Institutional modeling of the management system of regional participants in dual education in the context of neoindustrialization

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Abstract—The initial prerequisites for writing this article were the multiple tasks of forming an effective management system for the regional participants of the dual model in the context of new industrialization. The dual model is one of the most effective tools for reducing the “competence gap” caused by neo-industrial transformations. The main purpose of this article is the scientific substantiation of the choice of the institutional model of managing regional participants of the dual model in the context of neo-industrialization, as well as the assessment of its usefulness for individual participants: enterprises, government agencies, students and educational institutions. The methodology for the formation of an institutional model is based on the principles of the theory of utility, so the authors posed and solved the scientific problem of formalizing the utility of participation in the dual education model for individual stakeholders in the form of specific indicators. As a result of the study, the main targets of regional participants in dual education were identified and formalized in the form of specific indicators, two types of models of management of regional participants in dual education were identified: using and without using institutional superstructures, a quantitative study was conducted of the utility indicators of participants in dual education, which resulted in the formation of an institutional model for managing regional participants in dual education in the context of neo-industrialization.

Keywords — Neoindustrialization, dual education, institutional modeling, integrated indicator, utility, management model, target vector, secondary education, institutional superstructure

I. INTRODUCTION

A systematic look at the phenomenon of new industrialization, taking into account its historically-determined nature, allows to consider the works of J. Galbraith (“New Industrial Society”), D. Bell’s ideas about “post-industrial society” as the theoretical basis for the formation of a neo-industrial model of economic development as an independent type of society transformation, also researches of E. Toffler on the “super-industrial civilization”, as well as the work of Russian scientists V. Inozemtsev, Y. Yakovets and others [1].

At the level of regions and territories, the timing and socioeconomic effect of the new industrialization is directly determined by the results of the investment policy, as noted in the work of E.G. Animitsa and Ya.P. Silin: “the new industrialization in the economic space of the Sverdlovsk region implies not only a fundamental renewal of fixed assets, it also requires large-scale investments in the creation of new production infrastructure, in resource-saving solutions, in the development of new technologies and the transfer of foreign, the training of new personnel, the formation of a new organizational and production process, and even the emergence of a modernized person — both a producer and consumer of fundamentally new products, goods and services [2].
All researchers of long-term economic development trends are united by the idea of technological conditionality of changes related to human resources. S. Kergroach notes the special influence on the labor market of the fundamental digital transformation of production [3]. A more detailed justification of the connection between the development of regions and the availability of qualified personnel is presented in [4, 5]. Since the mid-2000s, the concept of “gap” has entered the concept of knowledge management in the sense of the “knowledge gap”. Analysis of the gap in knowledge and skills, the gap in competencies as a method of systematic assessment of the level of knowledge and skills (competencies) allows not only to quantitatively compare the competence model of a graduate and the competence model of a specialist (job profile), but also to develop and implement an individual program of knowledge and skills development competencies with the goal of bridging the gap [6].

Assessing the institutions of development of the professional labor market, business representatives highlight the issues of participation of enterprises in the implementation of projects on vocational guidance for schoolchildren - 37.6, and in the second place of the rating with a small margin of 2% is the promotion of the best experience of partnership of industrial enterprises and educational institutions on practice-oriented dual education - 35.6%.

The purpose of this article is to substantiate the methodological basis of the institutional modeling of the management of regional participants in dual education. As a key criterion for choosing a model of management of the dual education system in the region, the authors propose the use of a criterion for maximizing the integrated utility indicator for participants in the dual model.

II. THEORETICAL AND METHODOLOGICAL BASE OF RESEARCH

The basic source of information for studying the institutional model of management is data on the organization of the management system in Germany. According to the work of Thomas F. Remington [7, 8], about 20% of firms offer training in manufacturing, most of which are small and medium-sized businesses. Corporate industrial academies such as Volkswagen, Siemens and Bosch have corporate training academies and workshops, other enterprises are included in the system of dual education, formed in accordance with the contingent of students based on the staffing needs of educational institutions and upon completion of training, carry out registration and independent assessment of students' qualifications in the learning process, train teachers, carry out an assessment of the level of knowledge and skills (competencies) with the goal of bridging the gap.

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number of employers who do not have the resources for industrial training, their functions are usually performed by industry associations.

The participation of state authorities of the region in the dual education model is determined by the following goals: ensuring the balance of supply and demand on the labor market, forming additional positions in the region’s investment attractiveness ratings and solving the problems of the vocational education system's effectiveness [29]. Being the main customer in the system of secondary vocational education, the state authorities are interested in the gradual transfer of this function, and accordingly the cost of employers. The dynamics of this process is quite obvious in the basic industrial sectors, when the participation of corporations allows for the loading of institutions of secondary and primary vocational education. At the same time, without state participation it is impossible to effectively organize the process of transition from general to professional education.

Corporate participants exist in the harsh conditions of global competition [18] and the transformation of governance structures and labor organization. As a rule, dual education schemes fall into the general target vector of increasing labor productivity and reducing production costs, namely, training costs. Financing of secondary vocational education remains a state prerogative, while the participation of companies at certain stages of designing a dual education system is not capital-intensive and allows to get an employee with a clearly higher competence. The main goals of participation of corporate structures in the dual education model include targeted training for specific workplaces with specified competence characteristics, reduction of terms and costs for the adaptation of new employees and costs for additional training.

The interest of students in participation in dual education programs is due, above all, to job security at partner enterprises, which allows them to overcome the risks of structural changes in the labor market that may arise during the training period. However, the absence of a wider universal education can adversely affect the life prospects of a graduate, in many ways putting him at risk if the employer can be closed.

The interest of educational organizations in the implementation of dual education programs is due, above all, to receiving assignments for students to learn from the region’s employers and to update the material base. The situation in the markets related to the field of education is described in more detail in [19], which shows that the sphere of activity of the institutions of primary and secondary vocational education is quite competitive. Accordingly, the formation of long-term strategies should include a system of dual education, allowing the moving to receive resources directly from partner employers.

Identifying the goals of the main participants in the dual education system in the region allows us to form a comprehensive indicator of the participants' utility, table 1.

Next, we consider the types of institutional superstructures found in the management systems of the dual model of education. The purpose of the formation of institutional superstructures is to simplify the process of interaction of the basic participants, to address issues of coordination in industries with a multi-segment structure and to perform the function of an independent assessment of the qualifications of graduates. Types of institutional superstructures responsible for coordinating the activities of the regional dual education system: chambers of commerce, business interaction centers and secondary vocational education systems, development agencies, coordination councils, etc.

| Category of participants | Characteristics of the participant’s objective function | Calculation formulas | Evaluation procedure |
|--------------------------|--------------------------------------------------------|----------------------|---------------------|
| Utility for employer companies TUe | Increase productivity | $K_1 = \frac{\sum q_1}{\sum T_1}$ | Evaluation characterizes the percentage of productivity growth costs of training personnel |
| | Reducing the cost of training | $K_2 = \frac{\sum S_1}{\sum T_1}$ | Evaluation characterizes the percentage reduction in the cost of training personnel |
| Utility for educational institutions TUe | The volume of orders for training by employers partners | $K_3 = \frac{Z_1}{Z_0}$ | Evaluation is formed according to the reporting of educational institutions. |
| Usefulness for state authorities TUsa | Balance of supply in the labor market | $K_5 = \frac{\sum d_1}{\sum s_1}$ | Evaluation describes the dynamics of the ratio of supply and demand. |
| Formation of additional positions in national rankings | | $K_6 = \frac{R_1}{R_0}$ | Evaluation characterizes the growth of the region’s |

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As a rule, such organizations should manage the process of implementing the dual model, provide support in government bodies, prepare normative documents, and it is possible to perform the functions of personnel needs assessment and some aspects of vocational guidance activities.

The second category of institutional superstructures is organizations that reflect the interests of regular participants, such as industry councils, associations, business associations, etc. These organizations perform a set of tasks related to the prerogative of employers in the dual process: participation in the formation of educational programs, the coordination of an order for training, the organization of industrial training, the formation of industry standards of qualifications.

In addition to the above types of institutional superstructures in the system of dual education, organizations are created that responsible for the independent assessment of qualifications in accordance with industry standards.

Summarizing the domestic and foreign experience of managing the dual model of education at the regional level, we can single out the two most common models differing in the number of institutional superstructures that implement the functions of the main participants in the dual model. When creating a regional management system for the dual education model consisting only of the categories of permanent participants, it assumes a high workload when performing the functions assumed by partner companies and educational institutions. This scheme of interaction assumes that both parties will invest significant time and material resources, respectively, such a scheme of work is expedient if it is possible to fully use the results. Within the framework of this interaction scheme, the company partners provide equipment, conduct training for industrial education masters, actively participate in the formation of professional educational standards and curricula, and evaluate the training of graduates. In turn, educational institutions conduct large-scale work on the adaptation of curricula to industry-specific professional standards, and retraining of teaching staff. The paper [21] presents the management system of the dual model, covering a variety of corporate participants and educational institutions. In this model, there are institutional superstructures organized according to a sectoral principle, covering the functions of streamlining the activities of educational institutions in accordance with the competence and qualification needs of the industry.

When implementing this scheme, partner employers do not incur significant costs in the creation of a training base and, as a rule, are limited to work on adapting curricula and organizing work practices.

The central role in coordinating the activities of regular participants is played by the formed institutional superstructures in the form of industry associations, chambers of commerce, etc., there is low cooperation between partner companies and educational institutions, the role of government bodies being the main customer in training. As noted in Helmer M., Conway M. (2014) [22], participants in the dual scheme make relatively modest investments of time and resources. The scope of their activity mainly affects the harmonization of standards required for the preparation of industry workers, the formation of industry councils, which later work with educational institutions in the field of adapting curricula to the needs of the industry [23]. It is also necessary to note the complexity of the institutional implementation of such a scheme, the preparation of the necessary regulatory framework governing the behavior of participants. Therefore, most of the workload is redistributed to educational institutions that adapt educational programs with the involvement of several companies-employers.

### IV. RECOMMENDATION PART

In accordance with the presented methodology, we will evaluate the institutional models for managing regional participants in dual education.

#### TABLE II. RESULTS OF COMPARATIVE EVALUATION OF INSTITUTIONAL MODELS OF MANAGING REGIONAL PARTICIPANTS OF DUAL EDUCATION

| Category of participants | Characteristics of the participant’s objective function | Model without institutional settings | Model with institutional add-ins |
|--------------------------|-----------------------------------------------------|------------------------------------|---------------------------------|
| Utility for employer companies TUs | Increase productivity | 1 | 0,56 |
| Utility for educational institutions TUs | Reducing the cost of training | 1 | 0,89 |
| Utility for state authorities TUs | The volume of orders for training by employers | 1 | 0,9 |
| | Improving the material and technical base at the expense of partner employers | 0 | 0 |
| Usefulness for students TUs | Balance of supply in the labor market | 1 | 1 |
| | Formation of additional positions in national rankings | 0,9 | 1 |
| Utility for students TUs | Employment in the company partners in the framework of the dual education model | 1 | 0,8 |
As can be seen from the table, the institutional model without institutional superstructures has the greatest utility for regional participants in dual education in the context of neo-industrialization. In our opinion, this is due to the narrow-industry specificity of the formation of this model, which is common, as a rule, in metallurgy, the fuel and energy complex and unites key employers and specialized educational organizations.

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