BASICS OF DEVELOPING A COMPLEX MODELS OF DIGITAL TECHNOLOGIES FOR REGULATION OF RELATIONSHIPS IN THE RURAL LABOUR MARKET

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Abstract: The article researches the foundations for the development of a complex of models of digital technologies for regulating relations in the rural labour market in labour-surplus regions in the conditions of the functioning of a socially oriented market economy.

It proposes interrelated stages of complex modeling of digital technologies for regulating social and labour relations in the rural labour market: the goal and the list of problem-optimization problems to be solved are identified, the type of economic and mathematical models is selected, a complex of models (CM) and their consistency are developed, the CM proposed methods of solution are identified, the collection, analysis and assessment of the reliability of the necessary information are conducted, computer validation developed by the CM is conducted, software options are selected, a comprehensive analysis of the obtained computer results, a strategy for the effective implementation of digital technology in the research object is developed.

In this work, on the basis of the abovementioned stages, it is recommended to develop digital technologies of CM for regulating relations on the main problems in the object of research: improving the demographic-social basis of the formation of the rural labour market, optimizing the economic indicators of the formation of the rural labour market, achieving a match between the demand and supply of labour and their optimal social-economic regulation, increasing the dynamics of inter-sectoral movements of labour resources, ensuring the proportionality of jobs with labour resources, reducing the level of rural unemployment, formation of rational

employment of the rural able-bodied population, effective development of the rural labour market and the rational use of the rural labour resources.

Key words: Digital economy, digital regulation technologies, rural labour market, a set of models, optimization models, econometric models, simulation models, economic and statistical models.

Introduction

At present, in the Republic of Uzbekistan, the study of world trends and global opportunities for the development of the digital economy is of particular relevance [4,5]. Further prosperity, the prospects of the state and the success of large-scale socio-economic, organizational and legal reforms largely depend on the introduction of digital technologies.

In this regard, resolutions of the President of the Republic of Uzbekistan Mirziyoyev Sh.M. "On measures for the development of the digital economy in the Republic of Uzbekistan" dated July 3, 2018 and "On measures for the widespread introduction of the digital economy and e-government" dated April 28, 2020 were introduced.

A key factor in the success of digitalization processes is the availability of a sufficient number of highly qualified personnel, appropriate jobs, as well as a training system for specialists with certain competencies for the development and implementation of digital technologies, which are ensured on the basis of the effective functioning of the labour market.

The transition to a digital economy is fundamentally changing the labour market, as digital skills become critically important from the point of view of employers along with the spread of information technology in all spheres of life, A massive transformation in talent requirements is also expected, as many operations that have not been affected by previous waves of digital adoption which maybe be automated in the near future.

Big data analytics is becoming a main competency that will determine the specific benefits of companies in the future. The ability to work with large arrays of

structured and unstructured information allows companies to improve the quality of demand forecasting, optimize processes and etc.

The introduction of digital technologies in Uzbekistan leads to significant changes in the demand and supply of labour in the labour market, also radically transforms the regulation of social and labour relations into it. Therefore, it is necessary to conduct scientific research on the development of a set of models (CM), which will allow the implementation of mathematical support of digital technologies for regulating relations in the labour market, especially in the labour-abundant rural regions of the republic, where more than 60% of the working-age population lives and more than 15% are unemployed.

Research methodology

In mathematical arsenal of Digital Technology that is regulated by the economy does not have enough experience in the development and testing of complex models, which are firstly used in complex analysis and forecasting of economic and social indicators, and in finding their optimal values in the planned period [1,2,3]. At the same time, foreign scientists studying this area have developed a CM at the levels of the national economy, inter-sectoral complex, territorial systems, industry and enterprise [7,8,9,10, 11,12]. In connection with the transition to a digital market economy, the importance of the latter has significantly decreased. In this case, there is an urgent need to develop a CM, reflecting the processes in digital technologies for regulating the economic, social and demographic development of economic entities of market economy in the analysed and forecasted periods.

Regulated rural market economy in the context of the labour technology (CLT) is the least explored part of an integrated modelling. The main reason for this is the multidimensionality (economic, social, demographic, organizational, legal and etc.) and the complexity of modelling the relationship between employees and employers in rural areas, especially in regions with a surplus of labour.

Research findings

In the previous section, the first attempt to the integrated modelling of digital technologies for regulating relations on the CLT are made, and the mechanisms of their functioning are developed.

The rural labour market is a new object of complex economic and mathematical modelling of socio-economic and labour relations regarding the hiring of employees by employers [6, p. 87]. Under influences of many factors and conditions in this market there is sale and purchase "capacity for work" for employed and unemployed working age population on the basis of mutually beneficial individual and collective labour agreements. The mathematical formulation of individual components of the regulation of relations on the CLT does not lead to increase the adequacy of economic and mathematical models.

Regulation of relations the labour forces (LF) and working places (WP) in rural markets depends not only on the level of demand, supply, pricing, competition and other elements of the market economy by hiring employees, but also on the existence of economic, demographic and social potential in the labour-surplus region.

At the same time, the effective functioning of various forms of CLT is largely determined by the optimal regulation of employment of the rural working-age population by the relevant state and territorial management services with the help of optimal parameters (regulators and mechanisms) of the impact obtained as a result of approbation of the corresponding economic and mathematical apparatus and methodological provisions.

Research in general as well as the reaction and all the factors, conditions generate needs for the application integrated simulation digital technology regulation relationship CLT based on optimal use of the achievements of domestic and foreign economic and mathematical modelling and computer equipment. Complex modelling is carried out on the basis of interrelated stages of mathematical economics.

In the first stage, the list of objectives and problem-solved optimization problems using a " tree-purposes " digital technology regulation of relations in

the CLT in a labour surplus region. The main goal of integrated modelling is to develop a scientific concept and optimal options for the development of CLT in the interaction of the main components of market economy. The main problem-optimization tasks include: determining the optimal options for the formation and development of CLT (z01); formation of a rational structure of employment (z02); assessment of the scale of labour supply (z03); determining the volume of demand for labour (z04): studying the relationship between demand and supply of labour and optimizing their regulation (z05); study of the proportionality of jobs with labour resources (z06); conducting a multi-criteria assessment of the rational use of the rural labour force (z07); system analysis and forecast of the state of unemployment (z08); study demo-social basis for the formation of the rural labour force market (RLFM) (z09); determination of economic indicators of the formation of the rural labour market (RLM) (z10), as well as drawing up inter-sectoral balances for labour (z1 1). The above optimization tasks can be subdivided into several subtasks.

In the second stage, the choice of the type of economic and mathematical models is carried out. The study shows that the most appropriate mathematical apparatus for the optimization problem z01 is a set of simulation models, z02, z0 5, z0 6, z07 - optimization; z03, z04, z10 and z1 1 - econometric, z08 - multifactorial and z 0 9 - economic and statistical, and z1 1 inter-sectoral (balance). At the same time, it should be noted that in the solution z08 it is possible to apply the models of the theory of queuing, which make it possible to determine the parameters of the elimination of queues of the unemployed in the employment of surplus regions.

In the third stage the CMs will be developed and their consistency, to which can be delivered: economic and statistical models demo-social bases forming SRRS (DEMOSOC); inter-sectoral models of movement of labour resources and labour costs (MOV-T) econometric models of the main economic indicators of CPPM education (ECONOM), labour supply and demand (SPROS RS , PRED RS); optimization models of socio-economic regulation of

demand and supply of labour (REG SP), is proportional to s working places with human resources (RR RMTR), generating the rational employment of the rural working-age population (RZANY) and rational use of labour resources (RISPOL TR); multivariate models for the analysis and forecast of the level of rural unemployment (BEZRAB) and the simulation system of models for effective development of CLT (RCLT) (see Fig. 1).

The described CM is being developed according to the principle of targeting digital technologies for regulating relations in the rural labour market. At the initial stage of development, CM closely interacts with models of economic and demo-social development of rural labour-surplus regions, as well as cross-sectoral models of labour costs.

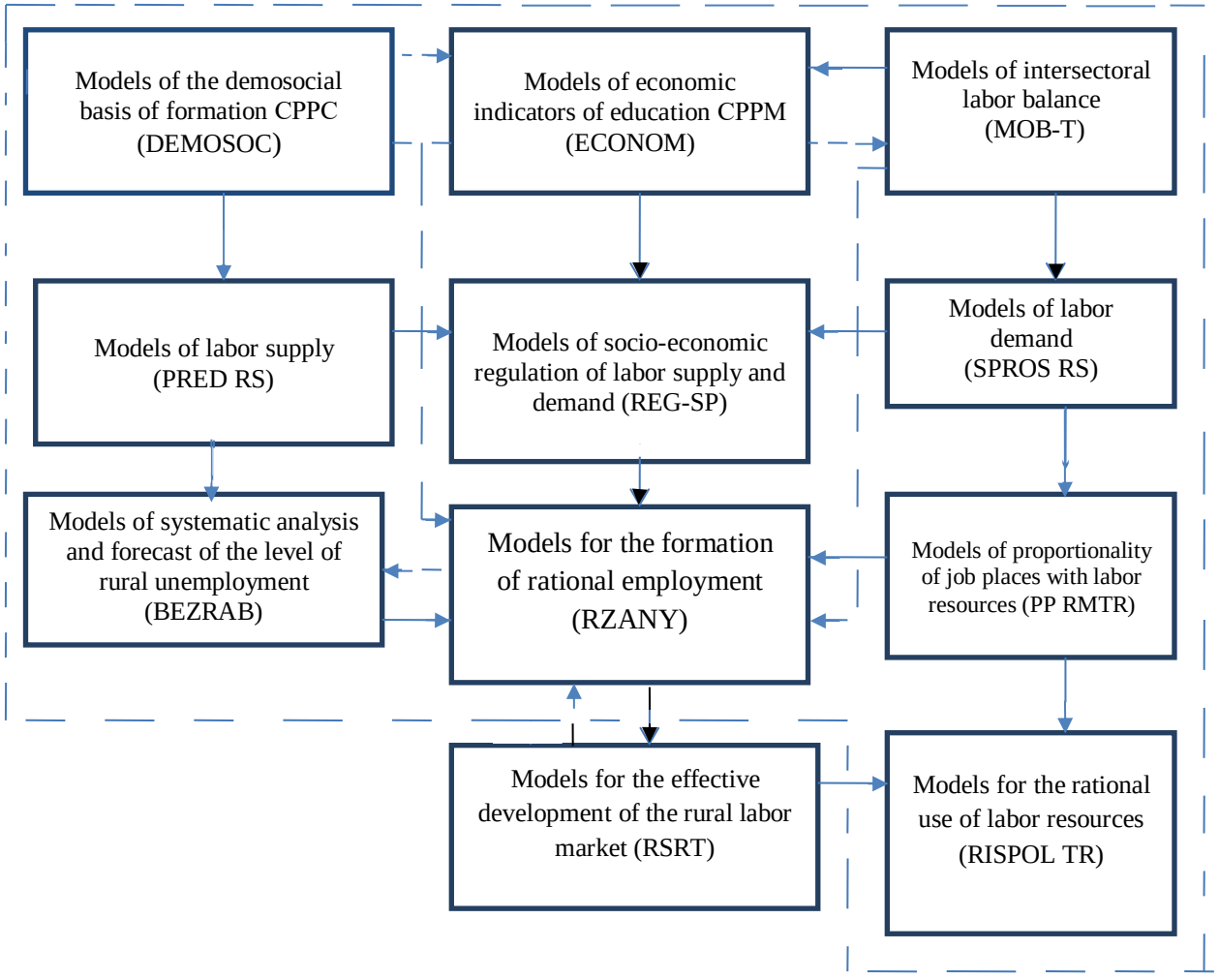

Figure 1. Diagram for the information interconnections of an integrated set of models of digital regulation technologies in the rural labour market.

main information flow;
auxiliary information flow.

In the development of CM, CLT is knowingly applies reflex approach [2, p.39]. It fully takes into account the internal (Vi) and external (Wi) conditions of regulation of the CLT subsystems. CM is developed according to the type of Vi Wi and based on this approach the main attention is paid to the internal conditions of the development of subsystems of the CLT. In its application to CM a subsystem typically stands out, which is described with the requisite degree of detail Vi of its functioning, and other subsystems and their connection to each other and with the investigated subsystem represented aggregated.

The development of the reflex approach is largely due to applied problems, the need to study individual subsystems as part of a single CLT.

The main feature of the reflex approach, as shown above, is a detailed description of the main subsystems and the aggregation of the rest of the CLT. When finding a solution to the reflex model for one object, iterative approvals are not required: it is only necessary to establish links between the “inputs” and “outputs” of the detailed and aggregated subsystem of the CLT. A much more complicated and insufficiently studied problem is the combination of conditions and solutions of several reflex models in which different objects are described in detail.

The reflex approach of CM agrees with each other on a horizontal connection, i.e., the output information of one model serves as the input data of the subsequent model and together form the models of the development of the CLT.

In the fourth stage, the methods of solution of a proposal 's CM for the regulation of relations in the CLT labour surplus regions, which include linear and block programming, machine imitation, correlation-regression analysis and others. Based on the nature of the formulation of the problem and its corresponding model, one of the listed methods will be applied. Synthesizing (main) simulation system of its exogenous parameters CLT models of development formed at the expense of output information rational employment patterns of demand and supply of labour and socio-economic regulation, proportionality working places with labour resources, analyses and forecasts the unemployment status, economic

and demo-social development of the workforce, inter-sectoral balances of labour expenditures, they are tested through applying the method of computer simulation.

At the same stage of complex modelling, special algorithms are developed for translating the listed models into machine language, and the possibilities of using application software packages (ASP) are explored. In case of insufficiency of the ASP, new software products will be used and analysed.

In the fifth stage, the collection of data, analysis and evaluation of the reliability of necessary information intended for realising to the CM CLT. The problems of its information security are successfully solved through specific marketing, statistical and sociological research.

It the sixth stage that the computer testing of the developed CM is conducted, where the produced software products and reliable information on the economic, demographic and social development of the studied labour-abundant region are optimally used.

It the final stage of complex modelling, a comprehensive analysis of the obtained computer results is carried out, on the basis of which the concept of a digital technology for regulating relations on the CLT is developed, which includes optimal calculations (options) for the formation of a rational structure of employment and the achievement of a natural (permissible) level of unemployment in labour-abundant regions.

Discussion of the findings

Now let's consider the operation of the process to the CM CLT, in other words, the order of model estimations. The estimations start with the DEMOSOC block model. After their testing, the data on fertility, mortality, the average length of life skills education, mechanical movement, the age structure and the number of the sex of the rural population directly supplies the block models PRED RS and SPROS RS.

Next, using the block models SPROS RS and PRED RS carried out the estimations for determining the appropriate supply and demand on the labour forces in different sectors and forms of ownership in the rural economy. These units come estimates of the amount of the basic production assets and the level of their use, wages, prices, labour costs and other necessary economic data obtained from testing of the block models ECONOM and MOU-T. Block model MOU-T allows determine the proportion between the costs of labour and materials, which improves the degree of validity of model calculations of blocks SPROS RS, PRED RS, REG SP and PP RMTR.

In testing CM and CLT, the important point is the calculate data on the release of workers from agriculture and other sectors of the rural economy resulting from the testing unit models BEZRAB. The output parameters of the last block characterize the number, structure and types of rural unemployment.

In case of changes of prices, supply and demand on the labour forces have carried out economic and social regulation of the main components of the formation of rural labour markets and jobs on the basis of the output information obtained by calculations of block models the REG SP.

The output data of the listed models comes first to the summary models of the rational employment formation unit (RZANY), then to the rational use of labour model (RISPOL TR).

Approbation of the CM is completed when, with the help of the main and auxiliary information flows, computer simulation calculations are made according to the RSRT model to determine the optimal options for the development of various subsystems of the SRT in the studied labor-surplus region.

CM and CLT are intersecting. This means that a number of indicators are the result of calculation according to two or more models, each of which enhances one or another aspect of reality. For example, the input parameters of the models of the SPROS RS block are mainly formed as a result of calculating the models of its four sub-blocks. In the process of coordinating

the indicators, the probability of the models correctly reflecting the actual state and dynamics of the development of CLT increases.

Conclusions

CM allows to conduct estimations for the intended purpose. In particular, according to the given target settings and indicators reflecting the formation of a rational structure of employment with an acceptable level of unemployment in the conditions of effective development of CLT in labor-surplus regions, one can find a number of optimal options for socio-economic development or their combination, with the help of which it will be achieved. A wide range of instrumental parameters of the models is used for this purposes.

CM forms a certain integrity, which means that calculations for it makes it possible to get something more than calculations for each model separately.

Approbation of CM, CPT enriches the information base of other models of the digital economy. For example, in the BEZRAB block model, the output can be the number of trained unemployed in certain professions, which is one of the main conditions for the formation of RZANY block models.

An important advantage of CM is the relative ease of its software and mathematical support. The difficulties associated with the algorithmization and programming of large nonlinear models are well known; their implementation is often difficult even for modern computer technology. CM CPT allows to eliminate these difficulties. It allows for fast algorithmization and programming of models, some of which are non-linear.

At the same time, it should be noted the available limitations of the developed CM. Although it implements both resource and target approaches, the latter is fairly weak. This is expressed, firstly, in an insufficient degree of substantiation of social needs, since the complex does not include models for determining the standard of living and poverty of the rural population; secondly, in the impossibility of identifying and solving on its basis all the socio-economic problems that arise in the conditions of the development of market relations in rural areas of labor-surplus

regions. The limitation of the developed CM is also in the predominance of cost indicators in it to the detriment of natural ones.

The above mentioned shortcomings of the complex modeling can be eliminated by developing additional models of digital technologies for regulating the social and economic development of the rural labor-abundant regions.

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