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Policy Analysis Framework to Measure Progress towards Innovative Human Capital for the attainment of Sustainable Development Goals in Pakistan

Dr. Nasir Shaheen

Assistant Professor, Centre for Management & Commerce, University of Swat, Khyber Pakhtunkhwa Pakistan, 19120, at- nasirshaheen@uswat.edu.pk

Rezwan Ullah *

PhD Scholar, Centre for Management & Commerce, University of Swat, Khyber Pakhtunkhwa Pakistan, 19120, at- rezwanullah1990@yahoo.com

Dr. Nasir Ahmad

Associate Professor, Center for Education and Staff Training, University of Swat, Khyber Pakhtunkhwa Pakistan, 19120, at- nasir_cupid@uswat.edu.pk

Asif Saud Jan

PhD Scholar, Centre for Management & Commerce, University of Swat, Khyber Pakhtunkhwa Pakistan, 19120, at- asif.saud@uswat.edu.pk

Dr. Syed Zubair Ahmad

Member Board, Islamabad Chapter, Association of Certified Fraud Examiner, Inc. USA at- syedzubairahmed@rocketmail.com

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Abstract

The study is intended to develop a policy analysis framework to measure progress toward developing innovative human capital in light of Sustainable Development Goals. The aim is to find the relevant themes in the literature about innovative human capital and thereby identify and meet relevant goals of sustainable development. Three themes were found: Digital Literacy, Inclusive Growth Policies, and Research and Development Infrastructure. Based on these themes, corresponding sustainable development goals are identified to develop the framework. Further, the proposed policy analysis framework is applied to measure Pakistan's progress toward developing innovative human capital. The data was extracted from published authoritative reports from 2015 to 2022. It found that Pakistan encounters challenges in developing innovative human capital to achieve sustainable development, such as [specific challenges]. The study recommended that the developed framework be employed to measure the progress of countries toward developing innovative human capital.

Keywords: Innovative Human Capital; Sustainable Development Goals; Digital Literacy; Inclusive Growth Policies; Research and Development.

Introduction

Innovation is the ability of individuals to turn creative concepts into products and services, enhancing efficiency and effectiveness. It encompasses new ideas, methods, products, services, or solutions with significant positive impacts across governance, society, and industry (Obradovic, T., & Vlacic, B., 2021). Human capital refers to skilled individuals within a nation developed through education, skills, and experience (Flores, E., & Xu, X, 2020). When these individuals innovate, they drive progress and productivity, which is crucial for a country's development and growth. Innovative human capital is not just a factor in development; it is the most significant one. It stimulates innovation, increases productivity, and enhances global competitiveness (Bye & Faehn, 2022). It enables the capacity of a nation to absorb new knowledge and utilize it in productive ways. The development and sustainability of innovative human capital begin with cognitive development, followed by supporting policies and a conducive research environment (Deming, D. J. 2022). It provides a culture that helps nurture innovative competencies in society, which helps find novel solutions to all complex challenges (Hanifah et al., 2020). Innovative human capital fosters development through creativity and innovation in all sectors of society. Your work in this field is not just important; it is crucial for the future of our society.

The idea of innovation not only covers industrial policies related to product, process, and business model innovation but also the grand challenges faced by modern societies, which need strategic investments in shaping the market to accommodate different sectors for the achievement of sustainable development goals (Mazzucato, M., & Kattel, R., 2020). Innovative human capital participates meaningfully in

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society by embracing diverse and inclusive ideas, which promotes social cohesion (Zapata-Cantu & González, 2021). Different social problems create socioeconomic and gender disparities. These problems require disruptive, innovative solutions. These solutions are not possible without innovative human capital (Bevilacqua & Ou, 2018). Therefore, the development of creative human minds is a mandatory requisite for the development of a society. Innovative human capital originates from cognitive development.

Education and skill acquisition are not just crucial; they are the backbone of fostering innovation, creativity, and problem-solving abilities. Teaching methods, curriculum design, and hands-on experiences all contribute to nurturing innovation in individuals. Research studies have identified that the inclusion of digital literacy in the curriculum is essential for technological advancements to improve human inventiveness (Sawyer, R. K., & Henriksen, D., 2024). Nations that have developed a robust pool of digital and technological education for their human capital to be innovative are prosperous in spearheading technological breakthroughs, driving digital transformation, and establishing new industries (Jahangir et al., 2022). The education system is aimed at developing knowledge and skills. However, the addition of digital skills to all branches of knowledge helps develop innovative capacity. It is further supported by research infrastructure for upbringing the innovative human capital to use their capabilities for the advancement of innovative products, processes, and models (Forrester, S. V., & Ustinova, G. H., 2016). The participation of the state in joint ventures of research and development projects plays a significant role as it takes a long duration of time for an innovation to develop and succeed and needs investors' patience, which is quite unlikely among the private sector (De Vries, H., & Bekkers, V., 2016). The development of conducive and flexible regulatory frameworks encourages risk-taking and entrepreneurship. Your contribution to the education system is not just valuable; it is indispensable for the future of our society.

In developed countries, economic policies support the nurturing of innovative human capital. To foster innovation, governments invest in macro-level mega projects, including education, the energy sector, industrial capabilities, and green environment to information technology. These research or innovation-based projects usually have a higher risk for failure. That is why venture capitalists are generally reluctant to invest (Mazzucato, M., 2011). Government investment in these projects may result in fewer financial gains but will also have more comprehensive economic benefits. Some research studies suggest that government policies on innovation tend to prioritize the supply side over the demand side (Van Reenen, J. 2021). This involves boosting the supply of innovators through education policies emphasizing STEM (Science, Technology, Engineering, and Mathematics), immigration policies aimed at attracting innovative talents, and the establishment of government-funded research labs. Instead of evaluating policies in isolation, it is often more practical to employ multiple or combined strategies. These policies can then be integrated into broader plans for comprehensive impact.

Different types of policies aim to cultivate an environment conducive to nurturing innovative human capital. Government investment in research capabilities and infrastructure is not just crucial; it is a game-changer in establishing an innovation-friendly economic structure

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(Reynolds, E. B., & Uygun, Y. 2018). This framework serves as a platform for the private sector to harness creativity and innovation through entrepreneurship and the establishment of new businesses. As businesses thrive, they not only create decent job opportunities but also stimulate economic activities, propelling society towards more productive avenues for finding innovative solutions. These innovations manifest themselves in various forms, enriching all facets of society (Oh, D. S., & Phillips, F., Park, S, 2016). Moreover, this environment fosters international collaborations, where the exchange of perspectives and expertise among global partners not only enhances capabilities but also promotes openness towards diversity, equity, and inclusion, underscoring the importance of international partnerships. Your work in policy-making is not just important; it is instrumental in shaping the future of our society.

The synergy between innovative human capital and Sustainable Development Goals is critical in present-day growth discourse, mostly in developing nations. This underlines challenges for policymakers to develop an inclusive innovation policy (Borrás, S., & Edquist, C., 2013), which supports a mission-oriented ecosystem sustaining cross-functional economic activities for all sectors to leverage the goals of sustainable development (Mazzucato, M., 2018). Policies based on innovative human capital empower citizens to contribute significantly to sustainable development. It serves as a linchpin for realizing sustainable development goals and constructing a more equitable, resilient, and sustainable world as described as an entrepreneurial society by Peter Drucker where the individual takes responsibility for their learning (Drucker, P., & Maciariello, J., 2014). This underscores the imperative of understanding how the objectives of sustainable development define innovative human capital, its inherent interconnections among different goals, and the methods to measure it effectively.

Rationale of the study

The concept of "innovative human capital" has been employed in previous research studies (McGuirk, H., & Lenihan, H., 2015; Lee, S. Y., & Florida, R., 2010), yet there lacks a specific index to gauge this intersection of innovation and human capital. While various rankings and indices exist for measuring innovation and human capital independently, there still needs to be a gap in evaluating innovative human capital, specifically in the context of sustainable development goals. We posit that innovation is fundamentally rooted in cognitive abilities and creative thinking. The recognition of the significance of innovation for human capital by the state, followed by the scientific process to develop it through investment in education, prioritize it in policies, and provide a feasible environment through research infrastructure, will result in higher levels of creativity (Nightingale, P. 1998). This innovative human capital development is necessary to achieve the goals of sustainable development.

Research question and objectives

The study intends to develop a Policy Analysis Framework to Measure Progress toward Innovative Human Capital for the attainment of Sustainable Development Goals by identifying interdependent goals contributing to the development and growth of innovative human capital.

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Therefore, this study aims to develop a policy analysis framework scientifically grounded in relevant theories for the measurement of creative human capital within the context of sustainable development goals. Moreover, the relevance of this framework in measuring Pakistan's advancement in fostering innovative human capital serves to demonstrate its practical utility and relevance. This leads to the following research objectives:

1. To develop a policy analysis framework to measure progress towards developing innovative human capital for the attainment of sustainable development goals.
2. To analyze progress towards innovative human capital in light of the proposed framework.

Research Methodology

The study was carried out in two stages. In the first stage, the study developed a policy analysis framework to measure progress toward developing innovative human capital for the attainment of sustainable development goals by identifying relevant goals through the theories of human capital and innovation. In the second stage, the developed framework was applied to measure innovative human capital in Pakistan. Data was extracted from published authoritative national and international reports. The period of these reports was taken from 2015 to 2022. The baseline was taken as 2015 being the beginning year for sustainable development goals. The objective was to gather published reports till 2022, but due to the unavailability of published data for 2022 in some cases, the available reports till the next preceding year were taken. These reports include the International Telecommunication Unit (ITU) United Nations (2023); United Nations Economic Commission for Europe (2022); Pakistan Labour Force Survey (LFS) 2018-19, 2019-20, and 2020-21; and World Bank Open Database (2022). Through these reports, we gain a contemporary understanding of the current state of innovation in Pakistan within the landscape of Sustainable Development Goals.

Results

Stage 1: Development of a policy analysis framework to measure progress toward developing innovative human capital for the attainment of sustainable development goals

A pragmatic philosophical approach was used to develop a framework to measure progress toward developing innovative human capital, focusing on empirical evidence. A comprehensive understanding of human capital and innovation is essential for creating a practical policy analysis framework. Innovation theory by Joseph Schumpeter highlighted the critical role of technological innovation and entrepreneurship in determining economic growth (Schumpeter, J. A., & Swedberg, R., 2021). Human capital theory, pioneered by Gary Becker, posits that investments in education, training, and skills development enhance individual productivity and drive economic growth (Becker, G. S, 2009). The resource-based view of the firm presented by Penrose conceives that innovation is the output of unique competencies acquired by its human capital through knowledge, skill, and experience. It provides a competitive advantage and facilitates innovation (Penrose, E. T., 2009). The

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learning of knowledge and abilities and its consequent reflection in actions for economic growth pertains to the concept of human capital (Coleman, J. S., 1988). Schultz, T. W. (1961) reveals skills acquisition for enhancing innovation and productivity. The role of digital technologies in fostering innovation in the knowledge economy is essential (Van Deursen, A. J., & Van Dijk, J. A. 2019).

The endogenous growth theory underlined innovation and knowledge creation in developing a sustainable economy (Romer, P. M., 1994). Diffusion of innovation theory describes the measures and steps to spread innovation in society and the role of human capital in adopting it (Rogers, E. M., & Williams, D., 1983). The open innovation concept advocates an innovative ecosystem developed through collaboration in knowledge sharing (Chesbrough, H. W., 2003). The policies for equitable access to research and development facilities and opportunities are essential for inclusive innovation (Rodrik, D., 2014). Human capital can contribute to economic growth through research and technological advancement facilities (Acemoglu, D., & Autor, D., 2011). These theoretical viewpoints lead to three main themes: digital literacy, inclusive growth policies, and research and development infrastructure. Digital literacy provides digital skills to human capital for using information technology for innovation. Inclusive growth policies promote innovation by developing innovation-based policies for all sectors of the economy, including entrepreneurship, decent job creation, and micro and macro levels enterprises. Research and development infrastructure serves as a platform for innovative human capital to use their capabilities to advance technological and other developments. Based on these three themes, relevant sustainable development goals were identified as follows:

1. Sustainable Development Goal 4 guarantees inclusive and equitable quality education for the promotion of lifelong learning opportunities for all. Its target 4.4, which is relevant to the first theme, 'digital literacy, ' states, "By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship". It represents the need for "digital literacy" to develop innovative human capital.
2. Goal 8 of sustainable development goals states to "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all." Its Target 8.2 states to "Achieve higher levels of economic productivity through diversification, technological upgrading, and innovation, including through a focus on high-value added and labor-intensive sectors." Target 8.3 states to "Promote development-oriented policies that support productive activities, create decent jobs, foster creativity and innovation, promote entrepreneurship, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services." It is relevant to the second theme "inclusive growth policies" to support innovative human capital to grow.
3. Goal 9 of sustainable development goals states to "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation." Its Target 9.5 states to "Enhance scientific research, upgrade the technological capabilities of industrial sectors in all

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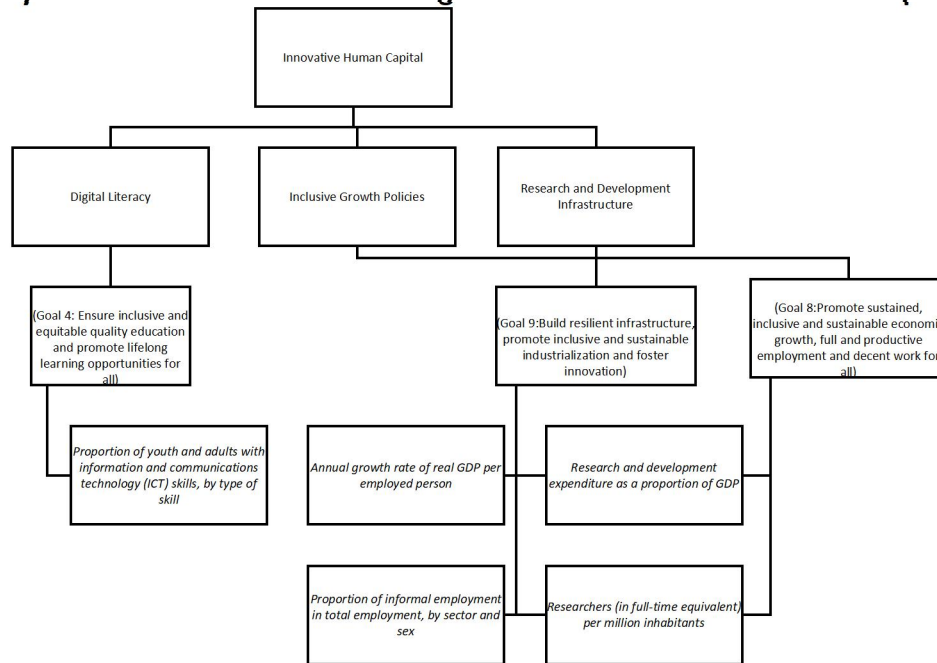
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countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending”. This goal is relevant to the third theme “Research and Development Infrastructure” where innovative human capital can utilize their skills.

In light of the above, Figure 1.1 describes the policy analysis framework for measuring progress toward innovative human capital for sustainable development.

Figure 1: Policy Analysis Framework to Measure Progress Toward Innovative Human Capital for Sustainable Development



Stage 2 Application of policy analysis framework to measure progress toward innovative human capital in Pakistan

In the second stage, the developed policy analysis framework to measure progress toward innovative human capital in light of sustainable development goals was used to describe the current state of innovative human capital in Pakistan:

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1. Digital Literacy

Table 1: Proportion of youth and adults with information and communications technology (ICT) skills by type of skills

Percentage of Type of ICT skills by type	2016	2019	2020
Copy or move file or folder	5.46	5.12	5.62
Presentation creation through software	1.68	1.47	1.58
Find, download, install, and configure software	3.44	2.59	2.40
Emails with attached sending	3.69	3.85	3.57
File transfer between computers and other devices	2.43	2.65	2.56
Arithmetic formula application in spreadsheet	2.084	2.14	1.99
Use of the copy and paste in a document	3.98	4.65	3.94
Using programming language to write a programming language	1.45	1.44	1.50

Source: International Telecommunication Unit (ITU) United Nations (2023)

Table 1 illustrates the evolution of digital skills proficiency among individuals over time. These skills encompass a spectrum from fundamental tasks to more advanced abilities. The percentages for skills such as file manipulation, sending emails with attachments, and utilizing copy-and-paste functionality indicate modest growth or stability over time. This may suggest that these fundamental skills are becoming more prevalent among individuals, contributing to their digital readiness for employment and entrepreneurship. However, some advanced-level skills have been declining in percentages over the years. This suggests potential challenges in ensuring widespread proficiency in specific technical areas, highlighting the need for continuous improvement in digital literacy in Pakistan.

2. Inclusive growth policies

Table 2: Annual growth rate of real GDP per employed person

Year	Percentage of the growth rate of real GDP per employed person
2015	2.97
2016	4.96
2017	3.6

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2018	4.98
2019	0.01
2020	-0.39
2021	-0.12
2022	3.41

Source: United Nations Economic Commission for Europe (2022)

Table 2 illustrates the fluctuating pattern of the annual growth rate of real GDP per employed person from 2015 to 2022. While there were periods of significant growth, there were also instances of decline, particularly notable in 2020 and 2021. The annual growth rate of real GDP serves as a critical indicator of economic expansion. It reflects the extent to which this growth impacts the living standards of all segments of society and underscores the need for inclusive growth policies. Fluctuations in the growth rate emphasize the significance of consistent and targeted policies to ensure sustainable and inclusive growth.

Table 3: Proportion of informal employment in total employment by sector and sex

Year	Female	Male	Total
2014-15	73.5	72.5	72.6
2017-18	71.8	72	72
2018-19	70.5	72.7	72.4
2020-21	65.5	73.4	72.5

Source: Pakistan Labour Force Survey (LFS) 2018-19, 2019-20 and 2020-21

Table 3 reveals that in 2014-15, informal employment in total employment was 72.6%, with males 72.5% and females 73.5%. In 2020-21, informal employment in total employment was 72.5%, with males 73.4% and females 65.5%. There was no significant difference in total employment and male employment; however, gender parity increased in female employment. This indicator offers insights for policy interventions in promoting inclusive growth by focusing on disparities in employment, creation of decent jobs, income inequality, and social protection to enable people to utilize their innovative skills. The data suggests that while there has been progress in reducing gender disparities in employment, there is still a need for policies that promote decent job creation and social protection for all segments of society.

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3. Research and Development Infrastructure

Table 4: Research and development expenditure (% of GDP)

Year	Percentage of GDP
2015	0.25
2017	0.21
2019	0.17
2021	0.16

Source: World Bank Open Database (2022)

Table 4 discloses that research and development expenditures in 2015 were 0.25 % of the GDP, gradually decreasing to 0.16% in 2021. This shows a negative trend in government budget expenditures on research and development.

Table 5: Researchers in R&D (per million people)

Year	R& D per million people
2015	278.854
2017	335.580
2019	382.892
2021	422.827

Source: World Bank Open Database (2022)

Table 5 shows that in 2015, there were 278.854 researchers per million people in Pakistan, which increased to 422.827 researchers per million people in 2021. This shows substantial progress in policies encouraging higher education.

Discussion

a. Policy analysis framework to measure progress toward developing innovative human capital

The study developed a policy analysis framework to measure progress toward innovative human capital in light of sustainable development goals. The framework was based on three themes: digital literacy, inclusive growth policies, and research and development infrastructure, which have emerged from literature on innovative human capital. Sustainable development goals 4, 8, and 9 were found to be consistent with these themes.

The first theme was digital literacy. Research studies underscore the critical impact of digital skills on fostering innovative human capital.

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Proficiency in digital literacy has a positive effect on innovation Higón (2012). This makes it imperative for governments in emerging economies to invest in artificial intelligence and related research to achieve sustainable development goals, especially in innovation Mhlanga (2021). The integration of digital skills into the curriculum supports preparing innovative human capital (Picatoste & Pérez-Ortiz, 2018). Its inclusion in educational frameworks helps digitalization play its role in empowering human capital for sustainable development (González-Salamanca & Agudelo, 2020; Vasilev & Stefanova, 2023). Further, the integration of cultural values in digital literacy through different teaching methods enhances learning, innovation, and opportunities for young learners (Yetti. E., 2024). This advancement in digital literacy in Pakistan offers a promising outlook for the country's future of human capital.

The significance of inclusive growth policies cannot be overemphasized. A recent study on innovation and human capital in sub-Saharan Africa revealed a strong positive correlation to inclusive growth (Oyinlola, Adedeji, & Onitekun, 2021). The current level of human capital is not sufficient to drive the innovative activities and technological advancements required for inclusive growth. In some economies, such as Mexico, the impact of human capital outweighs that of physical capital (Garza-Rodriguez & Almeida-Velasco, 2020). This underscores the urgent need for an innovation policy that focuses on human capital to boost demand-side measures for innovation (Edler, 2016). Such a policy shift could lead to a new technological paradigm and drive innovative renewal across the economic landscape (Veselovsky & Izmailova, 2019). Ultimately, establishing appropriate industrial structures is essential for achieving positive financial outcomes (Teixeira & Queirós, 2016). These insights collectively highlight the urgency of implementing inclusive growth policies to nurture the development of innovative human capital across different contexts.

The third theme was research and development infrastructure: Research and development often require huge investment and a very high risk of success. The government investment in research and development enhances innovation and provides opportunities to individuals and firms through funded technological advancements (Guo & Jiang, 2016). Positive and significant co-integration between innovation and research expenditure was found within European Union countries spanning from 1995 to 2014, underscoring the crucial role of government in prioritizing research and development for developing a structure for innovation by fostering economic opportunities (Pegkas & Staikouras, 2019).

The intertwining relationship between the themes of digital literacy, inclusive growth policies, and research and development infrastructure not only invites philosophical contemplation but also serves as a base for critical policy analysis, aligning with Sustainable Development Goals 4, 8, and 9, respectively, for measuring progress towards the development of innovative human capital. The theoretical frameworks provide philosophical discourse on human capital linked to relevant goals of sustainable development. This philosophical synthesis provides policy analysis with a holistic view of interconnected themes and relevant goals to measure a country's progress toward developing

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innovative human capital to contribute to achieving sustainable development.

b. Progress towards innovative human capital in light of the developed framework

Progress towards developing innovative human capital regarding digital literacy shows increasing trends in basic information and communication skills among youth and adults but decreasing trends in advanced-level technical skills. Pakistan ranks as a low or moderate level of development in digital infrastructure in Asia Pacific countries, which is a potential explanation for the low levels of digital skills observed (Maji, S. K., & Laha, A. 2022). The investment to improve information and communication technology infrastructure may help people acquire relevant skills (Siddiqui, A., & Salim, Z. 2017).

Secondly, policies were unfavorable towards inclusive growth as described by the annual growth rate of real GDP and disparities in the creation of decent jobs, entrepreneurship, and innovation. Fluctuating patterns in the annual growth rate of real GDP per employed person reflect the dynamic nature of economic activity influenced by internal and external factors. Pakistan demonstrates lower levels of inclusive growth (Kamran, M., & Rafique, M. Z., 2023). Proactive economic policies, such as fiscal stimulus packages and targeted industry support, are essential to mitigate adverse effects and enhance productivity. Despite gender parity increasing, specifically among females, informal employment continues to dominate Pakistan's labor market. There is a necessity to foster inclusive growth through women's employment-related policies (Abrar ul Haq, M., & Akram, F., 2019). Challenges persist in achieving meaningful progress toward job creation entrepreneurship and business enterprises.

Thirdly, opposing trends were observed in government spending on research and development. While simultaneously witnessing an increasing trend in the number of research and development workers per 1 million people, progress in policies is shown. Despite the positive growth in the research workforce, challenges persist in fostering innovation and technological advancement (Wadho, W., & Chaudhry, A. 2018). The increase in the number of researchers per million people in Pakistan indicates progress towards higher education (Qazi, W., & Raza, S. A., 2014). But at the same time, it poses challenges for enhancing scientific research and building technological infrastructure aligning with the objectives of encouraging innovation. An investment in research and development will help in developing research infrastructure for a larger pool of researchers to conduct cutting-edge research, develop innovative solutions, and contribute to advancements in various sectors.

Conclusions

The study concludes with an effort to scientifically and empirically develop a policy analysis framework to measure the progress toward developing innovative human capital in light of sustainable development goals. Applying the developed framework found that Pakistan encounters challenges in education, policy formulation, employment, and research expenditure; the growth in the research workforce offers a glimmer of hope for fostering innovation and driving economic growth to achieve the goals of sustainable development for developing

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innovative human capital.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. The framework for policy analysis of innovative human capital may be used by the United Nations and developing countries to measure their progress towards developing innovative human capital and accordingly take policy measures for improvement.
2. Pakistan needs to prioritize the inclusion of digital literacy in its education system.
3. The economic policy needs to embrace inclusive growth-supporting initiatives across different sectors to support innovative human capital development.
4. Increase funding to strengthen research and development infrastructure and provide incentives for the private sector to build industrial capabilities and research institutes that will utilize innovative human capital's potential.

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