Status and evaluation of workforce quality in agroindustrial complex

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Abstract: The article suggests using the author's technique of expert evaluation when assessing the quality of workforce in agriculture. The author explains the necessity of increasing the quality measures in modern labor potential, and creating integrated educational and industrial networks in the region.
[Davydkina O. **Status and evaluation of workforce quality in agroindustrial complex.** *Life Sci J* 2014;11(10):1321-1325]. (ISSN:1097-8135). http://www.lifesciencesite.com. 194. doi:10.7537/marslsj111014.194.

Keywords: agriculture, investment, quality of workforce, expert evaluation, quality measure.

1. Introduction

Workforce is one of the most important elements in the resource potential of rural areas. It is the degree of efficient use of labor resources that has a direct impact on and mainly determines all other aspects of the potential.

The transition to the market economy makes it necessary to implement essential changes in the HR department of the agricultural sector. The transformations should begin with professional trainings for employees to help them know the law of markets, to be flexible in a developing economic environment, to be technology savvy, and to gain entrepreneurial skills.

Efficient land resource and production management in agriculture is mainly determined by the development of workforce, which is capable of integrating land resources, fixed and current assets, financial resources to the manufacturing process through the ability to produce new values in their work. [5]

Among the conditions of manpower replacement there are specific ways of workforce and economic development, as well as demographic and social structure of the population, which determines the needs of agro-industrial business in labor workers, professionals and managers, and also determines possible ways and strategies to meet the needs.

Rural areas are undergoing major changes, which is the increase of working population employed in public production and the growing differentiation of labor. These tendencies are common for a number of regions in the country, but each of the regions has their own characteristics.

Penza region has a population of about 1.37 million people, with a number of urban residents increasing and rural population decreasing (from 36.6 % in 1990 to 32.3 % in 2013). [7]

The dynamics of the regional population is partly dependent on the economic situation, but is determined by many factors. Further forecasting raises two main questions: whether there will be an influx of people from outside areas and whether there will be a raise of birth rate during the next 5-7 years. In case of active development Penza region has good chances to create a positive dynamics by 2014-2015 and have the same number of population by 2025 as it was in 2005. In case of the inertial scenario, there is a possibility that Penza region will experience a significant decrease in population (by about 100 thousand people in 2025), despite a gradual grow of population after 2015. [1]

The population forecast for Penza region till 2025 is presented in Figure 1.

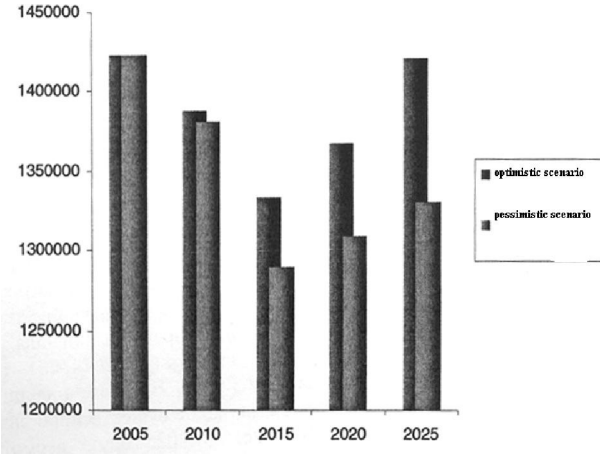

Figure 1. Population forecast for Penza region until 2025 [1]

Recently, new jobs have hardly been created in rural areas, so rural unemployment becomes stagnant. It leads to the increase of average duration of registered unemployment in the proportion of citizens who were not able to find a job and have been registered in Employment Centers for more than one year.

One of the problems in Penza region is low rates of employment of rural able bodied population. High

unemployment rate leads to lower income, more crimes, alcohol abuse, and social conflicts. According to the official data from the Local Department of the Federal Agency of State Statistics in Penza region, in 2011 27.6 % of the population lived in rural areas: 38.9 % of the population is able to work, but only 12.4% are officially employed. In terms of working age about 40 % of the rural population is in the range of employable (20 to 40 years). [3]

Professional training schools and the whole network of vocational classes are in a very difficult financial situation. In this regard, every year there are less trainings and professional development classes for agricultural workers. The institute of agriculture is losing its rich background and long traditions that have been established for many years.

Workforce reproduction is mainly influenced not only by a positive dynamics in population growth, but also by age and sex of the population. Recently the proportion of working-age population has been decreased, the number of children and adolescents.

Modern agriculture creates new requirements for workers to meet: implementation of new technologies, active participation in the management of production, technical upgrade.

A wide range of tasks connected to the growth of agricultural productivity, efficient use of labor resources, changing nature of labor, they all are related to workforce saving based on technical progress. [1]

The health of rural population is also very important in terms of low birth rates.

In the next 5 - 10 years in the economy of the country and Penza region there will be changes in the employment and labor markets due to the following factors:

- development of main industries, transition to innovative technologies;
- growth in the service sector;
- development of new economic sectors and social sphere.

Limited by natural resources, Penza's key strategy for sustainable development of the region is its intellectual resources.

2. Material and Methods

In modern research there is no effective technique to assess the workforce quality, the method that would equally and objectively consider the interests of all subjects of economic relations. To measure the quality of labor resources, we propose the author's method.

The numerical value of the quality assessment *K* of the object is determined by the indicators of functional purpose, which made a positive contribution to the quality assessment *F*. Further evaluation is performed for each functional indicator, which has entered into a proved entry list F_Z = Fj (j = 1, e). It is necessary to set up the quality grades for each indicator Fj. Every functional component will be considered as a linguistic variable, i.e. a variable whose values are expressed by words or phrases of an existing language. Linguistic variable F is defined by the following four characteristics:

$< F_j , T_{j(i)} , P_{j(i)} , , W_{j(i)} >$, (j = 1,e), (i = 1,r);

where Fj - the variable; Tj(i) - the set of variables of Fj, which is a set of all names of linguistic variable; Pj (i) - the semantic rules that generate a lot of names of linguistic variable; Wj(i) - the level of quality importance corresponding to Tj(i). Each indicator in the form of a functional linguistic variable is mapped to the set of Tj (i). i- th term of j-th functional index is a graded quality value of this index, which has the name of Fj and the quality measure of Wj (i). [3: p.32]

Our task is to choose such ways of quantitative assessment of quality that will be convenient for practical use, reasonably accurate and as informative as possible. The most critical part of the work on the qualitative assessment of the resource is the definition of quality scales (scaling) for each of the evaluated parameters Fj. The general recommendations for scaling quality indicators are following:

1. After a model of reference resource for each indicator Fj is developed, they set limit values of its properties (W_{max} and W_{min}). For example, numerical values of the bonitet score of farmland soil fertility varies from 13 (W_{max}) to 65 (W_{min}). While the lower bonitet score corresponds to one area of the region, and the higher score - to another area.

2. Limit values of properties in terms of the indicators Fj correspond with marginal qualitative estimates that range from 0 to 1. For example, if the soil fertility score = 13, then $W_{min} = 0$ (the bottom of the scale), but if the score = 65, $W_{max} = 1,0$ (the upper part of the scale).

3. The middle part of the scale in terms of qualitative assessment of Fj is formed. The number of intermediate calibration values is determined individually for each indicator. For example, in relation to the scale of the bonitet score there can be 5 scale levels one of which is the top, one is the bottom, and 3 levels are intermediate. If the scale is graded evenly, the scale value will be $\frac{65-13}{4}=13$, and the whole range will be: 13→26→39→52→65. Scales can be convergent if each previous graduation is included into the following one, and divergent if each grade is independent.

The sequence of quality assessment K of any resource can be represented by the following algorithm:

1: = Define the meaning of logical variables included in the rules P_{11}. It means that you must specify the probability VD (specify one out of five scale values VD), the probability of VB and identify one of the binary values of logical variables that have the greatest impact on quality grading of the functional index, based on the achieved level of quality of the evaluated resource.

2: = Solve logic productions P_{11}, substituting the variables values in them. The result is binary: 1 (true) or 0 (false). It is determined what production will result in 1. For example, it can be the production $P_{11(3)}$.

3: = Determine the term corresponding to the production, with the result of 1. For example, if it was the production $P_{11(3)}$, then it corresponds to the term $W_{11(3)}$. This term determines the name of the linguistic variable <productivity>: = <average productivity>.

4: = According to the term, quantitative measure of productivity is defined. For example, if the term was $T_{11(1)}$, then it corresponds to the measure of productivity $W_{11(3)}$.

The quality level for all other functional parameters is determined in a similar way; the parameters are included in the list of their entry screening F_Z, which determines the quality index K. Its numerical value is found by the formula:

$$K = \frac{1}{b}\sum_{i=1}^{p} W_{i(j)},$$

where b - a number of quality indicators, which should be a base for an evaluation by the NOK (The Independent Evaluating Committee) or by agricultural producers;

$W_{i(j)}$ - numerical gradation of quality by properties Fj;

p - actual number of performance indicators [2]

If each functional indicator that has entered into the many $F\_Z = F_j$ (j = 1, e), is related to quality indicators $W_{j(i)}$, where j - the number of a functional index, and i - the number of a term or graded quality value for the j-th indicator; then you can start the determination of quality.

It is necessary to further explain why the quality score K is averaged not by the actual number of functional parameters e, which determined the evaluation $W_{j(i)}$, but by the number of parameters b, which were included in the entry list. In other words, if K is averaged by e, it can lead to unreasonable overestimation of K.

The numerical value of the quality index K for the evaluated object is determined by the indicators of functional purpose, which made a positive contribution to the grade F. Further quality evaluation is performed for each functional indicator that has entered into a proved entry list $F\_Z = F_j$ (j = 1, e).

The range indicator for functional properties of resources can be found by the following formula:

$F = \beta_1 F_1 + \beta_2 F_2 + ... + \beta_e F_e$,

where F_e - properties of resources

β_e - importance index of the properties. [2]

The importance index β_q corresponds to each of these properties. A lot of these indicators of properties' importance build a vector of importance

$\beta = \{\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}\}$.

3. Results

We build up functional properties of human resources in Penza agriculture sector. The structure of these properties depends on the subject of evaluation: the time or the consumer of resources. The full range of estimates can be formed in relation to the reference type of resources. The reference type means this kind of resources that has such a set of functional properties at the relevant time and in relation to certain agricultural producers, that puts it in a unique position in comparison with other types of resources. In actual practice, this is the type of resources it is necessary to strive to stay competitive. This complete set of functional properties is used by the subject of assessment to selects the most important ones for their assessment. The following set of properties will be considered complete for the reference type of agricultural workforce in Penza region:

F1 - the structure of rural population in Penza region (% of working population);

F2 - the level of employment of rural population, %;

F3 - the average age of the working population, years;

F4 - the ratio of documented and total unemployment, %;

F5 - the number of working hours per year;

F6 - the average life expectancy, years;

F7 - the number of years at school and university, years.

The table of importance indexes by properties is based on these parameters. The column J shows the importance indexes of properties, which this kind of resources should have at a given time interval (J_1 - 1995-2000, J_2 - 2001 to 2006, J_3 - 2007-2012). The columns Q_1, Q_2 and Q_3 present the importance indexes of properties, actually selected agricultural producers Q_1 - agricultural businesses (LLC, JSC, JSC, etc.), Q_2 - farms and Q_3 - farming population.

We determine the range indicator of the properties F when an independent evaluator is involved:

the first time interval (J_1 - 1995-2000):

$\mathbf{F^{J1}} = \beta_1 F_1 + \beta_2 F_2 + ...+\beta_e F_e = \beta_1 F_1 + \beta_2 F_2 + \beta_4 F_4 + \beta_5 F_5 + \beta_7 F_7 =0,20\ 1+0,15\ 1 +0,10\ 1 +0,15\ 1 +0,10\ 1 + 0,15\ 1 =$ **0,85**.

The number 1 as the second factor by β shows that this type of resource has this kind property;

the second time interval (J_2 – 2001-2006):

$\mathbf{F^{J2}} =\beta_1 F_1 +\beta_2 F_2 +\beta_3 F_3 + \beta_4 F_4 + \beta_5 F_5 + \beta_6 F_6 + \beta_7 F_7 =0,20\ 1+0,15\ 1 +0,15\ 1 +0,15\ 1 +0,10\ 1 + 0,15\ 1 =$ **0,90**;

the third time interval (J_3 – 2007-2012):

$\mathbf{F^{J3}} =\beta_1 F_1 +\beta_2 F_2 +\beta_3 F_3 + \beta_4 F_4 + \beta_5 F_5 +\beta_6 F_6 + \beta_7 F_7 =0,20\ 1+0,15\ 1 +0,10\ 1 +0,15\ 1 +0,10\ 1 + 0,15\ 1 =$ **0,85**.

The range indicator of properties F is determined when the evaluation is performed by agricultural enterprises of the first time interval (J_1 – 1995-2000):

$\mathbf{F^{J1}_{Q1}} =\beta_1 F_1 + \beta_2 F_2 + \beta_4 F_4 + \beta_5 F_5 + \beta_7 F_7 =0,15\ 1+0,15\ 1 +0,15\ 1 +0,25\ 1 + 0,15\ 1=$ **0,85**.

Table 1. Importance Indexes of Workforce Properties

Importance Vectors β	Independent Evaluating Committee	Periods of Time			Agricultural Producers		
		J_1	J_2	J_3	Q_1	Q_2	Q_3
β_1	0,20	0,15	0,20	0,20	0,15	0,20	0,25
β_2	0,15	0,15	0,25	0,15	0,15	0,15	0,15
β_3	0,10	0,15	-	0,15	0,15	0,15	-
β_4	0,15	-	0,15	0,15	0,15	0,15	0,15
β_5	0,15	0,25	0,15	-	0,25	0,25	0,15
β_6	0,10	0,15	0,10	0,25	-	0,10	0,15
β_7	0,15	0,15	0,15	0,10	0,15	-	0,15
Total	1,00	1,00	1,00	1,00	1,00	1,00	1,00

The similar ways are used to evaluate the manpower by the indicator F of anagricultural enterprise. The evaluation results are summarized in Table 2 (the superscript to F shows the time period, the subscript is the farmer using this type of resources).

Table 2. Range Indicator of Workforce Properties

1995-2000		2001-2006		2007-2012	
F^{J1}	0,85	F^{J2}	0,90	F^{J3}	0,85
F^{J1}_{Q1}	0,85	F^{J2}_{Q1}	0,85	F^{J3}_{Q1}	0,75
F^{J1}_{Q2}	0,85	F^{J2}_{Q2}	0,85	F^{J3}_{Q2}	0,75
F^{J1}_{Q3}	0,85	F^{J2}_{Q3}	1,00	F^{J3}_{Q3}	0,85

As seen from the table, the range indicator and the functional properties of human resources do not range widely (0.75 to 0.95). It means the agricultural requirements coincide with the status of resources in different time intervals, both by the properties stucture and by the evaluation of their significance.

In terms of the range of functional properties for farmers Q_1 the status of workforce in 1995-2000 and 2001-2006 is considered preferable ($F_{J1}Q_1$ = 0,85 and $F_{J2}Q_1$ = 0,85). Farming companies (Q_2) are also satisfied in human resources during the same time intervals ($F_{J1}Q_2$ = 0,85 and $F_{J2}Q_2$ = 0,85). Agricultural producers (Q_3) content with the status of the resource in 2001-2007 ($F_{J2}Q_3$ = 1,00).

There are following quality grades with regard to accepted properties indicators for evaluation of material and technical resources:

- mediocre quality (threshold) $W_0 = 0$;
- satisfactory quality $W_1 = 0,3$;
- good quality $W_2 = 0,5$;
- high quality $W_3 = 0,7$;
- super quality $W_4 = 1,0$.

The results of quality evaluation for each of the indicators of human resources K are shown in the following Table 3.

Table 3. Results of Evaluation of Quality Range for Each Properties Indicators of Human Resources

F_1b_1	j1	+	+	+	+	-
	j2	+	+	+	-	-
	j3	+	+	+	-	-
F_2b_2	j1	+	+	+	+	-
	j2	+	+	+	-	-
	j3	+	+	-	-	-
F_3b_3	j1	+	+	+	+	-
	j2	+	+	+	-	-
	j3	+	+	-	-	-
F_4b_4	j1	+	+	+	+	+
	j2	+	+	+	+	-
	j3	+	+	+	+	-
F_5b_5	j1	+	+	+	+	-
	j2	+	+	+	-	-
	j3	+	+	+	-	-
F_6b_6	j1	+	+	+	-	-
	j2	+	+	+	-	-
	j3	+	+	+	+	-
F_7b_7	j1	+	+	+	-	-
	j2	+	+	+	-	-
	j3	+	+	+	+	-
Quality Level –W		W_0= 0	W_1= 0.3	W_2= 0.5	W_3= 0.7	W_4= 1

Collective results of quality assessment for material and technical resources are shown in Table 4.

The table shows that in recent years the quality level of labor resources in a cross-sectional assessment is incompliant in comparison with the previous periods. The grades in 1995-2006 are from 0.45 to 0.55, and in 2007-2012 - from 0.42 to 0.48. The maximum grade possible in the proposed method is 1, which if considered as 100%, lets us say that the quality of modern human resources needs to be improved by an average of 58%.

Table 4. Collective Results of Quality Assessment for Material and Technical rResources of Agriculture

1995-2000			2001-2006			2007-2012		
K^{J1}_{Q1}	K^{J1}_{Q2}	K^{J1}_{Q3}	K^{J2}_{Q1}	K^{J2}_{Q2}	K^{J2}_{Q3}	K^{J3}_{Q1}	K^{J3}_{Q2}	K^{J3}_{Q3}
0,55	0,55	0,52	0,45	0,45	0,53	0,42	0,42	0,48

4. Discussions

In the author's opinion, the quality improvement of labor potential in Penza region should be facilitated by creating integrated educational and industrial complexes which combine material and technical resources with human resources specialists having bachelors and masters degrees, as well as with professional development of agriculturural specialists.

It will promote consecutive agricultural education, shorten the training period by1-1.5 years, it will help establish and consolidate the material-technical base, will expand field trainings for specialists, who can contribute significantly to agricultural production activities during their field work.

In general, the proposed method can be successfully used by manufacturers to evaluate the quality of human resources and to strengthen competitiveness in the Russian business market.

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7/11/2014