UDC 332
JEL: P25, P28, O2, R1, R11, R58

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PROVIDING RUSSIA'S AGRO-INDUSTRIAL COMPLEX WITH A HIGHLY QUALIFIED WORKFORCE AMID A SHIFT TO A "GREEN ECONOMY"

The shift to new conditions of economic management within the agro-industrial sector is setting new requirements for staffing. A highly qualified agro-industrial workforce is one of the key conditions for creating a platform for the transition from industrialization to environmentally responsible economic growth. However, not all existing agro-industrial workforce training and retraining programs are good enough to provide the labor market with specialists whose professional competencies include environmentally responsible context. Therefore, it is worth exploring the possibility of and prospects for reforming educational programs with a focus on training highly qualified specialists for the Russian agro-industrial complex. Methodologically, this paper is based on a content-analysis of research and statistical data which credibly characterize the latest trends in the development of Russia's agro-industrial complex. One of the most rational approaches to providing the Russian agro-industrial sector with highly qualified human resources with proper competencies in the area of environmentally responsible organization of activity may be based on the Triple Helix model. Based on the materials examined in this paper, a set of key conclusions have been drawn. Firstly, the environmentally responsible development of both the economy as a whole and its particular sectors and spheres, as well as the social sector, is a key condition for the physical preservation of modern civilization. Secondly, the Russian system of preparing the workforce for the agro-industrial sector still lacks sufficient focus on implementing the concept of environmentally responsible and innovation-oriented learning, which is causing the nation's agrarian regions to experience shortages of qualified manpower with a proper level of professional competence in the area of resource-effective nature management. The conclusions drawn as part of this work could be employed both at the macroeconomic level, for the purpose of working out various programs for the development of the Russian agro-industrial complex, and at the microeconomic one, for the purpose of enhancing existing methods and techniques related to corporate training. An in-depth focus on specific methodologies for organizing agro-industrial workforce training and developing the sector's manpower potential is beyond the scope of this work. This aspect will be the object of the authors' future research.

Keywords: agro-industrial complex, "green economy", environmental responsibility, sustainable development, manpower potential, Triple Helix model, corporate training, highly qualified workforce, integrated system, agrarian regions

Introduction

The evolution of various types of economic activity is an absolutely significant and immutable global trend within the framework of a new scientific/managerial paradigm — the green economy (Pearce, Markandya, & Barbier, 1997; Chapple, 2008; Ashton & Green, 1996; Dunleavy, 2013). This new paradigm, which is a logical continuation to the 'sustainable development' concept, represents the only possible evolutionary scenario that not only will help ensure the physical preservation of present-day generations but will also help conserve the base of future generations (including in the long term and beyond) (Dudin et al., 2016). To make the nation's transition to the new scientific/managerial paradigm "green economy" possible in the mid-term already, it will help to resolve the following objectives:

— ensure the implementation of environmental standards for activity within both the production and services/retail sectors. With that said, special attention ought to be devoted to processes of ecologization of the types of economic activity that are most aggressive to the natural system, including within the agro-industrial complex, which accounts for 20 % to 30 % (in some regions up to 50 %) of total greenhouse gas emissions released into the atmosphere[1]. And that is without factoring

[1] United Nations Environment Programme. (2012). Global Environment Outlook-5. Environment for the future we want. Retrieved from: http://web.unep.org/geo/sites/unep.org.geo/files/documents/geo5_report_full_en_0.pdf (date of access: April 2, 2017); Food and

in economic damage from the operation of these sectors (e.g., soil erosion, water body pollution, and declines in biodiversity) (Teece, 2016);

— create new integrated training and development systems for boosting the caliber of human resources sought after within the agro-industrial complex. Here, it is, above all, worth considering the possibility of joining up in educational processes the neoinstitutional and environmental paradigms so as to promote the sustainable encouragement of environmental responsibility (Menne, 2017).

Issues of environmental standardization are beyond the scope of this paper. At the moment, active work is being carried out at the statutory level with respect to creating a set of statutes on the environmental responsibility of corporations and entrepreneurs. With this in mind, the authors are focusing in this paper on working out a set of approaches to the development of relevant educational technology and improvement of the caliber of staffing within the nation's agro-industrial complex within the context of the transition from the traditional industrial to environmentally responsible (green) post-industrial economy.

The study of issues related to staffing amid increasing requirements for the environmental responsibility of corporations and entrepreneurs is increasingly gaining in relevance in light of the implementation of import substitution objectives. To be specific, just over the last five years livestock Russia's farming output has grown 30 %, and its crop farming output has gone up 60 %, while the nation's output of import-substituted food products has increased more than 70 %[2].

Concurrently with this, environmental organizations, those representing state interests and independent ones alike, are registering greater anthropogenic and technogenic strains on the ecology of Russia's agrarian regions[3]. Data from monitoring by RIA Rating make it possible to establish a close and direct correlation between the level of strain on the ecosystem and scientific/technical activity within a region (the greater the strain, the lower the level of scientific/technical activity[4]). This aspect also points to the need for transformations within the system of teaching, training, and retraining a workforce for the national agro-industrial complex.

Methods and information base

This paper employs content analysis and available scientific/educational and social/economic statistics to examine the interrelationship between boosts in the environmental responsibility of economic agents and the social sector (Fahimni, Bell, Hensher, & Sarkis, 2015; Dyckhoff, Lackes, & Reese, 2013) and the context of change of trends (Malhotra, 2001) within the systems of vocational and higher education, as well as the sphere of continuing education, of human resources employed within the sphere of agro-industrial and agricultural production. The paper's general methodological idea consists in that it is impossible to achieve boosts in environmental responsibility without altering the educational paradigm, where the overriding objective is not man's total subjugation of nature but the harmonious development of communities and ecosystems.

In other words, the anthropocentric idea of civilization's evolution ought to be replaced with the idea of biocentrism, which is totally in keeping with the concept of green economy. This concept is predicated on the following fundamental postulates (Pearce, Markandya, & Barbier, 1997; Chapple, 2008; Ashton & Green, 1996; Dunleavy, 2013; Fahimni, Bell, Hensher, & Sarkis, 2015; Dyckhoff, Lackes, & Reese, 2013; Malhotra, 2001):

Agricultural Organization of the United Nations. (2015). The state of food insecurity in the world. Meeting the 2015 international hunger targets: Taking stock of uneven progress. Retrieved from: http://www.fao.org/3/a-i4646e.pdf (date of access: April 2, 2017).

[2] Russian Federal State Statistics Service. (n.d.). Pokazateli, kharakterizuyushchie importozameshchenie v Rossii [Indicators characterizing import substitution in Russia]. Retrieved from: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/importexchange/ (date of access: April 1, 2017). (in Russian).

[3] Green Patrol. (n.d.). Ekologicheskii reiting subektov RF 2016 [Environmental Rankings of the Constituent Entities of the Russian Federation — 2016]. Retrieved from: http://greenpatrol.ru/ru/stranica-dlya-obshchego-reytinga/ekologicheskiy-reyting-subektov-rf?tid=291 (date of access: April 2, 2017). (in Russian); Federal Service for Hydrometeorology and Environmental Monitoring of Russia. (2016). Obzor sostoyaniya i zagryazneniya okruzhayushchei sredy v Rossiiskoi Federatsii za 2015 god [A review of the state of the environment and environmental pollution in the Russian Federation at year-end 2015]. Available at: http://www.meteorf.ru/product/infomaterials/90/?year=2015&ID=90 (date of access: April 2, 201). (in Russian).

[4] Green Patrol. (n.d.). Ekologicheskii reiting sub"ektov RF 2016 [Environmental Rankings of the Constituent Entities of the Russian Federation — 2016]. Retrieved from: http://greenpatrol.ru/ru/stranica-dlya-obshchego-reytinga/ekologicheskiy-reyting-subektov-rf?tid=291 (date of access: April 2, 2017). (in Russian); RIA Rating. (2016, October 20). Indeks nauchno-tekhnologicheskogo razvitiya sub"ektov RF — itogi 2015 goda [Index of Scientific/Technological Development in the Constituent Entities of the Russian Federation — 2015 results]. Retrieved from: http://www.riarating.ru/regions_rankings/20161020/630044723.html (date of access: April 2, 2017). (in Russian).

— transitioning to high-carbon to low-carbon energy within the nation's economy and social sector;

— rationalizing the consumption of primary resources and employing recycling to ease the strains on the eco-system and obtain secondary resources;

— conserving the natural environment with a view to providing for the needs of future generations and laying down the groundwork for their well-balanced life's activity;

— renouncing the domination of ultranationalist ideas in the governance of modern states and countries.

In addition, the paper draws upon some of the key tenets of the educational/managerial concept of the Triple Helix model (Etzkowitz & Leydesdorff, 1995; Etzkowitz & Zhou, 2018; Etzkowitz & Leydesdorff, 2000), which implies that the optimum development of the national economy, society as a whole, and its particular segments and strata could be achieved based on partnership-based cooperation among the state, the business, and the scientific/academic environment. A shift from the hierarchic form of interaction among these entities to a partnership could help create new reserves for economic growth based on a systemic/synergetic effect and not only help maximize revenue for entrepreneurs but also ensure increases in national wealth (Mutchler, Shih, Lyu, Bruce, & Gottlieb, 2015; Mehlhorn, Bonney, Fraser, & Miles, 2015; Sherrard & Alvarado, 2017). It is worth noting that nations which are integrated into the Organisation for Economic Cooperation and Development (OECD) are already using this model to stimulate national social/economic development. This facilitates the expansion of both internal and external markets. Empirical data indicate that OECD member states are characterized by greater levels of competitiveness both from the economic and social/educational perspectives[5].

Information/analytical data employed in this paper are from open sources available on the official websites of Russia's Ministry of Education and Science and Ministry of Agriculture, the Russian Federal State Statistics Service, and Eurostat, and resources provided by the BRICS coalition. In addition, the paper utilizes some data from independent Russian and foreign consulting and research agencies.

Results

The education level of personnel, and, above all, their erudition, is a crucial component in the competitive advantage of any business entity. Russia's agricultural sector is currently experiencing a shortage of highly qualified human resources. Table compares data for those employed within Russia's economy, agriculture, hunting, and forestry.

Table

Comparative Picture of Those Employed within Russia's Economy, Agriculture, Hunting, and Forestry Based on Education Level (% of the total number of employed citizens)[*]

Employment area	Education					
	higher	secondary-level vocational		secondary general	basic general	no basic general
		mid-tier specialists	qualified workers (office-based employees)			
Economy as a whole	32.2	25.8	19	19.2	3.5	0.2
Agriculture, hunting, and forestry	10.5	17.8	21.3	35.5	13.4	1.4

[*] Compiled based on: Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2015 g. [Labor and employment in Russia — 2015]. Available from http://www.gks.ru/bgd/regl/B15_36/Main.htm (in Russ.)

The above-mentioned dynamics are compounded with the age characteristics of those employed within the agro-industrial complex. An analysis of relevant information sources7 indicates that the average age of those employed in the sector has increased by 2.5 years and is now 43.7 years (Fig. 1).

[5] Centre for Human Technologies. (2016, December 28). Vsemirnyi ekonomicheskii forum: Reiting global'noi konkurentosposobnosti 2016–2017 [World Economic Forum: The Global Competitiveness Report 2016–2017]. Retrieved from: http://gtmarket.ru/news/2016/09/28/7304 (date of access: April 4, 2017). (in Russian); Centre for Human Technologies. (2016). Reiting stran mira po urovnyu obrazovaniya [World education rankings]. Retrieved from: http://gtmarket.ru/ratings/education-index/education-index-info (date of access: April 4, 2017). (In Russian).

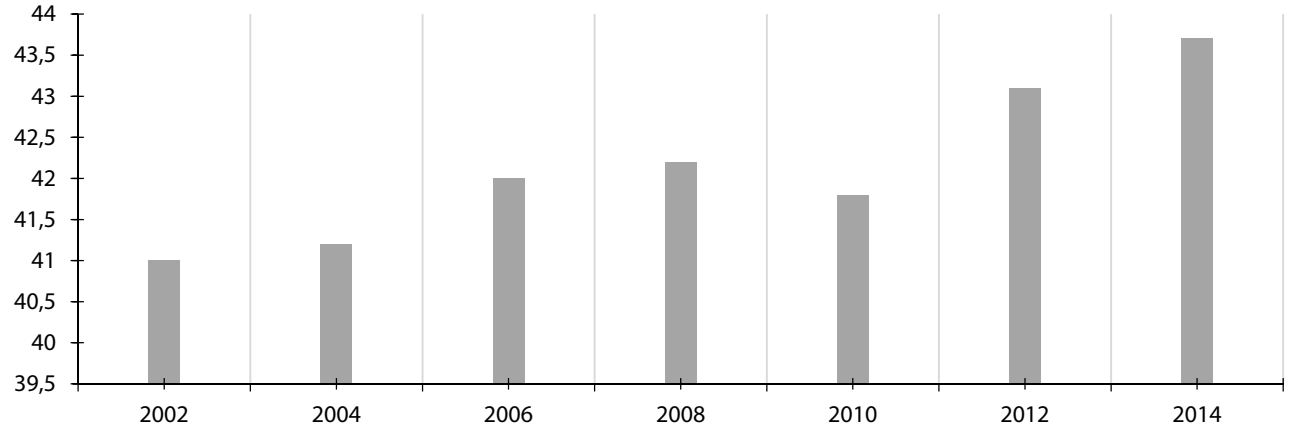

Fig. 1. *Change in the average age of those employed within Russia's agri-food complex in the period 2002–2014 (Compiled based on: Russian Federal State Statistics Service. (n.d.). Trud i zanyatost' v Rossii — 2003 g. [Labor and employment in Russia — 2003]. Available at: http://www.gks.ru/bgd/regl/B03_36/Main.htm (in Russian); Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2005 g. [Labor and employment in Russia — 2005]. Available at: http://www.gks.ru/bgd/regl/B05_36/Main.htm (in Russian); Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2007 g. [Labor and employment in Russia — 2007]. Available at: http://www.gks.ru/bgd/regl/B07_36/Main.htm (in Russian); Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2009 g. [Labor and employment in Russia — 2009]. Available at: http://www.gks.ru/bgd/regl/B09_36/Main.htm (in Russian); Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2011 g. [Labor and employment in Russia — 2011]. Available at: http://www.gks.ru/bgd/regl/B11_36/Main.htm (in Russian); Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2013 g. [Labor and employment in Russia — 2013]. Available at: http://www.gks.ru/bgd/regl/B13_36/Main.htm (in Russian); Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2015 g. [Labor and employment in Russia — 2015]. Available at: http://www.gks.ru/bgd/regl/B15_36/Main.htm (in Russian))*

The uptrend associated with a change in the average age persisted in a consistent manner through the period 2015–2016, with the average age of those employed in the agricultural sector reaching 44.3 years[6].

However, it is worth noting that, despite quite an unfavorable situation with regard to age-related changes, the nation delivered in 2017 a record grain harvest –135.4 million tons. This is a twofold increase in a five-year period.

In the period 2012–2017, the nation's production of wheat increased more than 2 times (85.9 million tons), buckwheat — 2 times (1.5 million tons), soybeans — 2 times (3.6 million tons), rape — в 1.6 times (1.5 million tons). The nation's harvest of vegetables rose 12 % (16.4 million tons), greenhouse vegetables — 1.6 times (922,000 tons). Its harvest of fruits increased 10 % (2.94 million tons).[7]

With that said, the unemployment rate in agriculture is no more than 8 %, and it is no more than 6 % in the nation's food production sector (on average across the period 2013–2016)[8].

It, however, may be worth giving a thought to what these indicators, which characterize the nation's current situation with respect to human resources as optimum, actually mean (from the perspective of education). Above all, attention should be drawn to the fact that, based on open data for 2015, the level of provision of the national agro-industrial complex with human resources with a suitable level of education is about 71 % in agriculture and over 78 % in food production (Figure 2).

In other words, a third of workers employed in agriculture do not have the level of education required for their occupation. The situation is slightly better in the food production sector, where only a fifth of all workers do not have a suitable level of education. With that said, the degree to which the agro-industrial complex is provided with human resources varies region-to-region. Based on state statistics, it currently is 82 %.

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[6] Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii — 2017 g. [Labor and employment in Russia — 2017]. Available from http://www.gks.ru/bgd/regl/b17_36/Main.htm (in Russ.).

[7] Aleksandr Tkachev prinyal uchastie v otchete Pravitelstva Rossii v Gosdume [Aleksandr Tkachev took part in a government briefing at the State Duma]. Retrieved from: http://mcx.ru/press-service/news/aleksandr-tkachev-prinyal-uchastie-v-otchete-pravitelstva-rossii-v-gosdume/ (date of access: (2018, April 11). (in Russian).

[8] Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii [Labor and employment in Russia]. Available at: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1139916801766 (in Russian).

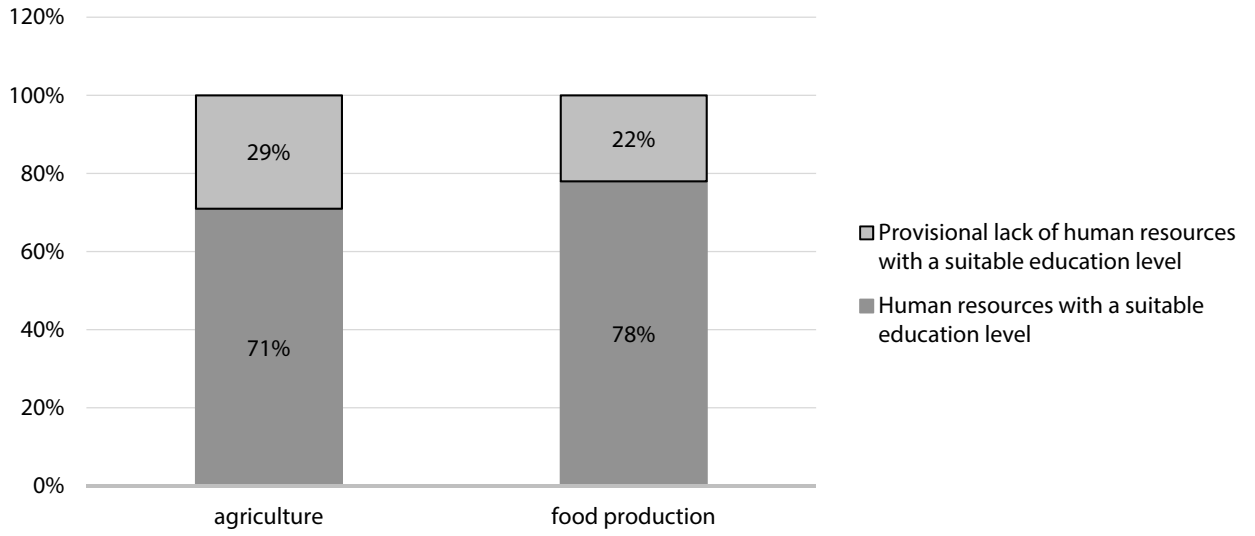

Fig. 2. *Human resources within Russia's agro-industrial complex based on education level (2015 data) (Compiled based on: EY. (n.d.). Obzor agropromyshlennogo kompleksa Rossiiskoi Federatsii [A survey of Russia's agro-industrial complex]. Available at: http://www.ey.com/ru/ru/about-us/ey-25-years-in-the-cis-knowledge-sharing-initiatives (in Russian); Deloitte. (n.d.). Tekushchee sostoyanie i tendentsii razvitiya agropromyshlennogo biznesa v Rossii — 2015 [The current state and trends in the development of Russia's agro-industrial business — 2015]. Available at: https://www2.deloitte.com/ru/ru/pages/consumer-business/articles/current-issues-of-agribusiness-in-russia-2015.html (in Russian))*

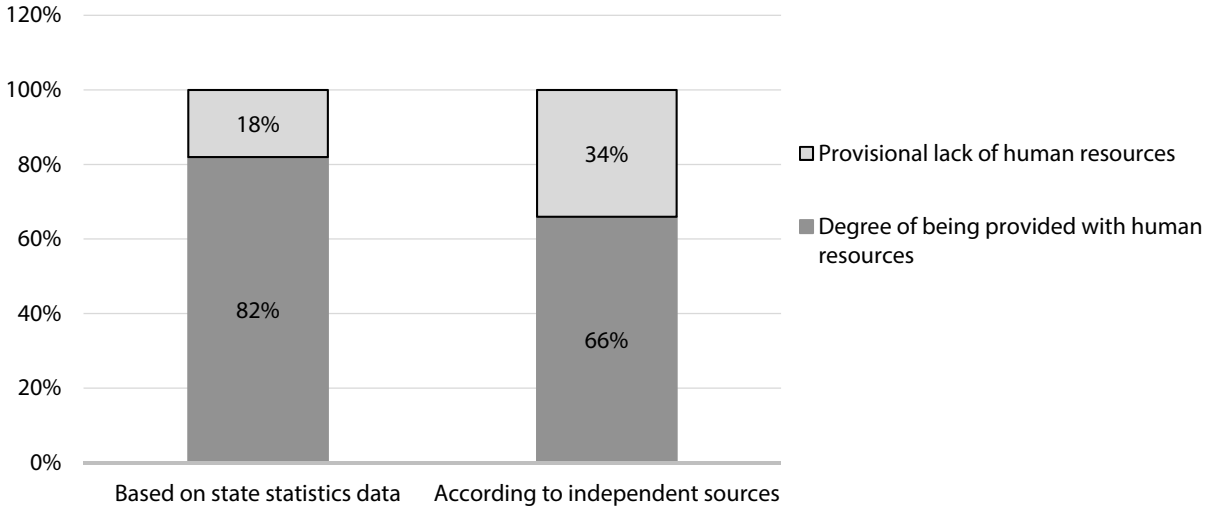

Fig. 3. *How well Russia's agro-industrial complex is provided with human resources (2015 data) (Compiled based on: EY. (n.d.). Obzor agropromyshlennogo kompleksa Rossiiskoi Federatsii [A survey of Russia's agro-industrial complex]. Available at: http://www.ey.com/ru/ru/about-us/ey-25-years-in-the-cis-knowledge-sharing-initiatives (in Russian); Russian Federal State Statistics Service. (n.d.). Trud i zanyatost v Rossii [Labor and employment in Russia]. Available at: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1139916801766 (in Russian); Deloitte. (n.d.). Tekushchee sostoyanie i tendentsii razvitiya agropromyshlennogo biznesa v Rossii — 2015 [The current state and trends in the development of Russia's agro-industrial business — 2015]. Available at: https://www2.deloitte.com/ru/ru/pages/consumer-business/articles/current-issues-of-agribusiness-in-russia-2015.html (in Russian))*

However, as according to independent consulting and research agencies, in reality, this indicator does not exceed 66 % (Fig. 3).

The significant dispersion in indicators may be due to both the differences in methods for keeping track of manpower and different approaches to putting together a sample for the study. However, if we take the average value, we will find that nearly a fourth of all enterprises within the agro-industrial complex are not provided with qualified human resources. In point of fact, this is testimony that Russia's agro-industrial complex is currently in a state of permanent manpower famine.

To boost the caliber of labor resources, many business entities within the agro-industrial complex are engaged in personnel training and development. Thus, for instance, in 2016 vocational training was provided to nearly 46,000 agro-industrial workers. With that said, there are several major forms

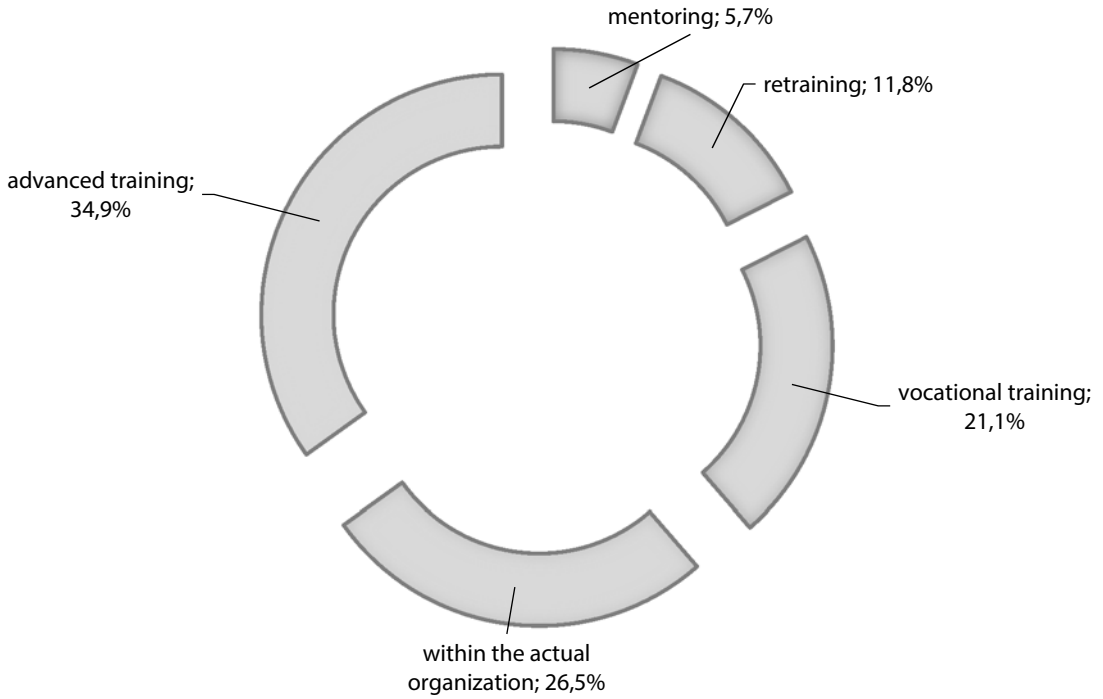

Fig. 4. *Forms of learning and training with those employed within Russia's agro-industrial complex. (Mutchler et al., 2015; Anfinogentova, Blinova, & Vorotnikov, 2016; Gerasimova, 2011)*

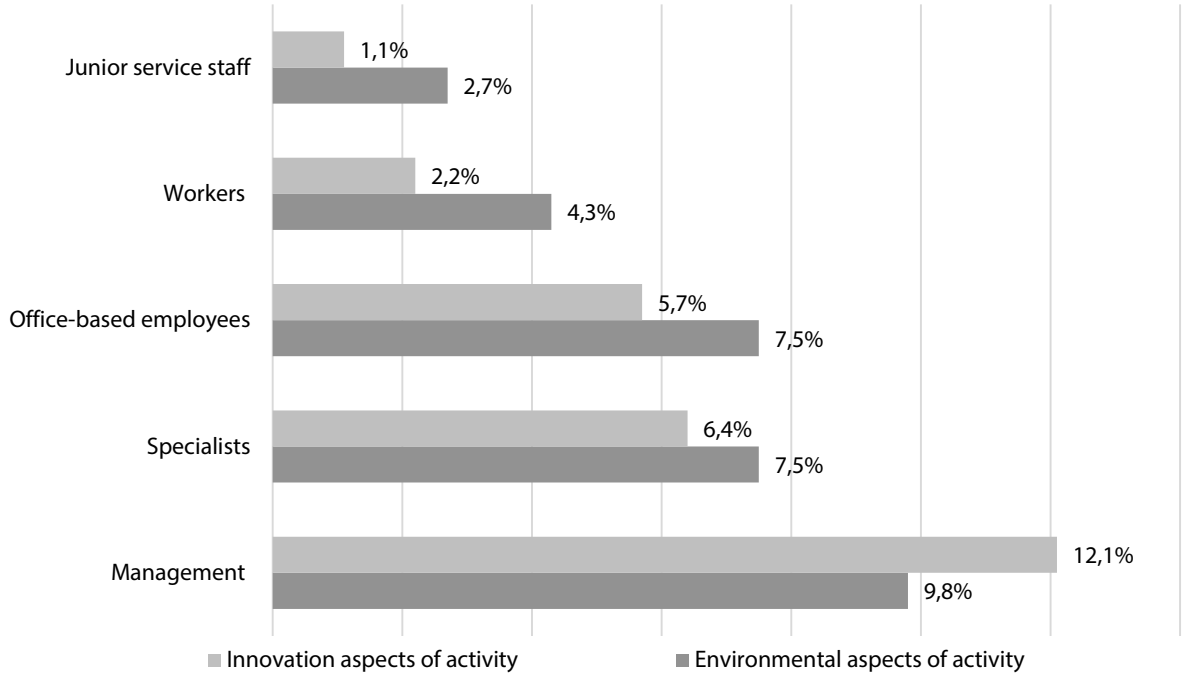

Fig. 5. *Relative share of environmental and innovation topics within advanced training programs. (Bautin, 2016; Rodionov & Shashlo, 2016; Parshukov, Khodos, Pyzhikova, & Vlasova, 2016)*

of training for agro-industrial personnel within the framework of their professional activity: advanced training, training within the actual organization, vocational training, retraining, and mentoring (Fig. 4).

It is apparent that this is a traditional approach to organizing training and retraining for agro-industrial workers. But, if we examine the content of programs for advanced training for these workers, it may be found that, depending on the professional (occupational) category, just no more than 10 % of the curriculum is reserved for the discussion of the environmental aspect of the activity. It is worth noting that, when it comes to advanced training for executives of enterprises within the agro-industrial complex, a little more attention is devoted to innovation-related aspects (Fig. 5).

What is more, it is worth noting that advanced training programs for agro-industrial workers are mainly focused on issues of technospheric safety and environmental engineering. However, issues

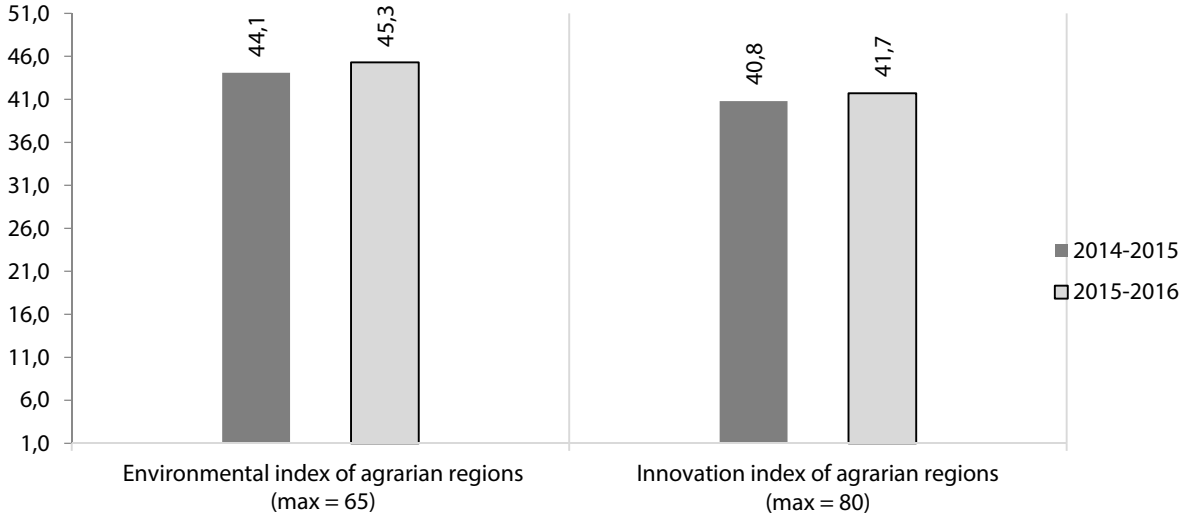

Fig. 6. *Environmental and innovation index of Russia's agriculture-oriented regions (Calculated based on: Green Patrol. (n.d.). Ekologicheskii reiting subektov RF 2016 [Environmental Rankings of the Constituent Entities of the Russian Federation — 2016]. Retrieved from: http://greenpatrol.ru/ru/stranica-dlya-obshchego-reytinga/ekologicheskiy-reyting-subektov-rf?tid=291 (date of access: April 2, 2017). (in Russian); RIA Rating. (2016, October 20). Indeks nauchno-tekhnologicheskogo razvitiya sub"ektov RF — itogi 2015 goda [Index of Scientific/Technological Development in the Constituent Entities of the Russian Federation — 2015 results]. Retrieved from: http://www.riarating.ru/regions_rankings/20161020/630044723.html (date of access: April 2, 2017). (in Russian))*

related to the analysis and assessment of environmental risks from irrational nature management are not always featured in training and retraining programs for mid- and top-level executives at agro-industrial enterprises. It is also worth noting a trend that is associated with the fact that not all agro-industrial colleges are taking part in international projects aimed at the implementation of educational programs related to the sustainable development of agricultural regions. Thus, for instance, the SARUD (Sustainable Agriculture and Rural Development) program, launched by Hohenheim University (Germany), is currently implemented in 10 Russian agrarian colleges. With that said, the Russian colleges participating in the project have a focus on the development of a master's program (economics, ecology, renewables, and the social sphere). This kind of integrated programs for training specialists for the nation's agro-industrial sector and agricultural sphere are not offered at this time to those pursuing a bachelor's degree and in secondary-level vocational agrarian institutions (Buraeva, 2017; Shindelov, Shindelova, & Schmidt, 2017).

This kind of approach to the development and training of personnel within the national agro-industrial complex may, in large part, be regarded as outmoded, which substantiates this study's hypothesis. The same tenet is also substantiated by the practice of development of agriculturally oriented Russian regions. Specifically, the average value of the environmental index for these regions does not exceed 44–45 points (out of 65), and of the innovation index — 41–42 points (out of 80) (Fig. 6).

It is apparent that the existing situation within the Russian agro-industrial complex with respect to ecology and innovation requires radical transformations, which it may help to begin specifically with altering existing approaches to arranging the entire training system.

Discussion

The strategic concept of the green economy is a replacement for the scientific/practical paradigm of sustainable development (Pearce, Markandya, & Barbier, 1997; Chapple, 2008; Ashton & Green, 1996; Dunleavy, 2013; Dudin et al., 2016; Teece, 2016; Menne, 2017). The green economy is currently viewed as a key condition for the physical preservation of modern civilization. It implies that resource-wasteful and energy-intensive models of social/economic development employed around the world must be replaced with low-carbon and resource-saving models. This will help to not only minimize existing environmental damage but proceed to recovering some of the natural capital lost in past centuries. Ecologization is crucial for the Russian economy also because a major portion of national revenue is derived from outcomes that in large measure depend on the use of resource rent.

It cannot be denied that the Russian economy is a rent-based economy, but it should, too, be kept in mind that Norway's is a rent-based economy as well. With that said, Norway is ranked 12th

in the rankings of national systems of higher education, whereas Russia ranks just 34th (2016)[9]. This may mean that in Norway resource rent is used intensively to boost human capital. While in Russia resource rent is used extensively, and its use is governed by different goals and objectives. The need for a conceptual shift to a green economy has been discussed quite widely in recent years both at the level of federal authorities and at the level of the Russian Academy of Sciences. However, in practice this shift has not been implemented yet, and here is why:

— Russia lacks a sound theoretical and empirical base on environmentally responsible mineral resources management;

— Russia has virtually no research institutes that are directly engaged in the development of scientific and scientific/methodological foundations of the green economy;

— Russia's system of continuing education is fragmented in many respects, with there being a lack of focus on lifelong learning.

Among the key scientific/methodological foundations that need to be worked out in order to develop the new paradigm's professional concepts are the place of the green economy within the resource-saving and resource-effective model of national social/economic development and the concept, essence, purpose, goals, and objectives of the shift from the resource-wasteful to environmentally responsible concept of economic and social development.

These tenets need to be integrated both into the higher education system and into the continuing education subsystem across the nation's agricultural colleges. It will also help to draw upon the experience of nations within the EU and North America — adopt certain positive aspects of the experience which combine educational programs in the area of environmentally responsible mineral resources management with practical programs on the ecologization of the agro-industrial complex. This combination could be implemented directly via business establishments seeking human resources with relevant competencies in the use of green technology.

Evidence from practice indicates that business establishments within the agro-industrial complex which are keen to boost their competitiveness through the environmentally responsible approach are mostly interested in hiring workers who possess competences in the following areas:

— a shift to environmentally safe production organization technology;

— implementation of environmentally safe technology for storing agricultural raw materials and their derivatives, this area also highly in need of specialists in green logistics;

— a shift to a "green partnership" among the state sector, entrepreneurs (including competitors and clients), and the scientific/academic sector (Buraeva, 2017).

It is apparent that in the educational context most socially and economically advanced nations have been quite active in developing and implementing relevant scientific approaches in the area of environmentally responsible mineral resources management, fitting them to the needs of the real sector of the economy. This enables nations within the EU and North America to retain leading positions in the economic and social sphere, as well as the scientific/academic one[10]. The BRICS nations and above all Russia ought to be more active in implementing these achievements and interact more keenly in the scientific and practical context, for among the BRICS nations it is Russia that possesses the most robust and highest-quality scientific/academic potential[11], which can be employed to enhance the national model of vocational and continuing education in the direction of the green economy.

Currently, due to the shift to a green economy, enterprises within the agro-industrial are faced with the pressing issue of staffing, with the share of human resources with a core agricultural education having dropped several times in recent years, as a major portion of agricultural college graduates tend to stay in the city and get a job that is not aligned with their college major (Anfinogentova, Blinova,

[9] Centre for Human Technologies. (2016). Universitas 21: Reiting natsionalnykh sistem vysshego obrazovaniya 2016 goda [Universitas 21: Rankings of National Systems of Higher Education, 2016]. Retrieved from: http://gtmarket.ru/news/2016/08/25/7298 (date of access: April 5, 2017). (in Russian); QS. (n.d.). World University Rankings 2015/16. Retrieved from: http://www.topuniversities.com/university-rankings/world-university-rankings/2015#sorting=rank+region=+country=+faculty=+stars=false+search (date of access: April 5, 2017). (in Russian).

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& Vorotnikov, 2016; Parshukov, Khodos, Pyzhikova, & Vlasova, 2016; Buraeva, 2017; Shindelov, Shindelova, & Schmidt, 2017).

The nation's system of higher education currently features 59 agrarian colleges, which offer training in over 122 specialties. Secondary-level vocational workforce training is provided by 26 educational institutions. There is also a system of continuing vocational education in place. All of these institutions provide instruction in both traditional and novel agricultural specialties, like animal science, mechanization, agronomical science, economic specialties, marketing services, information technology, and others. In addition, over the past ten years, agrarian colleges have been supplemented by 22 technical schools, 41 advanced training institutes, and 1 research institute[12]. However, the national education system is not yet fully able to resolve all of its target objectives on providing business entities within the agro-industrial complex with high-quality human resources. In the view of one of Russia's leading economists O.V. Inshakov, a key factor in the sustainable development of the agro-industrial complex going forward will be "people, their qualifications, abilities, work motivation, and culture. For this reason, training and retraining, advanced training, and a pool of human resources take on deciding significance for all sectors within the complex" (Inshakov, 1995). Considering the above, it is worth noting some of the key reasons behind today's declines in the educational level of workers employed within the nation's agro-industrial complex: low pay, Russia's poorly developed market for labor and housing in the countryside, and lack of support measures on the part of public authorities.

However, concurrently with this, it is also worth noting one positive factor: within Russia's scientific/academic sphere, a set of relevant preconditions have already been created in the nation's top colleges for enhancing the model of vocational and continuing education employed in respect of the agro-industrial complex, namely:

— at the state level, there is sufficient awareness of the need to conserve the environment and minimize existing environmental damage;

— certain leading Russian agrarian colleges are taking part in international projects on the creation of educational programs that incorporate the environmentally responsible approach to training highly professional human resources for the agro-industrial sector (e.g., Novosibirsk State Agricultural University, Buryat State Agriculture Academy, and Stavropol State Agrarian University);

— the nation's business establishments are interested in engaging human resources with professional competencies in the area of the green (environmentally responsible) economy (Buraeva, 2017; Shindelov, Shindelova, & Schmidt, 2017).

Russia's education system, which possesses significant scientific potential, has a great opportunity to advance into the top ranks, notwithstanding that the current state of the nation's scientific/academic environment can hardly be regarded as optimum. Evidence from global practice substantiates that one of the most effective schemes for the self-organization and evolution of national innovation systems through the development of university and academic science, the economy, entrepreneurship, and the state is the use of the Triple Helix model (Etzkowitz & Leydesdorff, 1995; Etzkowitz & Zhou, 2018; Etzkowitz & Leydesdorff, 2000) (Fig. 7).

Under Triple Helix Theory, the helix consists of an internal pivot and external space. The state, universities, and the business have different sources of knowledge capitalization. This form of cooperation, proposed by H. Etzkowitz and L. Leydesdorff, may be regarded as the most effective scheme for an innovative system of arranging societal relationships. In their works, the above scholars explore the evolution of the Triple Helix model — from administrative/command control over science and industry to the market-based type (laissez-faire), whereby science, the business, and the state are independent from each other and interact moderately outside their clearly demarcated boundaries. It is the interaction of the institutional spheres of universities, enterprises, and public authorities, engaged in performing both their standard functions and an extended range of functions, that may be viewed as a key precondition for a creative approach to putting in place the organizational process, which, in turn, becomes a reason for the emergence of various innovative solutions.

When knowledge is transformed into capital, any representative of the institutional sphere may act as a potential entrepreneur or a firm founder. Under the Triple Helix model, in interacting with the other two each helix enables an overlay of communications, networks, and organizations. There takes place development based on the type of helix specifically, i.e. a synthesis of evolution in the vertical axis

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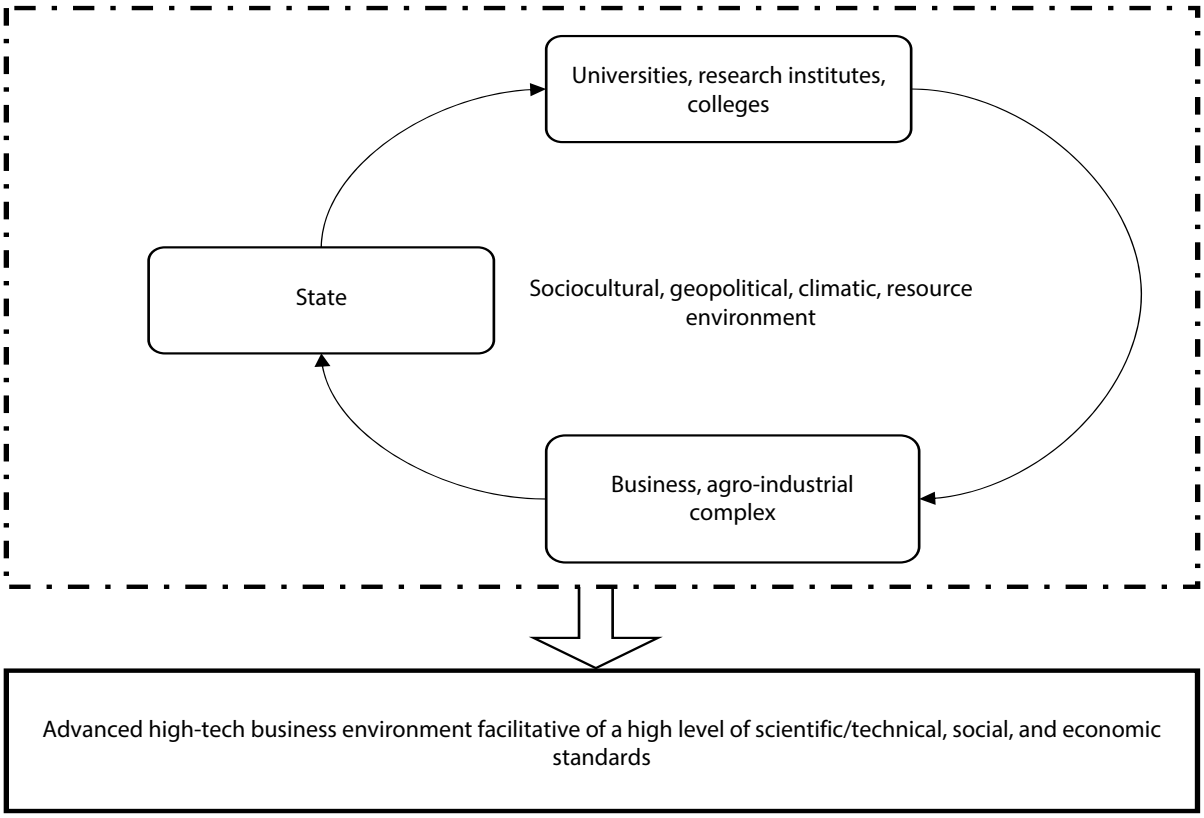

Fig. 7. *Triple Helix model and effects from implementing it, which provide for a mechanism for interaction among the state, the business, and the scientific/academic community*

and circulation in the horizontal one. Well-established interaction based on the 'universities — industry (i.e., the agro-industrial complex) — government' scheme has produced a powerful economic, scientific/technical, and social effect in countries and regions where they use the Triple Helix model (e.g., North and South America, Japan, Southeast Asia, Australia, and Russia).

Conclusion

To sum up, it may be stated that there currently is a need to modernize existing approaches to training and retraining specialists for the agro-industrial sector factoring the green economy concept and restore the multilevel system of education based on the integration of efforts by agrarian colleges, vocational training institutions, science, and the state.

New conceptual approaches that form the basis of a scientific paradigm of the future, such as the green economy (as an integration of economic, environmental, and social context and the renewable resource approach to rational nature management), ought to be reflected in full measure in the educational process of agrarian colleges, including in specialist training programs at institutions of secondary and continuing education. The education system, which supplies human resources for the agro-industrial complex, must be balanced out in the context of including in the process of training specialists' environmental disciplines and disciplines on the theory and practice of innovation.

To make this happen, there must be achieved at the macro- and microeconomic levels a unity of views with respect to resolving the issue of boosting the environmental responsibility of business entities within the agro-industrial complex. With that said, it is worth remembering that the objective of modernizing the education system is indissolubly linked with resolving an entire array of issues of social/economic development in rural areas.

It may be stated, based on relevant best practices from advanced nations, that the national education system needs to be reformed and optimized factoring in the environmental scientific paradigm of innovative economic activity. It may help to start resolving this issue as soon as possible, including through the cultivation of scholarly ties and exchange of best practices with the world's leading universities.

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