EXPLORING THE ROLE OF TEACHERS AND ANALYSING PILLARS OF INNOVATION: A CASE STUDY OF UZBEKISTAN'S DEVELOPMENT

DR. SREEKANTH PERINGANAM VELUTHEDAN,
Visiting Lecturer, School of Banking & Finance, Management Development Institute of Singapore in Tashkent (MDIST), Bunyodkor Avenue 28, Tashkent, Uzbekistan
sreekanth06vijay@gmail.com

Abstract. *Teachers are essential resources in education, serving as guides, mentors, and facilitators in the acquisition of knowledge and skills across all levels of learning. This study investigates into the multifaceted roles of teachers and their significant contributions to education, research, and knowledge dissemination. Utilizing data from the Global Innovation Index, the study also try to explored the performance of Uzbekistan across various pillars, including education, tertiary education, research and development (R&D), knowledge creation, impact, and diffusion. The findings reveal positive trends in knowledge creation and diffusion, indicating advancements in innovation within the country. However, challenges persist in certain areas, highlighting the need for continuous improvement and investment in education and research. Overall, this study highlights the critical role of teachers in driving innovation and fostering socio-economic development.*

Keywords: *Teachers Education, Research & Development, Knowledge Creation, Knowledge diffusion and Global Innovation Index.*

1. INTRODUCTION

Teachers are the most important resource in education programs. Teachers play an indispensable role in the development of a nation, serving as fundamental contributors to various facets of societal progress and advancement. Teachers are essential agents of development, shaping the present and future of a country by empowering individuals, fostering innovation, promoting social cohesion, and driving economic growth. Investing in teachers and education is essential for sustainable development and prosperity. Developing countries typically spend from 15 to 35 percent of their national budgets on education (Farrell, J., & Oliveira, J. (1993). Adoniou, M. (2013) studied the importance of connecting contexts in teacher education. Teachers play a pivotal role in education, serving as guides and facilitators in the acquisition of knowledge, skills, and values for students at all levels of learning. They create engaging learning environments, deliver effective instruction, and assess student progress to ensure meaningful learning outcomes. Beyond academics, teachers serve as mentors and role models, inspiring students to reach their full potential and guiding them through personal and academic challenges. They foster critical thinking, creativity, and problem-solving skills, preparing students to navigate the complexities of the modern world. Teachers also play a

crucial role in promoting social and emotional development, nurturing empathy, resilience, and positive relationships among students. Ultimately, teachers contribute to shaping the future of society by empowering students with the knowledge, skills, and attitudes necessary for success in both their personal and professional lives. This study tried to eexplore the role of teachers and analyzing pillars of innovation.

2. REVIEW OF LITERATURE

A literature review provides the context for the research by summarizing existing knowledge, theories, and findings related to the topic. Leu, E. (2005) conducted a literature study on the role of teachers, schools, communities and process at the local level in creating quality education in less-developed countries and the study focused on focus programs intended to improve quality of

Education. An essential role of teachers is to encourage and motivate students to engage in learning. Johnson, D. (2017) explored the role of teachers in motivating students to learn and additionally, the teacher's ability to develop students' competence, interest in subject taught, and perception of self-efficacy are all important factors that influence students' motivation to learn. Teachers' role in the 21st century has become more complex in the present changing world here knowledge is almost unlimited as outlined by Amin, J. N. (2016). Teachers fulfill a diverse range of roles across education, research and development, and knowledge dissemination. They serve as educators, mentors, and innovators, guiding students in their learning journey, conducting research, and disseminating knowledge to wider audiences. Through their multifaceted contributions, teachers play a vital role in shaping the intellectual landscape and fostering societal progress.

By considering the multifaceted roles of teachers and the complexity of identifying specific variables, the variables are selected from Global Innovation Index published by World Intellectual Property Organization (WIPO) as studied by many authors (Bate (2023), Huarng (2022) and Coutinho (2024)).

3. METHODOLOGY

This section involves deciding on the overall strategy for conducting the research, including the type of study, the sampling method, and the data collection techniques. The data collected from the "Global Innovation Index" reports published by the World Intellectual Property Organization, from the year 2020 to 2023. There are six variables considered for the analysis. They are;

1. Education
2. Tertiary Education
3. Research & Development (R&D)

4. Knowledge Creation
5. Knowledge Impact
6. Knowledge Diffusion

The role of teachers in educational institutions is multifaceted. Primarily role of teachers is facilitating the students in the acquisition of knowledge, skills, and values in all the levels of their education such as, primary, secondary and tertiary level. The teachers also engage in research and development (R&D) which will create a culture of continuous improvement and collective learning. Overall, teachers' involvement in research and development activities is vital for driving innovation, cultivating educational practice, and progressing the field of education as a whole.

Knowledge creation refers to the process of generating new insights, theories, or discoveries through research and experimentation. Knowledge impact refers to the influence or effect that on innovations and developing new scientific and technical articles. Knowledge diffusion refers to the spread or dissemination of knowledge, ideas, or innovations from their source to a broader audience or community. Teachers play a significant role in the processes of knowledge creation, knowledge impact, and knowledge diffusion.

The selected pillars are selected from the Global Innovation Index and consist of specific sub-variables, which are discussed here. Education component include Government expenditure on education as a % of GDP, Government funding per secondary pupil as a % of GDP per capita, School life expectancy, primary to tertiary education, both sexes in years, PISA- Programme for International Student Assessment- scales in reading, mathematics and science and the number of pupils enrolled in secondary school divided by the number of secondary school teachers.

Tertiary education index pillar consists of the ratio of total tertiary enrolment, regardless of age, to the population of the age group that officially corresponds to the tertiary level of education, Graduates from science, technology, engineering and mathematics programs as a % of total tertiary graduates and the number of students from abroad studying in a given country as a percentage of the total tertiary-level enrolment in that country.

The score of Research and development (R&D) include Researchers, full-time equivalent (FTE) per million population, Gross expenditure on R&D (GERD) which is the total domestic intramural expenditure on R&D during a given period as a percentage of GDP, Average expenditure of a country's top three global companies on R&D in million USD and Average score of the top three universities according to the QS world university ranking.

The knowledge creation includes number of resident patent applications filed at a given national or regional patent office per billion PPP$ GDP, number of Patent Cooperation Treaty (PCT) applications per billion PPP$ GDP, number of resident utility model applications filed at the national patent office per billion PPP$ GDP, number of scientific and technical journal articles per billion PPP$ GDP and the H-index is the economy's number of published articles (H) that have received at least H citations.

The Knowledge impact score has made up of growth rate of GDP per person employed %, five-year average which means Labor productivity growth, %, combined valuation of a country's unicorns % of GDP - A unicorn company is a private company with a valuation over USD 1 billion, Computer software spending includes the total value of purchased or leased packaged software, such as operating systems, database systems, programming tools, utilities and applications as a percentage of GDP and high-technology and medium-high-technology output as a percentage of total manufacturing output.

The Knowledge diffusion has made up of Charges for use of intellectual property, i.e., receipts, Production and export complexity based on The Economic Complexity Index is a ranking of countries based on the diversity and complexity of their export basket, High-technology exports as a percentage of total trade, ICT services exports as a % total trade and ISO 9001 Quality management systems – number of certificates issued per billion PPP$ GDP.

The pillars in the Global Innovation Index (GII) hold significant importance as they serve as foundational elements for assessing and understanding a country's innovation ecosystem. Each pillar represents a key aspect of innovation capacity and performance, providing insights into the strengths, weaknesses, and overall competitiveness of a nation's innovation.

4. DATA ANALYSIS AND INTERPRETATION

Teachers serve as key drivers of education, research, and knowledge dissemination, playing important roles in various domains. They also contribute to expanding the body of knowledge through research and experimentation, disseminate research findings to broader audiences, and apply their expertise to address real-world challenges, thereby fostering innovations. The crucial role of teachers is outlined as follows:

Education: Teachers play a pivotal role in facilitating learning, imparting knowledge, and nurturing the intellectual and social development of students across various subjects and grade levels. They design curriculum, create engaging learning

environments, and assess student progress to ensure meaningful learning outcomes (Datnow, A. (2020)).

Tertiary Education: Teachers in tertiary education provide specialized instruction, mentorship, and guidance to students pursuing higher education at colleges, universities, or vocational schools. They facilitate advanced coursework, conduct research, and mentor students in their academic and professional endeavors in their respective fields as outlined by Zapke et al (2009).

Research & Development (R&D): Teachers play a significant role in research and development (R&D) by conducting research. Teachers engage in scholarly research within their fields of expertise, contributing to the expansion of knowledge and the development of innovative ideas, theories, and methodologies. Postholm (2009) explores the distinction between developing teachers as researchers and merely as teachers in the context of research and development work.

Knowledge Creation: Teachers engage in scholarly research and experimentation, generating new insights, theories, and discoveries within their fields of expertise. Through teacher's research activities, they contribute to expanding the body of knowledge and advancing understanding in their respective disciplines. Tahir at al (2013) investigate the process of creating knowledge practices in schools, particularly focusing on teachers' involvement in knowledge creation.

Knowledge Impact: Fennema and Franke (1992) examine the impact of teachers' knowledge on educational outcomes and practices. Teachers disseminate their research findings through publications, presentations, and collaborations, thereby influencing the development of new scientific and technical articles. Additionally, they apply their expertise to address real-world challenges, contributing to innovations and advancements with tangible societal impact.

Knowledge Diffusion: Teachers play a vital role in disseminating knowledge and ideas to a broader audience through teaching, mentorship, and outreach activities. They share their expertise with students, colleagues, and the community, facilitating the spread of knowledge and fostering a culture of continuous learning and innovation. Wolf Jr and Fiorino (1972) and Collinson (2004) conduct a study on the diffusion and utilization of educational knowledge, investigating the dissemination and practical application of educational research findings.

The data collected from various sources and analyzed and interpreted in this section. The data are presented below in the forms of tables and graphs. Table 1 displays the scores secured by Uzbekistan on selected pillars for the years spanning

from 2020 to 2023, encapsulating a four-year period focusing on Uzbekistan. Scores are normalized values falling within the 0–100 range.

Table 1 - Scores for Selected Pillars in Uzbekistan: 2020 - 2023

Pillars	2020	2021	2022	2023
Education	49.70	57.30	57.40	46.40
Tertiary Education	30.90	32.00	33.90	27.40
Research & Development (R&D)	2.00	2.00	1.20	1.90
Knowledge Creation	7.30	10.60	9.10	12.40
Knowledge Impact	28.00	35.10	33.90	33.90
Knowledge Diffusion	7.10	8.00	10.70	11.60

Source: Global Innovation Index published by the World Intellectual Property Organization.

These scores provide an overview of Uzbekistan's performance across various pillars related to education, tertiary education, research and development (R&D), knowledge creation, knowledge impact, and knowledge diffusion throughout the specified four-year period. Knowledge Creation scores show a steady increase from 7.30 in 2020 to 12.40 in 2023, suggesting advancements in knowledge generation and innovation within the country. Both Knowledge Impact and Knowledge Diffusion scores experience fluctuations but maintain relative stability over the years, indicating consistent dissemination and application of knowledge within Uzbekistan.

Table 2 - Rank for Selected Pillars in Uzbekistan: 2020 - 2023

Pillars	2020	2021	2022	2023
Education	52	42	50	78
Tertiary Education	73	68	54	74
Research & Development (R&D)	94	95	93	92
Knowledge Creation	84	77	78	72
Knowledge Impact	49	42	42	44
Knowledge Diffusion	131	102	101	100

Source: Global Innovation Index published by the World Intellectual Property Organization.

Research & Development (R&D) ranks were improved slightly and indicate a strong emphasis on research and development activities within Uzbekistan. There is a slight increase in Knowledge Impact in 2023 compared to 2020, suggesting a

potential improvement in the dissemination and application of knowledge during this period. There is a notable increase in Knowledge Diffusion 2023 compared to 2020. The variability in rank suggests there is an improvement in knowledge dissemination and sharing practices within the country. Overall, the analysis highlights both strengths and areas for improvement in Uzbekistan's innovation ecosystem and knowledge economy across different variables over the four-year period.

Conclusion

The multifaceted role of teachers in education is emphasized, highlighting their crucial involvement in knowledge acquisition, research, and development activities. Furthermore, teachers play a pivotal role in knowledge creation, impact, and diffusion processes, underscoring their significance in driving innovation and advancing the field of education. Over the four-year period from 2020 to 2023, Uzbekistan has shown positive performance across various pillars of research and development, knowledge creation, knowledge impact, and knowledge diffusion. While there have been improvements in education and tertiary education. Addressing these challenges and building upon the strengths identified could further enhance Uzbekistan's innovation ecosystem and contribute to its long-term socio-economic development.

References:

1. Adoniou, M. (2013). Preparing teachers-The importance of connecting contexts in teacher education. *Australian Journal of Teacher Education (Online)*, *38*(8), 47-60.
2. Amin, J. N. (2016). Redefining the role of teachers in the digital era. *The International Journal of Indian Psychology*, *3*(3), 40-45.
3. Bate, A. F., Wachira, E. W., & Danka, S. (2023). The determinants of innovation performance: an income-based cross-country comparative analysis using the Global Innovation Index (GII). *Journal of Innovation and Entrepreneurship*, *12*(1), 20.
4. Collinson, V. (2004). Learning to share, sharing to learn: Fostering organizational learning through teachers' dissemination of knowledge. *Journal of Educational Administration*, *42*(3), 312-332.
5. Coutinho, E. M. O., & Au-Yong-Oliveira, M. (2024). Innovation's Performance: A Transnational Analysis Based on the Global Innovation Index. *Administrative Sciences*, *14*(2), 32.
6. Datnow, A. (2020). The role of teachers in educational reform: A 20-year perspective. *Journal of Educational Change*, *21*(3), 431-441.
7. Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (Eds.). (2020). *Global innovation index 2020*. Johnson Cornell University.
8. Dutta, S., Lanvin, B., León, L. R., & Wunsch-Vincent, S. (Eds.). (2021). *Global innovation index 2021: tracking innovation through the covid-19 crisis*. WIPO.

9. Dutta, S., Lanvin, B., Rivera León, L., & Wunsch-Vincent, S. (Eds.). (2023). *Global Innovation Index 2023: Innovation in the face of uncertainty*. WIPO.
10. Dutta, S., Lanvin, B., Wunsch-Vincent, S., & León, L. R. (Eds.). (2022). *Global Innovation Index 2022:: What is the Future of Innovation-driven Growth?* (Vol. 2000). WIPO.
11. Farrell, J., & Oliveira, J. (1993). Teachers in developing countries. *Washington, DC, EDI/World Bank*.
12. Fennema, E., & Franke, M. L. (1992). Teachers' knowledge and its impact. *Handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics*, *326*, 147-164.
13. Huarng, K. H., & Yu, T. H. K. (2022). Analysis of Global Innovation Index by structural qualitative association. *Technological Forecasting and Social Change*, *182*, 121850.
14. Johnson, D. (2017). The Role of Teachers in Motivating Students to Learn. *BU Journal of Graduate studies in education*, *9*(1), 46-49.
15. Leu, E. (2005). The Role of Teachers, Schools, and Communities in Quality Education: A Review of the Literature. *Academy for Educational Development*.
16. Postholm, M. B. (2009). Research and development work: developing teachers as researchers or just teachers?. *Educational Action Research*, *17*(4), 551-565.
17. Tahir, L. M., Ozay, M., Sumintono, B., & Matzain, I. (2013). Creating knowledge practices in school: Exploring teachers knowledge creation. *International Journal of Humanities and Social Science*, *3*(1), 147-154.
18. Wolf Jr, W. C., & Fiorino, A. J. (1972). A Study of Educational Knowledge Diffusion and Utilization.
19. Zapke, N., Leach, L., & Butler, P. (2009). The role of teacher-student interactions in tertiary student engagement. *New Zealand Journal of Educational Studies*, *44*(1), 69-82.