

Research Article

Impact of Human Capital Development and Economic Growth on Global Competitiveness

Nayab Minhaj^{*} , Roohi Ahmed 

Department of Economics, University of Karachi, Karachi, Pakistan
E-mail: nayabminhaj@yahoo.com

Received: 17 June 2022; **Revised:** 8 October 2023; **Accepted:** 8 October 2023

Abstract: The focus of this study is on the growing importance of human capital development in a number of developed, emerging, and developing countries, including Pakistan. The panel data analysis uses traditional approaches to examine observations from 1990 to 2019. The study's main goal was to look at the impact of human capital development and growth on competitiveness. The dependent variable in the model is the global competitiveness index (GCI), with human capital, GDP per capita, GNP per capita, physical capital growth, and inflation as explanatory variables. Empirical data consistently demonstrates that human capital is the paramount asset in all economies, regardless of their development status. Its strong connection to competitiveness underscores the need to thoroughly evaluate policies impacting human capital development across nations. This assessment is crucial for understanding the interplay of policies and human capital development, a key factor in achieving desired outcomes.

Keywords: human capital development, panel data, global competitiveness index

JEL Code: C1, C4

1. Introduction

The prosperity and progression pace of nation solely depends on the economic growth installed by the human capital development which is the main factor to attain growth and development, The prosperity and progression pace of a nation solely depends on the economic growth installed by the human capital development which is the main factor in attaining growth and development (Essardi & Razzouk, 2017), as it leads an economy to adopt new technologies and build a large efficient facility for utilization of resources at a national and international scale, so the economy gains a competitive advantage and enhance their competitiveness. Furthermore, competitiveness is explained in different ways such as productivity, the capacity to create welfare and the capacity to offer on outside markets. The best-known interpretation is proposed by Michael Porter and the World Economic Forum. They characterize national competitiveness as a set of variable arrangements and teach that decide the level of efficiency of a nation. Raising productivity means making better use of economic resources which enhances efficiency. Moreover, Productivity is significant on the grounds that it has been discovered to be the fundamental factor driving development and income levels and income levels are firmly connected to human government assistance (Bassanini & Hemmings, 2001).

So, understanding the components that take into account this chain of functions to happen is significant. Rising competitiveness essentially equates to economic growth. According to the World Economic Forum, competitive economies are those that are well on their path to being able to develop more economically and comprehensively, which means a greater probability that everybody in the public arena will profit from the products of economic development.

Economic growth measures through the per capita income of a certain nation are the foremost determinant of the national progress along with the physical capital extracted through the industrial, agricultural, and service sectors. Ostensibly, the signified nexus of public and private sector collaborates and outcomes as a national income source which further leads to economic growth and public welfare. Contradictorily, in developing nations, inadequate infrastructure tends to paralyze the aforementioned developmental pace which is responsible for creeping rank in the global competitiveness index. GCI created by the World Economic Forum (WEF) has been utilized as a norm to quantify a nation's competitiveness and along these lines is required to be identified with economic quality and development. Pakistan has used a variety of planning tactics to grow its economy since the eighteenth century, although has only focused on the construction of physical capital as a viable way of defining progress while neglecting human capital development. Most planning in Pakistan focuses on capital formation exclusively for intrinsic growth while ignoring the immense benefits of capital formation among individuals. As a result, the expansion of investment among Pakistan's workforce is terribly mismanaged., exacerbating the national evolution process to malfunction. In this scenario, physical capital and human capital constitute the expansion and glean the economic output humanized by sound research and development, technical innovation as well as administrative posture.

The core essence of this study is to examine economic progress by panel data regression models through different economies of developing countries, less developing and developed world along with Pakistan. In developed countries, the study incorporated Singapore, South Korea, and Japan. Whereas, developing countries include China, Turkey, and Malaysia while less developing countries comprised India, Bangladesh and Pakistan. Certainly, here are concise summaries of the three categories of countries based on their development status:

1. Developed Countries (e.g., Japan, Singapore, South Korea):
 - High-income levels, advanced infrastructure, and technology.
 - Stable governance, high Human Development Index (HDI), and low poverty.
 - Strong education and healthcare systems, leading to a high standard of living.
2. Developing Countries (e.g., China, Malaysia, Turkey):
 - Moderate income levels with growing industries.
 - Expanding infrastructure, urbanization, and varying political stability.
 - Progress in education and healthcare, striving for improved living standards.
3. Less Developed Countries (e.g., Bangladesh, India, Pakistan):
 - Low income, limited infrastructure, and technology.
 - Governance challenges, lower HDI, and higher poverty rates.
 - Unequal access to education and healthcare, with a focus on economic development and poverty reduction.

These categories provide a simplified framework to understand the economic and social development of nations, though each country's unique circumstances and progress can lead to variations within these classifications.

A key subject that emerges in the social sciences is the variation in cross-country income, i.e., the question of why some nations are richer than others and why some countries score higher in the GCI than others. Why is one country's economic growth faster than others? Alternatively, why are certain countries' manufacturing industries more sophisticated than others? As a result, further work is needed in this area. The study's main goal is to assess if human development is a significant growth determinant that influences GCI rankings in different countries, as well as to analyze the association among human capital development, economic growth and global competitiveness. Through panel data analysis, this study aimed to look into whether human capital can effectively explain growth and GCI rankings of developed, developing, and less developing economies and the impact of human capital development, GDP per capita, GNP per capita, physical capital growth, and inflation, on the GCI rank, which seems to be a measure used to gauge the competitiveness of various economies, has been examined.

1.1 Review of variables and economic progress

1.1.1 Disparities in GDP between countries

Researchers looked into the differences in economic productivity between developed countries and developing countries and determined that human capital and expertise are much more significant than physical capital in ensuring effectiveness. Adequate institutions and infrastructural facilities are thus required for the growth of the working population. The production function states that every country may reach maximum output level if somehow the magnitude of the workforce, quantity of physical capital, measure of human capital, and level of technology are all adequately managed. When two countries are assessed, the one with more physical assets, labor, better educated and trained labor, and technological prowess will produce more output and prosper. In reality, GDP expansion is the most desirable goal in every economy. It varies per country as well. Almost every country's GDP has increased since its start. As a result, the true image has become fuzzy. For a better understanding, consider GDP per capita, which is the country's economic output divided by the number of people living there.

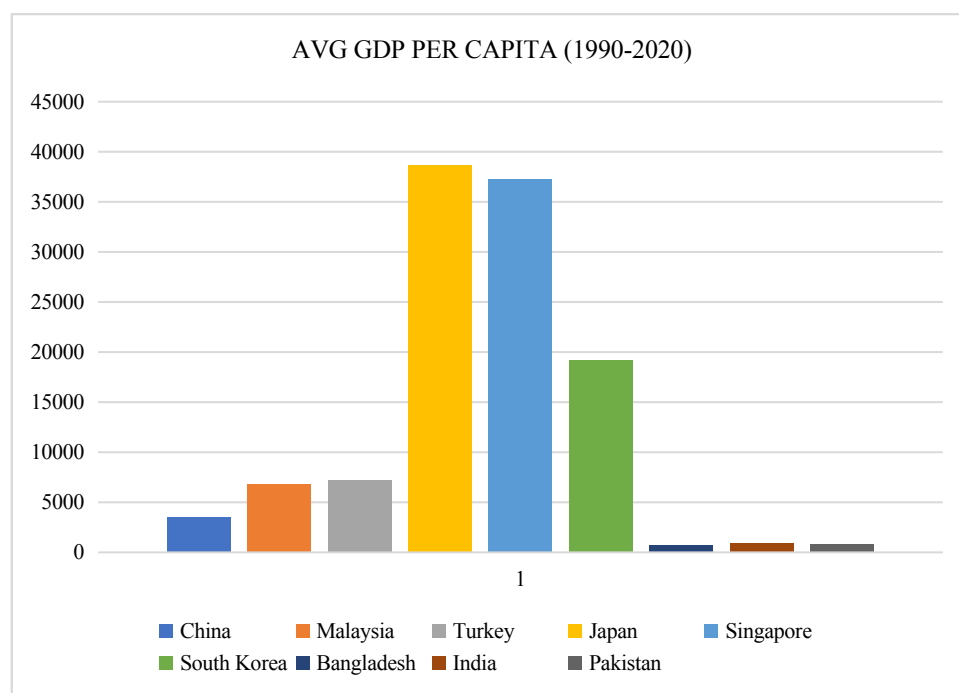


Figure 1. Avg GDP per capita (author's estimation)

Source: World Development Index (1990-2020)

From 1990 through 2020, the graph in Figure 1 depicts the average GDP per capita of developed, developing, and less developed countries. In the developed world, Singapore has shown a sharp increase in its GDP per capita, and South Korea has shown consistent increases in GDP per capita. Developing nations, such as Singapore, provide well education system, advanced training resources, and strong academic institutions and research facilities, all of which help to improve their human capital, allowing them to achieve optimal levels of development while maintaining low population growth. it demonstrates that Singapore and Japan have made significant progress in terms of average GDP per capita, while developing countries seem to be doing effectively, whereas less developed countries' GDP is growing at a snail's pace. When the average GDP per capita of these countries has been compared, it becomes clear that there are significant variations between developed, developing, and less developed countries. Despite the fact that differences in these inputs are frequently visible. Major economies, in essence, have a larger workforce than small states. The capital goods of advanced economies are more abundant and of better quality. Less developed countries, on the other hand,

have been unable to effectively utilize their human capital due to a lack of investment and inadequate infrastructure. Due to robust infrastructure, developing countries recover quickly from economic turmoil and therefore are trying to catch up to the developed world. Further investment in human capital through research and education systems, advanced training facilities, academic institution reforms, and financial aid, all of which contribute to improving their human capital and allowing them to achieve maximum standards of living while maintaining constant population levels. In the less developed world, Bangladesh is likewise on the upswing. Pakistan's progress, on the other hand, is glacial. Less developed countries have been unable to cope with the economic crisis because of their poor infrastructure. Further, they have been afforded insufficient financial, educational, and training opportunities, limiting their labor potential. In a nutshell, the less developed world is lagging far behind the developed world, and their total rate of growth is drastically lower.

1.1.2 Disparities in human capital development between countries

Education and skill gaps probably contribute to some of the variations between countries. Researchers discovered evidence that educational achievement is linked to individual GDP. Education levels in less developed countries are low because the economy is suffering, and the country is underprivileged because education is low. According to Hall and Jones (1999), we could incorporate education and training metrics to assess the degree of human capital. This would allow us to compare the quantity of human capital developed in different countries. Since 1990, the United Nations Development Programme (UNDP) has measured and presented data on HDI, which combines the three basic dimensions of human development: life expectancy at birth, which reflects the ability to live a good health, entails years of education and projected years of schooling, which reflects the insights and knowledge, and gross national income per capita, which reflects the ability to achieve a sustainable livelihood. The HDI scale ranges from 0 to 1, with 0 representing the lowest level of human development and 1 representing the highest level. HDI values for selected developed, developing, and less developed countries are shown below in Table 1.

Table 1. Human Development Index in developed, developing and less developed countries

Countries	1990	1995	2000	2005	2010	2015	2016	2017
Bangladesh	0.387	0.425	0.468	0.505	0.545	0.592	0.597	0.608
China	0.502	0.55	0.594	0.647	0.706	0.743	0.748	0.752
India	0.427	0.46	0.493	0.535	0.581	0.627	0.636	0.64
Japan	0.816	0.84	0.855	0.873	0.885	0.905	0.907	0.909
Malaysia	0.643	0.683	0.725	0.821	0.729	0.772	0.799	0.802
Pakistan	0.404	0.428	0.45	0.5	0.526	0.551	0.56	0.562
Singapore	0.718	0.773	0.819	0.868	0.909	0.929	0.93	0.932
South Korea	0.728	0.778	0.817	0.855	0.884	0.898	0.9	0.903
Turkey	0.579	0.607	0.655	0.69	0.734	0.783	0.787	0.791

Source: Authors' presentation based on the data from <http://hdr.undp.org/en/data>

Figure 2 depicts the average HDI values for a number of developed, developing, and less developed countries. From 1990 to 2017, Japan was the leading participant in terms of HDI, according to statistics. After that, Singapore

is in second place, followed by South Korea. In the developing world, Malaysia is ranked fourth, followed by Turkey and China. Over the duration of the study, Pakistan looked to have the lowest HDI values of all the sample countries. Whereas, according to the statistics in Table 2, Bangladesh had a lower HDI value in 1990 than Pakistan, and yet Bangladesh improved its HDI, whereas Pakistan's progress stayed stagnant until 2017.

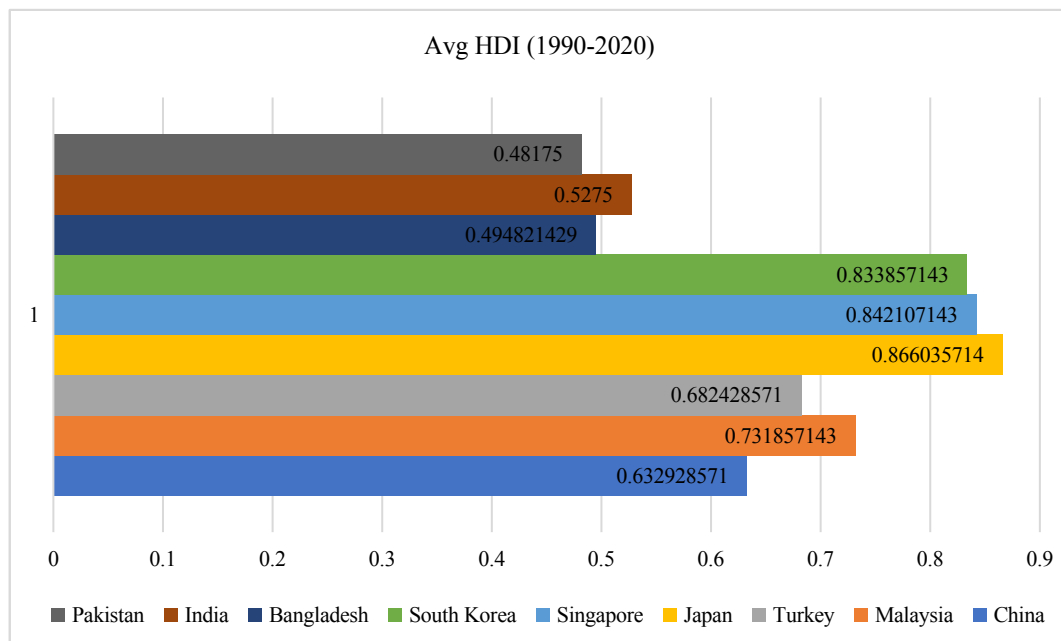


Figure 2. Avg. HDI (author's estimation)

Source: UNDP. Org (1990-2020)

Individuals are essential for economic performance and advancement (Schultz, 1961). The quality of social assets is based on the fact that a skilled and productive individual might perform more efficiently, and economically, and socialize on more productive activities, which contributed to the economic headway (Baldacci et al., 2008). Numerous inclusive growth strategies have been determined to be more effective than others, and they are fundamental when attempting to improve the financial circumstances of developed countries. According to data, Singapore's expansion and asset development are both higher than in developed countries. Singapore's economy is more prosperous than others owing to its high degree of human investment. The ostensible advantages of neoliberal globalization have stimulated the interest of developing countries. Under this viewpoint, markets are linked to competitiveness, economic efficiency, and choice. As a result, these economic sectors will require human funding. Training the workforce in emerging countries to meet rising needs for increased poverty alleviation, enhanced employability, productivity, and ultimately worldwide competition, which become national training and skill development goals to promote growth. China and Turkey's outstanding achievement in HDI. In addition, Malaysia is on the rise in human capital development. This is the main reason that the developing world achieves economic stability by investing in humans.

In less developing nations India and Bangladesh are substantially improving their HDIs, whereas Pakistan is still lagging behind. However, for economic progress, this would be insufficient. The current human capital development system is highly fragmented and uneven. Although the performance of the high-skilled urban sectors is increasing on its own, the rate of improvement is slow and unsustainable when compared to the developed and developing countries. This problem may occur as a consequence of a lack of coordination in the education and training of the workforce in less developed countries.

1.1.3 Disparities in global competitiveness index between countries

Global competitiveness is only accomplished if all countries throughout the world collaborate toward achieving their goals in accordance with evolving technology and advancements. World Economic Forum has published the Global Competitiveness Report, which has monitored the ongoing development factors and establishments that are important for sustainable growth and competitiveness, as well as allowing countries to be calibrated in order to maintain competitiveness. The Global Competitiveness Index (GCI) is a composite measure made up of twelve components, classified into three latent functions. First and foremost, fundamental prerequisites, include institutions, infrastructure, the macroeconomic environment, health, and elementary education. Second, efficiency improvers are based on higher education and training, product market efficiency, labor market efficiency, financial market development, technical competence, and size of the market. Finally, there are elements that are based on business sophistication and innovation. GCI also takes values ranging from 1 to 7, with 1 being the lowest score and 7 being the maximum. The value of GCI for the selected developed, developing, and less developing nations is shown in Table 2.

Table 2. Global Competitiveness Index in developed, developing and less developing countries

countries	2013	2014	2015	2016	2017
Bangladesh	3.547942	4.835891	4.736538	4.698532	4.565805
China	4.897789	4.835891	4.736538	4.698532	4.565805
India	4.304978	4.328038	4.303131	4.326408	4.33399
Japan	5.396211	5.36931	5.369902	5.375314	5.426291
Malaysia	5.084289	4.883098	4.873699	5.044747	5.097477
Pakistan	3.578805	3.483689	3.581879	3.652812	3.770316
Singapore	5.625705	5.477664	5.545332	5.534784	5.447093
South Korea	5.02079	4.930196	5.003964	5.275884	5.396472
Turkey	4.280638	4.24749	4.160859	4.148129	4.246872

Source: Authors' presentation based on the data from <https://www.weforum.org>

The value of GCI for the selected developed, developing, and less developing nations is represented by the graph in Figure 3 for the period 2010-2017. According to the data, Pakistan trailed behind the other competitive countries throughout the studied period of 2010-2017. While being the least competitive of all the countries. During the investigated time, Singapore was the most competitive country among the countries considered. The government of Singapore has risen to prominence in capacity building, spending heavily on the development of high-level skills to assist targeted industrial restructuring. The country's higher education system has been expanded and tailored to meet the needs of the country's industrial policy, allowing the economy to develop as well as the region to progress in the GCI rankings throughout the world.

GCI value of developed countries is steady and closer to 7, which is deemed to be the optimum and indicates that first, and most fundamental, result was that more productive countries generate better economies, greater affluence, and more satisfaction for their citizens. Second, more productive countries offer higher investment returns. This is important when companies are deciding whether or not to invest in physical capital. However, this means that national investments in infrastructure, education, and skills development have a stronger chance of translating into productivity expansion.

Finally, future prosperity and persistence are implied by competitiveness. Addressing the challenges of a planned, persistent, and demand-driven system that is responsive to innovative variations in the global economic production process in developing countries. In essence, developing countries have always been attempting to develop linkages between skills, efficiency, and employment in order to encourage economic and social development. Furthermore, the GCI of developing countries reveals that the standard of living and individual prosperity is at a positive range because the values are not distant from desirable levels. In compared to Pakistan and Bangladesh, India shows a considerable improvement in GCI in less developing countries. Less developed countries, such as Pakistan, Bangladesh, and others, must improve their other economic indicators in order to improve their ranking and strengthen their economic position. As competences delivered to have an influence on productivity, it is critical to have coherent training and education in accordance with national skills planning process.

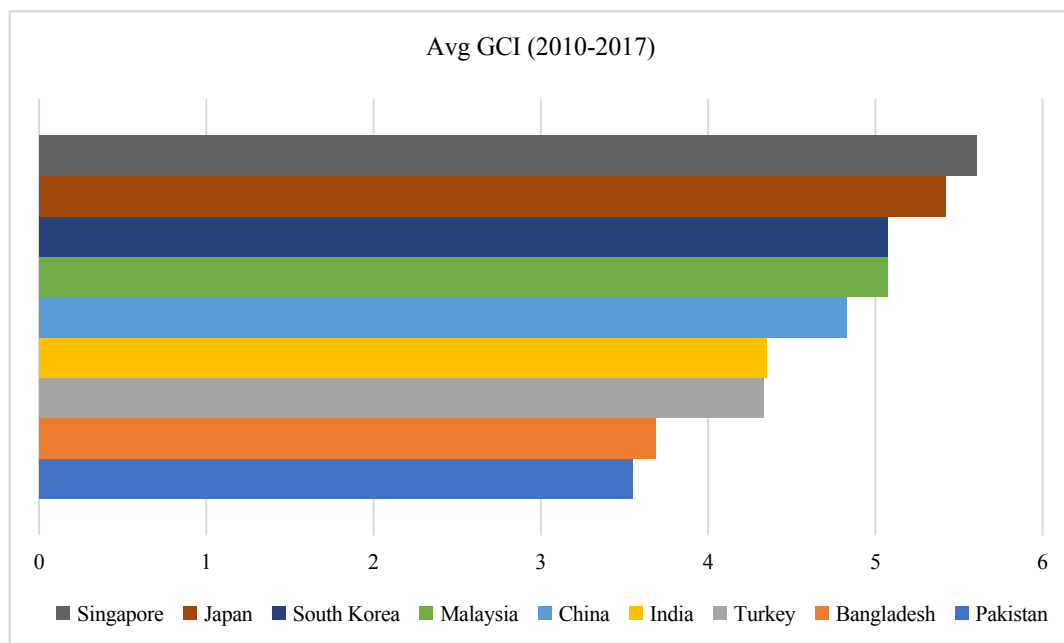


Figure 3. Avg GCI (author's estimation)

Source: World Economic Forum (2010-2017)

1.2 Objective of the study

This study aims to provide a comprehensive understanding of how human capital influences economic growth and a country's position on the Global Competitiveness Index, using empirical data and statistical analysis, with a particular focus on various economies, such as developing, developed, and less developing nations including Pakistan.

1.3 Contribution of the study

This study has explored the journey towards economic prosperity and competitiveness in various contexts, encompassing the developing, emerging, and developed worlds. While previous research has investigated the impact of human capital on economic growth and the Global Competitiveness Index (GCI), this study distinguishes itself by offering a comparative examination of diverse economies, including Pakistan. It accentuates the crucial role of human capital in achieving favorable GCI rankings and fostering economic growth. Notably, this research stands out for its utilization of statistical tools, particularly classical techniques, to provide valuable insights.

2. Literature review

This section delves into an array of research studies concerning the interconnected topics of economic growth, the development of human capital, competitiveness, and the intricate relationships among them. It offers a theoretical framework encompassing human capital and growth theories and provides concise summaries of the empirical results derived from the numerous studies discussed.

2.1 *Economic growth, competitiveness and human capital: foundational concepts*

2.1.1 *Economic growth and competitiveness*

Economic growth is the steady increase in a country's output. It measures the per capita income of a certain nation as the foremost determinant of national progress along with the human and physical capital extracted through the industrial, agricultural, and service sectors. Ostensibly, the signified nexus of public and private sector collaborates and outcomes as a national income source which further leads to economic growth and public welfare. Whereas, four factors influence competitiveness: economic performance, corporate efficiency, government efficiency, and infrastructure. Contradictory, in developing nations the inadequate infrastructure and lack of investment in human capital to make it productive tends to paralyze the aforementioned developmental pace which is responsible for creeping economic growth, as well as low ranking in the GCI index.

2.1.2 *Human capital*

Human capital refers to the process of converting human inputs into productive output. Further explanation is to say that man's contributions in the areas of technology, skills training and experience, and life span assist the government in enhancing national output, which leads to an increase in GDP and, as a result, economic growth and development. However, this study uses numerous variables as indicators of human capital to quantify the influence of human capital. All of these factors have an impact on growth, and we can determine if the economy is at risk or not based on these effects. Human capital theory is premised on the conception that "the most desirable of all capital is that invested in humans" (Marshall 1890, cited in Becker, 1975). So, human capital is an economic fundamental propelling component that occurs spontaneously. So, in order to gain a deeper understanding of our issue, we can go over these indicators in detail using a variety of existing literature.

2.2 *Theoretical review*

Throughout the ages, numerous researchers have come forward with their own ideas related to human capital and economic development. These ideas laid out by the researchers display the factors that bring about economic prosperity achieved by capital development. Many economic development theorists believe that human resources having been fully consumed has an impact on the development and growth of the economy. Apart from this, a certain level of implicit and non-economic output is induced by the elevation of lifestyle and standard of living of the labor force. This change is indicated in their concepts and choices having direct effects on certain marginal levels of investment, which result in substantial outcomes related to reaping economic growth. Below are some relative ideas to be discussed concisely:

2.2.1 *Modernization theory of development*

The modernization theory explains how humans have progressed within the collective resources of societal improvement. Numerous researchers supported modernization theory, including director Rostow (1960), Lewis (1965), Parsons (1951), and Lerner (1958). Exposure to modern institutions such as educational facilities, factories, and the media evokes modern values such as innovation and independence from local authorities, as well as plans to make cost-related expenses exempt in order to reach particular levels on the social and political ladder (Schultz, 1993). By attempting to fix the upsurge of change in an individual's life to his or her social class, which is more glaring in the sense of the individual attending social initiative of life, greater modern capital development is attained, thus a portion of the population can change, affecting the slopes of the trends in development, growth, all based on modernization effects.

2.2.2 Endogenous growth theory

Endogenous growth theory, which was founded by Romer (1986) and Lucas (1988), has sparked a resurgence of preference in the determinants of long-term growth. Human capital is claimed to have a part in the growth process by both endogenous growth theory and the (augmented) Solow model, although their foundations are distinct. Both theories can explain the inclusion of human capital levels and growth rates in output, therefore they are difficult to separate experimentally. According to endogenous growth theory, internal instead of external forces boost the economy. It contends that higher productivity is connected to steadily increasing private sector and government investments in human capital. Endogenous growth theory, despite its lack of empirical validity, presents the benefit of attempting to explain the mechanisms that lead to technological advancement. The advantage of endogenous growth theory is that it explains the mechanisms that lead to technological improvement. Grossman and Helpman (1991) in particular provide important insights into the R&D-growth link. They establish an internally consistent link between aggregate growth theory and the R&D literature pioneered by Griliches (1958), and Edwin (1968).

2.3 Review of studies

Human capital, as well as economic and industrial advancement, walk hand in hand. Therefore, it's crucial to assess their relationship in order to boost productivity and capabilities, resulting in competitive advantages and surplus value that may be used to progress technology and diversify economic activities, allowing for economic expansion. So, the development of human capital has become essential to attain growth. Numerous researchers concur that government spending on health and education to strengthen human capital had a favorable and considerable impact on the economy (Javed et al., 2013). The development of human capital is equally essential for economic success (Ali et al., 2012). Human potential and economic expansion are inextricably intertwined, according to the assertions (Asghar et al., 2012). The relevance of education in promoting the development of human resources and the influence on GDP in Pakistan was highlighted by Jalil and Idrees (2013) during the period 1960 to 2010. The findings suggest that education is vital for rapid expansion and plays a major role in the formation of intellectual resources, which is required for an economic boom.

The economic process is strongly influenced by human capital, as evidenced by a study conducted in Pakistan using time series data and the Cobb-Douglas production function. The study found a significant relationship between human capital and growth in the country. Additionally, the research highlighted the importance of investments in the health and education sectors, as they significantly contribute to the overall economic process (Qadri & Waheed, 2011). Annual Pakistan time series data from 1970 to 2009 were used by Afzal et al. (2010), and the short and long-term interconnections between financial sector development and economic expansion were investigated. The statistics showed that education had a significant long- and short-term impact on the economy. Furthermore, the study argued that pro-human capital investment is critical. Whereas, Khan and Rehman (2012) aimed to figure out human capital in different regions of Pakistan from 1979 to 2008 such as rural, urban, and inclusively four provinces of Pakistan. The study noticed detectable contrasts in human capital conditions among rural and urban areas of Pakistan. Building on human resources strengthens the skilled labor force, which causes expansion in the marginal productivity of capital. Human potential and economic advancement have long-term mutual relationships (Chani et al., 2012).

Human capital, according to scholars, is one of the most important factors in increasing productivity, attracting (FDI), and speeding up economic progress. (FDI) is a technique for increasing an economy's financial muscle, which is necessary for growth. Furthermore, foreign direct investment (FDI) in capital-intensive manufacturing processes stimulates the economy. Foreign assistance helped Pakistan improve the quality of its human capital (Ali et al., 2018). Regardless of the researcher's emphasis on the importance of a well-developed human capital pool for economic success. The improvement of human resources could be instrumental in pulling in FDI by utilizing panel data for 23 non-industrial nations and the result suggested that the expenditure on health for the development of human capital is positively related to attracting FDI to promote sustainable growth (Majeed et al., 2008). The development of human capital is a driver of economic progress according to Awan and Kamran (2017). They noted one causative association between HDI and growth between 1980 and 2016, as well as the two-way causal relationship between human capital and HDI. Using Johansen co-integration and Granger causality, and used an (ARDL) to distinguish the relationship between human resources improvement and economic advancement through education and health sectors. Also, Azam

and Ahmed (2015) investigated the effects of human capital and foreign direct investment on growth in commonwealth countries using the endogenous growth model. A growth theory-based linear regression model and a panel data set encompassing the years 1993 to 2011 were used. Fixed and random effects models are utilized. Based on the Hausman test, the fixed effects model was chosen above the random effects model. The research also emphasized the necessity of investing in both education and health. As a result, increasing levels of education and health should be the primary aim, functioning in collaboration with other factors, in order to stimulate economic progress,

Human capital is exemplified by the nation's skilled and capable workforce. Human capital is evaluated on a regular basis and can be improved through formal or informal education or training. Human capital would not have to be restricted to formal schooling in this regard. It encompasses both on-the-job and non-traditional technical training programs that help improve abilities. Kazmi et al. (2017) examined formal and informal schooling, as well as other socioeconomic variables such as school enrollment, life expectancy, health, knowledge, and skills, using time series data from 1992 to 2014. To emphasize the importance of human capital, an intangible resource managed cooperatively by people and organizations within a community, and to examine how human capital development affects Pakistan's economic expansion. The most persuasive evidence of a relationship between human resources and development may have been obtained. Moreover, human capital is crucial to empirical studies that explain the factors that influence economic advancement. Despite the fact that many researchers suggest that human capital has a positive and considerable impact on economic growth, empirical studies have shown varied results. In theoretical literature, the subject of measuring human capital is commonly addressed. The research looked into the strong link between human capital and economic recovery using the Johansen multivariate cointegration test and the Granger causality test. The BMA procedure then takes into account the uncertainty associated with the model's specification. (Essardi & Razzouk, 2017). Furthermore, high-quality institutions encourage research and development, which is crucial for economic growth. Therefore, boosting R&D expenditure is advised in order to achieve long-term growth (Khan and Khattak, 2014). Bassanini et al. (2001) used panel data to examine how economic growth is linked to policymaking and institutions in OECD countries from 1971 to 1998. The findings revealed that R&D plays a significant role in generating economic growth through influencing policy in a variety of ways. Long-term economic growth is determined by both human and physical capital. On the other hand, poor policies of human capital are negatively contributed to growth (Abbas & Peck, 2008). Additionally, Akram (2009) examined the influence of multiple health indicators on economic growth in Pakistan from 1972 to 2006 by applying VECM techniques. The results exhibited that health indicators are to be considered essential in the long run to achieve growth.

Human resources are fully implemented when women contribute equally and effectively. However, the women component has been frequently neglected. So, Khan et al. (2016) inquired at how women's human capital affects the country's economic progress. The study employed gender-specific human capital as an explanatory variable to determine its value in comparison to other parameters like total labor force and physical capital, by applying Johanson's co-integration approach for the long run and (VECM) for the short-run relationship from 1972 to 2012 in Pakistan. The findings supported the notion that there is a favorable long-term and short-term link between female human capital and economic prosperity. Human capital and growth in Sub-Saharan Africa were the subjects of Akinlo's (2016) research. Panel data was used in this work from 1986 to 2013, and OLSM and GMM approaches were used. Both human resources and financial availability, according to the research, have a positive economic impact. Institutions and interest rates, on the other hand, have a negative impact on growth. And, Khan (2005) focused on 72 developing countries from 1980 to 2002, including Pakistan, for the influence of investment and improved institutions on relative economic growth. The findings showed that physical capital, institutional quality, health and education supervision, as well as effective policies, have a direct influence on growth. In their paper, Akram et al. (2008) looked at how health protection aided Pakistan's economic progress from 1972 to 2006. The findings demonstrated that health variables play a significant role in the development of human capital for improved growth in the economy.

Human capital boosts productivity by increasing profitability in a given economy's total factor productivity. Ali and Krammer (2016) stressed the importance of labor productivity and institutions in a country's social and economic prosperity, as well as the Middle East and North Africa region's contemporary institutional framework. The findings revealed that labor productivity, technical efficiency, and institution quality were all linked to economic success. And, Alataş and Çakir (2016) studied the relationship between human capital advancement and economic expansion in 65 countries through clustering by using panel data from 1967 to 2011. The obtained result assists the existence of human

capital development in growth. The intensive use of human resources, which boosts GDP growth, is attributed to increased productivity and technical innovation. Excessive investment in human resources stimulates investments in developing new technologies by extending the (R&D) sector, stimulating technological developments at the forefront of economic success (Becker et al., 1990).

3. Data and methodology

This research study employs panel data analysis over the full period 1990-2019. The following investigation includes both factors that vary and those that don't. Data for several periods are unavailable in the sample period under review, whereas the collection of various variables for which data is available in developing, less developing, and developed nations is considered. In addition, developed countries include Singapore, South Korea, and Japan, while developing countries include China, Turkey, and Malaysia, with Pakistan, Bangladesh, and India falling into the less developed countries. Variables have been collected based on world development indicators, the World Economic Forum, and the United National Development Programme. Multiple variables, along with human capital, which is the study's main focus, have been explored in a cross-country study in order to assess growth and GCI. Furthermore, the impact of human capital development on GCI and growth is observed by employing comparative modeling using both Classical and Bayesian techniques.

3.1 Data and construction of models

This research employed a range of data sources, including Pakistan's economic survey, World Development Reports, and other public information. The primary goal of the study is to scrutinize the impact of human capital development on GCI and growth using different methodologies in order to find the optimum statistical model. Moreover, to deal with panel data, two models have been employed, and the time-varying variables have been constrained from 1990 to 2019. Both dependent variables have a significant relationship, since increased growth improves a country's GCI ranking, whereas all explanatory variables have been identified from the literature and have a strong association with growth and GCI. Even this component is responsible for determining whether the economy is strong or weak in any form, especially in terms of human capital development. The following statistical model, based on Hall and Jones (1999), is utilized in a proposed framework for quantifying the effect of human capital on economic expansion. The model can also be represented in this way:

The model considers the following variables to measure competitiveness which can be written as

$$GCI_{it} = \beta_0 + \beta_n Y_{it} + \beta_n y_{it} + \beta_n k_{it} + \beta_n inf_{it} + \beta_n h_{it} + \mu_{it} \quad (1)$$

Where GCI_{it} is the dependent variable that represents competitiveness, β_0 is the intercept of the model,

Y_{it}	GDP per capita
y_{it}	GNP per capita
gk_{it}	Growth of physical capital
inf_{it}	Inflation
h_{it}	Level of human capital (UNDP human capital index)
μ_{it}	Error term of the model

3.2 Methodology of analysis for classical framework

3.2.1 Panel data regression models

Time periods and cross-sectional units separate the three basic categories of data. A collection of information known as time-series data is data that changes over time. There are many ways to measure time, from a second to an hour to a year. At the same time, data for a certain variable was obtained from a variety of sources.

$$GCI_{it} = F(x_{it}) + \mu_{it} \quad (2)$$

These assumptions are used to estimate the model in question. The “common effect model,” “fixed-effect model,” and “random effect model” are all based on these assumptions. According to CNLRM, a common effect model is one in which all the model’s parameters indicate a common effect for both time and cross-sectional units. Estimation of a common impact parameter from limited follow-up data” is used by Greenland and Robins (1985). It is calculated using the least squares method. Instrumental variable techniques, such as 2SLS or GMM, can be used to address endogeneity concerns. At least one model parameter in a fixed-effect model changes over time or across cross-sectional units. The fixed effect (LSDV) model compensates for heterogeneity by assigning an intercept value to each of its possible entities. Consider the model in (3) of a common effect

$$GCI_{it} = \beta_{0i} + \beta_1 Y_{it} + \beta_2 y_{it} + \beta_3 k_{it} + \beta_4 inf_{it} + \beta_5 h_{it} + \mu_{it} \quad (3)$$

The subscript “*i*” in the above equation shows that we can allow intercepts to vary or differ among countries because each country has its characteristics. As a result, the overhead model is referred to as a fixed effect model because each country has its specific intercept value that does not change over time, making it time-invariant. If the variable fluctuates across time, we can include time dummies in the model for all time periods. How can we allow for differences in fixed-effect intercept between countries? Using the dummy variable method, we can effectively deal with the situation. We can now write the model as follows:

$$GCI_{it} = \beta_1 + \beta_{01}D_1 + \beta_{02}D_2 + \beta_{03}D_3 + \beta_{04}D_4 \dots + \beta_{08}D_8 + \beta_1 Y_{it} + \beta_2 y_{it} + \beta_3 k_{it} + \beta_4 inf_{it} + \beta_5 h_{it} + \mu_{it} \quad (4)$$

Where,

$D_2 = 1$ for country 2,

Otherwise 0;

$D_3 = 2$ for country 3,

Otherwise, zero and so on.

The research involves nine distinct nations, eight dummies can be used. By following the example of Kaushik et al. (1984), who used a dummy variable method in their research study. While numerous cross-sectional units are investigated, using an LSDV or fixed-effects model might be costly in terms of the degree of freedom. Supporters of the ECM (error component model) or random effect model proposed that if a dummy variable offers limited information about the model, an error term may be included in the model to reflect such information.

By introducing an error term that represents random fluctuations in one or more parameters, we may simply express REM as though the parameters of the model are predicted to change randomly over time units or time periods. This is an example of a random-effect panel data model.

$$\beta_{0i} = (\beta_0 + \varepsilon_i) \quad (5)$$

Where,

$i = 1, 2, 3, \dots N$.

Instead of interpreting β_{0i} as a random variable with a mean value and an intercept value for every individual, we might assume that β_0 is fixed. We can assume that is fixed, and β_{0i} is treated as a random variable with a mean value of β_{0i} and the intercept value for an individual country. Where is a random error term with a mean value of zero and variance $\sigma^2\varepsilon$

$$GCI_{it} = \beta_{0i} + \beta_1 Y_{it} + \beta_2 y_{it} + \beta_3 k_{it} + \beta_4 inf_{it} + \beta_5 h_{it} + \varepsilon_{it} + \mu_{it} \quad (6)$$

so,

$$w_{it} = \varepsilon_{it} + \mu_{it} \quad (7)$$

In addition to the time-series and cross-sectional error components, the complex error term includes the time-series error component as well. According to the standard assumptions of ECM, there is no correlation between the individual error components. There is also no correlation between units or time periods and the specific error term.

Estimating this model using OLS without considering the assumptions above would yield inaccurate results. The GLS technique is the best choice in this situation. Using an instrumental variable approach, such as 2SLS or GMM, is possible when regressors and error terms are linked. Using the random-effects model, Abrahamson and Youngs (1992) developed a reliable approach for regression analyses.

3.3 Diagnostic tests

3.3.1 F-test Statistic

We can create a formal test to determine whether to use the common effect model or the fixed effect model. The restricted F-test has been applied in that case. Simply put, the common effect model is accepted under the null hypothesis, while the fixed effect model is accepted under the alternative hypothesis. If the F-test statistic is significant, we may reject the null hypothesis and declare that the fixed effect model is appropriate; but, if the F test statistic is insignificant, we can accept the null hypothesis and say that the common effect model is suitable. The F test formula is as follows:

$$F = \left(\frac{\frac{R_{ur}^2 - R_r^2}{p}}{\frac{1 - R_r^2}{l - m}} \right)$$

Where

R_{ur}^2 = Unrestricted model's coefficient of determination

R_r^2 = Restricted model's coefficient of determination

p = No of linear restrictions

m = No of parameters in the unrestricted model

l = No of observations

3.3.2 Hausman test statistic

When comparing the fixed effect model with the random effect model, there are differences to consider. Is it possible to rely on the results of this study? It's also possible to choose between the two models. In a random effect model, is unrelated to any of the independent variables, and that is a component of "wit." Unreconcilable results are produced by the ECM or random effect model if this occurs. This assumption may be tested using the Hausman test. To determine if a hypothesis is true or false, one can use the Hausman test. Assuming both models are correct, one might assume that REM is the best or most appropriate model, whereas FEM is acceptable if both are correct.

4. Results and discussion

4.1 Estimation of panel data models under classical framework

The model's parameters, which contain both time-period and cross-sectional units as well as the error term, are referred to as a common effect model. This model may also be estimated using the conventional least square approach,

however only if done properly.

The table above displays the results of three-panel data models, which have undergone various diagnostic tests. The F test is employed to differentiate between the common effect model and the fixed-effect model. In the context of the F test, a lower F test score indicates a better model. In the table, the Common Effect Model displays a lower value compared to the Fixed Effect Model. Therefore, we can conclude that the Common Effect Model is the most suitable choice. using

Table 3. Results of Classical estimation of panel data Model

Models	Common effect model	Fixed effect model	Random effect model
	Estimates	Estimates	Estimates
Coefficients	[std. Error]	[std. Error]	[std. Error]
	(P-value)	(P-value)	(P-value)
Intercept	2.30	2.02	2.30
	0.33	0.32	0.33
	0.00	0.00	0.00
Y_{it}	0.000060	0.00010	0.000060
	0.000040	0.000040	0.000040
	0.14	0.02	0.14
y_{it}	0.000060	0.000092	0.000060
	0.000040	0.000034	0.000040
	0.10	0.09	0.10
gk_{it}	0.03	0.02	0.03
	0.10	0.10	0.07
	0.70	0.74	0.70
h_{it}	-3.05	-3.20	-3.10
	0.50	0.45	0.50
	0.00	0.00	0.00
inf_{it}	0.30	0.42	0.30
	0.10	0.07	0.10
	0.00	0.00	0.00
R2	0.85	0.90	0.90
Adjusted R2	0.84	0.84	0.85
F test	61.17	82.08	-
Hausman test	-	-	0.51

Next, we consider model selection the Hausman test. According to the Hausman test, if the p-value exceeds 0.05, we fail to reject the null hypothesis, implying that the fixed effect model is not applicable. Instead, the random effect model is preferable. Conversely, if the null hypothesis is rejected, the random effect model becomes unsuitable, and the fixed effect model is chosen.

In this specific case, the Hausman test results indicate a p-value greater than 0.05. Consequently, the null hypothesis is not rejected, rendering the common effect model inappropriate. Thus far, only the random effect model has been evaluated.

The obtained result from Table 3 suggested that GCI strengthened by 0.000060 units with a standard error of 0.000040 for a unit change in Y_{it} . When it is changed by a unit, the GCI value is increased to 0.00010 units, which is statistically negligible. GCI becomes strengthened by 0.032 when a unit changed h with a standard error of 0.71. A unit change in h it is responsible for a 3.04 unit drop in GCI ranking, with a standard error of 0.50 and a statistically significant effect. Moreover, one unit change in $\ln Y_{it}$ 0.30 unit increase in GCI with standard error 0.10 and show a significant effect. In addition, the coefficient of determination is 0.85, indicating a stronger model fit. The adjusted R^2 value is 0.84, showing that GCI and other dependent variables have a strong positive correlation.

Although the preponderance of some other variables in the GCI model are insignificant, apart from human capital where the P-value of human capital is 0.000, but the intercept is negative, indicating that human capital has a negative significant effect on the global competitiveness index. It is not supposed to be a desirable outcome. In contrast, both GDP and GNP exhibit a positive impact on the Global Competitiveness Index.

5. Conclusion

Economic growth plays a pivotal role in determining a country's standing on the Global Competitiveness Index (GCI). It fosters productivity, innovation, infrastructure development, and human capital investment, all of which are crucial for competitiveness. Growing economies attract investment, expand global reach, and exhibit resilience in the face of challenges. In essence, sustained economic growth is a fundamental driver of success on the GCI, as it underpins various factors that contribute to a nation's competitiveness and global prosperity. Moreover, any economy that considers its workforce size, physical capital, human capital, and technological level knows how much production it generates. When two countries are compared, the one with more physical capital, more labor, a more educated and trained workforce, and superior technology will almost certainly produce more and rank higher in the global competitiveness index. The study places a strong emphasis on the pivotal role of human capital and growth. Human capital includes the knowledge, skills, education, and health of a country's workforce. It asserts that investing in and developing human capital is crucial for achieving maximum economic growth and for securing a favorable position on the GCI. As a result, crucial inputs like human capital and growth must be prioritized in order to achieve the desired outcomes to achieving global competitiveness index in various economies. Additionally The study relies on statistical tools, with a particular emphasis on classical techniques, to underpin its findings and analysis. This indicates that the research employs well-established statistical methodologies to examine data and formulate conclusions regarding the connections between economic growth, human capital, and competitiveness. Furthermore, for optimal modeling to support policy formulation, it is imperative to employ a diverse range of statistical tools in the analysis of data.

5.1 Limitations

The study's limitations include potential issues related to data quality and availability, the challenge of generalizing findings across diverse economies, the impact of the chosen time frame on analysis, the influence of selected statistical techniques on results, the complexity of establishing causality, a lack of in-depth policy analysis, vulnerability to external shocks, the dynamic nature of economic conditions, under-exploration of regional variations, and an element of subjectivity in research decisions. Recognizing these limitations is crucial for a more nuanced interpretation of the study's findings and recommendations.

5.2 Recommendations

- Human capital is the most important aspect of economic growth, and it should be prioritized if we want to achieve a high and constant improvement in GCI rankings.
- The impact of human capital varies by country or region. Specific considerations, such as the “development stage of an economy,” should be addressed first when planning and implementing education and health reforms aimed at boosting human capital formation.
- Improve data collection and analysis capabilities to better monitor and evaluate the impact of policies on human capital development and economic growth.
- The government should provide assistance and incentives to all individuals engaged in R&D activities, fostering innovation and creativity while also assisting manufacturing sectors and SMEs in improving their performance. The Global Competitiveness Indicator, which combines the macroeconomic and microeconomic components of competitiveness into a specific factor, is a boon for population development, as is a substantial resource to enhance aspects of output so that a country’s population may experience an improved standard of living by effectively utilizing existing resources.
- Raise public awareness about the importance of human capital development and its connection to overall economic prosperity.

These recommendations aim to enhance human capital, promote economic growth, and improve competitiveness in a holistic manner.

Conflict of interest

The authors declare no competing financial interest.

References

- Abrahamson, N. A., & Youngs, R. R. (1992). A stable algorithm for regression analyses using the random effects model. *Bulletin of the Seismological Society of America*, 82(1), 505-510.
- Afzal, M., Farooq, M. S., Ahmad, H. K., Begum, I., & Qudus, M. A. (2010). Relationship between school education and economic growth in Pakistan: ARDL bounds testing approach to cointegration. *Pakistan Economic and Social Review*, 48(1), 39-60.
- Alataş, S., & Çakir, M. (2016). The effect of human capital on economic growth: A panel data analysis. *Yönetim Bilimleri Dergisi*, 14(27), 539-555.
- Ali, H., Siddique, H. M. A., Ullah, K., & Mahmood, M. T. (2018). Human capital and economic growth nexus in Pakistan: The role of foreign aid. *Bulletin of Business and Economics*, 7(1), 13-21.
- Ali, M. S. B., & Krammer, S. M. (2016). The role of institutions in economic development. In *Economic Development in the Middle East and North Africa* (pp. 1-25). Palgrave Macmillan, New York.
- Ali, S., Chaudhry, I. S., & Farooq, F. (2012). Human capital formation and economic growth in Pakistan. *Pakistan Journal of Social Sciences (PJSS)*, 32(1), 229-240. <http://pjss.bzu.edu.pk/index.php/pjss/article/view/147>
- Akinlo, T. (2016). Institution and economic growth in sub-Saharan Africa (1986-2013). *Emerging Economy Studies*, 2(2), 170-180.
- Akram, N., Ihtshamul, H. P., & Khan, M. (2008). The long-term impact of health on economic growth in Pakistan. *The Pakistan Development Review*, 47(4), 487-500. <https://www.jstor.org/stable/41261236>
- Akram, N. (2009). *Short-run and long run dynamics of the impact of health status on economic growth Evidence from Pakistan*. Munich Personal RePEc Archive. <https://mpra.ub.uni-muenchen.de/id/eprint/15454>
- Asghar, N., Awan, A., & Rehman, H. (2012). Human capital and economic growth in Pakistan: A cointegration and causality analysis. *International Journal of Economics and Finance*, 4(4), 135-147.
- Awan, A. G., & Kamrun, M. (2017). Impact of human capital development on Pakistan’s economic growth. *Global Journal of Management Social Humanities*, 3(3), 418-439.
- Azam, M., & Ahmed, A. M. (2015). Role of human capital and foreign direct investment in promoting economic growth: Evidence from Commonwealth of Independent States. *International Journal of Social Economics*, 42(2),

98-111. <https://doi.org/10.1108/IJSE-05-2014-0092>

- Baldacci, E., Clements, B., Gupta, S., & Cui, Q. (2008). Social spending, human capital, and growth in developing countries. *World Development*, 36(8), 1317-1341.
- Bassanini, A., Scarpetta, S., & Hemmings, P. (2001). *Economic Growth: The Role of Policies and Institutions*. Panel data evidence from OECD countries.
- Becker, G. S. (1975). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. New York: National Bureau of Economic Research.
- Becker, G. S., Murphy, K. M., & Tamura, R. (1990). Human capital, fertility, and economic growth. *Journal of Political Economy*, 98(5, Part 2), S12-S37.
- Chani, M. I., Hassan, M. U., & Shahid, M. (2012). Human capital formation and economic development in Pakistan: An empirical analysis. *Forthcoming in: Actual Problems of Economics No. 6*. Munich Personal RePEc Archive. <https://mpra.ub.uni-muenchen.de/id/eprint/38925>
- Edwin, M. (1968). *Industrial Research and Technological Innovation*. New York: W. W. Norton for the Cowles Foundation in Economics at Yale University.
- Essardi, O., & Razzouk, R. (2017). Human capital and economic growth in Morocco: Evidence from Bayesian model averaging. *International Business Research*, 10(12), 167-182.
- Faisal Sultan Qadri, F., & Abdul Waheed, W. (2011). Human capital and economic growth: Time series evidence from Pakistan. *Pakistan Business Review*, 1, 815-833. <https://mpra.ub.uni-muenchen.de/id/eprint/30654>
- Greenland, S., & Robins, J. M. (1985). Estimation of a common effect parameter from sparse follow-up data. *Biometrics*, 41(1), 55-68. <https://doi.org/10.2307/2530643>
- Griliches, Z. (1958). Research costs and social returns: Hybrid corn and related innovations. *Journal of Political Economy*, 66(5), 419-431.
- Grossman, G. M., & Helpman, E. (1991). Quality ladders and product cycles. *The Quarterly Journal of Economics*, 106(2), 557-586.
- Hall, R. E., & Jones, C. I. (1999). Why do some countries produce so much more output per worker than others? *The Quarterly Journal of Economics*, 114(1), 83-116.
- Human development data. United Nations Development Programme. <http://hdr.undp.org/en/data>
- Jalil, A., & Idrees, M. (2013). Modeling the impact of education on economic growth: Evidence from aggregated and disaggregated time series data of Pakistan. *Economic Modelling*, 31, 383-388. <https://doi.org/10.1016/j.econmod.2012.11.035>
- Javed, M., Abbas, S., Fatima, A., Azeem, M. M., & Zafar, S. (2013). Impact of human capital development on the economic growth of Pakistan: A public expenditure approach. *World Applied Sciences Journal*, 24(3), 408-413.
- Kazmi, S. M., Ali, K., & Ali, G. (2017). *Impact of Human Capital on Economic Growth: Evidence from Pakistan*. Working Papers id:12233, eSocialSciences.
- Khan, J. (2012). *The Role of Human Capital in Economic Growth of Pakistan (1971-2008)*. Doctoral dissertation, University of Peshawar.
- Khattak, N. U. R. K., Khan, J., Khan, I., & Tariq, M. (2012). An analysis of the demand for higher education in Pakistan with special reference to Khyber Pakhtunkhwa. *City University Research Journal*, 3. <https://mpra.ub.uni-muenchen.de/id/eprint/51182>
- Khan, M. A., & Rehman, H. U. (2012). Regional disparities in human capital: The case of Pakistan. *Pakistan Economic and Social Review*, 50(1), 57-69. <https://www.jstor.org/stable/24398817>
- Khan, M. K. (2016). Contribution of female human capital in economic growth: An empirical analysis of Pakistan (1972-2012). *Quality & Quantity*, 50(2), 709-728.
- Khan, M. S., Amjad, R., & Din, M. U. (2005). Human capital and economic growth in Pakistan [with comments]. *The Pakistan Development Review*, 44(4), 455-478. <https://www.jstor.org/stable/41260728>
- Kaushik, S. J., & Luquet, P. (1984). Relationship between protein intake and voluntary energy intake as affected by body weight with an estimation of maintenance needs in rainbow trout. *Zeitschrift für Tierphysiologie Tierernährung und Futtermittelkunde*, 51(1-5), 57-69.
- Lerner, D. (1958). The passing of traditional society: Modernizing the Middle East. *Political Science Quarterly*, 74(1), 127-129. <https://doi.org/10.2307/2145947>
- Lewis, W. A. (1965). A review of economic development. *The American Economic Review*, 55(1/2), 1-16.
- Lucas, J. R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42.
- Majeed, M. T., & Ahmad, E. (2008). Human capital development and FDI in developing countries. *Journal of Economic Cooperation*, 29(3), 79-104.
- Parsons, T. (1951). Illness and the role of the physician: A sociological perspective. *American Journal of*

Orthopsychiatry, 21(3), 452.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037.

Rostow, W. W. (1960). *The stages of economic growth: A non-communist manifesto*. Cambridge: Cambridge University Press.

Schultz, T. W. (1961). Investment in human capital. *The American Economic Review*, 51(1), 1-17.

Schultz, T. P. (1993). Investments in the schooling and health of women and men: Quantities and returns. *Journal of Human Resources*, 28(4), 694-734. <https://doi.org/10.2307/146291>

World Development Indicators. The World Bank Group. <https://databank.worldbank.org/source/world-development-indicators>

World Economic Forum. <https://www.weforum.org/>