Technology Transfer, Technological Progress and Economic Growth: The Role of Institutional Quality in Pakistan

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Abstract: This study investigates the role of institutions in Pakistan's efforts to stimulate technological progress, specifically analysing the evolution of institutional quality, technology transfer through technical cooperation grants, technological progress and economic growth. The role of institutional quality is emphasised, as proactive institutional coordination is paramount to achieve technological upgrading. As the evidence amassed shows, Pakistan's institutional quality ranks lower than the successful industrialisers of East Asia, such as Japan, Korea and Taiwan. To ensure the robustness of our findings, data from 1996 to 2020 was deployed. The findings underscore the importance of policymakers in Pakistan directing their attention to fostering skills and competencies essential for patents or cultivating an entrepreneurial mindset, underlining the critical role of strong institutions in this process.

Keywords: Technology transfer, technological progress, economic growth, institutions, Pakistan
JEL classification: O2, O3, O5, N7, P41

1. Introduction

Considering the economic dimension, Smith's (1776) proposition asserts that economic growth primarily arises from the accumulation of capital. In contrast, the Scottish economist Rae (1834), argues that alongside capital accumulation, technological advancements represent one of the primary drivers of economic growth. Rooted in Marx's concept of capitalist integration and accumulation, this theoretical framework was subsequently expanded upon by scholars such as Abramowitz (1956), Gerschenkron (1962) and Veblen (1915). These scholarly contributions collectively engendered the notion that the state possesses a progressive role extending ahead of its regulatory functions. North (1993) characterises institutions "the rules of the game" in a society in a more rigorous context, as the constraints intentionally devised by humans help shape and mould human interpersonal dynamics. The factual underpinnings of the progressive

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state, which underscore the proactive involvement of government in driving industrial structural transformation can be traced to studies elucidating industrial catch-up experiences of Japan (Johnson, 1982), Korea (Amsden, 1989) and Taiwan (Wade, 1990).[1] Nevertheless, it is worth noting that while Amsden (1989) and Amsden and Chu (2003) offer comprehensive empirical account of catch-up within specific industries, Johnson (1982) and Wade (1990) focus more on institutional arrangements with a strong focus on industrial policies administered through ministries.

Furthermore, the process of industrial deepening has also been facilitated by institutional changes spearheaded by government initiatives, as elucidated by Fagerberg (2006). Starting from the end of World War II, governments in developing nations have predominantly deployed industrial policies aimed at enhancing their domestic technological capabilities. Amsden (1991) in particular explains how latecomer economies have developed national technological capabilities through licencing and acquisition of foreign firms. In fact, the import substitution industrialisation (ISI) strategy envisioned the accumulation of indigenous technological expertise as a vital prerequisite for catalysing economic growth (see also Helpman & Krugman, 1989). While in the initial stages of development, countries such as Japan, Korea and Taiwan primarily acquired technology through purchases rather than through domestic development, the focus was on adapting imported technology through learning and the rooting of technological upgrading in-house. The innovation system of a country encompasses its institutions, the trajectory of its politics, firm's participation in innovative activities (including in-house R&D), and the embedding ecosystem intermediary organisations that attract funding, human capital, public and university-based R&D and incubators to scale up prototypes, which collectively shape how knowledge is created, disseminated, acquired and applied. Global knowledge serves as a powerful tool in promoting technological advancements through various means, such as foreign direct investment (FDI), technology transfer, technological licensing and international trade. As succinctly argued by Amsden (1989, 1991), economies that enter the global stage later have reaped benefits by importing and adapting technology from developed nations to accelerate their progress (see also Rasiah, Singh & Ernst, 2015). To this literature, Saxenian (2007) and Rasiah, Lin and Muniratha (2015) refer to the incisive role of the diaspora carrying tacit and experiential knowledge (especially from the United States), to lead industrial upgrading in Korea, China, India and Taiwan. The interface between a nation's innovation system and ISI plays a crucial role in harmonising policies related to science, technology and innovation in emerging economies.

The prevailing body of literature emphasises the need for focusing the institutions–growth relationship on country-specific investigations to gain insights into the diverse mechanisms by which institutions can impact a nation's economic development (Pande & Udry, 2005). Similarly, in a diverse range of industries, technical cooperation (TC) has also played a significant role in enhancing the accumulation of human intellectual capital, which refers to the ability to make more efficient use of existing resources.

[1] With heartfelt remembrance, we dedicate this research paper to the late Prof. Cheong Kee Cheok, whose passion for knowledge and commitment to learning remain an enduring inspiration. He was also exceptional in mentoring Nazia Nazeer, though officially she was not his student.

While policy and academic debates have continued over the relative effectiveness of loans and grants or both (Bulow & Rogoff, 2005; Burnside & Dollar, 2000; Chang & Chow, 1999; Cordella & Ulku, 2007; Gupta et al., 2006; Iimi & Ojima, 2008; Meltzer, 2000; Oqubay et al., 2020), only a limited number of studies have delved explicitly to examine the variations in aid types and their impact. Specifically, there has been a notable lack of exploration into the efficacy of technical cooperation grants.

This study seeks to address this research gap by examining how institutions facilitate the transfer of technology from donors to recipients of grants. Hence, this study explores the economic factors contributing to countries' inability to emulate the economic success of the Asian tiger economies of Korea and Taiwan in achieving sustained, long-term economic growth. In doing so, this paper focuses on Pakistan, which gained independence in 1947. The paper scrutinises the structural shifts that led Pakistan towards pursuing technological upgrading, and more specifically, the role of institutions in governing technology transfer (through technical cooperation grants), technological progress and economic growth. Indices grounded in technological innovation and annual data series are used to enhance the reliability of the findings.

In Section 2, we explore the theoretical concepts essential for assessing the manufacturing landscape of Pakistan. Section 3 provides an overview of the research methodology and the sources of data used in the study. Finally, section 4 presents the conclusions.

2. Theoretical Consideration

Technology, viewed as a body of knowledge, encompasses both technical aspects, which pertain to product attributes and physical procedures, and transactional aspects, which relate to the social frameworks (inclusive of diverse market and contractual structures) employed in the dissemination of knowledge (Westphal et al., 1985). The act of knowledge transfer itself entails transactional elements, encompassing associated costs and the requisite competencies for its execution, as well as the presence of particular institutional arrangements. While sharing similarities with technology transfer carried out by individuals, this avenue possesses distinct financial, public/private characteristics and institutional frameworks. Likely owing to its institutional particularities, it has generally not yielded significant effectiveness on average. It appears that the aid system has fallen short in terms of adequately investing in human resource capabilities while disproportionately allocating resources towards capital equipment (OECD, 1992). Nonetheless, in terms of economic value, this remains a noteworthy path for technology transfer. A significant synergy between official development aid and foreign direct investment has recently been observed, particularly in the case of Japan (Hiraoka, 1995).

Transactional components exert an impact on the assessment of transferred technologies. Frequently, they are intertwined with the essence of what is being transferred, namely, the technology itself. Unless the transfer pertains to an entity like a patent or another form of abstract knowledge, it becomes challenging to discern the extent of technology transfer. In situations involving informal conduits, such as subcontracting, distinguishing between the trade in components and products and the concurrent transfer of technology becomes exceedingly intricate, if not virtually impossible.

Although like transfer of technology by people, technical assistance and co-operation resembling possesses distinctive financial characteristics, as well as public and private elements, and is governed by unique institutional arrangements. Possibly, due to these institutional particularities, it has generally exhibited limited effectiveness on average. It appears that the aid system has not adequately invested in developing human resource capabilities while disproportionately allocating resources to capital equipment (OECD, 1992). Nevertheless, in terms of economic value, this remains a significant pathway for technology transfer.

As proposed by Gradstein (2004), the institutional framework can impact the accumulation and dissemination of knowledge that should implies a possible connection between the institutional quality and the volume of patent submissions. While this connection is frequently considered in the literature, only a limited number of studies have delved into it. Similarly, some empirical research such as, Gould and Gruben (1996), Maskus and Penubarti (1995), Sala-i-Martin (2001) and Tebaldi and Elmslie (2013) has shown that specific institutional factors, like the control of corruption, rule of law, regulatory quality, risk of expropriation, patent regimes and the role of protecting intellectual property rights significantly influence the number of patents and economic development across different nations. In the context of developing countries, a significant relationship exists between the institutional governing patents and economic development (Branstetter et al., 2011). Also, Chen and Puttitanun (2005) proved the positive outcome of legal shield for innovations on economic development, Hall et al. (2007) and Kanwar (2012) stressed on unclear influence of patent regulations and laws on economic development.

Extractive nature of institutions is detrimental to economic growth because they primarily serve the interests of a select few in society. Acemoglu and Robinson (2012) highlight the “extractive” nature of these institutions as the fundamental reason behind the underdevelopment experienced by many developing countries. While this point is well taken, as Zhang and Rasiah (2015) have argued, neither do Acemoglu offer a robust definition of institutions nor have they got the history of institutions in countries, such as Korea and China right. In Pakistan’s context, a flawed institutions and an inadequate bureaucratic machinery are recognised as the “restraining elements”. Though Pakistan’s capability for economic development mostly depend on its institutional workability (Lopez-Calix & Touqeer, 2013). Similar to other under developing nations, Pakistan’s extractive characteristic of its institutions, and unrestricted and mystification of political power, corrupt governance, red-tapism and weak contract executions are the main reason of its unsatisfactory economic growth (Akbar, 2015; Haider et al., 2011; Husain, 2009; Husain & Bhattacharya, 2004; Qayyum et al., 2008). Henceforth, technical cooperation grants are counted in as they could intensely impact on the adoption as well as diffusion of technologies, increasing innovation activities and competitiveness. In a fast-changing worldwide environment, technological progress is essential for sustaining economic growth, and investigating the effect of cooperative grants on technological progress is specifically appropriate for a nation like Pakistan, which is seeking to stimulate its technological capabilities. Also, the proxy of technological progress is important in evaluating the nature and pace of developments in different sectors. In the case of Pakistan, where industries are struggling to keep pace with world

paradigms, investigating the impact of technological progress on economic actions offers understandings into the country's competitiveness and adaptability. Institutions contribute predominantly in shaping governance and regulatory framework within which technological and economical activities unfold. Therefore, to analyse the impact of institutions in Pakistan it is important to understand how these institutions hinders or facilitates technological and economical advancements. Institutions includes political, legal and social structures that directly affect the ease of doing businesses, innovation strategies and overall nation's progress.

Pakistan's science and technology policy traced back to the 1960s where the National Science Commission was centred on the creation of research and development institutions and universities. In 1964, a division dedicated to scientific and technological research was established within the central government to oversee the execution of science and technology policy on a national scale. Concurrently, the National Science Council, established in 1962, was tasked with providing counsel to the government on policy-related issues and harmonising the efforts of various research organisations. In spite of the advancements achieved in establishing a scientific infrastructure, it became increasingly evident that the national science and technology endeavours were not integrated with the manufacturing sector or the industrialisation process of the nation. In 1971, the nationalisation policy introduced by the government had a detrimental impact on both domestic and foreign investments. Subsequently, the Ministry of Science and Technology was established in 1972. In 1973, the Pakistan Science Foundation was created to play a role of principal organisation responsible for advancing science and offering financial assistance for research focused on socioeconomically significant issues. During the year 1975, in partnership with the National Science Council, the Ministry extended invitations to distinguished scientists to contribute to the enhancement of state science and technology policy. This policy received approval from the central government in the year 1984, leading to reconstitution of the National Commission for Science and Technology, with the first in command of the country assuming its leadership. In 1976, a comprehensive assessment of R&D organisations was conducted and underscored a notable disparity: despite significant development plans in various sectors of the economy, there was a conspicuous absence of concurrent R&D initiatives, resulting in severe financial constraints for most organisations. From 1977 till 1985, several modern institutes were founded such as the National Institute of Power, National Institute of Electronics, National Institute of Oceanography, National Centre for Technology Transfer and National Institute of Silicon Technology.

During 1985, the Ministry of Science and Technology initiated the Human Resource Development Program. Concurrently, to foster the advancement of native technology, the state founded the Scientific and Technological Development Corporation (STEDEC). The primary objective of the corporation was to facilitate the commercialisation of processes and products that had been developed by R&D institutions. Despite offering incentives to experts, R&D institutions and universities, the anticipated outcomes were not achieved. The primary factor identified was the absence of effective coordination among the various stakeholders (government, R&D institutions, universities, support organisations, extension services and end-users, such as the social sector industry and production) within the innovation system.

In 1992, a cabinet committee was established to conduct a thorough evaluation of the functioning of R&D institutes. The aim was to improve coordination, eliminate unnecessary redundancies, and enhance overall efficiency. In 1994, both the national technology policy and development action strategy received official approval. The significance of research aligned with demand and the commercialisation of R&D outcomes was emphasised during the Eighth Five-Year Plan (1993–98) (Government of Pakistan Planning Commission, 1994).

In 2010, the Presidential Science and Technology Commission (PSCT) developed the initial version of a science, technology and innovation (STI) policy for Pakistan. According to this draft, a fundamental change in perspective is necessary, one in which innovation is acknowledged as an essential component of the science and technology (S&T) ecosystem. In the year 2014–15, a budget of Rs1211.357 million was allocated for 39 developmental projects within the Public Sector Development Program. These projects aimed to advance scientific knowledge and technological progress. By March 2015, which marked the end of three quarters, Rs547.999 million had been disbursed and put to use. Furthermore, eight projects are anticipated to reach completion during this fiscal year. In the year 2015–16, the policy agenda will prioritise the acquisition of world-class expertise in emerging technologies. Additionally, there are plans to establish nanotechnology parks and innovation incubators, while also working on building a pool of technically trained professionals.

However, the preliminary steps for the formulation of the Action Plan for the STI Policy–2022 have commenced. A comprehensive Action Plan consisting of six (06) policy measures related to the Pakistan Council for Science and Technology has been formulated and submitted to the state Ministry of Science and Technology.

A project named "Digitalisation of the evidence-based Science, Technology & Innovation policy advisory process at PCST," aligned with one of the policy actions, has been formulated and presented to the Ministry of Science and Technology for their consideration. An updated action plan has also been created, encompassing over 100 Policy Actions across various policy statements. But, in Pakistan, the science and technology sector did not once reach a position where it significantly contributes to national and economic development. This is primarily because of the neglect and flawed concepts of policymakers in consecutive regimes.

3. Methodology and Data

Six indicators from the *World Development Indicators* (WDI) were selected to serve as proxies for assessing the country's institutions. These indicators included corruption control, government effectiveness, rule of law, political stability, supervision quality and the right to comment, are assessed using a weighted average method. In our study, we also combine residents and non-residents patent applications to calculate a country's technological progress and economic growth using GDP. Throughout the years, Pakistan has consistently been the recipient of technical cooperation grants, a proxy that we have included in our study. Since 2005, various sources, such as the Asian Development Bank, Pakistan–U.S. Science and Technology Cooperation Program, and nations such as China, Canada and Japan have extended technical cooperation grants. These grants'

purpose is to promote mutual collaboration and accelerate the commercialisation of emerging and high-tech industries in Pakistan.

To the best of the authors' understanding, these proxies have not been incorporated in earlier studies using this specific combination. However, institutions are assessed by integrating these factors in the context of environmental-related subjects. We focus on annual data encompassing Pakistan, Malaysia, Thailand, the Philippine, Korea Republic and Vietnam, spanning from 1996 till 2020. Table 1 shows a detailed breakdown of the proxies employed in this study.

Table 1. Definition of variables

Variable	Definition	Source
GDP (economic growth)	Real GDP dollars	WDI
Technology transfer (Balance of payment (BoP), current US$)	Technical cooperation grants	WDI
Technological progress	Patent applications*	WDI
Institutional quality	Governance index#	WDI

Notes: The analysis covers the period from 1996 to 2020.

* Technological progress is determined by aggregating patent applications including residents and non-residents.

The governance index, which includes corruption control, government effectiveness, rule of law, political stability, the right to comment and supervision quality is measured using a weighted average method.

Selection of the dataset spanning from 1996 to 2020 is based on accessibility within this timeframe. The data ahead of 2020 was not accessible for our analysis. While we acknowledge the potential influence of recent global happenings, like the COVID-19 pandemic and economic crises, technical cooperation grants and technological advancement, our study was confined to the data that was reliably obtainable within the specified range. We believe that this specific timeframe still provides valuable insights into the trends and patterns relevant to our study focus.

3.1 Economic Growth

Preliminary analysis was conducted to examine economic growth, as measured by GDP per capita, through an examination of selected countries for which data is available. This assessment will provide a comparative insight of Pakistan's GDP per capita with other selected Asian countries including Malaysia, Thailand, the Philippines, Korea Republic and Vietnam. As industrialisation is anticipated to retain its significance, even as deindustrialisation emerges, it remains feasible to investigate the relationship between GDP per capita even in developing and developed nations. While rapidly industrialising nations like the Korea Republic, Thailand and Malaysia witnessed significantly more substantial growth as compared to Pakistan. Also, the Philippines and

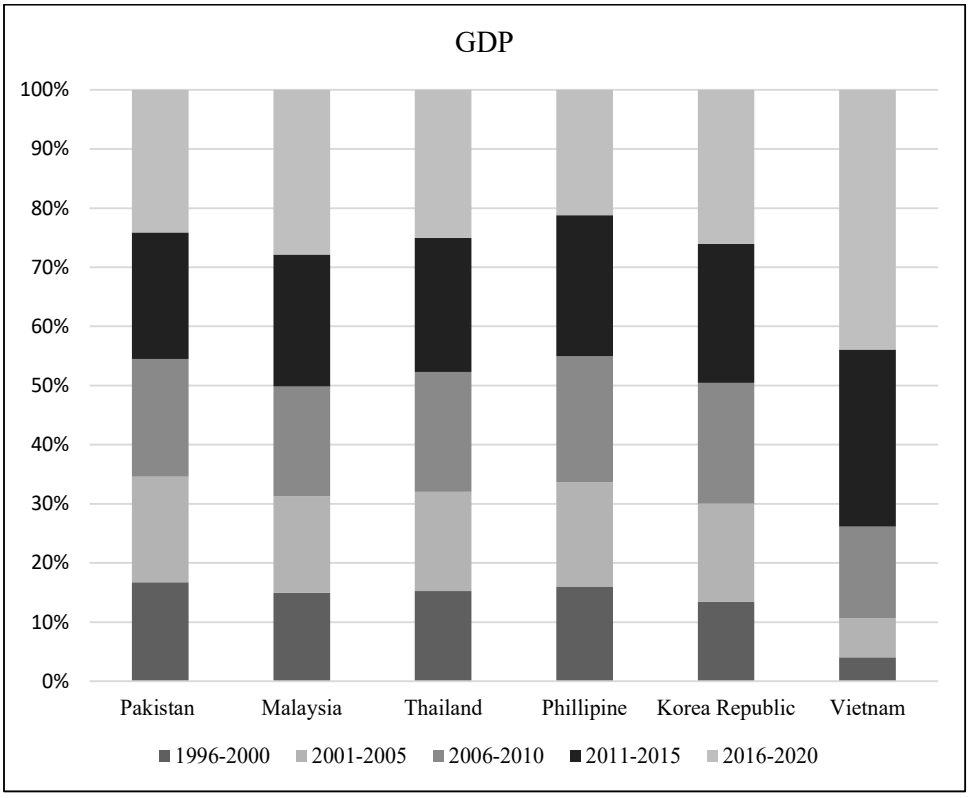

Figure 1. Percentage of GDP
Source: Author's calculations.

Vietnam had achieved advanced development status by the beginning of 2011 till 2015. Substantial economic growth in Pakistan can be seen from 2001 to 2005 which jumps from 951.1% to 1016.6% (refer to Figure 1).

Korea Republic's share rose in trend terms from 23821.5% in 2010 to 30417.1% in 2020. While Malaysia's share increased to 2185% till the end of 2010 from 1759% in 2000. Thailand experiences a steady rise of 4825.4% to 5963.4% in 2010 to 2020 respectively. The Philippines and Vietnam show good progress for the last five-year span showing an upsurge of 3% to 4% till 2020. In the 1980s, the Philippine automobile industry was in a less favourable position compared to its ASEAN counterparts. On the other hand, South Korea's advantage can be attributed in part to the industrial infrastructure left by Japanese colonialism and the presence of automobile repair operations stemming from the Korean War. Interestingly, the Philippine automobile industry also experienced growth due to military conflicts. Both World War II and the Vietnam War opened up market opportunities for Philippine companies involved in manufacturing auto parts and adapting jeeps that were abandoned by US forces. It's worth noting that all five countries faced similar barriers to entry and had to address

the same challenges related to multinational automobile corporations. National firms have continued to play a significant role in advancing technological frontiers in various industries, including shipbuilding, memory chips, consumer electronics, iron and steel, and smartphones. Their aim has been to support manufacturing as the primary driver of economic development in Korea Republic. In the case of Thailand, the emphasis is on supplying East Asian markets by adopting foreign technology in sectors like automotive manufacturing to contribute in increasing its GDP. Among these selected countries under examination, the Korea Republic stands out for its dynamic industrial policy. Employing a combination of incentives and regulations, the government effectively promoted capital accumulation by subsidising the *chaebols*' (conglomerates) ventures in high technology and heavy industries in catching up with, even to surpass established competitors. Malaysia's capability to offer robust infrastructure, security and political stability, attracted significant FDI inflows. While this contributed to growth and benefited from natural resource rents (such as oil and gas, and oil palm), the absence of robust science and technology policies, modern education system along with inefficient tactics for importing foreign technology, limited its capability to promote technological catching-up in high technologies and heavy industries. Interestingly, Thailand showed good progress by upgrading its light industries, including canned foods and jewellery and also provided favourable incentives to foreign firms to engage in regional automobile assembly. However, the absence of a substantial industrial policy focusing on learning and technological catching-up has constrained the state's ability towards rapid economic development. The inconsistent economic growth in Pakistan can be attributed in large part to its turbulent economic history. However, the slow growth can also be attributed to fundamental factors, including limited adoption of new technologies, brain drain, challenges in enabling firms to access international best practices, institutions which includes regime changes and power contestation, and inadequate science and technology policies.

3.2 Technology Transfer through Technical Cooperation Grants

Our analysis reveals that Pakistan has received a substantial amount of technical cooperation grants, amounting to $112,790,000 starting in 2000. This figure steadily increased over time, reaching $243,980,000 in 2020. However, Malaysia, Korea Republic, Vietnam, Thailand and the Philippines have also received significant amounts of technical cooperation grants but with relatively stable levels of funding. For instance, Malaysia, Thailand and Korea experienced fluctuations in their TC funding between 2000 and 2005, with Vietnam being the exception as it saw an increase during this period. From 2006 to 2020, these countries witnessed a slight decline in funding. Malaysia's TC funding decreased from $58,985,000 to $39,500,000, Thailand's decreased from $159,950,000 to $77,220,000, the Philippines' dropped from $222,740,000 to $162,490,000, while Vietnam experienced a modest increase from $278,975,000 to $282,590,000 during this period (refer to Figure 2).

In both Thailand and Malaysia, their development plans during the 1970s and 1980s included comprehensive discussions on aid utilisation policies. These discussions encompassed various aspects, including the allocation of aid within the overall resource

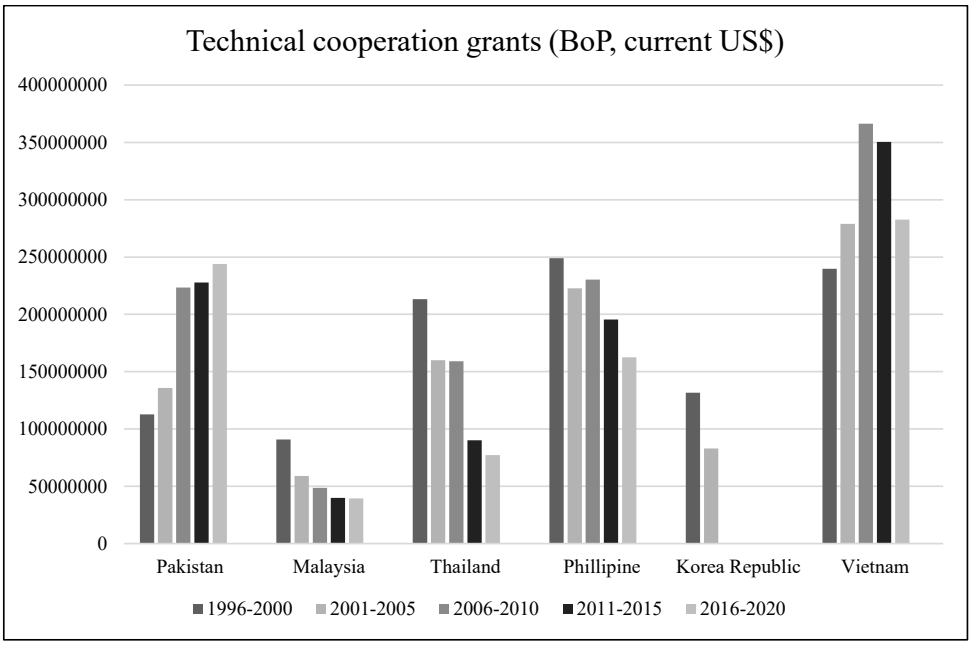

Figure 2. Technology transfer through technical cooperation grants (BoP, current US$)
Source: Author's calculations.

mobilisation framework, the identification of priority areas for requesting donor assistance, the intended roles of major donors, the progress of project implementation, and strategies aimed at enhancing the capacity to absorb aid effectively. These issues were not as clearly expressed in the previous development plans of the Philippines. Since the 1990s, the Malaysian régime has put in significant attempts to enhance its international cooperation policy. In recent development plans, there is an extensive discussion of various avenues of cooperation, including bilateral, regional and multilateral partnerships, as well as through the Malaysian Technical Cooperation Program (MTCP). These discussions underscore Malaysia's role as an emerging donor and its commitment to being a responsible member of the global community.

In the late 1980s, the Philippine government has been diligently working to improve the alignment of development planning, public investment planning and budget formulation. This includes the introduction of tools like the Medium-Term Expenditure Framework (MTEF) and other innovative instruments. However, these efforts often face challenges due to congressional interventions in the annual budget process. These interventions can erode the trustworthiness of development plans and public investment strategies. Between 1951 and 1985, South Korea welcomed a total of 4,643 overseas experts and sent 20,877 Koreans abroad to gain expertise, training and skills. Yearly semi-technical assistance received by the Korea Republic during this time includes overseas agencies delivering technical services, goods and equipment. Though,

it will be challenging to precisely determine the breakdown of technical assistance from 2005 till 2020. Officially, technical assistance for the Korea Republic concluded in the year 1999, marked by the completion of the guest training project facilitated by the Japan International Cooperation Agency (JICA). This suggests that the Korea Republic was likely to have received considerably more technical assistance than existing accounts, which reflect the period up to the mid-1980s. Obtaining accurate data and information on the technical assistance received by Korea after the mid-1980s is even more challenging.

It's important to note that the specific allocation and utilisation of technical cooperation grants depend on the agreements and priorities established between Pakistan and donor countries or international organisations providing the grants. The government typically works in collaboration with these partners to ensure that the grants are used effectively to achieve development goals and address pressing challenges in the country. But Pakistan's investment in R&D has historically been relatively low compared to some other countries. A significant portion of grants may not necessarily be directed toward fostering innovation and research. Grant funding may not be evenly distributed across sectors that are conducive to patent development, such as technology, biotechnology, or pharmaceuticals.

3.3 Technological Progress

Patent-based proxies have been employed to assess research and development efforts with accumulation of knowledge. Patents are widely recognised as a valuable gauge of intellectual capital and economically significant knowledge (Pakes & Griliches, 1980). While focusing on Pakistan, the total figure of patent proposals recorded from 1996 till 2020 was very low; during 2000 the total number of patents recorded was 1139.5% which increased in the time span of 2005 till 2010. A dismal downfall in the patents produced can be seen from 2011 (867.5) till 2020 (523.5). When we consider patents registered, Korea Republic emerges as the dominant contributor, accounting for 80,243 till 2020. Malaysia (31,723) and Thailand (28,455) also generate a substantial number of patents, albeit in slightly lower numbers compared to Korea Republic. In the middle tier, we find Vietnam (41,6349) and the Philippines (16,500) (refer Figure 3). These variations in patent recorded indices highlight significant differences in the science and technology competence and the usefulness of STI policies among selected countries.

Malaysia is often recognised as the second most appealing market for patenting. This is due to its well-educated workforce and a proactive approach to attracting foreign direct investment (FDI), supported by a robust intellectual property rights (IPR) judicial system. In comparison, Vietnam, and the Philippines, have now developed relatively similar market sizes for patenting. However, it's essential to note that these markets are comparatively smaller when compared to the patent markets in Korea Republic, Malaysia and even Thailand. Vietnam's progress towards this state began in the early 1990s when it unlocked its doors for foreign investments. The country implemented a range of incentive policies, including tax reductions, favourable land use terms, and streamlined administrative measures. These incentive plans and policies, combined with competitive labour costs, successfully draw substantial investments from countries such

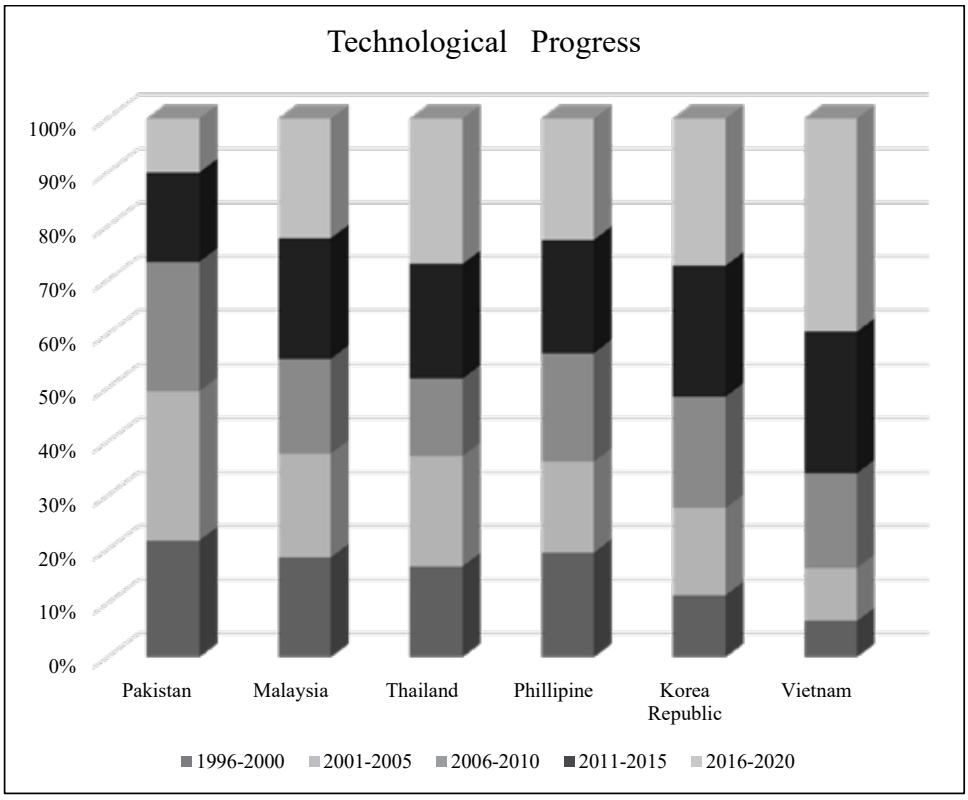

Figure 3. Technological progress
Source: Author's calculations.

as Japan, South Korea, the European Union and the United States. These strategies have positioned Vietnam, and the Philippines, to become increasingly competitive in terms of patents registered, even though they still lag behind the larger markets in the region. Their concerted efforts to create attractive investment environments and policies have contributed to their growing significance in producing patents (Vu, 2012).

Forming an effective patent regime necessitates the development of policies that actively encourage research and development activities with enhancement of innovative capabilities. Regrettably, the current patent regime in Pakistan lacks the necessary incentives to achieve these objectives. The effectiveness of a patent system depends on strong intellectual property protection. In Pakistan, there have been concerns about the enforcement of intellectual property rights, which can discourage inventors and companies from pursuing patents due to fears of infringement. Cultivating a culture of innovation is essential for patent production. Pakistan has faced challenges in fostering such a culture, including limited support for entrepreneurship, a shortage of innovation hubs and incubators, and insufficient incentives for individuals and businesses to invest in innovation.

Investing in research and development along with patent activities plays a pivotal role in advancing economies toward the technological forefront and laying the foundation for innovation. However, the effectiveness of R&D expenditure, the incorporation of technology, and the successful transformation of inventive concepts into commercial ventures necessitate the activation of particular skill sets. Entrepreneurship plays a pivotal role in translating ideas into the realm of commerce. It is not only crucial for the adoption of existing technologies by industrialising nations but also for the innovation process itself.

3.4 Institutions

The state serves as the primary driver of economic, as well as social development in any country, and hence, serves as the key institution of economic and social development. State investment, foreign investment and government policies aimed to foster local and international enterprises to promote technological advancements in rapidly developing nations such as East Asian countries.

Considering Malaysia and Korea Republic, both demonstrate relative strength in terms of institutions. Starting from the year 1996 till 2020 both countries show almost stable figures, i.e., in 2000 the institutional quality of Malaysia was 0.707%, in 2005 was 0.76213%, in 2010 was 0.654%, in 2015 was 0.619% and in 2020 was 0.7044%. The institutional quality of Korea Republic by the end of 2005 was 1.0971%, in 2010 was 1.3465%, in 2015 was 1.4085% and in 2020 was 1.7002%.

In contrast, Pakistan, the Philippines and Vietnam lag behind in institutional quality as compared to the average position of the examined countries. Notably, a negative sign can be found in terms of institutional stability among these three countries. In the span of 1996 till 2005, Thailand shows some stability at 0.5160% and 0.2018% respectively. During the same time span, Pakistan, the Philippines and Vietnam show negative signs. In 2000, Pakistan's institutional quality was -1.680%, in 2005 was -1.791%, in 2010 was -2.001%, in 2015 was -2.173%, and in 2020 was -1.917%. For Vietnam, the institutional quality in 2000 was -0.909%, in 2005 was -0.984%, in 2010 was -1.107%, in 2015 was -0.942%, and in 2020 was -0.649%. For the Philippines, the institutional quality in 2000 was -0.504%, in 2005 was -0.744%, in 2010 was -1.0740%, in 2015 was -0.637%, and in 2020 was -0.609% (refer to Figure 4).

The political landscape in Pakistan exhibits recurring disruptions in the constitutional and political order, along with the presence of feeble and unsustainable political institutions and processes. This has been accompanied by a rapid expansion of influence by military and bureaucratic elites, periods of military rule, and governments dominated by the military. The governance style has leaned towards authoritarianism and has often been confined to a narrow power base (Rizvi, 2000). In the absence of a stable politico-economic structure, the relationships among various power elites have continually evolved in response to internal and external developments and changes in strategic leadership. Consequently, these shifts in the dynamics among diverse power centres have led to fluctuations in the politico-economic landscape occupied by these influential actors during different time periods.

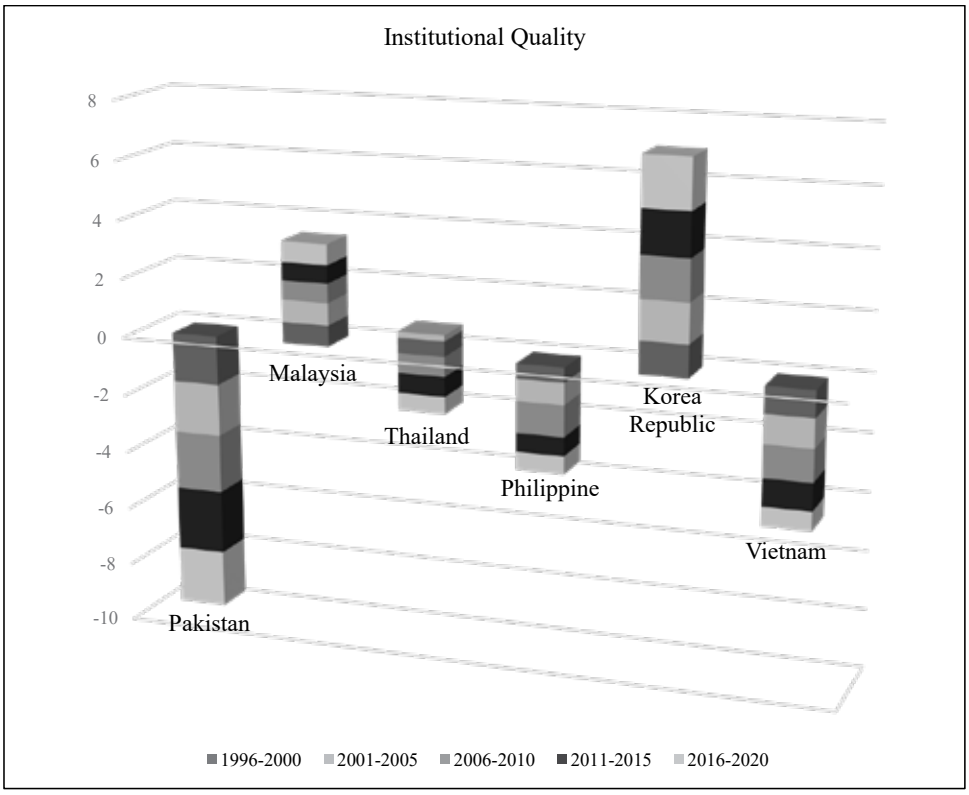

Figure 4. Institutional quality
Source: Author's calculations.

4. Conclusions and Policy Implications

Institutions are crucial in shaping economic growth by providing incentives and administering penalties to stimulate economic and social upgrading. The quality of institutions is particularly significant, as poor institutional quality can negatively affect technological upgrading. Besides, there is a time-inconsistency challenge that confronts countries and their governments. Embracing technological change can lead to short-term disruptions, and policymakers often have relatively short time horizons as their thinking are often conditioned by election cycles. Additionally, they may hear more from concentrated interest groups that are adversely affected by new technologies, leading to resistance to change among policymakers and their voting constituents. This bias can impede the adoption of innovative technologies and policies that could lead to broader benefits and sustained economic growth. The solid alliance between the scientific community and the industrial sector has brought about a transformation in the structure and character of the economy, which is increasingly reliant on fresh knowledge and innovative concepts.

As this paper shows, Pakistan's experience with economic development compared to the successful economies of Japan, Korea and Taiwan at most remains dismal.

Policymakers in Pakistan should focus on the skills and competencies required for stimulating patent filing, which requires institutions that promote entrepreneurship, underlining the critical role of strong but business-friendly institutions in this process. Universities and other tertiary institutions play a crucial role in assisting companies in assimilating and upgrading their technology. Countries, such as Japan, Korea and Taiwan have introduced various reforms, often in conjunction with governance reforms (such as granting universities greater autonomy), to foster stronger links between universities and industry. While businesses have been slow to establish connections with universities in Pakistan, the governance institutions ought to play a pro-business role in enabling the environment to establish and foster cluster cohesion (Rasiah, 2019). This challenge is not unique and stems from the disparities in capabilities between universities and businesses. Universities excel in their depth of knowledge within specific subject areas and their interdisciplinary reach. Still, given the lack of incubatory learning where universities and colleges send students to cutting edge firms for training, Pakistan's universities have remained devoid of grounded teaching and learning. The technical training institutes in Pakistan too require such exposure, which requires enabling by the government (Nazia & Rasiah, 2024). Furthermore, companies may lack the capacity to identify and effectively utilise the knowledge available at universities (Kodama & Suzuki, 2007).

While as Schumpeter (1934) aptly argued that innovations are central to technological progress, institutional coordination is mandatory to achieve it. The government of Pakistan has attempted to strengthen the ecosystem embedding to stimulate firm-level industrial upgrading by establishing the textiles training centre at Faisalabad and to generate engineers and technicians for the textiles and clothing industry. In addition, through the 3rd Textiles and Apparel Policy, the government gave a slew of incentives following the 3rd Textiles and Clothing Policy (2021–2025) for firms to set-up solar panels to support greening initiatives and to solve the high power-outage problems faced by the country (Ministry of Commerce Pakistan, 2020). In addition to political stability, such policy-oriented institutional coordination accompanied by a profound and regular review of actions plans are vital for the country to achieve rapid industrial upgrading in its key sectors. The conclusions drawn are specific to the Pakistani perspective, which may differ from findings in other studies.

References

Abramovitz, M. (1956). Resource and output trends in the United States since 1870. In *Resource and output trends in the United States since 1870* (pp. 1–23). National Bureau of Economic Research. http://www.nber.org/chapters/c5650

Acemoglu, D., & Robinson, J.A. (2012). *Why nations fail: The origins of power, prosperity, and poverty*. Crown Publishers.

Akbar, A. (2015). The role of corporate governance mechanism in optimizing firm performance: A conceptual model for corporate sector of Pakistan. *Journal of Asian Business Strategy, 5*(6), 109–115. https://doi.org/10.18488/journal.1006/2015.5.6/1006.6.109.115

Amsden, A.H. (1989). *Asia's next giant: South Korea and late industrialization*. Oxford University Press.

Amsden, A.H. (1991). Diffusion of development: The late-industrialization model and greater East Asia. *American Economic Review, 81*(2), 282–286.

Amsden, A.H., & Chu, W-W. (2003). *Beyond late development: Taiwan's upgrading policies*. MIT Press.

Branstetter, L., Fisman, R., Foley, C.F., & Saggi, K. (2011). Does intellectual property rights reform spur industrial development? *Journal of International Economics, 83*(1), 27–36. https://doi.org/10.1016/j.jinteco.2010.09.001

Bulow, J., & Rogoff, K. (2005). Grants versus loans for development banks. *American Economic Review, 95*(2), 393–397. https://doi.org/10.1257/000282805774669727

Burnside, C., & Dollar, D. (2000). Aid, policies, and growth. *American Economic Review, 90*(4), 847–868. https://doi.org/10.1257/aer.90.4.847

Chang, O.H., & Chow, C.W. (1999). The balanced scorecard: A potential tool for supporting change and continuous improvement in accounting education. *Issues in Accounting Education, 14*(3), 395–412. https://doi.org/10.2308/iace.1999.14.3.395

Chen, Y., & Puttitanun, T. (2005). Intellectual property rights and innovation in developing countries. *Journal of Development Economics, 78*(2), 474–493. https://doi.org/10.1016/j.jdeveco.2004.11.005

Cordella, T., & Ulku, H. (2007). Grants vs. loans. *IMF Staff Papers, 54*, 139–162. https://doi.org/10.5089/9781589066052.024

Fagerberg, J. (2006). Innovation: A guide to the literature. In J. Fagerberg & D.C. Mowery (Eds.), *The Oxford handbook of innovation*. Oxford Academic. https://doi.org/10.1093/oxfordhb/9780199286805.003.0001

Gerschenkron, A. (1962). On the concept of continuity in history. *Proceedings of the American Philosophical Society, 106*(3), 195–209.

Gould, D.M., & Gruben, W.C. (1996). The role of intellectual property rights in economic growth. *Journal of Development Economics, 48*(2), 323–350. https://doi.org/10.1016/0304-3878(95)00039-9

Government of Pakistan Planning Commission. (1994). *Eight Five Year plan (1993-1998)*. https://www.pc.gov.pk/uploads/plans/Eighth_1993-1998.PDF

Gradstein, M. (2004). Governance and growth. *Journal of Development Economics, 73*(2), 505–518. https://doi.org/10.1016/j.jdeveco.2003.05.002

Gupta, S., Pattillo, C.A., & Wagh, S. (2006). Are donor countries giving more or less aid? *Review of Development Economics, 10*(3), 535–552. https://doi.org/10.1111/j.1467-9361.2006.00344.x

Haider, A., ud Din, M., & Ghani, E. (2011). Consequences of political instability, governance and bureaucratic corruption on inflation and growth: The case of Pakistan. *Pakistan Development Review, 50*(4), 773–807.

Hall, B.H., Thoma, G., & Torrisi, S. (2007, August). The market value of patents and R&D: Evidence from European firms. *Academy of Management Proceedings, 2007*(1), 1–6. https://doi.org/10.5465/ambpp.2007.26530853

Helpman, E., & Krugman, P. (1989). *Trade policy and market structure*. The MIT Press. https://itpc2015.ir/Content/upload/200581310955124.pdf

Hiraoka, L.S. (1995). Japan's coordinated technology transfer and direct investments in Asia. *International Journal of Technology Management, 10*(7-8), 714–731.

Husain, I. (2009). The role of politics in Pakistan's economy. *Journal of International Affairs, 63*(1), 1–18.

Husain, Z., & Bhattacharya, R.N. (2004). Attitudes and institutions: Contrasting experiences of Joint Forest Management in India. *Environment and Development Economics, 9*(4), 563–577. https://doi.org/10.1017/S1355770X04001548

Iimi, A., & Ojima, Y. (2008). Complementarities between grants and loans. *Journal of the Japanese and International Economies, 22*(1), 109–141. https://doi.org/10.1016/j.jjie.2007.03.001

Johnson, C. (1982). *MITI and the Japanese miracle: The growth of industrial policy, 1925-1975*. Stanford University Press.

Kanwar, S. (2012). Intellectual property protection and technology licensing: The case of developing countries. *Journal of Law and Economics, 55*(3), 539–564. https://doi.org/10.1086/665566

Kodama, F., & Suzuki, J. (2007). How Japanese companies have used scientific advances to restructure their businesses: The receiver-active national system of innovation. *World Development, 35*(6), 976–990. https://doi.org/10.1016/j.worlddev.2006.05.015

Lopez-Calix, J., & Touqeer, I. (2013). *Revisiting the constraints to Pakistan's growth* (World Bank Policy Paper Series on Pakistan, no. PK 20/12). World Bank. http://hdl.handle.net/10986/17858

Maskus, K.E., & Penubarti, M. (1995). How trade-related are intellectual property rights? *Journal of International Economics, 39*(3–4), 227–248. https://doi.org/10.1016/0022-1996(95)01377-8

Meltzer, A. (2000). The report of the International Financial Institution Advisory Commission: Comments on the critics; reform of the international architecture. *CESifo Forum, 1*(4), 9–17.

Ministry of Commerce Pakistan. (2020). *Textiles and Apparel Policy 2020-25*. https://www.commerce.gov.pk/wp-content/uploads/2022/02/Textiles-and-Apparel-Policy-2020-25.pdf

Nazia, N., & Rasiah, R. (2024). Industrial upgrading in the textiles and clothing industry: Pakistan and late industrialization, forthcoming.

North, D.C. (1993). *Economic performance through time.* Lecture to the memory of Alfred Nobel, December 9, 1993. https://www.nobelprize.org/prizes/economic-sciences/1993/north/lecture/

Organisation for Economic Co-operation and Development. (1992). *Round table on sustainable development*. https://www.oecd.org/sd-roundtable/papersandpublications/39365131.pdf

Pakes, A., & Griliches, Z. (1980). Patents and R&D at the firm level: A first report. *Economics Letters, 5*(4), 377–381. https://doi.org/10.1016/0165-1765(80)90136-6

Pande, R., & Udry, C. (2005). *Institutions and development: A view from below*. Yale University Economic Growth Center Discussion Paper (928). http://ssrn.com/abstract=864044

Qayyum, A., Khawaja, I., & Hyder, A. (2008). Growth diagnostics in Pakistan. *European Journal of Scientific Research, 24*(3), 433–450.

Rae, J. (1834). *Statement of some new principles on the subject of political economy, exposing the fallacies of the system of free trade, and of some other doctrines maintained in the "Wealth of nations"*. Gary Hilliard. https://www.loc.gov/item/ltf90032803/

Rasiah, R. (2019). Building networks to harness innovation synergies: Towards an open systems approach to sustainable development. *Journal of Open Innovation: Technology, Market, and Complexity, 5*(3), Article 70. https://doi.org/10.3390/joitmc5030070

Rasiah, R., Lin, Y., & Muniratha, A. (2015). The role of the diaspora in supporting innovation systems: The experience of India, Malaysia and Taiwan. In P. Shome & P. Sharma (Eds.), *Emerging economies: Food and energy security, and technology and innovation* (pp. 353–373). Springer. https://doi.org/10.1007/978-81-322-2101-2_14

Rasiah, R., Singh, A., & Ernst, D. (2015). Alice Hoffenberg Amsden: A consummate dirigiste on latecomer economic catch-up. *Institutions and Economies, 7*(1), 1–8.

Rizvi, H-A. (2000). Pakistan in 1999: Back to square one. *Asian Survey, 40*(1), 208–218. https://doi.org/10.2307/3021235

Sala-i-Martin, X. (2001). What have we learned from a decade of empirical research on growth? Comment on "Growth Empirics and Reality," by William A. Brock and Steven N. Durlauf. *World Bank Economic Review, 15*(2), 277–282. https://doi.org/10.1093/wber/15.2.277

Saxenian, A.L. (2007). *The new argonauts: Regional advantage in a global economy*. Harvard University Press.

Schumpeter, J.A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest and the business cycle*. Harvard University Press.

Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. https://www.earlymoderntexts.com/assets/pdfs/smith1776_1.pdf

Tebaldi, E., & Elmslie, B. (2013). Does institutional quality impact innovation? Evidence from cross-country patent grant data. *Applied Economics, 45*(7), 887–900. https://doi.org/10.1080/00036846.2011.613777

Veblen, T. (1915). *Imperial Germany and the Industrial Revolution*. Macmillian Publishers. https://historyofeconomicthought.mcmaster.ca/veblen/ImperialGermany.pdf

Vu, T.A. (2012). An insight into the patent systems of fast developing ASEAN countries. *World Patent Information, 34*(2), 134–142. https://doi.org/10.1016/j.wpi.2011.12.007

Wade, R. (1990). Industrial policy in East Asia: Does it lead or follow the market? In G. Gereffi & D.L. Wyman (Eds.), *Manufacturing miracles: Paths of industrialization in Latin America and East Asia* (pp. 231–266). https://doi.org/10.1515/9781400862030.231

Westphal, L.E., Kim, L., & Dahlman, C.J. (1985). *Reflections on the Republic of Korea's acquisition of technological capability* (Development Research Department discussion paper, no. DRD 77). World Bank. http://documents.worldbank.org/curated/en/771951468273590388/Reflections-on-Koreas-acquisition-of-technological-capability

Zhang, M., & Rasiah, R. (2015). *Institutionalization of state policy: Evolving urban housing reforms in China*. Springer. https://doi.org/10.1007/978-981-287-570-9