



ASSESSMENT OF TRANSFORMATION PROCESSES IN THE COMPLEX SOCIO-ECONOMIC SYSTEM OF TRANSITION PERIOD

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Abstract. The article deals with the changes and trends caused by the transformation of the centralised planned economy to free market economy. Such transformation affects not only the economy but also the whole social environment as privatisation is the key transformation element. Thus, models dealing not only with the economic field but also with other aspects must be used when assessing transition processes: quality of life, technological and knowledge innovations, ecological problems. The article presents models of summarised indicators that take account of their correlation and changes in time. The analysis is based on empirical data: gross domestic product, energy consumption, criminality, housing construction, etc. The concluded models allow to have a complex look at the problems caused by the transition period, and to assess their impact on further development of knowledge economy.

JEL classification: O110, P200.

Keywords: transition period, complex system, socio-economic processes, quality of life, knowledge economy.

Reikšminiai žodžiai: pereinamasis laikotarpis, kompleksinė sistema, socialiniai-ekonominiai procesai, gyvenimo kokybė, žinių ekonomika.

1. Models of assessment of transformation processes

Modelling the transition processes in a simplified form can be based on some broad, partly overlapping categories of models: mathematical equation-based, system dynamics, statistical, expert systems, and/or evolutionary or hybrid. By applying these models, the possibility of discontinuous transformation of quantity into quality (that can arise during the initial transformation phases) should be suggested. The non-linear dynamic phase is expected when the old system enters a period of crisis. Such a dynamic period can also be observed after an economy has hit the bottom and begun to grow again (Rosser, 2002).

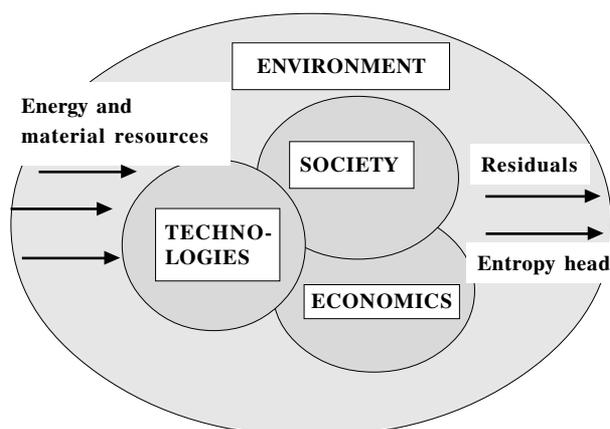
There are two cardinal different tendencies to apply when looking at fluctuations of social economic variables. The linear method assumes that socio-economic fluctuations can be explained as a phenomenon, i.e. distributed by exogenous stochastic shocks. On the other hand, fluctuations may be explained as generated endogenously by non-linear properties of the system. Many scientists assess socio-economic fluctuations as a result of the interaction of economic forces, social changes, and technologies and preferences (Feichtinberg, 1996; Lorenz, 1993).

As it is known any life support system is taking material resources from the surrounding and disposing residuals to the environment. Any process is characterized by the entropy production as

the measure of the irreversibility of the processes within the system. Most of the life support systems are dissipating residuals of hard, liquid and gaseous form and disposing low entropy heat to the environment (Schneider, Kay, 1994).

Economics are open systems. They receive inflows of energy and materials. Economics use that incoming energy to develop and build new structures. Social constraint reflects social aspect of system and added values that improve the quality of human life. In the social aspect of the system is included risk of environmental changes and health. Any crises of the system are preceded with corresponding changes in the adequate indicators of the system. Qualitative measurement of these indicators may lead to the forecast of the economic or social crises. The assessment of technological development implies adaptability complex system (Fig. 1).

Figure 1. Complex Social Economic System and its Surrounding



The mutual interaction between the system and its surrounding is immanent for any system. The changes in the interaction rate will affect the safety of the system. For example, sudden change in the environment can lead to social disturbance.

The structure of the global complex system as well as feedback loops among the different hierarchical levels induce non-linear behaviour of the system. Such systems are composed of a large and an increasing number of components and have the ability to adapt to new changing conditions. Complex system theory establishes that sometimes smooth and continuous behaviour is possible, but it is not always like that (Nicolis, Prigogine, 1977). This is because positive feedback loops might generate self-reinforcing mechanisms. Non-linear behaviour of a system and for equilibrium situations leads to the existence of a multiplicity of stable states or attractors. An attractor represents a region in which the

behaviour exhibited by the system is coherent and organised. Once the system reaches the attractor, it fluctuates around it at least for a certain period of time (Kay et al., 1999). If the system is on an 'attractor point', some change parameters (e.g., GDP) will not always lead to adequate changes in other variables. This situation leads to 'bifurcation' points in which, for given boundary conditions, there are many stable solutions. When the parameters go beyond a critical threshold, the system becomes most sensitive and is therefore unstable (Faber, Proops, 1998; Dyke, 1994). Any crises of the system are preceded with corresponding changes in the adequate indicators of the system. Qualitative measurement of these indicators may lead to the forecast of the economic or social crises. The assessment of technological development implies adaptability in a complex system. Further improvement can be achieved with the use of information knowledge, organization and the introduction of new processes.

Complex models are more sensitive with regard to potential observation errors, and their application improves the complexity of forecast and the uncertainty of outcomes. As the article analyses short time lines, their analysis is carried out using probability models of the aggregated indicators that assess the correlation of variables and approximate time-related alteration.

2. Restructuring and efficiency of the economic system

Since 1989, the economic system of Lithuania has been undergoing transformation: centralised economy had to gradually transit to the free market economy. Such transformation is a very complex process, as, together with microeconomic liberalisation and macroeconomic stabilisation, the main transformation component that affect essential social relationship (state property privatisation and return of the extant immovable property) is being implemented.

Most problems were caused by privatisation of the major industrial enterprises. Although equipment of these enterprises were morally obsolete, inefficient and polluted the environment, and unjustified amount of raw materials and energy resources were consumed for production, the above mentioned enterprises employed thousands of employees. And what is more, after 1989 those enterprises lost sources of raw material and markets of finished production, their new owners did not know how to modernise production, implement modern management methods and get positions in the market. Production went down which caused huge unemployment and rapid decrease

in the gross domestic product (GDP): in 1994 GDP amounted only to 59.1% of the 1991 level. Most major industrial enterprises discontinued production, while the rest part of them was able to adjust to new conditions and starting with 1995 GDP has started slowly growing. How did the changes affect production efficiency and environmental pollution?

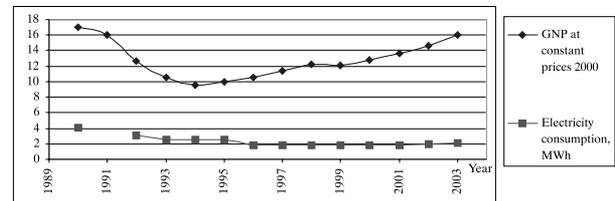
One of the key indicators that reveal the efficiency of an economic system is the amount of energy consumed for production. Many researches reveal that electricity consumption changes when socio-economic structures are being devised or fail (Suri, Chapman, 1998; Schneider, Kay, 1994; Beckerman, 1992). After analysing empiric data of the USA and other countries, (Hall et al., 1986) established that the correlation between the GDP and the consumed fuel was about 99%. No doubt, this could reflect a trend of a certain period between economic growth and fuel consumption and this relation is not necessarily linear. The relation between energy consumption and economic growth is important not only for its impact on the further development of the economy, but also for its close connection to problems of sustainable development (Spangenberg, 2004; Giampietro, Pimentel, 1991).

Another empiric indicator for the first time found in 1991 relates national revenue and change in the environmental harm (Grossman, Krueger, 1991). Due to its similarity to the pattern of income inequality time lines, described by Kuznets (1955), this curve trajectory was called "environmental Kuznets curve". The Kuznets curve has become one of the statistical tools used for interpretation and formation of environmental policy. Based on the shape of this curve, the hypothesis is being postulated that with the rising income of inhabitants the environmental pollution level keeps growing at the beginning but later, when the income reached a certain level, the pollution level starts gradually decreasing. Since the occurrence of the Kuznets curve many tests have been carried out aiming at finding out limits and validity of the application of this curve (e.g., Beckerman, 1992; Bruyn, 2000). However, works of recent years negate the versatility of this curve and the naive idea that economy growth is a measure to solve environmental problems (Suri, Chapman, 1998; Bruyn, 2000).

In Lithuania from 1990 to 2000, electricity consumption went down more than two times, while that of heat energy went down more than three times. In spite of the economy growth that started in 1995, the amount of production sold within the energy sector changed insignificantly. That was highly influenced by the increased elec-

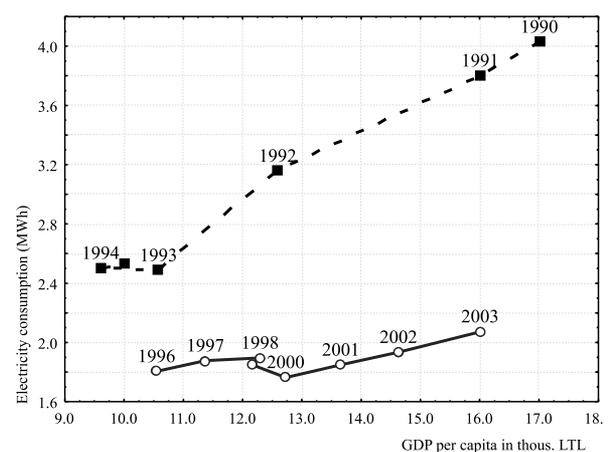
tricity prices in the domestic market, which made people and enterprises reduce its consumption. Total change in GNP and electricity consumption in Lithuania in 1990–2003 is given in Figure 2.

Figure 2. Diagram of Change in Electricity Consumption (MWh) and GNP at Constant Prices per Capita in LTL Thous. in 1990–2003



We see (Figure 2) that at the beginning of the period both decrease in GNP and electricity consumption was sharp. The lowest GNP per capita at constant prices 2000 (LTL thous.) was observed in 1994, while the lowest electricity consumption was observed in 2000. Inter-dependence of changes in the two indicators is clearly seen in their common diagram (Figure 3), which expressly reveals that the function that links them is salutatory and depends on the periods in question. With the help of regression model we may assess the analytic form of the function. This model will be used for the assessment of a statistical link between GNP and electricity consumption.

Figure 3. Diagram of the Final Change in Electricity Consumption (MWh) and GNP at Constant Prices 2000 per Capita in Thousand Litas from 1990–2003



The correlation of these two aggregated indicators and the form of the correlation show when their functional diagram is drawn in which EC (electricity consumption) is the GDP function, and both these indicators are time function: $EC = f(GDP(t))$. With the help of the linear regression

model we may assess the analytic form of the function f . This diagram clearly shows that the function f that relates EC and GDP jumps and in the course of analysis it is divided into two series at different levels.

The relation between the final change in electricity consumption (MWh) and GDP at constant prices in the year 2000 per capita in 1000 LTL in 1990–2003 could be expressed in an equation:

$$y_i = \begin{cases} 0.21x_i + 0.41 & \text{in 1990–1995;} \\ 0.04x_i + 1.36 & \text{in 1996–2003.} \end{cases} \quad (1)$$

In both cases, statistically significant determination coefficients are obtained: the upper line $R^2 = 0.98$ and the lower line $R^2 = 0.58$.

These results may serve as the basis for stating that the decline in transition economy lasted six years, from 1990 to 1995. At that period the GDP kept rapidly decreasing. At the same time, changes were also observed in electricity consumption: with the decrease in GDP in LTL1000, electricity consumption (MWh) on the average decreased by 21%. Since 1996, the decrease in GDP resulted in an insignificant growth of electricity consumption: with the decrease in GDP in LTL1000, electricity consumption (MWh) on the average decreased by 4%.

Based on the received results, it could be stated that a markedly lower level of electricity consumption was characteristic of the growth in GDP that started in Lithuania in 1996. With regard to the consumed electricity, the smallest value between these two levels at the same GDP is approximately one MWh. To explain these results, we may use the theory of dematerialisation of economies, based on the hypothesis that at the beginning of the development of economy process an increase of incomes was achieved due to the growing consumption of materials and energy. However, at a certain level it could be expected that a lower amount of energy and materials will be consumed for an increase of incomes (Malenbaum, 1978). It could be assumed that structural changes of a transit economy have created conditions that were necessary for a more intensive reduction of energy consumption. This was undoubtedly influenced by an increase in prices and a change in the consumption pattern.

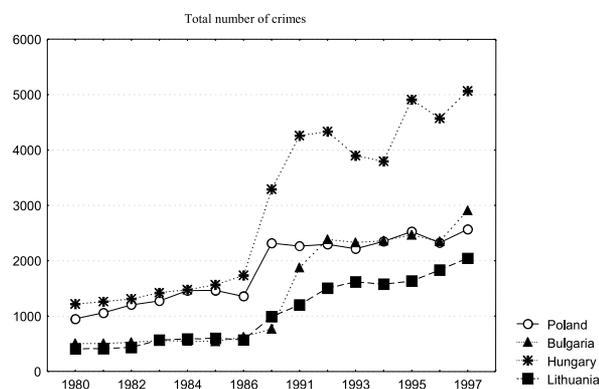
3. Social changes and quality of life

One of the most sensitive indicators reflecting social and moral state of society is criminality. Reduced income and growing gap between income distributions in transition economy were

the key reasons for the increase in the share of destitute population. Transit processes are especially painful for the inactive part of society: older people, the disables, and the unemployed who find it difficult to get accustomed to rapidly changing conditions. Until 1990, distribution of individual earnings was more even than that in many Western states. The ratio of individual earnings of 10% of richest and 10% of poorest people did not exceed three times. While in 1994 this gap was 4 times bigger; in 1995 it was even 8 times bigger. And these are only official data of Statistics Department that did not reflect shadow economy. Greater self-interest in society relations, clear socio-economic stratification had major impact on growing criminality (Statistical Yearbook..., 2000; Third to Sixth..., 2003) (Figure 3). Analysing data on general criminality level in Lithuania we observe its growth starting with the end of 70's. In Lithuania, in 1999 the total number of crimes, comparing to that in 1990, went up more than twice, and more than three times comparing with 1988.

The increasing level of criminality in the Baltic States and other states of the Eastern Europe was preconditioned by common reasons characteristic of all these states; and those reasons are related to the breakdown of the former Soviet block which resulted in the economic turmoil, lack of proper economic education, clear property inequality that replaced the secret Soviet privileges. These main reasons and illegal accumulation of initial capital gave rise to dramatic growth of criminality (Fig. 4).

Figure 4. Total Number of Crimes Falling to 100 Thous. Inhabitants in Lithuania, Poland, Hungary and Bulgaria



Carrying out reforms, the social sphere was of secondary importance and it was considered that rapid economy growth had to be achieved first of all and then social welfare of inhabitants

and salary increase could be cared for. Most citizens the idea of well-being refer to housing, job, common financial situation, health, and leisure (Ziliak, 2002). In Lithuania, real salary was very low because of strict fiscal policy. In 2002 it was approximately 8 times lower than the EU average and this preconditioned degradation of the national labour potential and emigration. Estimation of exact numbers is practically impossible but based on different sources from 300 to 500 thousand people have emigrated to other countries.

Housing provision is one of the most essential needs of a human being related to human right guarantees and human resource preservation and development, which has impact not only on the standard of living in the state but also pre-determining economic, social and demographic consequences. Housing privatisation was very rapid and hasty if compared with other transitional countries of Central and Eastern Europe (Statistical Yearbook..., 2000). In 2002, 97.6 % of the total housing stock was private.

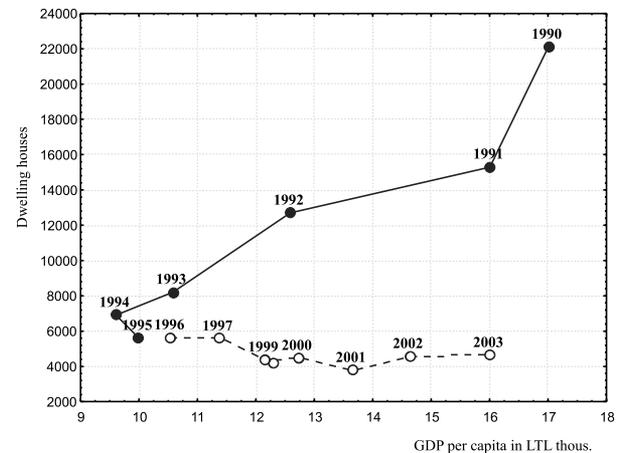
Since 1990, the annual volume of construction has been going down, resulting in decreasing contribution of housing construction into national economics and its strengthening. This has influence on deepening of social and economic problems.

The number of dwelling houses built in 1998 (4176) is 5.5 times lower than that of dwelling houses built in 1990 (22 100) (Housing and Dwellings..., 2003). The highest reduction in the construction of dwelling houses is seen in 2001. In 2002, the number of dwelling houses started going up. The annual construction of new dwelling houses accounts for 0,3 per cent, and the annual turnover reaches 2.7 per cent of the existing housing stock, meanwhile the average indicators of other EU countries is 1.5 and 3.5 per cent accordingly.

Negative changing direction of number of completed dwellings was connected with economical changes in State, which have been measured by changes of real GDP (Fig. 5). However, Fig. 3 shows that increase in GDP had not direct impact on the growth of dwelling house construction.

Fig. 5 reveals that starting with 1995 the rapid decrease in the construction volume stopped but more rapid growth was not achieved before 2005. The link between these two indicators is statistically significant only in the period 1990–1994. It is defined by linear regression equation $y_i = -11905.6 + 1876.8x_i$, $i = 1, 2, \dots, 6$. Both coefficients of the equation are statistically important (at 5% significance level), and the coefficient of determination is $R^2 = 0.92$.

Figure 5. The Change in Dwelling Houses that Have been Built and GNP at Constant Prices 2000 per Capita in Thousand Litas



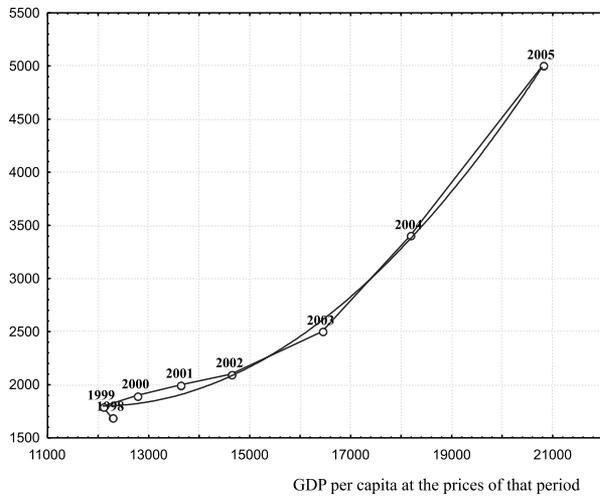
Since 1995, the slope of the regression line equals zero, and regression analysis is of no use in making prediction of dwelling houses from GNP.

In transit period migration of population from regional centres and rural areas to major cities of Lithuania became more active. Migration of educated and socially active population to the cities creates extensive preconditions for bigger disproportions in social and economic development of urban and rural areas. This is preconditioned by the lack of skilled employees, decline of the layer of people with higher and college education or transfer of their activities to the cities that grant a better living quality and more career opportunities (Counties of Lithuania, 2002; 2003; Burinskiene, Rudzkiene, 2004).

Emigration of these inhabitants from regions to major towns resulted in even higher lack for housing in several major towns of Lithuania: Vilnius, Kaunas, Klaipėda where most constructions of housing took place. In 2002–2005, small volume of construction, growing GDP and better credit conditions resulted in significant rise in prices. Fig. 6 shows a ratio of GDP and the average price of newly built apartments with partial finishing in Vilnius (Fig. 6).

After approximation of the curve seen in Fig. 6 applying polynomial regression, equation $y = 0.000042x^2 - 0.998x + 7801.6$ is obtained. The determination coefficient of this equation is $R^2 = 0.996$ which shows that this equation describes 99.6% of the change in the average price of newly built apartments with partial finishing in Vilnius in 1998–2005. Since 2006, growth in the apartment prices in Vilnius started slowing down, and talks about a price bubble and its possible explosion ever occurred.

Figure 6. The Ratio of GDP Per one Inhabitant at the Prices of That Period and of the avverage Price of Newly Built Apartments with Partial Finishing in Vilnius



Source: International Property Advisers Resolution.

During the transition period the reduction in construction volumes was conditioned by lower direct financing by the state, which has not been compensated by the private sector. That was influenced by lower income of inhabitants, high expenses for new infrastructure, limited supply of land plots for construction, unsolved issues of property return. The performed studies assess construction of new dwelling buildings as insufficient due to high prices and lack of diversity.

4. Transition period and knowledge economy

It is universally acknowledged that knowledge will condition further development and future competitiveness of economy. This fact is continuously emphasised by the European Commission and the European Council planning strategies to achieve the goal adopted in Lisbon in 2000, i.e. to create knowledge-based economy in the European Union by 2010.

Setting of advance assumptions is one of the key conditions for development of successful strategies. A complex system theory states that processes are generated by formation of necessary premises [Kauffman, 1995]. What preconditions are necessary for success of the strategy and at the same time of the whole organisation or event the state? Usually, when developing or presenting strategies, contemplations are related to desirable result rather than to assumptions that precondition occurrence of the result. In this was a complicated artificial system is constructed but no efforts are laid to perceive and create conditions

for the occurrence of this system [Davenport, Prusak, 1992; Burinskiene, Rudzkiene, 2006].

Did processes of transition period create conditions for stronger knowledge economy? Importance of knowledge for the economy changes together with the development of technologies, thus definition of knowledge may not be unambiguous or permanent. Today it is often stated that expenditure for R&D, IT infrastructure, human resources and related fields are the main indicators of knowledge.

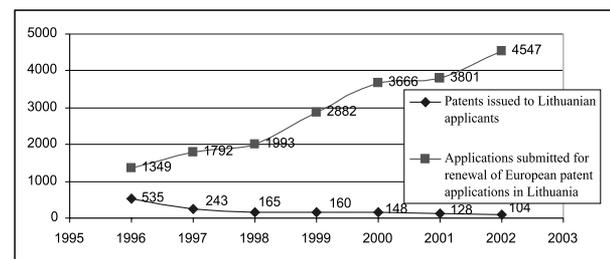
Distribution of knowledge among the states all over the world is very uneven.

In 1999 the World Bank stated that the real gap among and inside the states exists, thus an essential condition for the national economy is reduction or at least stabilisation of this gap. “Typically, developing countries have less of this know-how (i.e. knowledge about technology) than industrial countries, and the poor have less than non-poor.” (WB, 1999). The real gap among and inside the states exists, thus an essential condition for the national economy is reduction or at least stabilisation of this gap.

When knowledge becomes the grounds for economy, the intellectual property protection gains an increasing meaning. Selling trademarks, licences, software, carrying out examinations, providing education the developed countries earn billions and increase the gap between developed and developing countries. The developed countries strengthen intellectual property protection, thus the countries that lack behind in the formation of knowledge economy pay a big price. Actually, the developed states with large scientific and military potential make use of their power when protecti8ng their interests in the liberal market economy.

Fig. 7 gives Lithuania’s indicators of intellectual property protection in the transit period (based on the data of the Department of Statistics of Lithuania):

Figure 7. Patents Issued to Lithuanian Applicants and Applications Submitted for the Renewal of European Patent Applications LR 1996–2002



Curves given in Fig. 7 show that in 1996–2002 the number of Lithuanian applicants, patent appli-

cations and issued patents decreased, while renewal of patent applications of foreign states expanded. What systematic preconditions account for such trends?

In 1995–2005 Lithuania increased funds for R&D from 0.46% to 0.76% of GDP. These numbers are much lower than the EU average which is about 1.9% of GDP. Taking account of the fact that in Lithuania GDP per one inhabitant is more than twice lower than the EU average, it is obvious that in Lithuania research becomes narrower and looses its position. Problems are caused not only by emigration of researchers but also by the fact the researcher's career has lost its attractiveness. The main problems arise due to low salaries and under-financing of research. Because of low salaries the brightest graduates are apt to choose business, commerce or banking rather than research. In Lithuania, the average gross monthly salary of researchers is close to the average salaries thus most researches need some extra job.

No doubt, Lithuania has achieved a lot in the complicated transition period by liberalising economic relations, restructuring national economy, implementing resource efficient technologies and reducing environmental pollution. However, recently it has become clear that Lithuania keeps loosing its previous potential in education and science, while its social problems remain unsolved. To deal with these problems reforms must be introduced by increasing capacities and potential of R&D, infrastructure and education making use of the EU Structural Funds.

Conclusions

1. Vast privatisation of the major industrial enterprises at the beginning of the transition period, loss of markets, growing prices of raw materials, ignorance of marketing principles made many major enterprises to discontinue their activities or to restructure their production which resulted in huge unemployment and rapid decrease of GDP. Several years later, the enterprises that had survived managed to introduce innovations, install new technologies and significantly reduce energy consumption for production of the same amount of products, which also resulted in lower environmental pollution.

2. Non-transparent privatisation, rapid increase in unevenness of income distribution, moral decline of society, decay of previous social norms caused a sharp growth of criminality in the Baltic States and other states of the Eastern Europe that underwent economic transformation.

3. Low salary, unemployment, poor quality of life were reasons for migration from villages and small towns to the major towns. This in its turn resulted in the lack of apartments in the

major towns. However, because of poor credit conditions, missing land return documents and lack of private initiative, construction of housing went down several times. The economic growth that has started, the increasing GDP and better credit conditions in towns caused increase in housing prices.

4. Poor quality of life, low incomes and inefficient social security system, and disappointment in reforms were the caused for vast emigration which may not be stopped even by the improved economic situation.

5. Processes of transition period have not created conditions for stronger and developed knowledge economy. Because of limited funds allocated for R&D, small salaries of researches, the profession of a research has been loosing its status and previous potency in science and education.

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KOMPLEKSINĖS SOCIALINĖS-EKONOMINĖS SISTEMOS PEREINAMOJO LAIKOTARPIO TRANSFORMACIJOS PROCESŲ ĮVERTINIMAS

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Santrauka. Straipsnyje nagrinėjami centralizuotos planinės ekonomikos transformacijos į laisvos rinkos ekonomiką sukelti pokyčiai ir tendencijos. Tokia transformacija turi įtakos ne tik ekonomikai, bet ir visai socialinei sanklodai, nes svarbiausias transformacijos elementas yra privatizacija. Todėl vertinant pereinamuosius procesus būtina taikyti modelius, vertinančius ne tik ekonominę sritį, bet ir kitus aspektus: gyvenimo kokybę, technologines ir žinių inovacijas, ekologines problemas. Straipsnyje pateikiami apibendrintų rodiklių modeliai, kurie įvertina jų koreliaciją bei laiko pokyčius. Analizė pagrįsta empiriniais duomenimis: bendruoju vidaus produktu, energijos suvartojimu, nusikalstamumu, gyvenamųjų namų statyba ir kt. Sudaryti sudėtiniai modeliai leidžia kompleksiskai pažvelgti į pereinamojo laikotarpio sukeltas problemas, įvertinti jų įtaką tolesnei žinių ekonomikos raidai.

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