



## The role of science and technology in human development

**Timur Shamshetov**

Master's degree student Karakalpak state university  
named after Berdakh, The department of national  
idea, basics of spirituality and law

**Abstract:** This article discusses the importance of science and technology in human development and the role of knowledge in people's lives. The advancement of science and its connection for humanity is essential.

**Key words:** science, technology, humankind, human development.

Every epoch brings new challenges for people who are trying to solve them by their will, commitment and innovation. Inevitably and expectedly, our eyes are turned to scientists and researchers, innovative people of different professions, who are taking small and large steps toward the same goal and giving hope that a solution will be found.

The theoretical debate over the nature of development is broad, and contains many strands which address different purposes and concepts.[1] In contrast to the study of economic development, which is focused on the dynamics of economic activity, the study of human development has a broader focus on the question of human well-being. This scope approximately aligns with the United Nations Sustainable Development Goals, and their aim of increasing prosperity and harmony in a sustainable world.

A suitable starting point for conceptualising human development is the consensus emerging from the 'intellectual coup' initiated by Sen [2], which re-framed the notion of



human development as a question of access and capabilities, rather than economic resources. Sen[16] thus placed people at the centre of the development discourse. This conception of human development focuses on the cultivation of agency and capability, access to opportunity, and the freedom to work towards self-realisation in accordance with one's own beliefs and values. Development thus requires increasing levels of freedom, whether negative freedoms (freedoms from hunger, disease, poverty) or positive freedoms (freedom of self-expression, freedom of self-realisation). Sen[3] argues that freedom and capability are inextricably linked: freedom without the capability of its own realisation cannot contribute towards development. For example, famines may occur, not from lack of food, but because of a lack of resources to buy food. The freedom to achieve food security is meaningless without the capability to achieve it in practice. Sen's focus on capabilities and the development of human agency suggests that human development as an outcome of science and technology interventions should ideally be achieved through processes that include capability-building, social engagement and public participation.

For Castells, human development, also conceived as the freedom to exercise human capabilities, is tied to the production of resources and modes of social organisation that are increasingly dominated by technological drivers.[4] [5] Castells conceives of these broad socio-economic dynamics as a shift into the global information age'. This age is defined as 'a historical period characterised by the technological revolution in information and communication, the rise of networking forms of social organisation, and the global interdependence of economies and societies.[6] Castells views the organisation of infrastructures and activities for the creation, processing and transmission of information to be the main driver of wealth creation, a process termed 'informational development'.[7] [8] The notion of informational development suggests that assessments of the relation between science, technology and human development include a focus on access to the Internet, to information and communication technology (ICT) more broadly, and to opportunities for technological upgrading, and their impacts on human development.



Castells' conception of the relationship between science and technology on the one hand, and human development on the other, is aligned with an innovation systems theory of wealth generation, in which value is created by 'transforming information into knowledge, and then applying knowledge to all the tasks to be executed on the basis of the technological and human capability embedded in the system[9]. Innovation is commonly defined as the development of new products, processes or organisational structures. [10] Some strands of the innovation literature consider technology diffusion into households and the informal sector.[11] Innovation has a broad scope: a new product or process can be entirely novel, 'new to the world', or it can be 'new to the country', 'new to the sector', or 'new to the firm, [12] [13] [14] [15] The most common scale of analysis is at the national level, hence the term 'national systems of innovation' (NSI), defined as 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies. The NSI approach [9] [10] remains widely used in the innovation studies literature, and has become the standard theoretical framework for guiding national and international science and technology policy[11] [12]

Skills are fundamental enablers of innovation activity.[13] Without the requisite skills, new basic science cannot be performed, and new technologies cannot be developed, adapted or disseminated. The innovation studies literature suggests a strong causal interaction between the supply of higher levels of education, training and skills and increased demand for and supply of technical and organisational innovation. [14] [15] Innovation and skills development are thus intertwined in an unfolding process that has been described as 'co-evolution [16] [17] Co-evolution mechanisms include firm-level learning, technology and skills transfers through multinational corporations, local spillovers from innovation activities within firms, firm- level responses to the availability of local skills in terms of innovation activity, and university-firm interactions.[18] [19]

Innovation systems analysis is largely concerned with understanding informational development as an input towards human development, rather than about human



development per se. However, some strands of research within the discipline take the assessment of this relationship a step further. In his analysis of the linkages between technological development and human development, Castells observed that despite the advancement of technologies, in particular ICTs, the majority of the global population remain in economically fragile and technologically excluded positions. [20] This concern also drove increased interest in innovation in inclusive development. This intersection between innovation systems analysis and development studies raises questions about the manner in which big science projects have, or have not, been inclusive and helped to drive social development. Key areas of investigation are the inclusiveness of the innovation process, the nature of participation among marginalised communities, and innovation in low-income and informal settings.

### References:

1. Pieterse JN. Development theory. London: Sage; 2009. <http://dx.doi.org/10.4135/9781446279083>
2. Sen AK. Equality of what? In: McMurrin S, editor. Tanner lectures on human values. Cambridge: Cambridge University Press; 1995. p. 197–220. <https://doi.org/10.1093/0198289286.003.0002>
3. Sen AK. Development as capability expansion. In: DeFilippis J, Saeger S, editors. The community development reader. 2nd ed. New York: Routledge; 2012. p. 319–327. [https://doi.org/10.1007/978-1-349-21136-4\\_3](https://doi.org/10.1007/978-1-349-21136-4_3)
4. Pieterse JN. Development theory. London: Sage; 2009. <http://dx.doi.org/10.4135/9781446279083>
5. Sen AK. Equality of what? In: McMurrin S, editor. Tanner lectures on human values. Cambridge: Cambridge University Press; 1995. p. 197–220. <https://doi.org/10.1093/0198289286.003.0002>



6. Sen AK. Development as capability expansion. In: DeFilippis J, Saeger S, editors. The community development reader. 2nd ed. New York: Routledge; 2012. p. 319–327. [https://doi.org/10.1007/978-1-349-21136-4\\_3](https://doi.org/10.1007/978-1-349-21136-4_3)
7. Castells M. Materials for an exploratory theory of the network society. Br J Sociol. 2000;51(1):5–24. <https://doi.org/10.1080/000713100358408>
8. Castells M, Himanen P. The information society and the welfare state: The Finnish model. Oxford: Oxford University Press; 2002.
9. Castells MH. Reconceptualizing development in the Global Information Age: Oxford: Oxford University Press; 2014.
10. Martin BR. The evolution of science policy and innovation studies. Res Policy. 2012;41(7):1219–1239. <https://doi.org/10.1016/j.respol.2012.03.012>
11. Freeman C. The ‘National System of Innovation’ in historical perspective. Cambridge J Econ. 1995;19(1):5–24.
12. Nelson R, Winter S. An evolutionary theory of economic change. Cambridge, MA: Belknap Press; 1982.
13. Mowery D, Rosenberg N. Technology and the pursuit of economic growth. Cambridge: Cambridge University Press; 1991.
14. Lundvall BÅ. National systems of innovation: Towards a theory of innovation and interactive learning. London: Pinter; 1992.
15. Nelson RR, editor. National innovation systems: A comparative analysis. Oxford: Oxford University Press; 1993.
16. Lundvall BÅ. Innovation system research and policy. Where it came from and where it might go. Paper presented at: InCAS Seminar; 2007 December 04; Oslo, Norway.
17. Fagerberg J, Verspagen B. Innovation studies – The emerging structure of a new scientific field. Res Policy. 2009; 38 (2):218–233. <https://doi.org/10.1016/j.respol.2008.12.006>



18. Toner P. Workforce skills and innovation: An overview of major themes in the literature. OECD Education Working Papers. 2011; (55):0\_1.
19. Cohen WM, Levinthal DA. Absorptive capacity: A new perspective on learning and innovation. *Adm Sci Q.* 1990;35(1)128–152. <https://doi.org/10.2307/239355331>. Lewin AY, Couto V. Next generation offshoring: The globalization of innovation: 2006 survey report. Durham, NC: Centers for International Business Education and Research (CIBER), Duke University; 2007.
20. Losby B. Knowledge, institutions and evolution in economics. London: Routledge; 2000.