Tsotne Iashvili
Ivane Javakhishvili, Tbilisi State University

Sebastian Jakubowski
Opiekun naukowy — Scientific Tutor

DOI: 10.19195/1733-5779.22.1

Technological trap and its overcoming difficulties in transition economies

JEL Classification: P200, O140, O330

Keywords: technological trap, countries in transition, transition economies, necroeconomy

Słowa kluczowe: pułapka technologiczna, transformacja gospodarcza, gospodarki postkomunistyczne

Abstract: The aim of this article is to examine the technological trap and its impact on the economic growth. The most important question is: how the technological trap can be a burden for the economy, especially for the countries in transition. The paper provides the definition of the technological trap, the hazards of necroeconomy and how the necroeconomy can be a significant burden for economic growth of countries in transition. Our aim is to provide some theoretical examinations from above mentioned economic issues. The paper provides different sources of the technological trap and mostly is concentrated on the technological trap in transition economies.

Pułapka technologiczna i trudności jej pokonania w gospodarkach przejściowych

Abstrakt: Celem artykułu jest analiza mechanizmu pułapki technologicznej i jego wpływu na wzrost gospodarczy. Główne pytanie brzmi: dlaczego pułapka technologiczna oraz zjawisko nekroekonomii są jednymi z głównych barier w rozwoju krajów postkomunistycznych? Artykuł definiuje pojęcia „pułapki technologicznej" oraz „nekroekonomii". Opracowanie zawiera również analizę przyczyn i sposobu funkcjonowania pułapki technologicznej i nekroekonomii w realiach gospodarczych Wschodniej Europy.

Studenckie Prace Prawnicze, Administratywistyczne i Ekonomiczne 22, 2017
© for this edition by CNS

Introduction

In order to reach the long-run, stable economic growth concerning only on inputs is not optimal and efficient. Mostly, to reach the short-run economic growth it is enough to use more inputs and to speed up economic growth by using the extensional economic growth possibilities, additionally providing the expansionary fiscal or monetary policy. Concerning only on short-run economic growth has its own disadvantages. For example, providing the expansionary fiscal policy has a negative effect on long-run economic growth, also budget deficit is rising and accordingly the public debt. Reaching the long-run economic growth is mainly being based on technologies and innovations and as well as on government's aim to launch the innovative economy. New technologies, the increase in A_t, (macroeconomists tend to call increases in A_t "technological progress")[1] according to Solow Growth model, can shift the output curve and economy can postpone reaching the steady state level of economics.

Our aim is to examine how the technological trap can be a threat and burden for economic growth and why is it especially important and dangerous for the countries in transition. Nowadays, we live in the technological era, but sometimes countries can't or don't adopt the new technologies and they are experiencing the situation which is called "the technological trap".

Understanding the causes of technological trap

According to Evgeni Balacki (Балацкий 2003), the observation of the global economic development has demonstrated that technologically backward countries have low economic growth and economic growth dynamism significantly lags behind the developed countries. In terms of capital, finance, and technology mobility and the openness of countries the figure should be otherwise. On the contrary, technologies and innovations should be applied and there should take place the diffusion of technologies and innovations, which should facilitate the rapid economic growth of developing countries. However, in most cases, this does not happen. The difference between developed and developing countries, in most cases, is due to the difference between technologies they own. For developing countries, especially in a situation where the world is facing 4th industrial revolution, it is significantly important to bear in mind the importance of technologies and possible hazards of the technological trap.

The process of development of technologies is one of the most important issues to provide stable development and economic growth. The significance of technologies and innovations were emphasized by Joseph Schumpeter (Schumpeter, 1939). New technologies and innovations can disturb market equilibria and gave

[1] K. Whelan, "The solow model of economic growth", *EC4010 Notes*, 2005, p. 1.

© for this edition by CNS

it the new direction of development and force economy to develop extensively and leap forward[2]. Speaking about technologies we should bear in mind some of the features which are related to the development of technologies. Technologies are developing in one stream and their change is cumulative and depends on its trajectory[3]. During the development process of technologies may occur issues such as "technological trap" (Lock-in) or "technological break-out (Break-out)[4].

"Technological trap" is a situation when firms favor to use outdated or less modern and inefficient technologies, even when there is a possibility to use more modern technology[5].

Reasons of the technological trap are different for developing and developed countries and the possible causes of technological trap differ by the development level of countries. We should search causes on the micro as well as on the macro levels of economy. It is obvious that most of the treats are referred to developing and less developed countries, the hazard of the technological trap is even more significant for the countries which have passed the command economy system and are in transition or in post-transition period.

As we have already mentioned the technological trap is a situation where firm favors to use outdated technologies, despite the fact that on market there exist new and modern technologies. We can consider that the output produced by this type of technology would be non-competitive on the international markets, quality will be low and even more, the cost of the product could be relatively much more expensive. Overall, the demand for this type of product will be low.

But what are the reasons causing the technological trap? According to Brian Arthur (Brian 1989) when technology acquires market advantages and leadership for various reasons, then, even if the new technologies emerge out of the market, the market still continues to prefer old but still well-known technologies. Because of the dominance of one technology other new and modern technologies are stayed blocked (Lock-in)[6]. For the illustration, we can come up with one example: the QWERTY keyboard due to its first appearance on the market gained dominance and now it's well spread all around the world. Despite the fact that there were and still is, some much more modern and easy learning keyboards (for example DSK)

---

[2] W. Dolfsma, L. Leydesdorff, "Lock-in and break-out from technological trajectories: Modeling and policy implications", *Technological Forecasting & Social Change* 76, 2009, 932–941, p. 932.

[3] G. Dosi, (1982) "Technological paradigms and technological trajectories: A suggested interpretation of the determinants and directions of technical change", *Research Policy* 11, 1982, pp. 147–162.

[4] W. Dolfsma, L. Leydesdorff, op. cit., p. 933

[5] E.V. Balackij, "Ekonomicheskij rost i tekhnologicheskie lovushki [Economic Growth and Technological Traps]", *Obshchestvo i ekonomika* [*Society and Economy*], 2003, No. 11. (In Russian).

[6] W. Brian Arthur, "Competing technologies, increasing returns, and lock-in by historical events", *The Economic Journal* 99, 1989, No. 394 (Mar. 1989), p. 126.

© for this edition by CNS

QWERTY keyboard didn't lose its dominance and still is one of the most recognized keyboards around the world. Overall, QWERTY keyboard is the well-known example of the technological trap. Another reason for the technological trap could be microeconomic decisions of firms. In particular, we can discuss the situation when firms just are "not willing" to transfer to the new technological production, despite the fact they know there are some new and modern technologies on the market.

Generally, the transfer from one technological structure (formation) to another structural unit is (in this case these two are: old and new technologies) defined by 3 factors: the first and the second is current expenditures on output which is produced by old and new technologies Cs and respectively C_N and the third factor is capital expenditures T_o. These are the costs which occur when there is a transformation from old to new technologies. For the simplicity of analysis, it is considered that the entrepreneur is producing products either only old or only with new technology. Their combination in this particular case is excluded. The logic of the implementation of new technologies is following: even if the costs of the products produced by new technologies are less expensive than the costs of the product produced by old technologies the entrepreneur will not replace the old technology with new ones if the cumulative difference between old and new technologies does not cover capital expenditures. Only if the latter is fulfilled, then the old technology will be replaced by new one. It should also be noted that current expenditures are constant and capital expenditures have a single character, so they can only be compared to a certain τ period of time. Since the entrepreneur seeks to reduce the cost of production, the transformation to a new technological structure will only happen when the cost of gross output expenditures will be reduced. A situation whereby both technologies (old and new) are equally useful is following:

$$\int_0^{\tau} [C_S(t) - C_N(t)]dt = T_0$$

Whereas, t is a time, τ is the period of time in which the entrepreneur wants to replace the old technologies with new ones. If the left side of the equation is higher than the right side, then it is going to be a transformation to new technologies. If the τ period of time is large, then the chance that T will be less than the left side of the equation is higher, so the probability that the firm will move to new technologies is higher[7]. So, if the firm has long-term plans and is not oriented only on short-term quick and high profits, then it will definitely the movement to new technologies. In the absence of new technologies, there will be the technological trap. We can consider that the reason for the technological trap is not only micro-

[7] E.V. Balackij, op. cit., pp. 55–56.

© for this edition by CNS

economic decisions of the firms and entrepreneurs but also the macroeconomic instability plays a huge negative role in it. For instance, the macroeconomic instability makes the τ period of time unclear, so the decision to move to new technologies is lagging in time. The lack of trust in the institutions and government plays the same role as macroeconomic instability in case of the technological trap. Macroeconomic instability often occurs in developing countries, so we can assume that the technological trap is mostly characterized for this type of countries.

Technological trap in transitional economies

As we have mentioned above, the technological trap mostly appears in developing countries. Also, significant hazards are still remaining in the countries who have experienced the Soviet Union command economy system.

In this part of the article, there will be an attempt to analyze the possible threats regarding the technological trap in transition economies.

For many decades, the development of economic thinking was mainly determined by the confrontation between two economic schools — Keynesian and classical[8]. After the collapse of the Soviet Union, the world faced new problems in economic thinking — the transformation from command, central economy to free market. Economists didn't really have the solutions, mainly because the problems were new and in the economic theory it was never mentioned before.

After the collapse of Soviet Union, the new reality was revealed. As Adam Lipowski mentions, where the world is divided into "developed" and "developing" countries the command economy in the whole can be characterized as a "misdeveloped" economy. There are following features of "misdeveloped" economies:

1. the excessively high share of industry in GDP at the expense of domestic and foreign trade and financial and insurance services;
2. the excessively high share of manufacturing of production inputs, at the expense of the production of the means of consumption;
3. the insufficient share of internationally competitive goods in industrial production;
4. the large scope of low-quality unwanted production imposed upon buyers;
5. the excessive share of obsolete goods in industrial production at the expense of new and updated products[9].

As we have mentioned above, after the collapse of the Soviet Union the world faced a new type of economy and new problems regarding this. The collapse of the Communist regime and the breakdown of command economy "stripped off" the post-Communist economies. It turned out that with rare exceptions (partially

[8] E. Mekvabishvili, *Modern Macroeconomic Theories*, Tbilisi 2014, p. 121.

[9] A. Lipowski, *Towards Normality. Overcoming the Heritige of Central Planning Economy in Poland in 1990–1994*, Warsaw 1998.

© for this edition by CNS

hydroelectric power, mining, and primary processing of extracted raw materials) all goods produced in these countries were incompatible with international standards and could not compete with the Western products due to low quality and/or high prices. This type of economy Vladimer Papava calls "necroeconomics"[10].

Naturally, even if a certain section of the economy is "dead", the other sections may be "alive". For this reason, this section may be referred to as "vital" economy, or vitaeconomy[11].

Necroeconomy and vitaeconomy appeared in different spheres of post-soviet economy:

1. Necroeconomy existing in the public sector;
2. Vitaeconomy existing in the public sector;
3. Privatized vitaeconomy;
4. Privatized necroeconomy;
5. Private sector based on new investments — vitaeconomy[12].

The threat of technological trap is connected with the third group — privatized vitaeconomy. Privatized vitaeconomy is a part of the economy where there is a demand for products but these products are produced with outdated technologies. Accordingly, in order to make the products manufactured in this group to be competitive and answer international requirements it is important to meet the relevant standards of producing and to use modern technologies.

The first and the forth sections of the economy are dead, no matter the type of ownership they have. There is no chance to build competitive producing in these parts of the economy. The government should stop to support it and just to sell it by parts and pieces. Contrary, if the government decides to suspend the life of these sectors, due to the social factors it will be "greenhouse conditions" for the technological trap.

It should be noted that the new private economy created on the basis of new investments will not experience the technological trap, if they compete with the international market and if they stop expecting any help from the state and will try to base the production on their own entrepreneurial skills.

Reasons behind the technological trap in transition economies are even more significant than private decisions of entrepreneurs and macroeconomic instability. Firstly, it should be mentioned that in case of human capital the situation is even worse. For example, in Georgia, there is a lack of entrepreneurs. It is true that Georgia passed transformation path but in case of human capital the post-communist reflection is mostly still remained. Homo transformaticus still hasn't be-

---

[10] V. Papava, Necroeconomics and Post-communist Transformation of Economy, Tbilisi 2001, pp. 7–8.

[11] Ibid., p. 2.

[12] Ibid., p. 4.

© for this edition by CNS

come homo economicus as well as "post-delets" aren't yet entrepreneurs[13]. From that perspective, the microeconomic, entrepreneur decision to move on to new technologies is even more complicated, if we also add the macroeconomic instability then the future and "economic horizon" for entrepreneurs is uncertain. Barely, they will make a decision to adopt new technologies. We can name another reason causing the technological trap in transition countries. For instance, high interest rates create low possibilities and lack of the availability of financial resources. Another reason may be referred to a low quality of education. The unqualified staff does not allow entrepreneurs, regardless of their willingness to have modern technologies, since their qualification does not correspond with the knowledge and experience necessary for the use of new technologies. All of this creates the switching costs and it is not cheap for entrepreneurs to spend extra money on education and teaching their employees. We can connect this to an Evolutionary Theory of Economic Change[14], and to routines. Routines created during the command economy can barely change, and to establish new market-based routines and organizational memory and skill take some extra time.

Overcoming the technological trap

Economists offer different solutions to get rid of the technological trap. One of the main solutions will be in reducing the interest rate and to extend the allowance on financial resources. This will help to encourage entrepreneurs to start a business and to buy new technologies. Also, the state should facilitate the development of general education and not only this, also it should be bared in mind that general education or high education system should be close to the requirements of labor market demands. Otherwise, the gap between the educational system and labor market demand requirements should be reduced. The significant thing for the government is to pay attention to the development of science in the frame of the university. Furthermore, it is important to take into consideration the importance of applied research projects and provide a governmental funding especially for the projects who might have a significant future possibility of commercialization. In addition, the outcomes from these applied projects should be available for other market participants. Scientific knowledge and know-how should be spread in order not to have a monopoly on the market, which respectively could be one of the reasons of the technological trap.

The above-mentioned actions indicated more or less specific plans and tasks that the state could use to overcome the technological trap. In general, to talk about the role of the state in tackling technological trap, as mentioned above, it is necessary that there should be macroeconomic stability and, in addition, general

[13] Ibid., pp. 6–7.

[14] R.R. Nelson, S.G Winter, *An Evolutionary Theory of Economic Change*, Cambridge 1982.

© for this edition by CNS

economic and social goals should be declared by the state. This helps every firm, individuals and entrepreneurs to make appropriate decisions because they know what are the main goals of the country and overall it raises the trust in government.

As an example, we can bring the decision of the government of Georgia about the creation and formation of the unified social and economic development strategy of Georgia. The Strategy of Social-Economic Development of Georgia — "Georgia 2020" was very positive in this regard. The main problems and challenges of the Georgian economy were clearly identified in this document as well as, relevant goals and indicators for which the state should have achieved in several years of perspective. This document and the stated goals of the state created economic optimism[15] that helps the country and firms to overcome a technological trap. Consequently, these actions stimulate firms to have long-term plans and to move on to modern technologies. Consequently, the specific plans of the state are important for the development of general economic goals and strategies that will facilitate the motivation of the firms' behavior.

According to the strategy, Georgia must move into the development of an innovative economy and the economy based on knowledge and the respective ministries should be able to develop mid-term plans prior to 30th of June every year to help the country in the strategy and accomplishment of the goals set. Unfortunately, this was not fulfilled and tasks set out in the strategy were challenged. As a result, the state has forgotten about the strategy and offered the "4-point plan of government", which is an example of economic primitivism[16]. Of course, all of these actions will contrary reflect the activities of firms. These actions prevent the firms to have long-term goals.

Conclusions

In conclusion, we can say that the technological trap is a threat for both developed and developing countries. However, the reasons for its creation and the mechanisms of its overcoming are different. The main reason for the emergence of technological trap for developing and transition economies is the economy which was developed in the wrong direction -("misdeveloped") the past technological heritage and the role of human, namely homo sovieticus (the person who was born and raised in the Soviet Union and has a routine related to the command economy) and homo transformaticus (the persons who partially have a free market economy routines but still waiting for a help from the government), and according to the lack of entrepreneurial entities, innovator entrepreneurs.

The difference in the mechanisms to overcome the technological trap is determined by the difference of the causes of the technological trap. The role of the

[15] V. Papava, *Georgian Economy — from Optimism to Primitivism*, Tbilisi 2017, pp. 5–8.
[16] Ibid., p. 10.

© for this edition by CNS

state is decisive for developing and transitional types of economies, which should take over and eliminate the basic macroeconomic causes of the technological trap and for microeconomic reasons, such as the individual decisions of firms and entrepreneurs, we believe that this is a matter of time. In addition, the appropriate macroeconomic environment is one of the most important factors.

When we talk about transition and developing countries in the process of overcoming technological traps, we should take into consideration the role of the state that is not protected from failure. As the market economy is familiar with the market fiasco, also in non-traditional economics, the state is not protected from the fiasco too[17]. This is caused by the fact that people both in the market as well as in the public sector have their own (economic) interests.

In addition, taking into consideration the fact that the decision-making in the state sector in the transitional economy may still be made by homo transformaticus or by homo sovieticus, there is little likelihood that the goal of overcoming the technological trap will end up with the state fiasco.

Therefore, in the developing and transitional countries, the most important challenges are the goal of overcoming technological traps. In this respect, the role of the state is particularly important. While, for the developed countries, the technological trap is over-dependent on the decisions of firms, entrepreneurs, and individuals.

References

Balackij E.V., "Ekonomicheskij rost i tekhnologicheskie lovushki [Economic Growth and Technological Traps]", *Obshchestvo i ekonomika* [*Society and Economy*] 2003, No. 11 (In Russian).

Balackij E.V., "Instututional and technological traps: analyze the ideas", *Journal of Economic Growth* 2012, No. 2.

Brian Arthur W., "Competing technologies, increasing returns, and lock-in by historical events", *The Economic Journal* 99, 1989, No. 394 (Mar. 1989).

Dolfsma W., Leydesdorff l., "Lock-in and break-out from technological trajectories: Modeling and policy implications", *Technological Forecasting & Social Change* 76, 2009, pp. 932–941.

Dosi G., "Technological paradigms and technological trajectories: A suggested interpretation of the determinants and directions of technical change", *Research Policy* 11, 1982, pp. 147–162.

Lipowski A., *Towards Normality. Overcoming the Heritige of Central Planning Economy in Poland in 1990–1994*, Warsaw 1998.

Mekvabishvili E., *Modern Macroeconomic Theories*, Tbilisi 2014.

Nelson R.R., Winter S.G., *An Evolutionary Theory of Economic Change*, Cambridge 1982.

Papava V., *Georgian Economy — from Optimism to Primitivism*, Tbilisi 2017.

Papava V., *Necroeconomics and Post-communist Transformation of Economy*, Tbilisi 2001.

Papava V., *Nontraditional Economics* (In Georgian), Tbilisi 2011.

Schumpeter J., *Business Cycles: A Theoretical, Historical and Statistical Analysis of Capitalist Process*, New York-London 1939.

Whelan K., "The Solow Model of Economic Growth", *EC4010 Notes* 2005.

[17] V. Papava, *Nontraditional Economics (In Georgian)*, Tbilisi 2011, pp. 145–148.

© for this edition by CNS

Technological Trap and its Overcoming Difficulties in Transition Economies

Summary

The Technological Trap is a significant burden for economic growth. It interrupts the process of implementing new technologies. As it has been mentioned in the article, the threat is connected with both developing and developed countries. Especially, the economies, which have experienced the Soviet command system and passed the path of transformation, are in a dangerous situation. The main sources of the Technological trap in transition countries are the "Misdevelopment" and the Post-Communist economic routines. These routines serve in favor of outdated technologies. They create a fear to make an entrepreneurial decision. All the above-mentioned issues create a greenhouse for the Technological Trap. Furthermore, the macroeconomic instability and weak institutions play a significant negative role in this regard. The scarcity of macroeconomic stability causes the uncertainty. Accordingly, the decision to implement new technologies and to take an entrepreneurial risk is even more difficult. In conclusion, in order to overcome the Technological Trap, it is necessary to stabilize the economy. The government has to take a step forward and encourage the entrepreneurs to adopt new technologies. Thus, the role of government in transition economies should be implemented on macro, as well as on micro levels.

Studenckie Prace Prawnicze, Administratywistyczne i Ekonomiczne 22, 2017
© for this edition by CNS