Need for Government Support for Reindeer Husbandry in the Republic of Sakha (Yakutia)

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Abstract. The article justifies the need to subsidize reindeer husbandry of the Republic of Sakha (Yakutia). Statistical correlation and regression analysis of income and costs of reindeer husbandry was carried out, priorities were identified for areas that are more in need of state support, and financial indicators of areas without subsidies have been evaluated. The necessity for agricultural reform is highlighted, where measures aimed at reviving genuine cooperative forms and principles between economic entities should play an important role, since the formation of market relations calls for the development of cooperation, which historically and logically accompanies the formation of real monetary relations.

1. Relevance, scientific significance of the issue with a brief review of the literature
Since the earliest times, domestic reindeer husbandry has been the basis of life and the main traditional type of the economic activity, serving as the basis of the economy, culture, spiritual development and lifestyle of the most indigenous peoples living in the Far North of the Russian Federation, Scandinavian countries, North America, Greenland, China.

The economic and political situation that existed in the 60-80s of the XX century, in the country contributed to the development of reindeer husbandry in Russia, subsidies for the agricultural industries of the Far North were high.

Subsequently, however, the high results achieved in this sector have stalled and there has even been a significant decline in the development of reindeer husbandry. All production and economic indicators declined, and reindeer herding turned from economically efficient to a loss-making industry.

In general, reindeer herding is in a systemic crisis. This suggests the need for further research into the reindeer herding industry related to the analysis of the state of reindeer herding in the region.

The relevance of the above has determined the choice of the topic of scientific work and the main directions of research.

The issues of the Northern reindeer husbandry, its importance in the economy of the Far North, are contained in the works of scientists and major experts: Kurilyuk A.D., Mukhachev A.D., Vladimirov L.N., Darbasov V.R., Druri I.V., Zabrodin V.A., Pomishin S.B., Reshetnikov I.S., Safronov V.M., Syrovatsky D.I. Zhigunov P.S., Chugunov A.V. etc. General scientific, methodological approaches were used as a tool. In the process of research the methods of statistical, comparative analysis, provision of information in the form of tables were used.
production cooperatives to a large association in order to receive centralized state financial support. The general scientific and methodological approaches are used as a tool. The methods of statistical, comparative analysis and the provision of information in the form of tables are used in the study.

**The purpose of the scientific work** is to study the problem of profitability and the role of the state support for reindeer husbandry, the material interest of reindeer husbandry personnel in the northern regions of the Republic of Sakha (Yakutia).

In accordance with the objective set, **the following tasks** are formulated and solved:

- Based on the analysis of the financial results of reindeer herding farms in regions, taking into account the state subsidies, the areas where it is necessary to adjust the state support to their financial situation were identified;
- Assessment of the efficiency of state support to reindeer herding farms in regions of the Republic of Sakha (Yakutia);
- Proposals have been made to increase the number of specialize production cooperatives to a large association in order to receive centralized state financial support.

### 2. Theoretical part

Nowadays, the Republic of Sakha (Yakutia) is considered one of the model reindeer herding territories. Domestic reindeer are bred in the republic in 22 administrative districts, the total area of which is 36.8 million hectares or 15.6% of the entire territory of the Republic. The deer capacity of pastures is 371.5 thousand heads; the republic has large reserves for the further development.

Currently, the state policy of the supporting agricultural producers, in particular the reindeer herding does not meet the needs of the economy.

The state program of the Republic of Sakha (Yakutia) "Development of agriculture and regulation of agricultural markets for raw materials and food products for 2012-2020 under the subprogram "Development of traditional industries of the North", approved by the decree of the President of the Republic of Sakha (Yakutia) dated October 7, 2011 No. 934, is insufficient. You need the significant investment in the industry to get good result.

### 3. Practical significance, proposals and results of implementation, results of experimental research

The practical significance of the work is the possibility of applying the study results in the work of reindeer husbandry for the further development of the industry. Because of the lack of the material security for reindeer husbandry workers, as well as in the distribution of the subsidies by the Ministry of Agriculture to the regions of the Republic of Sakha (Yakutia).

Table 1 presents information on the income and expenses of reindeer husbandry by the regions of the Republic of Sakha (Yakutia). In all farms, the revenue from the goods sale, products, works, services sold, the financial result for the districts for three years is negative.

**Table 1. Income and expenses of reindeer husbandry in 2015-2017.**

| District    | Total income (Y), thousand rubles (Revenues costs) | Subsidy total (X1), thousand rubles | Total costs (X2), thousand rubles |
|-------------|---------------------------------------------------|-------------------------------------|-----------------------------------|
| Aldanskiy   | 1 807                                             | 20418                               | 24969                             |
| Anabarskiy  | -2500                                             | 49943                               | 62999                             |
| Bulunskiy   | -19325                                            | 48996                               | 98312                             |
| Neryungri   | -257                                              | 22475                               | 24207                             |
| Zhiganskiy  | -1333                                             | 13990                               | 21907                             |
| Kobyayskiy  | 5131                                              | 23601                               | 24734                             |
Consider a multiple linear regression model with two explanatory variables, where \( y = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + \varepsilon \) where \( \alpha_0, \alpha_1, \alpha_2 \) are unknown parameters, \( \varepsilon \) is a random variable (random term, random perturbation), reflecting the influence of unaccounted factors and measurement errors of the following data for 2017:

- \( Y \) - profit of reindeer husbandry, thousand rubles (Profit (loss) = Farm income - Total costs)
- \( X_1 \) - subsidies, thousand rubles
- \( X_2 \) - costs, thousand rubles

Fill in the matrix:

\[
X^T X = \begin{bmatrix}
\sum x_1 & \sum x_1 x_2 \\
\sum x_2 & \sum x_1^2 & \sum x_2 x_1 & \sum x_2^2
\end{bmatrix}
\begin{bmatrix}
16 \\
591514 \\
3140260313 \\
3670845681
\end{bmatrix}
\]

Find the matrix

\[
(X^T X)^{-1} = \begin{bmatrix}
0.214 & -0.000002 & -0.0000017 \\
-0.000002 & 0.0000000005 & -0.0000000004 \\
-0.0000017 & -0.0000000004 & 0.0000000004
\end{bmatrix}
\]

We calculate the matrix of coefficients:

\[
A = (X^T X)^{-1}(X^T Y) = \begin{bmatrix}
0.214 & -0.000002 & -0.0000017 \\
-0.000002 & 0.0000000005 & -0.0000000004 \\
-0.0000017 & -0.0000000004 & 0.0000000004
\end{bmatrix}
\begin{bmatrix}
16 \\
591514 \\
3140260313 \\
3670845681
\end{bmatrix}
\approx \begin{bmatrix}
-3035 \\
1302064444 \\
-247595697
\end{bmatrix}
\]

Thus, we obtain the multiple regression equation:

\[
\hat{y} = -2816.66 + 0.8x_1 - 0.6x_2
\]

Theoretical values of the effective characteristic:

| District       | X1   | X2   | Y         | \( \hat{y} = -2816.66 + 0.8x_1 - 0.6x_2 \) |
|----------------|------|------|-----------|------------------------------------------|
| Aldanskiy      | 20 418 | 24 969 | 26 776 | -1 463                                  |
| Anabarskiy     | 49 943 | 62 999 | 60 499 | -661                                    |
| Bulunskiy      | 48 996 | 98 312 | 78 987 | -22 607                                 |
| Verkhovanskiy  | 17 755 | 20 551 | 18 379 | -943                                    |
| Neryungri      | 22 475 | 24 207 | 23 950 | 639                                     |
| Zhiganskiy     | 13 990 | 21 907 | 20 574 | -4 769                                  |
With the obtained multiple regression equation

\[ \hat{y} = -2816.66 + 0.8 \cdot x_1 - 0.6 \cdot x_2 \]

In order not to get a negative profit (loss), i.e., minimum income to cover expenses, we equate profit to zero and get an equation for new values of subsidies:

\[ x_1 = \frac{2816.66}{0.8 + 0.6} - 0.6 \cdot x_2 \]

Equation for new cost values:

\[ x_2 = \frac{0.8}{0.6} \cdot x_1 - 2816.66/0.6 \]

**Table 3.** New values of subsidies and costs in the area of Republic of Sakha (Yakutia).

| District          | New values of subsidies | New values of expenses | "+" to add, "-" to remove subsidy | "-" to reduce, "+" to add expense |
|-------------------|-------------------------|------------------------|-----------------------------------|---------------------------------|
| Aldanskiy         | 22 248                  | 22 530                 | 1 829                             | -2 439                          |
| Anabaransk National | 50 770                | 61 897                 | 827                               | -1 102                          |
| Bulunskiy         | 77 255                  | 60 633                 | 28 259                            | -37 679                         |
| Verkhovanskiy     | 18 934                  | 18 979                 | 1 179                             | -1 572                          |
| Neryungri         | 21 676                  | 25 272                 | -799                              | 1 065                           |
| Zhiganskiy        | 19 951                  | 13 959                 | 5 961                             | -7 948                          |
| Kobyayskiy        | 22 071                  | 26 774                 | -1 530                            | 2 040                           |
| Momskiy National  | 15 355                  | 14 816                 | 722                               | -963                            |
| Nizhnekolymskiy   | 72 571                  | 109 373                | -12 979                           | 17 306                          |
| Oymyakonskiy      | 33 063                  | 39 815                 | -318                              | 425                             |
| Olekmniski        | 27 745                  | 32 041                 | 194                               | -258                            |
| Olenekskiy National | 37 311              | 73 861                 | -21 605                           | 28 807                          |
| Srednekolymskiy   | 9 661                   | 6 759                  | 1 071                             | -1 428                          |
| Tomponskiy        | 49 008                  | 42 458                 | 13 643                            | -18 191                         |
| Ust-Yanskiy       | 81 043                  | 122 430                | -14 300                           | 19 067                          |
| EVENO-BYANTAYSKY  | 33 509                  | 41 980                 | -1 497                            | 1 996                           |
| **Total**         | **592 171**             | **713 575**            | **657**                           | **-876**                        |
Based on the data from table 4, we concluded that there is a need to adjust government support in the following areas:

- the subsidy must be added to the Aldanskiy, Anabarskiy, Bulunskiy, Verkhoyanskiy, Zhiganskiy, Momski, Olekminski Srednekolymskiy and Tomaponskiy districts,
- costs must be reduced to all areas except Neryungri, Kobyayskiy, Nizhnekolymskiy, Oymyakonskiy, Olenekskiy, Ust-Yanskiy, Eveno-Bytantasykiy districts.

| District            | X1  | X2   | “+” Profit, “-” Loss |
|---------------------|-----|------|----------------------|
| Aldanskiy           | 0   | 24 969 | -17 798              |
| Anabarskiy          | 0   | 62 999 | -40 616              |
| Bulunskiy           | 0   | 98 312 | -61 804              |
| Verkhoyanskiy       | 0   | 20 551 | -15 147              |
| Neryungri           | 0   | 24 207 | -17 341              |
| Zhiganskiy          | 0   | 21 907 | -15 961              |
| Kobyayskiy          | 0   | 24 734 | -17 657              |
| Momski              | 0   | 15 779 | -12 284              |
| Nizhnekolymskiy     | 0   | 92 067 | -58 057              |
| Oymyakonskiy        | 0   | 39 390 | -26 451              |
| Olekminski          | 0   | 32 299 | -22 196              |
| Olenekskiy          | 0   | 45 054 | -29 849              |
| Srednekolymskiy     | 0   | 8 187  | -7 729               |
| Tomponskiy          | 0   | 60 649 | -39 206              |
| Ust-Yanskiy         | 0   | 103 363| -64 834              |
| Eveno-Bytantayskiy  | 0   | 39 984 | -26 807              |
| Total               | 0   | 714451 | -473737              |

Table 5. Regression statistics.

|                      | Multiple R | R-square | Rated R-square | Standard error | Observations | Dispersion analysis |
|----------------------|------------|----------|----------------|----------------|--------------|---------------------|
|                      | 0.895311129| 0.801582017 | 0.771056174      | 4778,384762    | 16           |                    |
|                      |            |          |                |                |              |                    |
|                      |            |          |                |                |              | df  
| Regression           | 2          | 1199147265 | 599573632,6     | 26,25912751   |              |
| Rest                 | 13         | 296828492,2 | 22832960,94     |                |              |
| Total                | 15         | 1495975757 |                |                |              |
|                      |            |          |                |                |              | Coefficients       |
|                      |            |          |                |                |              | Standard Error     |
|                      |            |          |                |                |              | t- Statistics      |
|                      |            |          |                |                |              | P-Value             |
| Y intersection       | -          | 2210,984625 | -1,27395553     | 0,22498418     |              |
The analysis then yielded the following results:

The regression equation is the same as \( y = -2816.696 + 0.8x_1 - 0.6x_2 \).

The value of the multiple determination coefficient \( R^2 = 0.8 \) shows that 80% of the total variation in the effective characteristic (farm profit) is explained by the variation in the factor characteristics \( X_1 \) (subsidies), \( X_2 \) (costs), and by 20% by other unaccounted for factors. This means that the selected factors significantly affect the profits of farms, which confirms the correctness of their inclusion in the built model.

The calculated significance level \( \alpha = 0.000027 < 0.05 \) (Significance indicator \( F \)) confirms the significance of \( R^2 \).

The next step is to check the significance of the regression coefficients: \( a_0, a_1, a_2, a_3 \).

The standard errors of all \( a_i \) coefficients are smaller than their standard errors. All of them are significant, as can be judged by the values of the \( P \)-value indicator, which should be less than the given significance level \( \alpha = 0.05 \).

| Coefficients  | Standard Error | P-Value |
|---------------|----------------|---------|
| \( Y \) intersection | 2816.696088 | 2210.984625 | 0.22498418 |
| Variable \( X_1 \) | 0.800063667 | 0.110441906 | 0.00000651 |
| Variable \( X_2 \) | 0.603563963 | 0.09169076 | 0.00001762 |

Empirical coefficients of correlation:

\[
\begin{array}{ccc}
Y & X_1 & X_2 \\
Y & 1 & \\
X_1 & 0.374472034 & 1 \\
X_2 & 0.024636648 & 0.896474388 & 1 \\
\end{array}
\]

Hence, we can conclude that factor \( x_1 \) (subsidies) is most closely related to factor \( x_2 \) (costs) \( r_{x_1x_2} = 0.89 \).

The regression equation is successful for predicting \( y \) (profit) values at given values of subsidies and costs.

4. Conclusions

1. Based on the correlation and regression analysis, a multiple linear regression model was considered with two explaining variables based on reindeer husbandry farm income and costs, where they determined the need to adjust state support for the following areas:

   - It is necessary to add a subsidy to Aldan, Anabarskiy, Bulunskiy, Verkhoyanskiy, Zhiganskiy, Momskiy, Olekminskiy, Srednekolymskiy and Tomponskiy districts.

   - Costs should be reduced to all areas except Neryungri, Kobyayskiy, Nizhnekolymskiy, Oymyakonskiy, Olenekskiy, Ust-Yanskiy, Eveno-Bytantaskiy districts.

2. Based on the study in all categories of farms in all areas, the total loss of all farms will amount to 473,737 thousand rubles. The financial result without state support is negative, i.e., the activities of farms are unprofitable. Subsidies are mainly allocated for the support and development of reindeer.
husbandry and a small portion for other activities. Therefore, it is advisable to continue to provide state support. Thus, we can say that all farms are directly dependent on the volume of state assistance.

3. Based on the above circumstances, reindeer herding in the Republic needs to develop a comprehensive sectoral program on the government protection for the development of Arctic districts. Moreover, it is necessary to direct resources of the Federal and Republican budgets to this program study and implement the possibility of directing funds from local budgets to support the traditional occupations of the North peoples, to social assistance to the nomadic population, to solve deeply neglected social problems in general.

4. Recommendations are given on strengthening and increasing the number of specialized production cooperatives in a large association in order to receive centralized state support.

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