Published by the decision of the Scientific Council
of Khachatur Abovian
Armenian State Pedagogical University

Department of Philosophy and Logic
named after Academician Georg Brutian

W I S D O M

Special Issue 1(2), 2022
PHILOSOPHICAL ISSUES OF ECONOMICS

Clarivate Analytics

WISDOM is covered in Clarivate Analytics' Emerging Sources Citation Index service

YEREVAN – 2022

DOI: 10.24234/wisdom.v2i1.791
Atom MARGARYAN,
Andranik MARGARYAN

CONVERGENT TECHNOLOGIES IN THE SYSTEM OF MODERNISATION OF ECONOMY: CONCEPTUAL-METHODOLOGICAL COMPARISONS

Abstract

The article discusses methodological issues related to the appearance and use of convergent technologies that determine the modernisation of the economy. The problems were examined from the point of view of conceptual approaches to the main economic paradigms. The hypothesis has been nominated, according to which convergent technologies form economics, business behaviour, management, production and consumer culture models and agendas. The article was based on the provision under which convergent technologies deepen and strengthen the leading positions of developed countries and major transnational companies through the formation and networking mechanisms of added value chains.

Keywords: convergent technologies, modernization, technological gap, innovative rent, value chain, inclusive growth, political rent.

Introduction

In recent decades, in the context of both national and global developments, the intensity of the impact of modern technology has reached unprecedented proportions. The technologies of the latest paradigm literally determine the main directions of the organisation of public life and the transformation of civilisation. Under their influence, radical changes are taking place in the fields of social thinking, behavioural patterns, political, economic, social and cultural. From this point of view, the main paradigms that determine the trends of global developments in the last 2 - 3 decades are mainly related to modern solutions in the field of information technology, biological technologies, in-depth development of nanotechnologies and programs for their mass application.

Among other areas, modern developments in the latest technologies have a decisive influence on the philosophical and methodological perceptions of economic thought and the behaviour of economic systems. Especially after the global financial and economic crisis of 2008-2009, it became clear that the system of positive concepts characterising the behaviour of economic systems, which is used to describe the mainstream theories and models, in the new conditions is not able to adequately reflect and describe their processes and offer solutions (Cameron & Siegmann, 2012).

Analysis of Literature and Theoretical Sources

From the 1990s onwards, theorists began to attribute the basis of the globally observed civilisational transition to the current-situational and long-term-strategic influences of a bunch of interconnected and fusion technologies of the latest technological cluster. As early as the 21st century, American theorists Mikhail Roco and William Bainbridge incorporated Nano-, Bio-, Info-Cogno technologies into this technological bundle- legal, moral, and social aspects of their development, as well as their long-term revolution-

ary effects, can have a profound effect on the progress of all human civilisation. According to M. Roco and U. Bainbridge (2002), "*with proper attention to ethical issues and societal needs, converging technologies could greatly improve human abilities, societal outcomes, the nation's productivity, and the quality of life. This is a broad, crosscutting, emerging and timely opportunity of interest to individuals, society and humanity in the long term*" (pp. 9-10). Thus, the creation and widespread dissemination of essential modern technologies can radically increase human society's intellectual and productive capacity, making it possible to dramatically increase labour productivity, based on it, the standard of living in society, and the quality of life.

In general, since the 1990s, when the world's leading economies faced the most serious challenges of the transition to basic technology, many theorists-researchers began to consider new opportunities for economic development and modernisation in the context of developing alternative concepts. Under these conditions, the traditional (mainstream) conceptual paradigms undergo significant revisions and changes. If the dominant directions of economic thought and methodology of the 20th century were related to the continuous debate and succession of theoretical directions of the Nordic (liberal or neo-liberal economic system) and Keynesian (centrally regulated economic system) paradigms, then, since the 1990s, there has been a shift in the dominance of the theoretical questions of the fundamental-qualitative shift of the institutional-evolutionary economic paradigms. Furthermore, this is connected with the growing process of reinterpreting and involving the crucial role of technologies and institutions in the issues of economic development.

The above is noted by one of the modern theorists of the evolutionary economic paradigm, Richard Nelson, who considers the decisive role of innovation in the development of capitalism over the last century and states that changes based on innovation are the principal capital of modern capital. He notes that "*change, largely driven by innovation, is a central characteristic of modern capitalist economies*" (Nelson et al., 2018, p. 3).

It should be noted that the views on the decisive role of technology, economic development and the interrelationships of institutions in the dynamic progress of the economy and society are not new. They are still the work of one of the founders of institutionalism, Thorstein Veblen, and have received a more complete and comprehensive justification in the works of Joseph Schumpeter. In particular, Weblen's works clearly define the components of business and industry, the relationship between which is determined by institutional factors. According to Veblen (1923), "*the technological system is an organisation of intelligence, a structure of intangibles and imponderables, like habits of thought. It resides in the habits of thoughts of the community. It comes to a head in the habits of thought of the technicians*" (p. 280). For his part, Josef Schumpeter bases economic development on the concept of "*creative destruction*" of the economic structure based on innovation, according to which the "*dynamic entrepreneur*" makes progressive changes by creating a new combination (innovation) and launching it on the market. Schumpeter writes about this in one of his works: "*The function of entrepreneurs is to reform or revolutionise the pattern of production by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way, by opening up a new source of supply of materials or a new outlet for products, by reorganising an industry and so on*" (Shumpeter, 2003, p. 132). Schumpeter (1939) as "*new Combination*" means new products, new technologies, new production methods, new processes, etc. (p. 104).

It should be noted that the most systematic research on technological changes and innovations dates back to the 1960s. The central part of the studies of that period was carried out by A. Rogers, A. Mansfield, R. Nelson, S. Winter, and A. Rosenberg (Freeman, 1990, pp. 15-16). The the-

ory of "*technological gap*", in particular, according to J. Fagerberg, presupposes the imitation-assimilation of technological achievements by a technologically underdeveloped country – "*imitator*", by "*developed generators*" by developed countries. Therefore, the success of this process depends on the ability to maximise the limited resources and use them effectively in innovative projects (Fagerberg, 1987, pp. 87-89).

Douglas North, one of the later researchers in the field Nobel Prize winner in private economics, believes that the primary source of economic development and growth is not technology but institutional change. He notes: "*A major failing of the literature of both economic history and economic development is that the emphasis is upon technology as the impetus for economic development and hence we have endless studies of technological failure or stagnation. In fact, the key to growth is the institutional/organisational structure and its effect upon incentives, not only the incentives to invent and innovate, important as they are, but the incentive to organise the production process more efficiently, to reduce transaction costs in factor and product markets, to organise a judicial system to enforce contracts, to create a policy that will specify and enforce property rights, and most important of all to maintain those incentives*" (North, 1993, p. 8).

Note that the most prevalent trends in research on profound technological change over the past three decades are related to large-scale economic and social impact assessments of the convergence of technologies. According to M. Roco & W. Bainbridge (2013), the effects of convergent technologies are presented in five main directions:

1. The interdependence of all components of nature and society,
2. Analysis of solutions for research, development and applications based on the dynamic system-logical deduction,
3. Improvement Creativity and innovation through evolutionary convergence processes that combine existing principles and diver gence that generate new ones,
4. the utility between domain languages of a higher level ingenerate new solutions and support for the transfer of new knowledge and
5. the value of an inspired by vision is that the basic Studies are embodied in grandiose problems (Roco & Bainbridge, 2013, p. 2).

Some theorists tend to evaluate the components of the latest cluster of convergent technologies as modern manifestations of general-purpose technologies (GPTs), considering the potential for their application in almost all fields. The existing discourse in the economic literature on technologies of general significance, at least, has elements of a certain consensus. In particular, R. G. Lipsey, K. I. Carlaw and T. B. Clifford (2006) singled out 24 technologies of general significance, for which they set four main criteria:

- initially has much scope for improvement but comes to be widely used across the economy,
- has many different uses,
- creates many spillover effects (pp. 131-218).

The quartet of convergent technologies (nano, bio, and info-cognitive technologies), according to the methodology developed by Lipsey, Carlaw and Clifford (2006), completely fit into the logic of these criteria. In this sense, we can say that convergent technologies are a modernising project developing on a global scale, which can create a new paradigm of development. Irina Politkovskaya, Daniel Khvichiya and Larisa Artamonova (2021) technological convergences are defined as the process of transformation of the structure of the economy, which began with the combination of the development of economic relations in the reproductive system and the merging of technologies. They emphasise. "*This process must radically change the scale of resource consumption; the structure, the production of closed-loop production to the place of the dominant industry; separate the growth of human well-being from the expansion of the natural resources used*" (Politkovskaya, Khvichiya, & Artamonova, 2021, p. 2).

Several economists, notably Natalia Ezdina and Elena Dotsenko (2021), highlight the benefits of convergent technologies while noting that they pose apparent risks and challenges. They write: "*The digital mode of operation of most enterprises will inevitably reduce routine work or a complete replacement with high-tech equipment. As a result, the incomes of low-skilled workers and living standards may decrease, while those with highly qualified staff will have a significant competitive advantage by increasing the share of automated production processes*" (Ezdina & Dotsenko, 2021, p. 5).

Comparing the different views on convergent technologies in the economic literature, it can be concluded that there are no clear perceptions and assessments of the prospects for their impact. One thing is clear: Convergent technologies have radical and ground-breaking effects on all public and economic life areas, opening up new opportunities for modernisation and quality of life. At the same time, these impacts involve significant uncertainties, serious risks, and challenges.

Main Discussion and Analysis

It can be expected that the development and penetration of convergent technologies in various spheres of economic and public life will ensure the progress of civilisation if combined with globally balanced legal, political, conventional and humanitarian solutions. The development or borrowing of convergent technologies at the level of national economies, if properly institutionalised, in turn, can help to address the increasingly acute problems of both sustainable development and quality of life. From this point of view, many researchers consider the development and spread of convergent technologies as a dominant factor in the modernisation of economies and the inclusion of economic growth. Convergent technologies, combined with nanotechnology, robotics and artificial intelligence solutions, state-of-the-art biological and genetic engineering, and new generations of digital devices and state-of-the-art equipment, can actually build new quality productivity that can be salty. Environmental and security issues of overcoming and increasing the living standards of socially vulnerable groups.

It can be stated that one of the main or dominant technological factors in the development and modernisation of the global economy for at least the last 60 years is the mass production and distribution of products based on computer technology, microelectronics and digital solutions in all spheres of economy, public life, government and security. Moreover, the rapid development of military technology after the Second World War can be said to have become a powerful driving force in the fields of science, research and innovation, and for a significant part of the country, it has also been a significant driver of demand for the military sector.

Vernon Ruttan emphasises that war and the production of means of war have become serious factors of economic growth for many countries. This is especially true in the United States, where research and development related to the technologies of the most common technologies in the economy, such as aircraft, nuclear power, computers, semiconductors, the Internet, and space communications, have developed, primarily through the orders of the Department of Defense (Ruttan, 2006).

It should be noted that the general purpose of convergent technologies is more or less well-commercialised systems. This is especially true of information, telecommunications and digital technologies, which have been building large platforms for research, development, education, management, production and consumption culture for almost three decades. The rapid development of these technologies has led to profound, qualitative changes in the structure of the economy and employment.

At the same time, the cluster of new technologies requires fundamentally new formats of capital formation, investment, entrepreneurship and marketing, taking into account the fact that the risks associated with them are much higher than the risks associated with the materialisation of traditional technology clusters. The emergence

and advancement of convergent technologies should explain the emergence of the latest institutions for financing risky investment projects, such as venture funds and venture financing schemes. Especially after the global financial shocks and crises, the fanciful financing of innovative businesses has sharply increased. This is what happened after the global financial crisis caused by the COVID-19 epidemic in 2019-2020. The 2021 Venture capital report compared to the previous year, the volume of venture capital investments in the world doubled, reaching 621 billion dollars in 2015. It has increased three and a half times (State of Venture GLOBAL, 2021).

Among the changes brought about by convergent technologies, we must single out the severe impacts on both the economic structure and employment. On the one hand, it was evident that along with traditional large-scale production, new technologies allow companies with relatively small financial and human capital investments to create companies with excellent market growth potential, which, in a very short period of time, can create large market segments and become production, service and sales monopolists. The success story of IBM, Microsoft, Amazon, Apple, Facebook, eBay, and many more shows how a small startup based on a radical and original idea can revolutionise the market and become one of the leading companies in its field in a short period time.

On the other hand, the market innovation of each of these companies is not only a serious alternative to traditional business systems but also a serious challenge to traditional approaches to economic thinking and economic policy. It is evident that, for example, the business empires of Bill Gates, Mark Zuckerberg, Steve Jobs and Jeff Bezos were serious challenges to the business culture of mass production and the era of Fordism. It is no coincidence that the latest high-tech companies' market value estimation and investment flow generation mechanisms operate in a different measurement system on a global scale than the existing traditional business asset valuation mechanisms. In this case, we are talking about the NASDAQ Composite Index, a system of exchange valuation and sales of corporate shares of high-tech companies.

It turns out that the high-tech sector, being very attractive for investment and business, has a high probability of accumulation of crisis risks and shocks, as the often unrealised expectations of profits and significant dividends from that sector can lead to excessive accumulation of risks and shocks. In particular, this happened in 1997-2000, when thousands of high-tech companies went bankrupt, while in the previous period, the share price of network companies almost tripled, and the total volume of investments in companies in this field reached about $ 5 trillion (Draper, 2012). Since the onset of the crisis, the NASDAQ Composite Index has fallen by 80 per cent, and millions of people who have invested in US IT companies have lost billions of dollars.

It should be noted that economic structures and business culture based on convergent technologies have a severe impact on the structure of employment and the movement of public incomes. Convergent technology-based productions and their products have a large share of value added and revenue, so profits and wages in those areas exceed those generated in many traditional industries. From this point of view, these newest segments of production and service delivery are becoming signals of deepening social stratification. Systems, especially those based on digital technologies, create network products and monopoly value chains that allow their owners to earn exceptionally high returns due to their assets' high level of specificity. On the other hand, there are serious problems with assessing the actual income level generated in these areas for the tax departments of the nation-states.

Thus, the exceptional revenues created in high technology, which several theorists describe as "technological rent", in fact, open a new field of institutional-functional regulation. It is noteworthy that in the late 1990s, against the backdrop of the rapid spread of the Internet and investment boom in network companies, all expec-

tations of economic growth and increased inclusion were accompanied by positive macroeconomic trends and the main flaw of capitalism - the cyclical development of the economy – was overcome when it was evident that the "overheating" of the markets - the euphoria of network companies - is simply due to the exaggeration of speculative transactions and the expansion of stock market bubbles. Naturally, those dot.com "bubbles" exploded, causing tens of thousands of companies to go bankrupt (Cassidy, 2003).

The logic of the current global economic developments and the world economy's structure, and each national economy's position in that the system is essentially conditioned by the emergence of convergent technologies and development factors. At the same time, the modernisation of each national economy as a whole depends on the place of this or that country in the world hierarchy of technologies, how much it can generate or borrow this or that technology of the convergent technological bunch, or that bunch as a whole.

The development of convergent technologies is, in fact, a competition for the acquisition of a monopoly position and technological rent on a global market scale. This fact has been discussed and substantiated by different theorists from different points of view. In particular, given this circumstance, some researchers refer to the income generated by the application of radical technological innovation in different ways – "*Schumpeter rent*" (Sautet, 2015), "*innovative rent*", or "*business rent*". In particular, the President of the Stockholm Institute of Industrial Economics, Mangus Henriksson, thinks that a dynamic entrepreneur seeks to prolong the formation of his business rent as much as possible, but at the moment, it is limited. He notes: "*The entrepreneur is needed for economic development, and entrepreneurial rents are a prerequisite for the emergence and implementation of entrepreneurship. If entrepreneurial rents did not exist or were subject to very high effective taxation, firms would continue producing existing goods and services, while the motivation to search for new products would be eliminated*" (Henrekson & Stenkula, 2016, p. 19).

Based on the above judgments, it can be stated that large international high-tech companies seek to position themselves globally and spatially as possible to build their business plans so that the technological value-added chains become as fast as possible. Such business networking enables such companies to control the agendas of potential technological breakthroughs, neutralise the acquisition of leadership by potentially strong competitors, and build fundamentally new high-tech chains full of surprises. This circumstance is why the vast majority of countries with transitional and emerging markets are still unable to solve the problems of rapid modernisation of their economies, based on which a sharp rise in the population's living standards.

Examining the system of international relations for the creation of the latest technologies and the dissemination of innovations, the experts of the World Bank, in their extensive report, stated that overcoming the technological backwardness of developing countries is associated with more complex problems. World Bank experts call this phenomenon the "Innovation Paradox" (Cirera & Maloney, 2017).

Logic suggests that the borrowing of convergent technologies should have allowed large-scale emerging markets to embark on large-scale modernisation programs, overcome the problem of the low or so-called "middle-income trap", and address the productivity of the economy in the face of competitive advantages based on lower production costs and sharply increase in the level and welfare of the population. However, the reality is that the vast majority of developing countries cannot take advantage of the latest technologies, and such a paradoxical situation continues. The main reasons for this situation are the insufficient investment in innovations in such countries and the lack of an effective institutional system conducive to the advancement of innovation projects.

Especially in the case of the former USSR countries, the processes related to the advance-

ment of innovations are very contradictory by nature. This is primarily due to applying the extreme liberal versions of the neoliberal reforms that began in those countries in the 1990s and the devaluation of previously specific assets due to them, the disintegration of technological and production systems, the disintegration and degradation of educational and research systems.

In fact, in the conditions of such liberal reforms, there have been irreversible losses of innovations and competitiveness in countries with emerging markets. Instead of innovative modernisation of economies and growth of competitiveness, in those countries, there are phenomena of rising poverty, rising incomes of the population, corruption and rising levels of crime. Large-scale privatisation of state property in those countries has not been accompanied by high-tech modernisation projects of established private economies and firms and the creation of high-income workplaces. Economic growth in such countries has not been inclusive, primarily based on mineral resources, energy extraction and sales, and speculative resale of previously created assets. As a rule, there was no culture of reproduction or transfer of political authority through fundamental democratic procedures in such countries. In these conditions, for the people who usurped political authority, their political position was a way to have monopoly businesses derived from the government, quota the markets, production, import-export, and extort "political rent" based on it. The possibility of extorting political rent by the state bureaucracy has been one of the main obstacles to establishing real competitive markets and the innovative modernisation of economies.

Conclusion

Studies and analyses show that the bouquet of convergent technologies is the current state of modern civilisation and the dominant factor in the development of the coming decades. The new technology set is created and rooted, demanding appropriate institutional and resource mechanisms and policy tools. The latest cluster of convergent technologies simultaneously has a revolutionary effect on economic thinking and economic policy approaches and mechanisms. It becomes clear that convergent technologies can initiate a variety of unique manufacturing value chains and consumer cultures.

Convergent technologies determine the main models and agendas of the modernisation of developed countries and transform their economies. At the same time, it becomes clear that large international companies in developed countries are trying to implement their strategies on a global scale and accommodate their production and technological value chains in that context. Its purpose through technology transmission of the majority of the world's significant majority of countries integrates and integrates the already approved schemes of increasing value chains. The companies of developed countries implement this agenda through the formation and embezzlement of the technological rentha. This scheme is performed with various tools, starting with the reservation and protection of intellectual property rights and various tools for standardisation and cost optimisation.

Studies show that most transition countries in developing markets in development conditions are doomed to release essential technologies in developed countries And services. The main obstacles to the modernisation of countries with developing markets and convergent technologies are related to the lack of investment resources, institutional vulnerabilities, corruption, and political quasirent.

Acknowledgements

This work was supported by the RA MES State Committee of Science within the frames of research project № 21T-5B313.

References

Cameron, J., & Siegmann, K. A. (2012). Why did mainstream economics miss the cri-

sis? The role of epistemological and methodological blinkers. *On the Horizon*, *20*(3), 164-171. https://doi.org/10.1108/10748121211256766

Cassidy, J. (2003). *Dot.com: How America lost its mind and money in the internet era*. New York: Perennial.

Cirera, X., & Maloney, F. W. (2017). *The innovation paradox: Developing-country capabilities and the unrealised promise of technological catch-up.* Washington, DC: The World Bank. Retrieved March 20, 2022, from https://openknowledge.worldbank.org/bitstream/handle/10986/28341/9781464811609.pdf

Draper, W. H. (2012). *The startup game: Inside the partnership between venture capitalists and entrepreneurs* (Rep. ed.). New York: Palgrave Macmillan.

Ezdina, N., & Dostenko, E. (2021). The neo-industrial role of digital and converged technologies in the Russian economy. *SHS Web of Conferences 93*(2), 01003. doi:10.1051/shsconf/20219301003

Fagerberg, J. (1987). A technology gap approach to why growth rates differ. *Research Policy, 16*(2-4), 87-99. https://doi.org/10.1016/0048-7333(87)90025-4

Freeman, C. (1990). *The economics of innovation*. Aldershot, Hants, England; Brookfield, Vt., USA: Edward Elgar Publishing.

Henrekson, M., & Stenkula, M. (2016). The entrepreneurial rent: The value of and compensation for entrepreneurship. *IFN Working Paper, 1128.* Research Institute of Industrial Economics (IFN), Stockholm. Retrieved March 18, 2022, from https://www.econstor.eu/bitstream/10419/175065/1/Wp11-28.pdf

Lipsey, R. G., Carlaw, K. I., & Clifford, T. B. (2006). *Economic transformations: General purpose technologies and long-term economic growth*. Oxford: Oxford University Press.

Nelson, R. R., Dosi, G., Helfat, C., Pyka, A., Saviotti, P. P., Lee, K., Dopfer, K., Malerba, F., & Winter, S. (2018). *Modern evolutionary economics*. Cambridge, UK: Cambridge University Press.

North, D. C. (1993). *The paradox of the west*. https://www.econbiz.de/Record/the-paradox-of-the-west-north-douglass/10005125828

Politkovskaya, I., Khvichiya, D., & Artamonova, L. (2021). Economic institutions of the converged technological platform for sustainable development. *E3S Web Conf., 278*, 03004. https://doi.org/10.1051/e3sconf/202127803004

Roco, M. C., & Bainbridge, W. S. (2013). The new world of discovery, invention, and innovation: Convergence of knowledge, technology, and society. *Journal of Nanoparticle Research, 15,* 1946. https://doi.org/10.1007/s11051-013-1946-1

Ruttan, V. (2006). Is war necessary for economic growth? Military procurement and technology development. *Staff Papers,* 13534, *University of Minnesota, Department of Applied Economics*. doi: 10.22004/ag.econ.13534

Sautet, F. (2015). Schumpeterian rents. In *The Palgrave encyclopedia of strategic management*. Palgrave Macmillan.

Schumpeter, J. A. (1939). *Business cycles: A theoretical, historical and statistical analysis of the capitalist process*. New York, McGraw-Hill Book Company.

Shumpeter, J. A. (2003). *Capitalism, socialism and democracy*. Edition published in the Taylor y Francis e-Library. London and New York: Routledge.

State of Venture GLOBAL. (2021). *Global data and analysis on dealmaking, funding, and exits by private market companies*. Retrieved March 13, 2022, from https://www.tadviser.ru/images/8/8a/C

B-Insights_Venture-Report-2021.pdf

Veblen, T. (1923). *Absentee ownership. Business enterprise in recent times: The case of America.* New Brunswick: Transaction Publishers.

ABOUT AUTHORS

Atom MARGARYAN - PhD in Economics, Head of Innovation and Institutional Research Scientific-Educational Laboratory of the ASUE, Yerevan, Armenia.
ORCID iD: https://orcid.org/0000-0002-5998-2227
E-mail: atom.margaryan@gmail.com

Andranik MARGARYAN - Master in Economics, Researcher of Innovation and Institutional Research Scientific-Educational Laboratory of the ASUE, Yerevan, Armenia.
ORCID iD: https://orcid.org/0000-0002-3692-3259
E-mail: a.margaryan.15@mail.ru