


Ecological Analysis of the Impact of Youth Development on the Development of Science, Technology and Innovation

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Article Info

Article type:

Original Research

How to cite this article:

Entezari, Y. (2025). Ecological Analysis of the Impact of Youth Development on the Development of Science, Technology and Innovation. *Quarterly Journal of Research and Planning in Higher Education*, 31(4), 1-21.



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ABSTRACT

The aim of this paper is to theoretically and empirically analyze the impact of youth development on the development of science, technology, and innovation processes. For this purpose, the conceptual framework of "human development ecology" and the "human development ecosystem" approach have been used. Within this framework, three main hypotheses have been proposed and tested using global secondary data and structural equation modeling techniques. The results of the tests show that the youth development construct, which consists of six indicators, contributes to the development of knowledge-based economy by contributing to knowledge absorption, knowledge creation, knowledge diffusion and knowledge impact in the economy. These findings indicate that the human development ecosystem is a self-generating system. That is, it continuously creates components and processes that lead to the growth of the ecosystem itself and higher human development. This feature is mainly due to the investment of families and the government in the human development of youth (as the center of human development). Because investment in youth development, in addition to accumulating human capital in the youth, which improves the level of human development of youth, also leads to knowledge-based development in the future due to knowledge-based employment and the use of advanced human capital in science, technology and innovation processes (as another part of the human development ecosystem). The development of knowledge and innovation leads to a multifaceted increase in economic growth, an increase in the country's per capita income, and an improvement in the welfare and standard of living of the people, which indicate a higher level of human development. Based on these results, five policy solutions have been proposed to the government.

Keywords: Human development, youth development, human development ecosystem, knowledge-based development, science, technology and innovation development.

Introduction

In the global knowledge economy, countries pursue two main goals: "enhancing economic competitiveness in the global arena" and "human development in the national arena." Achieving both goals require the development of science, technology, and innovation processes, which are collectively called knowledge-based development. How to develop these knowledge-based processes is the most important problem for economies in the present era. To solve this problem, two scientific theories and two policy approaches have been formed. The first theory is the theory of "endogenous growth," which emphasizes the approach of human capital accumulation; in contrast, there is the theory of "ecology of human development," which emphasizes the diversity of ecological factors and the interactions of human development ecosystems and knowledge-based ecosystems. Given the shortcomings of the first theory and approach in explaining human development and youth development, this article attempts to analyze the impact of youth development on the development of science, technology, and innovation processes within the framework of the second theory and approach.

Conceptual Framework and Hypotheses

Youth development is the focal stage of human development. Therefore, we used the conceptual framework of human development to derive a model for analyzing the impact of youth development on the development of science, technology, and innovation. Considering the fundamental forces of human development at the micro level, the determinants of human development at the macro level can be divided into three groups: biological, psychological, and ecological; biological and psychological determinants indicate the quality of life. However, ecological determinants indicate the well-being of life. In its recent "Human Development Index" reports, the United Nations Development Program (UNDP, 2024) has divided the determinants of human development into three groups: "long and healthy life", "knowledge," and "decent standard of living". Long and healthy life is a biological determinant, knowledge is a psychological determinant, and standard of living is an ecological determinant. Knowledge and long and healthy life have two functions together. They indicate both the quality of life of individuals and the human capital of individuals. If we consider them as human capital, they become the determinants of the standard of living. Therefore, we refer to them as determinants of the quality of life of individuals.

However, two key determinants have been neglected in the human development index; one of them is the quality of the biome and the other is the biome capital. As mentioned, the quality of life refers to environmental and social factors that affect the quality of life of individuals; but are not under their control. Such as freedom, democracy, justice, equality of opportunity, environmental pollution, war and insecurity, etc. In contrast, biome capital refers to all biome capabilities such as the existence of sufficient and equal opportunities for employment, the existence of a job appropriate to the field of study, appropriate activity with the level and field of study, and high wages in the economy, which are considered to be among the most important biome capabilities for earning income. In addition, the existence of a culture of competition and meritocracy in society are also among the biome capabilities that can affect family income.

Ecological theoretical analyses show that on the one hand, human development in general and youth development in particular are influenced by the development of science, technology and innovation; on the other hand, human development in general and youth development in particular affect the development of science, technology and innovation. Most importantly, both of them are influenced by the quality of the biome and the capital of the biome. In fact, the extent to which they influence each other depends on the quality and capital of the biome. The higher the quality and capital of the biome, the better their influence on each other.

In view of the above discussion, here we test three hypotheses:

Hypothesis 1: The production of new scientific knowledge is a function of the human development of youth.

Hypothesis 2: The production of new technology is a function of the human development of youth.

Hypothesis 3: New innovation is a function of the human development of youth.

Methodology

The present study was conducted with a descriptive approach and documentary method using secondary quantitative data. The dependent and independent variables of the study are latent variables (constructs) that are measured using several explicit variables. Data related to the six explicit variables of "youth development" were extracted from the 2023 survey, "Youth Development Index"; data related to the development of science, technology and innovation were also extracted from the 2023 report "Global Innovation Index". The unit of observation is the country and the number of observations of 140 countries has information at the global level. Data related to the explicit variables of youth development are standardized between 0 and 1. However, data related to the variables of science, technology and innovation are standardized between 0 and 100.

Considering the theoretical foundations, conceptual framework developed in the theoretical foundations section, general model, nature of research variables, and data structure, structural equation modeling (SEM) method was used to estimate the model, analyze the findings, and test the hypotheses.

Findings

Based on the conceptual framework presented in the theoretical foundations section and the hypotheses proposed therein, in this section, the impact of youth development on the development of science, technology, and innovation has been empirically analyzed and the hypotheses tested. The research findings can be summarized in four points:

1- Youth development as a whole contributes to knowledge-based development by helping to create knowledge, disseminate knowledge, and influence knowledge in the economy. However, not all of its components affect the components of knowledge-based development equally.

2- The variable of youth human capital has a positive and significant effect on the variables of science, technology, and innovation; this means that "countries that have healthier and more educated youth are also more developed in terms of science, technology, and innovation." Hence, it can be concluded that youth human capital has a positive effect on the development of science, technology, and innovation; this finding is in accordance with the endogenous growth theory, which emphasizes that human capital is the main factor in the development of science, technology, and innovation.

3- Youth biome capital (the existence of opportunities for education, employment, entrepreneurship, and interaction with society) does not have a linear and direct impact on the development of science, technology, and innovation; rather, it contributes to the development of science, technology, and innovation by helping to develop the human capital of youth.

4- The quality of the youth biome (such as justice, equal opportunities, freedom, welfare, and security) does not have a linear and direct impact on the development of science, technology, and innovation; rather, it contributes to the development of science, technology, and innovation by helping to develop the human capital of youth and motivating work and activity.

Conclusion

From the above findings, it can be concluded that the human development ecosystem is a self-generating system. That is, it continuously creates components and processes that lead to the growth of the ecosystem itself and higher human development. This feature is mainly due to the investment of families and the government in the human development of youth (as the focus of human development). Because investment in youth development, in addition to the accumulation of human capital in the youth, which leads to the improvement of the level of human development of youth, causes knowledge-based development in the future due to knowledge-based employment and the use of advanced human capital in science, technology and innovation processes (as another part of the human development ecosystem). The development of knowledge and innovation leads to a multifaceted increase in economic growth, an increase in the country's per capita income, and an improvement in the welfare and standard of living of people, which indicate a higher level of human development.

Suggestions for Iranian Policymakers

Given that Iran's economy does not have a worthy place in global competitiveness, human development ranking, and youth development ranking, and given the above result, it is suggested to Iranian policymakers; in addition to the youth of the population, they should focus on youth development and pursue the following measures:

1. In 1402, about 35% of young people did not use their youth power for their development. That is, they were neither employed; nor were they studying, nor were they training. This is while this indicator is about 3% in developed countries. Youth development in Iran requires reducing this figure to below 5%. This can be one of the important youth development goals for the Iranian government.

2. Youth development requires quality learning and education at the ages of 5 to 14 and 15 to 24. This is while a significant part of the Iranian population at these ages does not have access to quality learning and education. Therefore, providing everyone with access to quality learning and education for young people in the aforementioned ages can be the government's second program for youth development.

3. Youth development requires youth to have access to quality health, medical, nutritional, sports, and wellness services in the ages of 5 to 14 and 15 to 24. A significant portion of Iran's population in these ages does not have access to these services. Therefore, providing everyone with access to the aforementioned services for young people in the aforementioned ages can be the government's third program for youth development.

4. Youth development requires their access to biome capital (such as employment opportunities, entrepreneurship, information technology, political and civic participation opportunities) in the ages of 19 to 24. A significant portion of Iran's population in these ages does not have access to employment, entrepreneurship, and skills training opportunities, etc. Therefore, providing youth with access to biome capital in the aforementioned ages can be the government's fourth program for youth development.

5. Youth development requires improving the quality of the youth biome. A desirable biome for youth is one in which 1- complete psychological, physical, and financial peace and security are established; 2- sufficient opportunities and incentives for political and civic participation exist; 3- opportunities for youth growth and excellence are provided equally and equally for all (regardless of belief, ethnicity, tribe, and religion). Currently, this biome is not provided for Iranian youth. Therefore, providing a desirable biome at the aforementioned ages can be the government's fifth program for youth development.

References

- Barro, R., & Lee, J. W. (2013). A New Dataset of Educational Attainment in the World, 1950-2010. *Journal of Development Economics*, 104, 184-198. <https://doi.org/10.1016/j.jdeveco.2012.10.001>
- Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. National Bureau of Economic Research, New York. <https://www.nber.org/system/files/chapters/c3730/c3730.pdf>
- Bessen, J. (2015). *Learning by Doing: The Real Connection between Innovation, Wages, and Wealth*. Kindle eBook. [https://books.google.com/books?hl=en&lr=&id=rPLOBwAAQBAJ&oi=fnd&pg=PP1&dq=Bessen,+J.+\(2015\).+Learning+by+Doing:+The+Real+Connection+between+Innovation,+Wages,+and+Wealth,+Kindle+eBook.+%09&ots=C6RhT7GxH4&sig=GhiaYFga_6C G2LHIV4q-HivX7T4](https://books.google.com/books?hl=en&lr=&id=rPLOBwAAQBAJ&oi=fnd&pg=PP1&dq=Bessen,+J.+(2015).+Learning+by+Doing:+The+Real+Connection+between+Innovation,+Wages,+and+Wealth,+Kindle+eBook.+%09&ots=C6RhT7GxH4&sig=GhiaYFga_6C G2LHIV4q-HivX7T4)
- Boni, A., & Walker, M. (2013). *Human development and capabilities. Reimagining the University of the Twenty-First century*. Routledge, London and New York. <https://doi.org/10.4324/9780203075081>
- Bronfenbrenner, U. (1979). *The Ecology of Human Development: Experiments by Nature and Design*. Harvard University Press. [https://books.google.com/books?hl=en&lr=&id=OCmbzWka6xUC&oi=fnd&pg=PA3&dq=Bronfenbrenner,+U.+\(1979\).+The+Ecology+of+Human+Development:+Experiments+by+Nature+and+Design,+Harvard+University+Press.+%09&ots=yAP_N1VVRje&sig=wz SSUjTPitzhFCDUz6oS_JhIME0](https://books.google.com/books?hl=en&lr=&id=OCmbzWka6xUC&oi=fnd&pg=PA3&dq=Bronfenbrenner,+U.+(1979).+The+Ecology+of+Human+Development:+Experiments+by+Nature+and+Design,+Harvard+University+Press.+%09&ots=yAP_N1VVRje&sig=wz SSUjTPitzhFCDUz6oS_JhIME0)
- Bronfenbrenner, U. (2005). *Making Human Beings Human: Bioecological Perspectives on Human Development*. Sage, Thousand Oaks, CA. [https://books.google.com/books?hl=en&lr=&id=fJS-Bie75ikC&oi=fnd&pg=PR9&dq=Bronfenbrenner,+U.+\(2005\).+Making+Human+Beings+Human:+Bioecological+Perspectives+on+Human+Development,+Sage,+Thousand+Oaks,+CA.+%09&ots=QzKyN7NSs&sig=TfHvnUT1pmsc5SvqKALonQtIzj8](https://books.google.com/books?hl=en&lr=&id=fJS-Bie75ikC&oi=fnd&pg=PR9&dq=Bronfenbrenner,+U.+(2005).+Making+Human+Beings+Human:+Bioecological+Perspectives+on+Human+Development,+Sage,+Thousand+Oaks,+CA.+%09&ots=QzKyN7NSs&sig=TfHvnUT1pmsc5SvqKALonQtIzj8)
- Bronfenbrenner, U., Morris, P. A., Lerner, R. M., & Damon, W. (2006). The Bioecological Model of Human Development. In *Handbook of Child Psychology: Theoretical Models of Human Development* (pp. 793-828). John Wiley & Sons Inc. <https://doi.org/10.1002/9780470147658.chpsy0114>
- Cohen, D., & Soto, M. (2007). Growth and human capital: Good data, good results. *Journal of Economic Growth*, 12, 51-76. <https://doi.org/10.1007/s10887-007-9011-5>
- Crawford, M. (2020). *J Pub Health Issue Pract.* 4(2), 170. <https://doi.org/10.33790/jphip1100170>
- Darling, N. (2007). Ecological Systems Theory: The Person in the Center of the Circles. *Research in Human Development*, 4(3-4), 203-217. <https://doi.org/10.1080/15427600701663023>
- Delgado, M. (2002). *New frontiers for youth development in the twenty-first century*. Columbia University Press. <https://cup.columbia.edu/book/new-frontiers-for-youth-development-in-the-twenty-first-century/9780231504638/>
- Haq, K., & Kirdar, Ü. (1987). *Human development, adjustment and growth*. North South Roundtable, Islamabad. <https://nsrt.lums.edu.pk/sites/all/themes/nsrt/books/Human.pdf>
- Haq, K., & Kirdar, Ü. (1988). *Managing human development*. North South Roundtable, Islamabad. <https://nsrt.lums.edu.pk/sites/all/themes/nsrt/books/Managing.pdf>

- Haq, K., & Kirdar, Ü. (1989). *Development for people: Goals and strategies for the year 2000*. North South Roundtable, Islamabad. <https://wfp.tind.io/record/594?ln=en>
- Kail, R. V., & Cavanaugh, J. C. (2019). *Human Development: A Life-Span View*. Cengage Learning, Inc. <https://www.cengage.com/c/human-development-a-life-span-view-9e-kail-cavanaugh/9780357657959/>
- Kampelmann, S., Rycx, F., Saks, Y., & Tojerow, I. (2018). Does education raise productivity and wages equally? The moderating role of age and gender. *IZA Journal of Labor Economics*, 7, 1. <https://doi.org/10.1186/s40172-017-0061-4>
- Lerner, R. M. (2018). *Concepts and Theories of Human Development*. Routledge. <https://doi.org/10.4324/9780203581629>
- Lucas, R. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22(1), 3-42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Luhmann, N. (2012). *Theory of Society, Volume 1 Trans.* - Barrett, R. Stanford University Press. [https://books.google.com/books?hl=en&lr=&id=xt_LPvc7fX8C&oi=fnd&pg=PR9&dq=Luhmann,+N.+\(2012\).+Theory+of+Society,+Volume+1+Trans.+Barrett,+R.,+Stanford+University+Press.+%09&ots=Brv-LTu1ls&sig=MQ0DQPImxgN_NGhVvDwqwENRxEQ](https://books.google.com/books?hl=en&lr=&id=xt_LPvc7fX8C&oi=fnd&pg=PR9&dq=Luhmann,+N.+(2012).+Theory+of+Society,+Volume+1+Trans.+Barrett,+R.,+Stanford+University+Press.+%09&ots=Brv-LTu1ls&sig=MQ0DQPImxgN_NGhVvDwqwENRxEQ)
- Marten, G. G. (2001). *Human Ecology: Basic Concepts for Sustainable Development*. Earthscan Publications Ltd. <https://www.taylorfrancis.com/books/mono/10.4324/9781849776028/human-ecology-gerald-marten>
- Mingers, J. (1995). *Self-Producing Systems: Implications and Applications of Autopoiesis*. Springer Science & Business Media. <https://doi.org/10.5962/bhl.title.111972>
- Psacharopoulos, G., & Patrinos, H. A. (2008). Education and Human Capital. In *International Handbook of Development Economics* (Vol. 1 & 2, pp. 33). Edward Elgar Publishing. <https://doi.org/10.4337/9781848442818.00033>
- Romer, P. M. (1990). Endogenous Technological Change. *The Journal of Political Economy*, 98(5), S71-S102. <https://doi.org/10.1086/261725>
- Romer, P. M. (1994). The Origins of Endogenous Growth. *The Journal of Economic Perspectives*, 8(1), 3-22. <https://doi.org/10.1257/jep.8.1.3>
- Schultz, T. W. (1960). Capital formation by education. *Journal of Political Economy*, 68, 571-583. <https://doi.org/10.1086/258393>
- Sen, A. K. (1989). Development as capabilities expansion. *Journal of Development Planning*, 19, 41-58. https://doi.org/10.1007/978-1-349-21136-4_3
- Sen, A. K., & Emmerij, L. (1997). Development thinking at the beginning of the XXI century. In *Economic and Social Development into the XXI Century* (pp. 531-551). Inter-American Development Bank, Washington, DC. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1126934
- Tomer, J. F. (2016). *Integrating Human Capital with Human Development: The Path to a More Productive and Humane Economy*. Palgrave Macmillan. <https://doi.org/10.1057/9781137456748>
- Wilson, E. O. (1999). *Consilience: The Unity of Knowledge*. Vintage. <https://scispace.com/pdf/the-unity-of-knowledge-3mahk5c19i.pdf>