

# Evaluation of risk factors in the development of the viticulture and wine sector in the Republic of Moldova (compared to Ukraine, Romania, Czech Republic, Germany)

Nicolaescu Gheorghe<sup>1</sup>, Godoroja Mariana<sup>1</sup>, Nicolaescu Ana<sup>1</sup>, Cotoros Inga<sup>1,2</sup>, Nicolaescu Ana Maria<sup>1,2</sup>, Voinesco Cornelia<sup>1</sup>, Mogildea Olga<sup>1</sup>, and Procopenco Valeria<sup>1</sup>

<sup>1</sup>Department of Horticulture and Forestry, Technical University of Moldova, MD-2004, 168, Stefan cel Mare bd., Chisinau, Republic of Moldova

<sup>2</sup>Faculty of Accounting, Academy of Economic Studies of Moldova of Horticulture and Forestry, Technical University of Moldova, Editorial Department, MD-2005, 61, Banulescu-Bodoni str., Chisinau, Republic of Moldova

**Abstract.** The viticulture and winemaking sector of the Republic of Moldova is important and strategic for the national economy. The successful activity of enterprises in the viticulture and winemaking sector is closely related to some factors - risk factors. During the 2020-2022 years, enterprises from the Moldova, Ukraine, Romania, the Czech Republic, Germany, with viticulture and winemaking activities, were surveyed. Criteria for assessing risk factors ranged from 1.0 (low) to 5.0 (high). As a result of data processing, the following total average results were obtained - economic factors - Moldova - 4.08, Ukraine - 4.56, Romania - 3.92, Czech Republic - 3.51, Germany - 2.53; political factors - Moldova - 4.04, Ukraine - 4.82, Romania - 4.01, Czech Republic - 3.68, Germany - 2.86; technological factors - Moldova - 4.10, Ukraine - 4.02, Romania - 4.00, Czech Republic - 4.06, Germany - 3.60; environmental factors - Moldova - 4.06, Ukraine - 4.13, Romania - 3.75, Czech Republic - 3.24, Germany - 2.13; legislative factors - Moldova - 4.05, Ukraine - 4.60, Romania - 4.06, Czech Republic - 4.02, Germany - 4.00; information factors - Moldova - 4.02, Ukraine - 4.46, Romania - 3.48, Czech Republic - 3.92, Germany - 3.23; group of moral factors - Moldova - 4.04, Ukraine - 4.20, Romania - 4.15, Czech Republic - 3.95, Germany - 3.00; retrospective factors - Moldova - 4.13, Ukraine - 4.50, Romania - 4.02, Czech Republic - 4.01, Germany - 3.25; factor human resources - Moldova - 4.30, Ukraine - 4.42, Romania - 3.96, Czech Republic - 3.90, Germany - 3.02.

## 1 Introduction

The viticulture and wine sector, in complex with all components of the agri-food sector, are strategic in the Republic of Moldova, but also in other countries worldwide. The development of entities depends on a series of risk factors of different nature [1-8].

The risks in agri-food sector were studied by the many researchers, which divided their opinions variously. For real use of opportunities, it is necessary that decision-makers are able to correctly assess the level of risks, choose a sound strategy and tactics of economic activity in a market environment [9].

In different studies K. Murtazova [10] considered that the environmental and economic efficiency characterizes the aggregate economic performance of the agricultural production process, taking into account its impact on the environment.

As a result of their studies, O. Keichinger and M. Thiollet-Scholtus [11] established that to check to test the

effect of innovative viticultural systems on the socio-economic component of sustainability by taking into account measurable data (working time, treatment program, cost, etc.) but also the feelings of the winegrower the latter point being very important in the appropriation of innovation in its success and in its sustainability.

The purpose of this article is to evaluate of risk factors in the development of the viticulture and wine sector in the Republic of Moldova (compared to Ukraine, Romania, Czech Republic, Germany).

The main objective consists in determining the degree of influence of the factors in the group and individually, and establishing the correlation between them.

## 2 Material and methods

The study from this article was based on the results of the project "Impact of macro-environmental and

geographical factors on bankruptcy and business performance of economic entities in the agri-food sector in the Republic of Moldova” under the State Program (2020-2024), registered code 20.80009.0807.26 and is summarized as:

- studying the specialized literature;
- highlighting the entities in the agri-food sector for conducting surveys;
- assessment of risk factors of entities in the agri-food sector;
- analysis of survey results;
- processing survey results.

In the period from 2020 to 2022, 1045 entities from the Republic of Moldova, and 50 entities from each country - Ukraine, Romania, the Czech Republic, Germany, which carry out one or more activities in the agri-food sector (vegetal, animal, postharvest, processing, HORECA etc.), were interviewed based on the questionnaire developed by the research team. In regional profile of Moldova, they represented - Northern Region - 34,23%; Central Region - 45,61% and Southern Region - 20,16%.

**Table 1.** The structure of the analysed entities by country.

Country	All entities	Viticulture and winemaking sector	
		Entities	%
Moldova	1045	293	28,04
Czech	50	8	16,00
Romania	50	12	24,00
Ukraine	50	16	32,00
Germany	50	7	14,00

Specialized software (*Statistica*) and MS Excel were used to process the experimental data.

We determined the linear regression for the experimental data according to the model:

$$Y = a + b_1X_1 + \dots + b_nX_n \quad (1)$$

### 3 Results and Discussions

The risks, but also the performance factors in the development of entities, are of an economic, political, technological, environmental, informational and human resources nature.

The evaluation questionnaire was included the following groups, subgroups and risk categories:

#### **C. Group of risks according to the main factors of occurrence**

C.1. Subgroup of economic factors – Market/Cost of production factors/Financial assets/Exchange rate/Inflation/Subsidies/Tax system/Other risks

C.2. Subgroup of political factors - Political affiliation / President/Parlament/Government/Minister/Local public administration/National Food Safety Agency/Other risks

C.3. Subgroup of technological factors - Application of technical-scientific progress/Modernization of equipment/

Technology modernization/Know-how/Land consolidation/Rent for activity/Property/Other risks

C.4. Subgroup of environmental factors - Climate changes/Natural disasters/Landslides/Deforestation/ Drainage of water basins/Other risks

C.5. Subgroup of legislative factors - National legislation/International legislation/The codes - land, water, fiscal, etc./Laws/Government decisions/Sector development programs/Technical regulations/standards/Other risks

C.6. Subgroup of information factors - Late information/False information/Disclosure of production secrets and confidential information/Other risks

C.7. Subgroup of moral factors - Marketing of expired products/Purchasing expired products/Product theft/Other risks.

#### **D. Group of risks according to their occurrence**

D.1. Subgroup of retrospective factors - Production errors/Mistakes in promotion/Marketing mistakes - Other risks

D.2. Subgroup of current risks - Temporary interruption of the production process - Temporary machine failures - Staff incapacity for work - Other risks

D.3. Subgroup of prospective risks - Business plan/Development strategies and policies/Other risks.

#### **E. Group of risks according to the nature of the record**

E.1. Subgroup of external risks – Inflation/Currency/Nature/Other risks

E.2. Subgroup of internal risks – Partners/Providers/Consumers/Marketing strategy/Activity policy/Production potential/Technical endowment/Level of specialization/Workforce qualification/Safety at work/Other risks.

#### **F. The group of risks according to the scope of occurrence on which the fields of entrepreneurial activity are based**

F.1. Subgroup of production risks – Application of technical-scientific/Modernization of equipment/Technology modernization/Know-how/Land consolidation/Rent for activity/Property/Marketing strategy/Activity policy/Production potential/Technical endowment/Level of specialization/Workforce qualification/Safety of work/Other risks

F.2. Subgroup of risks from financial activity – Banks/Financial institutions/Other risks

F.3. Subgroup of commercial risks – Auction/Wholesale trade/Retail trade/Insurance/Other risks

F.4. Subgroup of risks from intermediate activity – Notary/Broker/Lawyers/Other risks.

#### **G. Other categories**

G.1. Other categories - Fixed assets/Stocks of raw materials/Materials/Market selection/Distribution channels selection/Other risks

### H. Group of human resources factors

H.1. Subgroup of human resources factors - Non-professional staff/Professional staff level 3 ECTS/Professional staff level 4 ECTS/Professional staff level 6 ECTS/Professional staff level 8 ECTS/Professional staff with other specialty studies/Other risks.

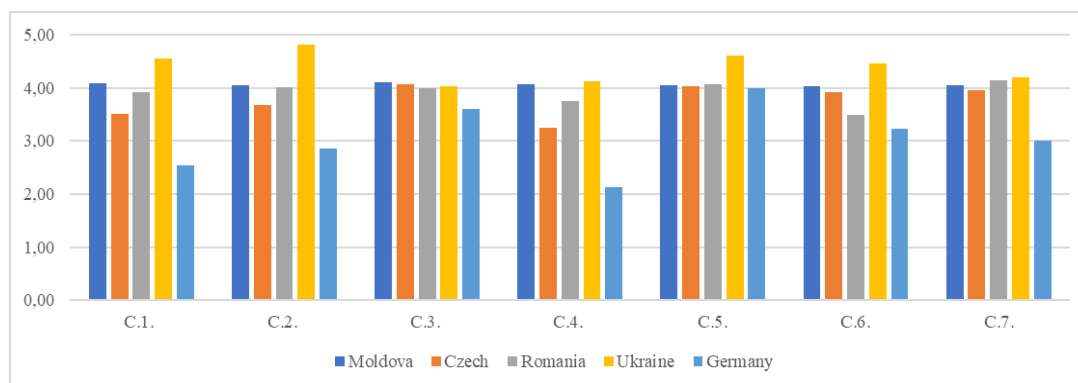
Analysing the data reflected in Figs 1 and 2, it can be seen that the highest value for all subgroups and risk categories obtained to entities from Ukraine, followed by Moldova, Romania and the Czech Republic. Germany

reflected the lowest risk assessment values.

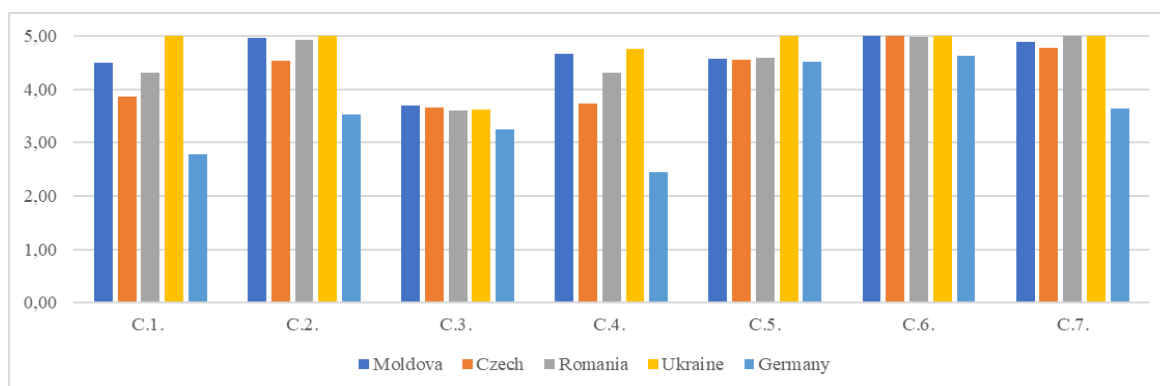
Compared to the data of C group of the agri-food sector, for the wine sector we obtained higher values, except for the group of technological factors.

The correlation coefficient  $r=0,64$ , the determination coefficient  $R^2=0,41$ , but the linear regression equation for the entities from the viticulture and wine making sector obtained the form:

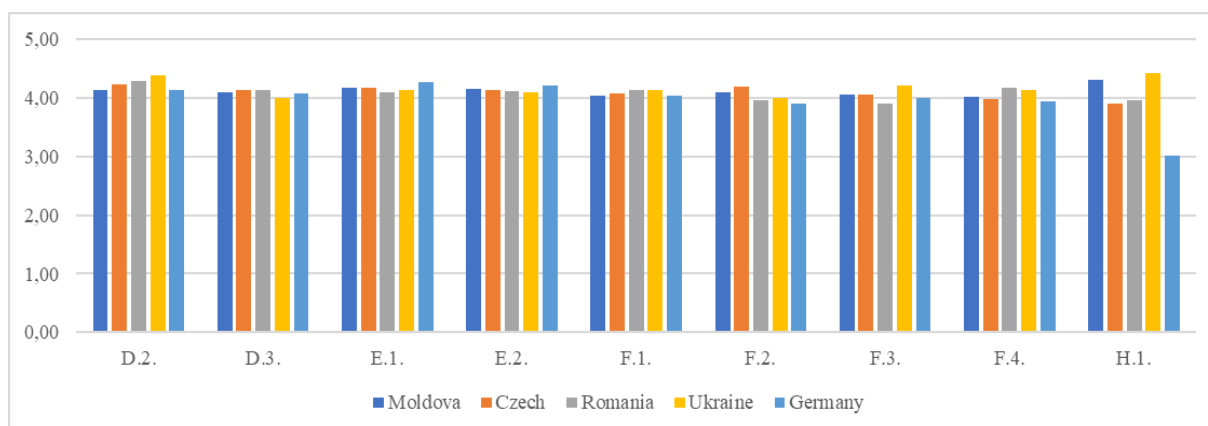
$$Y=0,49+0,95X_1+0,46X_2+0,23X_3+0,54X_4+0,83X_5+1,23X_6+1,01X_7 \quad (2)$$



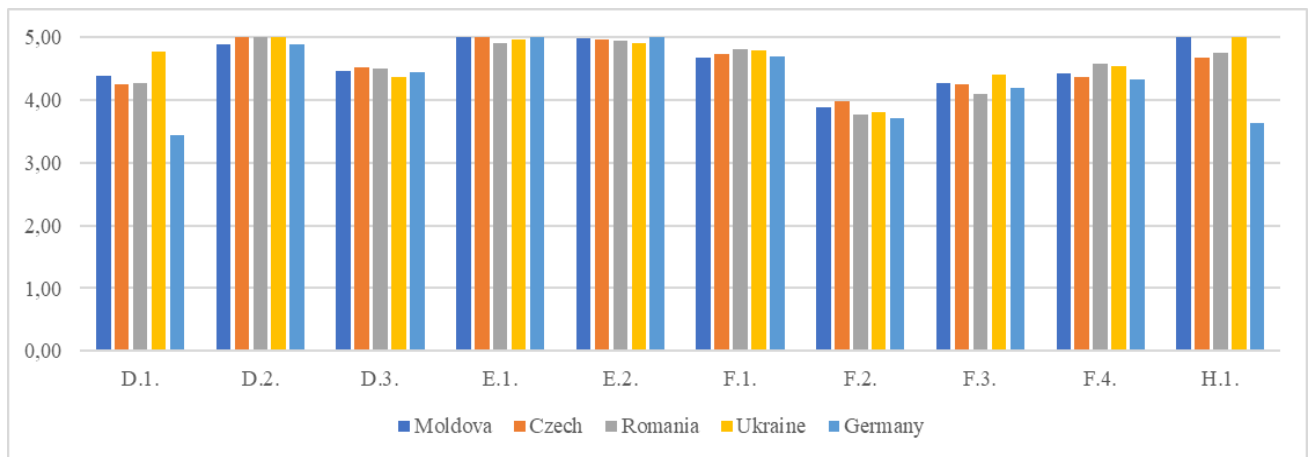
**Figure 1.** The average value of evaluation of the group of risks according to the main factors of occurrence (group C) on the all entities from agri-food sector.



**Figure 2.** The average value of evaluation of the group of risks according to the main factors of occurrence (group C) on the entities from the viticulture and wine making sector.



**Figure 3.** The average value of evaluation of the group of risks according to their occurrence (group D), to the nature of the record (group E), to the scope of occurrence on which the fields of entrepreneurial activity are based (group F) and group of human resources factors (group H) on the all entities from agri-food sector.



**Figure 4.** The average value of evaluation of the group of risks according to their occurrence (group D), to the nature of the record (group E), to the scope of occurrence on which the fields of entrepreneurial activity are based (group F) and group of human resources factors (group H) on the entities from the viticulture and wine making sector.

Analysing the data reflected in Figs. 3 and 4, the highest value for all subgroups and risk categories obtained to entities from Ukraine, followed by Moldova, Romania and the Czech Republic. Germany reflected the lowest risk assessment values.

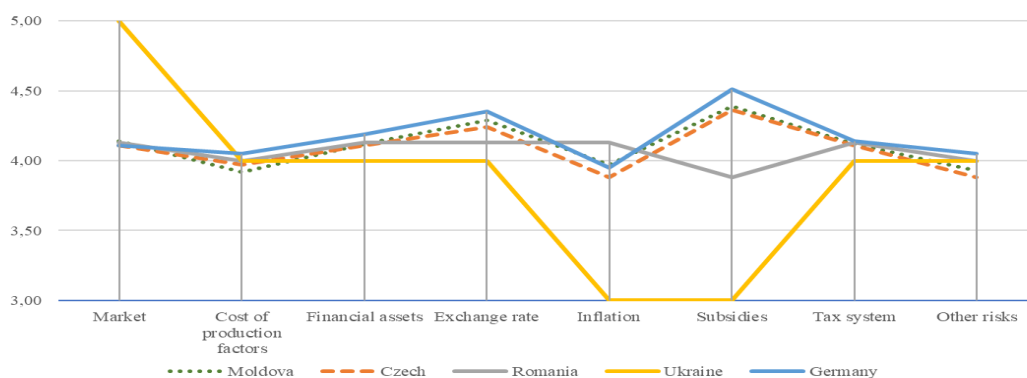
Compared to the data of D, E, F, H groups of risks or performance factors of the agri-food sector, for the wine sector we obtained higher values, except for the group of financial activities factors.

The correlation coefficient  $r=0,48$ , the determination coefficient  $R^2=0,23$ , but the linear regression equation for D group, for the entities from the viticulture and wine making sector obtained the form:

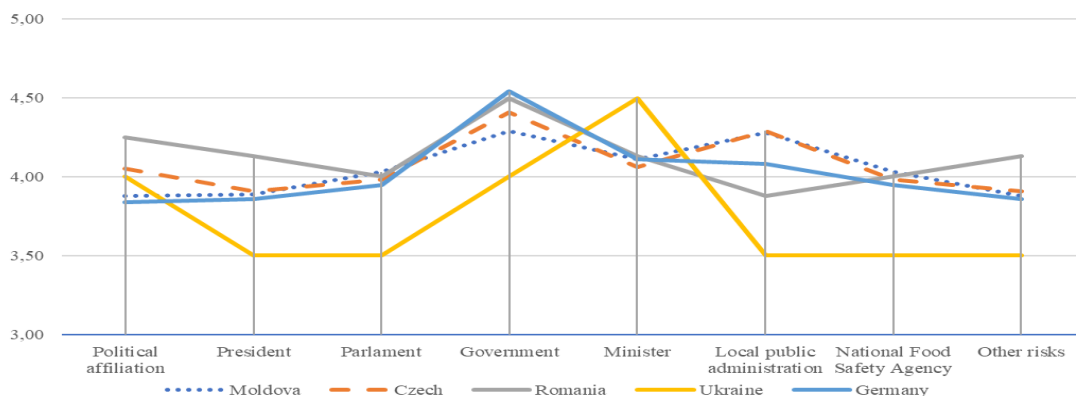
$$Y=0,49+0,95X_1+0,46X_2+0,23X_3+0,54X_4+0,83X_5+1,23X_6+1,01X_7 \quad (3)$$

The correlation coefficient  $r=0,73$ , the determination coefficient  $R^2=0,53$ , but the linear regression equation for F group, for the entities from the viticulture and wine making sector obtained the form:

$$Y=0,61+0,49X_1+0,91X_2+0,41X_3+0,93X_4 \quad (4)$$



**Figure 5.** Diagram of the economic risks assessment on the entities from the viticulture and wine making sector.



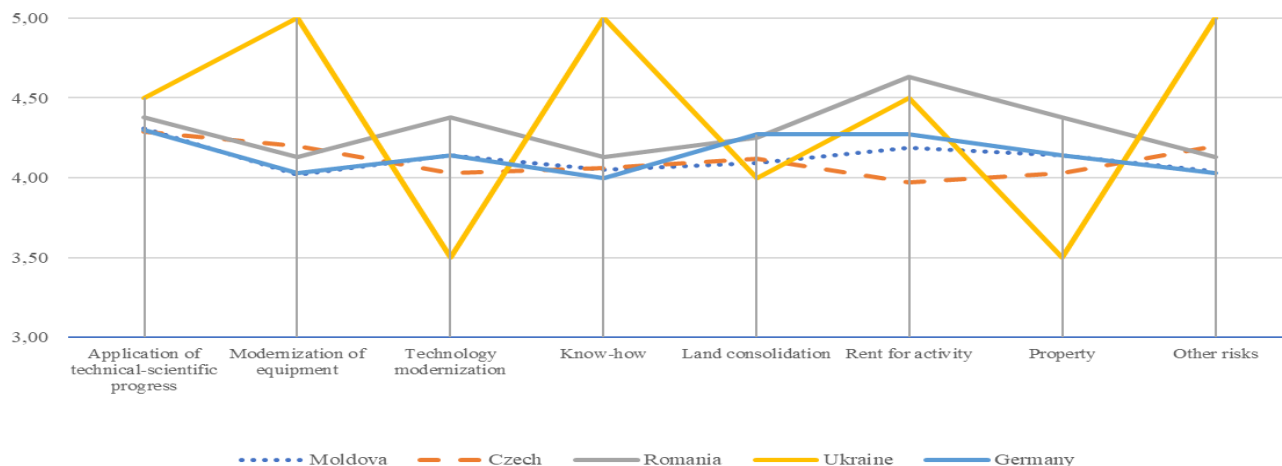
**Figure 6.** Diagram of the political risks assessment on the entities from the viticulture and wine making sector.

The correlation coefficient  $r=0,81$ , the determination coefficient  $R^2=0,66$ , but the linear regression equation for economic risks (Fig. 5), for the entities from the viticulture and wine making sector obtained the form:

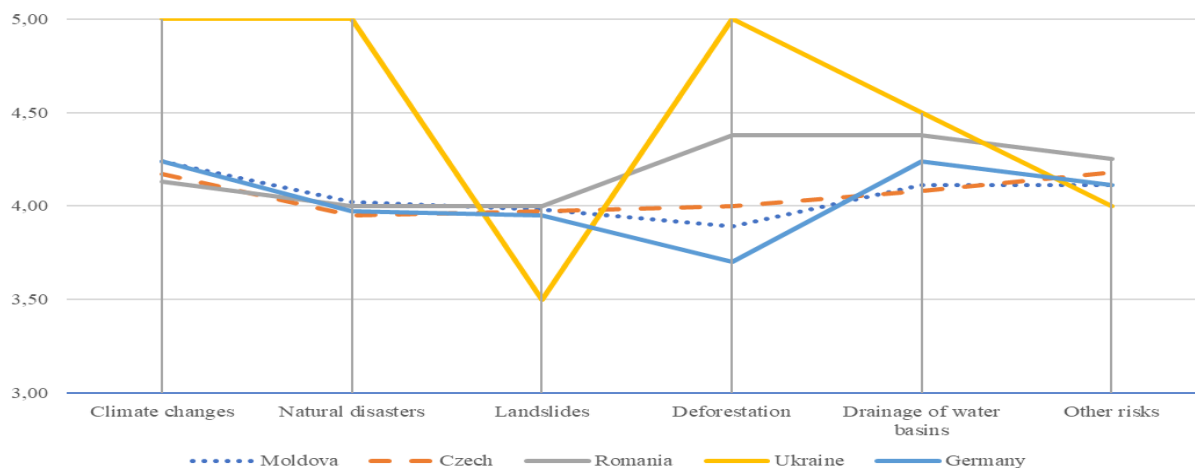
$$Y=0,29+0,63X_1+0,61X_2+0,68X_3+1,11X_4+5,31X_5+3,39X_6+0,76X_7+0,13X_8 \quad (5)$$

The correlation coefficient  $r=0,76$ , the determination coefficient  $R^2=0,58$ , but the linear regression equation for political risks (Fig. 6), for the entities from the viticulture and wine making sector obtained the form:

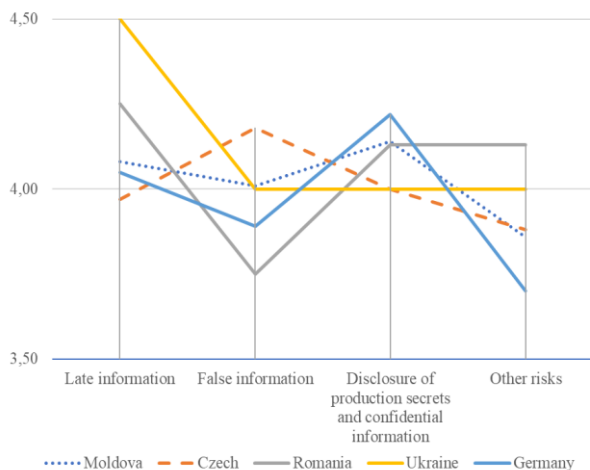
$$Y=2,15+1,41X_1+1,61X_2+1,01X_3+0,78X_4+1,46X_5+0,42X_6+0,36X_7+0,83X_8 \quad (6)$$



**Figure 7.** Diagram of the technological risks assessment on the entities from the viticulture and wine making sector.



**Figure 8.** Diagram of the environmental risks assessment on the entities from the viticulture and wine making sector.



**Figure 9.** Diagram of the information risks assessment on the entities from the viticulture and wine making sector.

The correlation coefficient  $r=0,91$ , the determination coefficient  $R^2=0,83$ , but the linear regression equation for technological risks (Fig. 7), for the entities from the viticulture and wine making sector obtained the form:

$$Y=4,30+0,61X_1+3,25X_2+0,78X_3+2,69X_4+0,83X_5+0,86X_6+0,16X_7+2,63X_8 \quad (7)$$

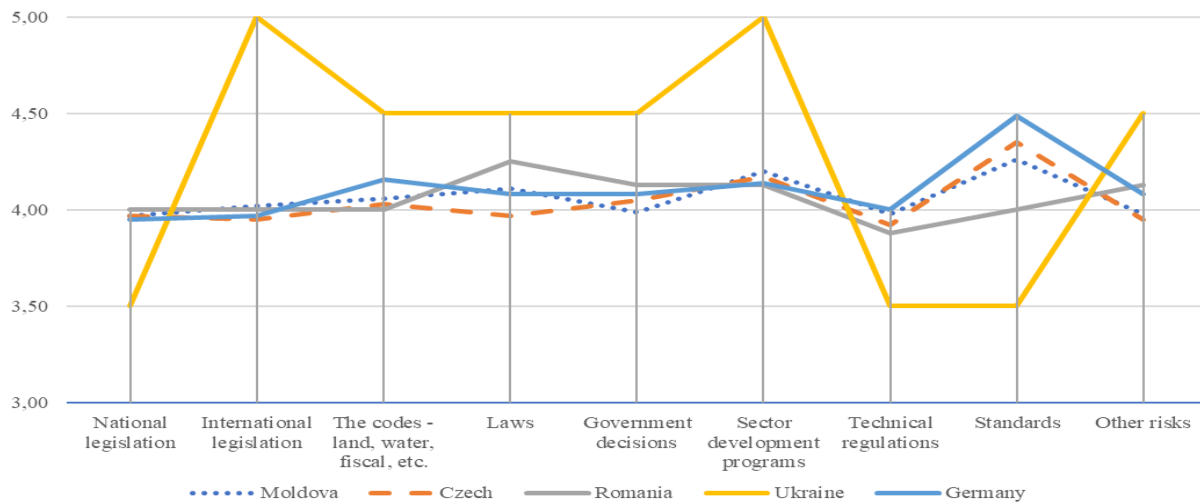
The correlation coefficient  $r=0,93$ , the determination coefficient  $R^2=0,86$ , but the linear regression equation for environmental risks (Fig. 8), for the entities from the viticulture and wine making sector obtained the form:

$$Y=3,71+2,15X_1+3,68X_2+0,28X_3+4,12X_4+1,63X_5+0,72X_6 \quad (8)$$

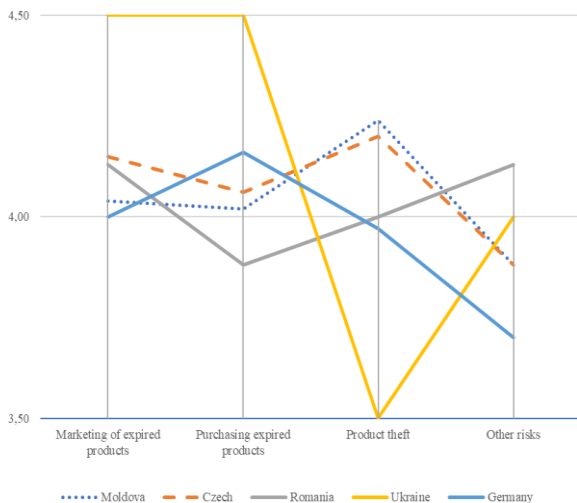
The correlation coefficient  $r=0,67$ , the determination coefficient  $R^2=0,45$ , but the linear regression equation for information risks (Fig. 9), for the entities from the

viticulture and wine making sector obtained the form:

$$Y=5,31+0,79X_1+0,83X_2+0,98X_3+0,99X_4 \quad (9)$$



**Figure 10.** Diagram of the legislative risks assessment on the entities from the viticulture and wine making.



**Figure 11.** Diagram of the moral risks assessment on the entities from the viticulture and wine making sector.

The correlation coefficient  $r=0,66$ , the determination coefficient  $R^2=0,44$ , but the linear regression equation for legislative risks (Fig. 10), for the entities from the viticulture and wine making sector obtained the form:

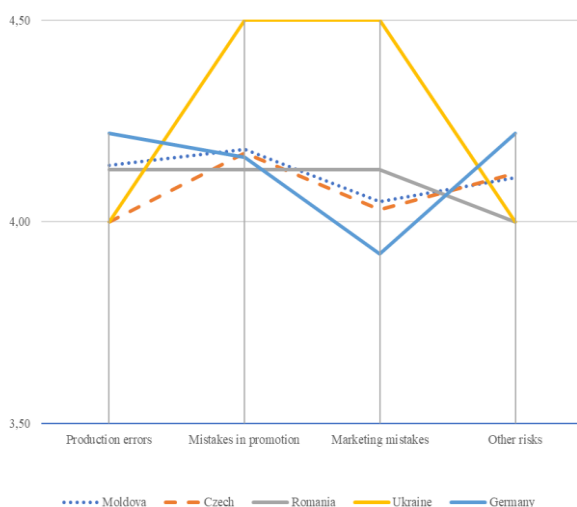
$$Y=4,30+0,61X_1+3,25X_2+0,78X_3+2,69X_4+0,83X_5+0,86X_6+0,16X_7+2,63X_8+2,63X_9 \quad (10)$$

The correlation coefficient  $r=0,43$ , the determination coefficient  $R^2=0,18$ , but the linear regression equation for moral risks (Fig. 11), for the entities from the viticulture and wine making sector obtained the form:

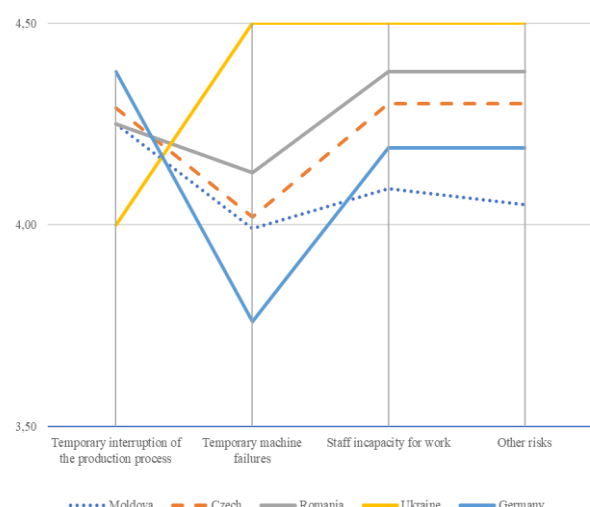
$$Y=2,01+0,72X_1+0,75X_2+0,61X_3-2,64X_4 \quad (11)$$

The correlation coefficient  $r=0,88$ , the determination coefficient  $R^2=0,77$ , but the linear regression equation for retrospective risks (Fig. 12), for the entities from the viticulture and wine making sector obtained the form:

$$Y=1,13+0,38X_1+2,43X_2+2,02X_3+1,15X_4 \quad (12)$$



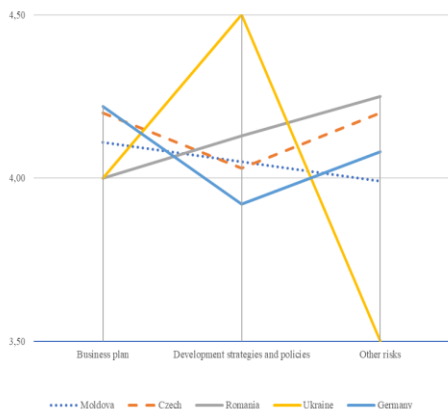
**Figure 12.** Diagram of the retrospective risks assessment on the entities from the viticulture and wine making sector.



**Figure 13.** Diagram of the current risks assessment on the entities from the viticulture and wine making sector.

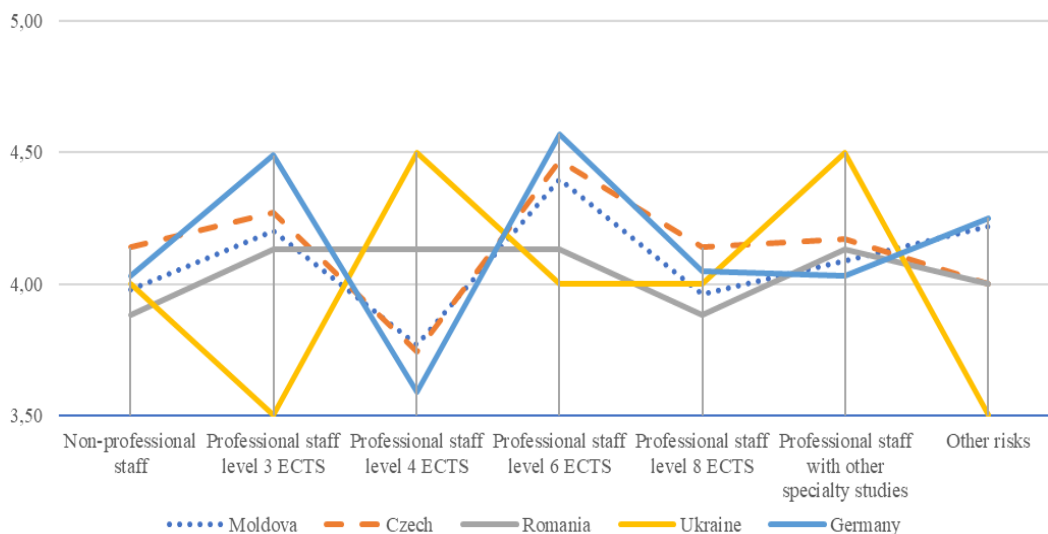
The correlation coefficient  $r=0,93$ , the determination coefficient  $R^2=0,86$ , but the linear regression equation for current risks (Fig. 13), for the entities from the viticulture and wine making sector obtained the form:

$$Y=0,67+0,38X_1+0,29X_2+2,83X_3+3,16X_4 \quad (13)$$



**Figure 14.** Diagram of the prospective risks assessment on the entities from the viticulture and wine making sector.

The correlation coefficient  $r=0,61$ , the determination coefficient  $R^2=0,37$ , but the linear regression equation for prospective risks (Fig. 14), for the entities from the viticulture and wine making sector obtained the form:



**Figure 16.** Diagram of the human resources risks assessment on the entities from the viticulture and wine making sector.

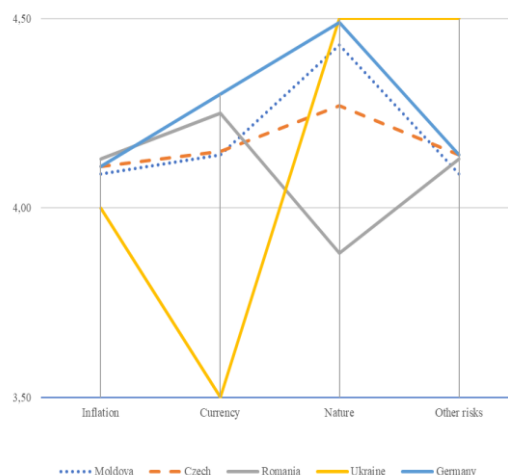
The correlation coefficient  $r=0,96$ , the determination coefficient  $R^2=0,92$ , but the linear regression equation for human resources risks (Fig. 16), for the entities from the viticulture and wine making sector obtained the form:

$$Y=3,47+0,79X_1+1,58X_2+0,33X_3+2,21X_4+0,68X_5+0,72X_6+3,21X_7 \quad (16)$$

Our previous studies in detail with reference to environmental and technological factors [13,14] gave us the opportunity to continue and deepen the study.

At the same time, the studies were extended not only for the horticultural sector, but also for the agri-food sector in the complex.

$$Y=2,69+0,46X_1+1,89X_2+1,33X_3 \quad (14)$$



**Figure 15.** Diagram of the current risks assessment on the entities from the viticulture and wine making sector.

The correlation coefficient  $r=0,82$ , the determination coefficient  $R^2=0,67$ , but the linear regression equation for current risks (Fig. 15), for the entities from the viticulture and wine making sector obtained the form:

$$Y=10,72+1,86X_1+3,46X_2+3,43X_3+1,42X_4 \quad (15)$$

## 4 Conclusions

For all risks groups the correlation coefficient ( $r$ ) obtained values between 0.48 and 0.96, this proves the presence of positive medium or strong correlation.

The value from 0,23 to 0,92 of the coefficients of determination ( $R^2$ ) shows us the influence of the assessed factors on the development of entities in the viticulture and winemaking sector at the 23-92% level.

In collaboration with the viticulture and winemaking sector, the development policies of the sector should be coordinated with the results of our research.

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