186/s13731-016-0059-3>
- Piermartini, R., & Rubínová, S. (2022). Knowledge spillovers through international supply chains. In A. Taubman & J. Watal (Eds.), *Trade in knowledge*. Cambridge University Press.
- Ponte, S., Gereffi, G., & Raj-Reichert, G. (2019). Introduction to the handbook on global value chains. *Handbook on global value chains*, 1–27. <https://doi.org/10.4337/9781788113779.00005>
- Prasanna, R., Jayasundara, J., Naradda Gamage, S. K., Ekanayake, E., Rajapakshe, P., & Abeyrathne, G. (2019). Sustainability of SMEs in the competition: A systemic review on technological challenges and SME performance. *Journal of Open Innovation: Technology, Market, and Complexity*, 5(4), 1–18. <https://doi.org/10.3390/joitmc5040100>
- Pratono, A. H. (2019). Cross-cultural collaboration for inclusive global value chain: A case study of rattan industry. *International Journal of Emerging Markets*, 15(1), 149–170. <https://doi.org/10.1108/IJOEM-01-2017-0028>
- Prud'homme, D., von Zedtwitz, M., Thraen, J. J., & Bader, M. (2018). Forced technology transfer policies: Workings in China and strategic implications. *Technological Forecasting and Social Change*, 134, 150–168. <https://doi.org/10.1016/j.techfore.2018.05.022>
- Qalati, S. A., Yuan, L. W., Khan, M. A. S., & Anwar, F. (2021). A mediated model on the adoption of social media and SMEs' performance in developing countries. *Technology in Society*, 64, 1–12. <https://doi.org/10.1016/j.techsoc.2020.101513>
- Shareiam, B. F. (2015). Theories of development. *International Journal of Language and Linguistics*, 2(1), 78–90.
- Strange, R. (2020). The 2020 Covid-19 pandemic and global value chains. *Journal of Industrial and Business Economics*, 47(3), 455–465. <https://doi.org/10.1007/s40812-020-00162-x>
- Tang, C., Tang, Y., & Su, S. (2019). R&D internationalization, product diversification and international performance for emerging market enterprises: An empirical study on Chinese enterprises. *European Management Journal*, 37(4), 529–539. <https://doi.org/10.1016/j.emj.2018.11.003>
- Tülüce, N. S., & Doğan, İ. (2014). The impact of foreign direct investments on SMEs' development. *Procedia - Social and Behavioral Sciences*, 150, 107–115. <https://doi.org/10.1016/j.sbspro.2014.09.012>
- Wang, C. C., & Wu, A. (2016). Geographical FDI knowledge spillover and innovation of indigenous firms in China. *International Business Review*, 25(4), 895–906. <https://doi.org/10.1016/j.ibusrev.2015.12.004>
- Weko, S., & Goldthau, A. (2022). Bridging the low-carbon technology gap? Assessing energy initiatives for the Global South. *Energy Policy*, 169, 1–10. <https://doi.org/10.1016/j.enpol.2022.113192>
- Wie, T. K. (2005). The major channels of ITT to Indonesia: An assessment. In *International Journal of Emerging Markets* A. H. Pratono (Ed.). Cross-cultural collaboration for inclusive global value chain: a case study of rattan industry. <https://doi.org/10.1108/ijoem-01-2017-0028>
- Wong, P. K., & Chan, K. W. (2018). The impact of ITT on technology catch-up in developing countries: Evidence from China. *World Development*, 106, 136–148.
- Zanello, G., Fu, X., Mohnen, P., & Ventresca, M. (2015). The creation and diffusion of innovation in developing countries: A systematic literature review. *Journal of Economic Surveys*, 30(5), 884–912. <https://doi.org/10.1111/joes.12126>

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