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ИСПЫТАНИЕ ФУНГИЦИДОВ В ОТНОШЕНИИ ВОЗБУДИТЕЛЯ ТВЁРДОЙ ГОЛОВНИ ПШЕНИЦЫ НА ИСКУССТВЕННОМ ИНФЕКЦИОННОМ ФОНЕ

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TESTING OF FUNGICIDES AGAINST THE PATHOGEN OF WHEAT SMUT ON AN ARTIFICIAL INFECTIOUS BACKGROUND

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DOI: 10.24412/9215-0365-2021-63-3-4

Аннотация
Представлены результаты изучения влияния фунгицидов Дивиденд Стар, Суми 8, Винцит и Виал ТТ на развитие возбудителя твёрдой головни озимой пшеницы (Tilletia caries Tul.). Исследования проводились в условиях искусственного инфекционного фона. Установлено, что биологическая эффективность препаратов Дивиденд Стар и Суми 8 составила 100 %. При испытании фунгицидов Виал ТТ и Винцит данный показатель был существенно ниже – 59,7 – 80,6 %.

Abstract
The article presents the results of studying the effect of the fungicides Dividend Star, Sumi 8, Vincit and Vial TT on the development of the causative agent of winter wheat smut (Tilletia caries Tul.). The studies were conducted in conditions of artificial infectious background. It was found that the biological effectiveness of the preparations Dividend Star and Sumi 8 was 100 %. When testing the fungicides Vial TT and Vincit, this indicator was significantly lower – 59,7 – 80,6 %.

Ключевые слова: фунгициды, возбудитель твёрдой головни (Tilletia caries Tul.), озимая пшеница, искусственный инфекционный фон, биологическая эффективность.

Keywords: fungicides, pathogen of smut (Tilletia caries Tul.), winter wheat, artificial infectious background, biological effectiveness.

При возделывании сельскохозяйственных культур не всегда формируется максимально возможная урожайность. Особенно это касается видов растений, занимающих значительные площади посева. В Центрально-Чернозёмном регионе к таким культурам относится озимая пшеница. На её урожайность оказывают влияние многие факторы, в том числе, поражение различными фитопатогенами. Одним из них является возбудитель твёрдой головни – гриб Tilletia caries Tul. Он распространён практически повсеместно, где возделывают пшеницу. Растения, пораженные данным патогеном, имеют низкую продуктивность и качество продукции. Основная опасность гриба Tilletia caries со-стоит в токсичности его спор. Они содержат алкалоид триметиламин, вызывающий тяжёлые заболевания теплокровных животных и человека. При высоком уровне заражения зерна телиоспорами возбудителя твёрдой головни, его нельзя использовать на пищевые и кормовые цели. Такие партии зерна подлежат выбраковке. Заболевание проявляется в начальной молочной спелости зерна. Если надавить на пораженный колос, то выделяется сероватая жидкость, имеющая запах сельдяного рассола. В период наступления полной спелости, у поражённых и здоровых колосьев различие в окраске практически исчезает. В зараженном колосе вместо зерна формируется черные плотные овальные головнёвые мешочки, наполненные массой мелких телиоспор. Они легко разрушаются, масса их значительно меньше, чем у здорового зерна. Во время уборки урожая головнёвые мешочки повреждаются и споры распыляются – происходит контаминация здорового зерна. После посева такими семенами, телиоспоры образуют мицелий одновременно с прорастанием семян и он проникает в проростки. В дальнейшем грибница па- тогена диффузно распространяется по стеблю, листьям, достигает формирующийся колос и заражает его [1,2,3]. Цикл развития гриба повторяется. Дополнительными путями распространения головнёвой инфекции могут служить уборочная техника, складские помещения, инвентарь. Если там присутствуют телиоспоры патогена, то последние неизбежно попадают на здоровое зерно. Чтобы остановить это опасное заболевание, необходимо разорвать цикл развития гриба Tilletia caries. Наиболее уязвимыми являются фазы покоя и прорастання телиоспор. Поэтому для борьбы с этим возбудителем применяют предпосевное обеззараживание семен-
ного материала различными химическими препаратами. За последние десятилетия для защиты семян пшеницы от головнёвых заболеваний было создано достаточно большое количество фунгицидов-протравителей семян. Но не все они способны полностью ингибировать развитие гриба Tilletia caries. Для нужд производства необходимы средства, обладающие максимальным эффектом. По этой причине возникает необходимость скрининга существующих протравителей семян для выявления наиболее действенных. Цель наших исследований состояла в оценке биологической эффективности современных фунгицидов в отношении возбудителя твёрдой головни пшеницы.

Опыты проводились в полевых условиях, на искусственном инфекционном фоне. В качестве материала исследований использовался семенной материал озимой пшеницы сорта Скипетр. Семена пшеницы заражали телиоспорами возбудителя твёрдой головни (Tilletia caries Tul.) из расчета 2 грамма спор на 100 грамм семян [4]. Затем их обрабатывали химическими препаратами: Дивиденд Стар КС, 1 л/т; Суми 8 КС, 2 л/т; Винцит СК, 2 л/т и Виал ТТ ВСК, 0,4 л/т. В контроле семенной материал был без обработки. Через сутки семена высеивали на делянках. Площадь делянки 0,3 м², повторность четырёхкратная. По достижении растениями пшеницы фазы восковой спелости их убирали с делянок и определяли количество здоровых и больных колосьев. Распространенность заболевания и биологическую эффективность испытываемых препаратов рассчитывали согласно общепринятым формулам.

Как показали проведённые исследования, испытываемые протравители семян проявляли неодинаковый уровень эффективности в отношении возбудителя твёрдой головни озимой пшеницы (таблица). Полностью (на 100 %) ингибировали развитие заболевания фунгициды Дивиденд Стар и Суми 8. Препараты Виал ТТ и Винцит снижали уровень поражения растений возбудителем твёрдой головни на 59,7 и 80,6 %, соответственно. Поражение растений в контроле составило 19,6 %.

Таблица

<table>
<thead>
<tr>
<th>Препарат, норма расхода</th>
<th>Поражение твёрдой головной, %</th>
<th>Биологическая эффективность, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Дивиденд Стар КС, 1 л/т</td>
<td>0,0</td>
<td>100,0</td>
</tr>
<tr>
<td>Суми 8 КС, 2 л/т</td>
<td>0,0</td>
<td>100,0</td>
</tr>
<tr>
<td>Винцит СК, 2 л/т</td>
<td>3,8</td>
<td>80,6</td>
</tr>
<tr>
<td>Виал ТТ ВСК, 0,4 л/т</td>
<td>7,9</td>
<td>59,7</td>
</tr>
<tr>
<td>Контроль</td>
<td>19,6</td>
<td>-</td>
</tr>
</tbody>
</table>

Исходя из выше изложенного, можно сказать, что испытание фунгицидов-протравителей семян в условиях искусственного инфекционного фона позволило оценить их биологическую эффективность в отношении возбудителя твёрдой головни пшеницы. Выявлены наиболее действенные препараты Дивиденд Стар и Суми 8, способные полностью ингибировать развитие заболевания. Результаты исследований могут быть использованы в производстве, при выборе оптимальных средств для обеззараживания семенного материала пшеницы.

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SPRING BARLEY PRODUCTIVITY IN DEPENDENCE ON MINERAL NUTRITION

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Vinnitsya National Agrarian University
DOI: 10.24412/9215-0365-2021-63-3-4-9

Abstract

Considering the sown areas and yields of spring barley out of many cereal crops in Ukraine as well as in the area of world agriculture it takes one of the priority places. In general, the sown area of spring barley in the world is about 75 million hectares. In Ukraine it is sown on an area of about 3-5 million hectares. Barley grain is in great demand, it is widely used as a fodder and for food purposes, in addition it is used for the brewing industry as an indispensable raw material.
According to the results of the research it was established that barley is a very valuable agricultural crop. We have determined that more effective conditions for preservation of spring barley plants in the crop will be under the condition of introducing mineral fertilizers in the dose of N_{60}P_{60}K_{60} into the pre-sowing cultivation and when growing after winter rape predecessor. Under these conditions, the density of plants at the time of harvesting ripeness was 275 pcs / M², and the survival rate was 68.8%. Nitrogen fertilizers N60 applied during pre-sowing cultivation on the variants with phosphorous-potassium nutrition (P_{60}K_{60}) ensured the height of spring barley plants at the heading stage, which was 38 cm after rape, 37 cm after maize and 35 cm after sunflower.

**Keywords:** barley, precursor, mineral fertilizers, height, density, individual productivity.

**Statement of the problem:** Barley is one of the most common crops in world agriculture and has been grown since prehistoric times. In the world structure of sown areas barley takes the fourth place after wheat, rice and corn, and in Ukraine by this index it is second only to winter wheat. Such a wide spread of barley is connected with its universal use. The total demand of the state in barley grain greatly exceeds the level of modern production. Unstable gross production of spring barley grain in different years had a noticeable influence of yield fluctuations.

Nowadays agriculture in Ukraine is considered to be the main branch of economy, stably forms high net profit. That is why the task of increasing the production of agricultural products, including grain, is so acute. Growth of grain production is provided mainly by the output and introduction of new varieties and hybrids, as well as by the improvement of existing production technologies. Domestic scientists - breeders created a wide range of high-quality high-yield varieties of various crops, including spring barley [2-4]. High-intensive, intensive and semi-intensive varieties with high yield potential and grain quality, adapted to the specific growing conditions, are recommended to the producers of enterprises of various forms of ownership [5].

**Summary of the basic material:** Sowing barley seeds in the field is the most responsible technological process, which significantly affects the time of appearance and completeness of the ladder, the subsequent growth and development of plants. It is known that in the Forest-steppe zone of the right bank in the spring there are sharp fluctuations in temperature, due to which a significant portion of the seeds (20-30%) does not germinate even with remarkable rates of laboratory germination (95-100%). Therefore, ensuring high field germination is one of the most important tasks of agricultural technique, because the level of future yields largely depends on it.

KWS Dante's spring barley seeding rate in the experience that in 2019 and 2020 was 4 million germinating seeds per hectare. Of course, the soil conditions at the time made adjustments to the field germination.

Research revealed that the indicators of thickness of spring barley plants in the phase of full sprouting were influenced by both the predecessors and the level of mineral nutrition (Table 1.). When spring barley was grown with winter rape on the control without fertilizers the plant density was 302 pcs/M², or 75.5% of field germination. The variant with mineral fertilizers at a dose of N_{60}P_{60}K_{60} plant density was 315 pcs / M² or 78.8% of field germination. Increasing the dose of nitrogen to 90 kg a.d. on phosphorus-potassium background was the reason that the density of plants of spring barley in the period of complete germination was 327 pcs / m², which was 81.8% of field germination.

Sowing of spring barley after the preceding corn on grain contributed to the fact that the variant without fertilizers plant density at the time of complete germination was 300 pcs / M², which was 75% of field germination. Application of 60 kg a.d. of nitrogen, phosphorus and potassium provided a similarity of 313 pcs / m² plants, or 78.3% of field germination. When N_{60}P_{60}K_{60} was applied, the number of barley plants in the period of full germination was 325 pcs/m², i.e., field germination was 81.3%.

**Table 1.**

Effect of predecessor and mineral fertilizers on field germination and plant density of spring barley in the phase of full sprouting (Average for 2019-2020).

<table>
<thead>
<tr>
<th>Predecessor</th>
<th>Level of mineral nutrition</th>
<th>Plant density, pcs/M²</th>
<th>Field germination, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter rape</td>
<td>No fertilizer</td>
<td>302</td>
<td>75,5</td>
</tr>
<tr>
<td></td>
<td>N_{60}P_{60}K_{60}</td>
<td>315</td>
<td>78,8</td>
</tr>
<tr>
<td></td>
<td>N_{60}P_{60}K_{60}</td>
<td>327</td>
<td>81,8</td>
</tr>
<tr>
<td>Corn (for the grain)</td>
<td>No fertilizer</td>
<td>300</td>
<td>75,0</td>
</tr>
<tr>
<td></td>
<td>N_{60}P_{60}K_{60}</td>
<td>313</td>
<td>78,3</td>
</tr>
<tr>
<td></td>
<td>N_{60}P_{60}K_{60}</td>
<td>325</td>
<td>81,3</td>
</tr>
<tr>
<td>Sunflower</td>
<td>No fertilizer</td>
<td>298</td>
<td>74,5</td>
</tr>
<tr>
<td></td>
<td>N_{60}P_{60}K_{60}</td>
<td>309</td>
<td>77,3</td>
</tr>
<tr>
<td></td>
<td>N_{60}P_{60}K_{60}</td>
<td>321</td>
<td>80,3</td>
</tr>
</tbody>
</table>

At spring barley growing on the variant with sunflower predecessor the lowest similarity indices were noted, namely at the variant without fertilization - 298 pcs/M², that was 74.5% of field germination. When fertilizers were applied, the similarity indicators slightly improved and were 309 pcs/M² and 77.3%, respectively, when using N_{60}P_{60}K_{60} and 321 pcs/M² and 80.3% - when using N_{60}P_{60}K_{60}.

Observing the dynamics of densities of spring barley plants during the growing season, it was noted that this indicator decreased slightly during the growth and development of plants as a result of fallout. This phenomenon was caused by a number of biotic and abiotic environmental factors.

The positive role of winter rape as a precursor for spring barley plants was noted. On this variant there was the greatest number of preserved plants (Table 2). Thus, on the variant without fertilizers the number of spring barley plants was 238 plants/M², i.e., survival rate was 59.5%. When N_{60} was added to the preplanting
cultivation on the background of P<sub>60</sub>K<sub>60</sub> densities of spring barley plants during the lean period was 260 pcs/M<sup>2</sup>; the survival rate was 65.0%. When the dose of nitrogen was increased to 90 kg a.d. on phosphorus-potassium background, the preservation of barley plants in the crop at the period of slope ripeness was 68.8%, while the density was at 275 pcs/m<sup>2</sup> plants.

<table>
<thead>
<tr>
<th>Predecessor</th>
<th>Level of mineral nutrition</th>
<th>Plant density, pcs/M&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Field germination, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter rape</td>
<td>No fertilizer</td>
<td>238</td>
<td>59.5</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>260</td>
<td>65.0</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>275</td>
<td>68.8</td>
</tr>
<tr>
<td>Corn (for the grain)</td>
<td>No fertilizer</td>
<td>225</td>
<td>56.3</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>254</td>
<td>63.5</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>266</td>
<td>66.5</td>
</tr>
<tr>
<td>Sunflower</td>
<td>No fertilizer</td>
<td>217</td>
<td>54.3</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>248</td>
<td>62.0</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>257</td>
<td>64.3</td>
</tr>
</tbody>
</table>

When using corn on grain, as a predecessor, on the option without fertilizer the density of plants at harvesting ripeness was 225 pcs/m<sup>2</sup>, thus the survival rate was 56.3%. With the application of full mineral nutrition at a dose of 60 kg a.d., the density of barley plants at harvest time was 254 pcs. /m<sup>2</sup>, and survival respectively - 63.5%. The application of 90 kg a.d.p. of nitrogen fertilizers in the preplanting cultivation on the background of P<sub>60</sub>K<sub>60</sub> resulted in making the barley stalk density at the harvesting period 266 pcs/m<sup>2</sup> of plants and, consequently, the survival rate - 66.5%.

During the study it was found that sunflower was worse for spring barley predecessor. Especially indicative was the dry 2020. Because of the low moisture reserves in the soil after sunflower crops spring barley crops during the growing season compared with other predecessors. Thus, on the version without mineral fertilizers densities of spring barley plants during the harvesting ripeness was 217 pcs/M<sup>2</sup>, which in terms of survival was 54.3%. Cultivation of spring barley on a background of N<sub>0</sub>P<sub>60</sub>K<sub>60</sub> contributed to the fact that the survival rate of barley plants at harvest time was 248 pcs/M<sup>2</sup>, or 62% of the crop. Slightly better preservation of plants with sunflower precursor was observed on the variant with N<sub>0</sub>P<sub>60</sub>K<sub>60</sub>. At the same time, preservation of spring barley plants for the period of slope ripening was 257 pcs/M<sup>2</sup>, and survival rate was 64.3%.

Thus, the best conditions for preservation of spring barley plants in the sowing in the phase of slope ripening are noted when mineral fertilizers in the dose of N<sub>0</sub>P<sub>60</sub>K<sub>60</sub> are applied. There is also a marked advantage of winter rape as a precursor for spring barley compared with corn or sunflower.

During the growing season of spring barley, we carried out phenological observations of the onset of the main phases: sprouting, tillering, emerging into the tube, earing, and full ripeness. Passage of these stages depends on environmental conditions. It is known that there are regularities and interrelation between development phases, stages of organogenesis and formation of productivity elements.

During the studies it was found that the period of sowing - full sprouts did not practically differ depending on the predecessor and levels of mineral nutrition and amounted to 10-11 days (Table 3).

<table>
<thead>
<tr>
<th>Predecessor</th>
<th>Level of mineral nutrition</th>
<th>Sowing -full sprouts</th>
<th>Vegetation periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sowing - full sprouts</td>
<td>Ladder tillering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tillering - coming out of the tube</td>
<td>appearing in the tube</td>
</tr>
<tr>
<td>Winter rape</td>
<td>No fertilizer</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Corn (for the grain)</td>
<td>No fertilizer</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Sunflower</td>
<td>No fertilizer</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>10</td>
<td>13</td>
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<tr>
<td></td>
<td>N&lt;sub&gt;0&lt;/sub&gt;P&lt;sub&gt;60&lt;/sub&gt;K&lt;sub&gt;60&lt;/sub&gt;</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

The process of tillering to a large extent depends on environmental factors and is regulated by elements of the technology of cultivation. In our case, it was noted that the greatest influence on the duration of the interphase periods had equal mineral nutrition. So, the period "seedlings - tillering" on the variant without fertilizer lasted 12 days, at application of N<sub>0</sub>P<sub>60</sub>K<sub>60</sub> - 13...
days, and at application of $N_{90}P_{60}K_{60}$ - 14 days regardless of a preceding.

Duration of the interphase period "tillering - exiting a tube" for the variant without mineral fertilizers, after any predecessor was 18 days. Application of mineral fertilizers during pre-sowing cultivation prolonged this period by 1 day, which was 19 days.

It is known that favorable conditions for plant life somewhat lengthen the interphase periods. In our case, the best conditions were formed after winter rape, as a predecessor, then went corn on grain, and at the end of sunflower.

It was noted that spring barley sown with winter rape as a predecessor the duration of the period "heading - earing" was 27 days in the version without fertilization and 28 days with the addition of mineral fertilization.

When using corn as a predecessor of spring barley the duration of the period "earing - earing" on the non-fertilized variant was 26 days. Application of full mineral fertilizer prolonged this period to 29 days.

On the variant without fertilizers the duration of the period "emerging into the tube - earing" with sunflower predecessor was 24 days and with the fertilizers - 25 days.

The study found that the duration of the period "earing - full ripeness" depended on both the fore crop and the level of mineral nutrition.

Thus, this period was 31-33 days in the variant with rape. The duration of the period "earing - full ripeness" depending on the fertilizer was 30-32 days. The shortest this period was with the sunflower fore crop and amounted to 29-31 days.

Taking into consideration the above-mentioned periods of the plant’s growth and development the duration of the period "shoots - ripening" for the spring barley which was grown after the winter rape was 88 days - for the variant without fertilization, 92 days - with the application of $N_{90}P_{60}K_{60}$, and 94 days - with the application of $N_{90}P_{60}K_{60}$.

At the variant with corn and without mineral fertilizers spring barley had the period "full sprouting - ripening" duration of 86 days, when $N_{90}P_{60}K_{60}$ was used - 90 days, when increasing the nitrogen dose to 90 kg a.d. on phosphorus-potassium background - 92 days.

The use of sunflower as a preceding event for spring barley resulted in the fact that the period "full sprouting-ripening" was 83 days in the variant without fertilizers. The application of 60 and 90 kg a.d. nitrogen on the phosphorus-potassium background ($P_{60}K_{60}$) prolonged this period to 87 and 89 days, respectively.

Thus, the role of the precursor and mineral fertilizers in the duration of the growth and development phases was noted. Optimization of conditions of spring barley slightly prolonged the phase, in turn, positively influenced the yield.

A characteristic indicator of growth processes that affects the formation of spring barley yield is its height. Stem growth in spring barley plants takes place mainly in the lower part of the internode, where the young tissue is located, protected by the base of the leaf sheath. Stem elongation usually ends after the phase of complete plant vicoloshvannya. Stem height in spring barley is a genetic property of the variety, but is subject to particularly wide variation under the influence of growing conditions. When there is a lack of moisture, the spikelet does not fully emerge from the sheath of the upper leaf. It is the length of the upper internode that is an important indicator of the plant's moisture supply during flowering and at the beginning of grain formation.

It is known that during the growing season the height of spring barley plants increases irregularly. For example, plants have almost the same height during tillering and emergence phase. This can be explained by the growth of plant mass to a greater extent, and in the late phases of earing and flowering there is an intensive growth of plants in height. The cessation of growth processes occurs in the phase of lacticiferous ripeness, as all the plastic substances are directed to the filling of the seeds.

Our research revealed that the height of spring barley plants from the phase of full sprouts to full maturity constantly increased and depended on both the levels of mineral nutrition and on the cover crop.

It was noted that in the phase of tillering the height of barley plants varied insignificantly and amounted to 5-6 cm in the whole experiment (Table 4). A more significant difference in the height of barley plants was manifested in the phase of spring barley emergence into the tube. Thus, when growing after winter rape, the height of spring barley was 9-11 cm, after corn - 8-10 cm, and after sunflower also 8-10 cm.

<table>
<thead>
<tr>
<th>Predecessor</th>
<th>Level of mineral nutrition</th>
<th>Growth and development phases of spring barley plants (average for 2019-2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>tillering</td>
</tr>
<tr>
<td>Winter rape</td>
<td>No fertilizer</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$N_{90}P_{60}K_{60}$</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$N_{90}P_{60}K_{60}$</td>
<td>6</td>
</tr>
<tr>
<td>Corn (for the grain)</td>
<td>No fertilizer</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$N_{90}P_{60}K_{60}$</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$N_{90}P_{60}K_{60}$</td>
<td>6</td>
</tr>
<tr>
<td>Sunflower</td>
<td>No fertilizer</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$N_{90}P_{60}K_{60}$</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$N_{90}P_{60}K_{60}$</td>
<td>6</td>
</tr>
</tbody>
</table>
A more significant difference in the height of spring barley plants was observed in the earing phase. So, on the variant without fertilizers barley plants height was 31 cm - after winter rape, 30 cm - after corn and 28 cm after sunflower.

Application of N$_{60}$ before sowing on the background of P$_{60}$K$_{60}$ provided the height of spring barley plants in the heading stage at 38 cm after rape, 37 cm after maize and 35 cm after sunflower.

Application of N$_{60}$P$_{60}$K$_{60}$ contributed to intensive growth of plants in height. The barley with rape was at the phase of earing the height of 47 cm, with maize - 45 cm and with sunflower - 43 cm.

The last measurements of plant height indicators we conducted in the phase of full ripeness. It was noted that the height of the plant with winter rape as a precursor was 55 cm - in the variant without fertilization, 62 cm - when N$_{60}$P$_{60}$K$_{60}$ was applied, and 66 cm - when N$_{90}$P$_{90}$K$_{90}$ was used.

When using corn as a fore crop for barley the height of the latter's plants in the phase of full maturity were noted in the phase of the emergence of the tube. The application of 60 kg of the fore crop, the average daily linear growth during the growing season), we can see a growth of spring barley plants from the phase of coming into the heading stage up to 1.39 cm/day. Whereas application of mineral fertilizers in the rate of N$_{60}$P$_{60}$K$_{60}$ allowed to increase the height parameters to 55 cm, whereas N$_{90}$P$_{90}$K$_{90}$ - to 63 cm.

One of the important indicators characterizing the rate of growth and development of plants at different stages of ontogenesis is the average daily linear growth. They clearly characterize the intensity of plant growth, in particular spring barley. To calculate it, we took the indices of height in one or another phase and divided by the number of days of its passage. Thus, the indices of linear growth of spring barley by phase and for the whole vegetation period were determined.

In the tillering phase average daily linear growth of spring barley was 0.38 - 0.43 cm a day depending on the levels of mineral nutrition (Table 5).

<table>
<thead>
<tr>
<th>Predecessor</th>
<th>Level of mineral nutrition</th>
<th>Average daily growth in the phase (cm / day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter rape</td>
<td>No fertilizer</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>N$<em>{60}$P$</em>{60}$K$_{60}$</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>N$<em>{90}$P$</em>{90}$K$_{90}$</td>
<td>0.43</td>
</tr>
<tr>
<td>Corn (for the grain)</td>
<td>No fertilizer</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>N$<em>{60}$P$</em>{60}$K$_{60}$</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>N$<em>{90}$P$</em>{90}$K$_{90}$</td>
<td>0.43</td>
</tr>
<tr>
<td>Sunflower</td>
<td>No fertilizer</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>N$<em>{60}$P$</em>{60}$K$_{60}$</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>N$<em>{90}$P$</em>{90}$K$_{90}$</td>
<td>0.43</td>
</tr>
</tbody>
</table>

Somewhat higher values of average daily growth were noted in the phase of the emergence of the tube. Thus, with winter rape on the fore crop without fertilizers it was 0.50 cm per day, with N$_{60}$P$_{60}$K$_{60}$ - 0.53 cm / day, and with N$_{90}$P$_{90}$K$_{90}$ - 0.58 cm / day.

Indicators of average daily linear growth of spring barley in the phase of exiting a tube that for the fore crop of sunflower, corn were the same and amounted to 0.44 cm / day - to the variant without fertilizers, 0.47 cm / day - when applying N$_{60}$P$_{60}$K$_{60}$ and 0.53 cm / day - with the use of N$_{90}$P$_{90}$K$_{90}$.

Barley plants showed intensive growth in height in the earing phase, which is associated with the physiological characteristics of the plant. Excluding the effect of the fore crop, the average daily linear growth was 0.97-1.0 cm / day, when using N$_{60}$P$_{60}$K$_{60}$ - 1.17-1.19 cm / day. Whereas application of mineral fertilizers in the rate of N$_{60}$P$_{60}$K$_{60}$ increased linear growth of spring barley plants in the heading stage up to 1.39-1.42 cm / day.

If we pay attention to the average daily linear growth of spring barley plants from the phase of complete sprouting to the phase of full ripeness (average daily growth during the growing season), we can see a significant influence of the levels of mineral nutrition on the process of growth in height. The lowest rate of growth was on the variant without fertilizers and amounted to 0.60-0.63 cm / day, at application of N$_{60}$P$_{60}$K$_{60}$ - they were in the range of 0.63-0.67 cm / day. The highest rates of average daily linear growth were noted at the application of mineral nutrition in the rate of N$_{90}$P$_{90}$K$_{90}$, and depending on the precursor, they were 0.70-0.71 cm / day.

Thus, the positive role of mineral fertilizers, including nitrogen fertilizers in the formation of high growth from the phase of plants in the tube until the phase of harvesting ripeness.

**Conclusions:** The best conditions for keeping the spring barley plants in sowing in the phase of skinny ripeness are observed under the condition of introducing mineral fertilizers in the dosage of N$_{60}$P$_{60}$K$_{60}$ during pre-sowing cultivation and when growing after the winter rape. Under these conditions, the density of plants at harvesting ripeness was 275 pcs/M2, and survival rate was 68.8%.

Duration of the period “complete shoots - ripening” for the spring barley which was grown after the winter rape was 88 days - for the variant without fertilization, 92 days - with the application of N$_{60}$P$_{60}$K$_{60}$, and 94 days - with the application of N$_{90}$P$_{90}$K$_{90}$.

The application of N$_{60}$ before sowing on phosphorus-potassium background (P$_{60}$K$_{60}$) provided the height
of summer barley plants in the heading stage at 38 cm after rape, 37 cm after maize and 35 cm after sunflower.

The lowest rate of spring barley average daily growth during the whole vegetation period was in the control without fertilization - 0.60-0.63 cm / day; after application of N<sub>60</sub>P<sub>60</sub>K<sub>60</sub> it was in the range of 0.63-0.67 cm / day. Whereas the highest rates of average daily linear growth were observed upon application of N<sub>90</sub>P<sub>60</sub>K<sub>60</sub> in preplant cultivation, and depending on the precursor they were 0.70-0.71 cm / day.

References

FORECASTING THE IMPACT OF THE PANDEMIC ON THE PAYING CAPACITY

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Abstract

The relevance of this topic is due to the fact that in modern conditions, income inequality can reach enormous proportions and pose a threat to political and economic stability in the country, exacerbated by the impact of the pandemic, because the standard of living of the population depends on them. According to forecasts, the poverty rate in the country due to the pandemic will increase from 27.2% to 43.6%, and in the worst case - up to 50.8% of the total population.

We recorded a sharp increase in poverty in the first quarter of 2020. In the first half of the year, the poverty rate rose to 51%. In the first half of 2019, 41% of Ukrainians were poor. The poverty rate in 2020 will be 45-50%. Despite the state’s efforts to help people who have lost their jobs, the average nominal amount of unemployment benefits in 2020 has decreased even in hryvnia equivalent. According to the State Employment Center, in January-November - by UAH 309. In dollar terms - from $ 164 to $ 126 per month.

The current situation in the field of income in Ukraine is characterized by a large accumulation of social tensions, which can be reduced by creating conditions for proper quality of life. The official assessment of inequality in Ukraine does not reflect the real state of affairs, insofar as it does not take into account undeclared cash income, the informal economy and informal income. Namely, informal employment is a significant source of income and consumption for a large part of the population. The deepening of social stratification is also influenced by the lack of state efforts to reduce social inequality.

Keywords: paying capacity, poverty, pandemic, unemployment, social inequality, income.

Introduction. One of the main indicators that reflect the quality of life of the population is the standard of living. The concept of living standards is determined by the ratio of monetary income and subsistence level, the proportion of poor and rich, the purchasing power of the middle classes, housing, housing and utilities. That is, in other words, the standard of living of the population is based on the availability of promising work and decent pay for it and the opportunity to use guaranteed quality services.

In recent years, the problems associated with ensuring income growth have become especially relevant. According to the State Statistics Committee of Ukraine, in the structure of income of the population the main part (more than 50%) is wages. The change in the ratio of wages and the subsistence level in recent years has not been in favor of wages.

Due to the COVID-19 pandemic, Ukraine may face the worst recession in decades, leaving more than 9 million people in poverty. This is stated in the UN report for October. According to the study, since the beginning of the pandemic, more than 80% of households have lost their income and more than 40% of families have lost at least one family member. It is emphasized that although there are currently no separate data on eastern Ukraine, the socio-economic consequences of this recession for the conflict-affected region are likely to be devastating. In the territories not controlled by Ukraine, 58% of families currently report the use of negative adjustment mechanisms to meet their basic needs, compared to 49% in early 2020. The share of households in debt is also increasing: 15% in September against 11% before the pandemic.

The urgency of this topic is due to the fact that in modern conditions, income inequality can reach enormous proportions and pose a threat to political and economic stability in a country amplified by the pandemic. That is why almost all developed countries are forced to constantly reduce the income gap population, because they depend on the standard of living.

Unlike most of the poor in other parts of the world, the poor in transition economies tend to have a fairly high level of vocational training, in the past they had employment guarantees, and when they reached retirement age they expected the state to pay a sufficient pension on a regular basis. and significant benefits. Unfortunately, Ukraine is one of the countries with a high level of poverty. A significant decline in production during the economic crisis, which lasted more than 10 years, inflation, declining productivity, artificial retention of surplus labor, rising unemployment and the duration of unemployment, combined with the monopoly position of certain industries and enterprises inevitably led to lower gross domestic product per capita, reducing the share of wages in its structure, reducing real incomes and real wages, reducing effective demand of the population and consumption while deteriorating its quality and structure. Added to this is the process of polarization of the former egalitarian society, which is characterized, on the one hand, by a rapid concentration of funds and property in the hands of small groups, and on the other by a progressive increase in poverty and deprivation. Communication with the poor indicates
the formation of a divided society, in particular because the poor consider themselves isolated from other citizens, forgotten by the state, and this view is held not only by the elderly but also by young people. Due to the lack of necessary self-organization and the natural lack of funds, the poor do not participate in informal mechanisms of mutual assistance.

Analytical review of studies. As a result of the review of theorists and practitioners to determine the nature and highlight the main problems associated with poverty and income inequality, we can conclude that this topic is quite relevant and important for today's society. With each passing year and the changes that are taking place at the legislative level, the situation is deteriorating and the number of the poor is increasing. Preliminary research on the problem of poverty is based on the works of VF Ojbon, S. Ringen, P. Tousend, O. Kangas, who focused on universal approaches to poverty, which, however, did not contain a complete picture of the factors and aspects of this phenomenon. Ukrainian researchers Yu.I. Saenko, GZ Goleusova and VP Bevz used methodological approaches to determining poverty and the peculiarities of this manifestation. To fully cover this problem, it is necessary to take into account a whole paradigm of factors - social, economic, political, cultural, regional, which must be adapted to the specifics of our state system and tools for implementing social policy.

Economic consequences of the pandemic.
At the same time, according to estimates of the Chamber of Commerce and Industry of Ukraine, only in the first two weeks of quarantine the number of unemployed increased by 500-700 000 people, over the next two weeks - in April - another 500-600 000 people were added. And the total number of unemployed in Ukraine (not only officially registered) is actually at least 2.5-2.8 million people.

According to Info Sapiens, in March 2020, 60% of respondents said they had financial losses, including due to: a decrease in regular income (38%), complete loss of power (16%) and job loss (14%). Only 46% of respondents 5 expect to receive their full salary in March, while almost every second respondent believes that he will be paid only for the days he worked; 29% of Ukrainians said they were afraid of losing their jobs as a result of quarantine, and 34% - a decrease in regular income.

As of 2019, Ukraine has the lowest purchasing power per capita in Europe. According to a study published by GfK, the average Ukrainian can spend an average of 1,830 euros a year after paying mandatory payments. This amount is almost 37 times less than the average resident of Liechtenstein. There, a resident can spend 67,550 euros a year on food, accommodation, payment for services and energy supply, pension savings, etc. In addition to Liechtenstein, the highest rates are in Switzerland, Luxembourg and Iceland, the lowest - in Kosovo, Moldova and Ukraine. Analysts estimate that in 2019, European consumers in 42 countries had almost 10 trillion euros at their disposal. This is 3.5 percent more than last year. The overall average purchasing power for all European cranes was 14,739 euros per year per person. At the same time, the results of only 16 countries were higher than the European average. The GfK study takes into account nominal indicators without inflation adjustments. The researchers calculated per capita income after taxes and mandatory payments and taking into account subsidies and other payments. All indicators were converted into euros. Ukraine every year is last in this ranking.

Theoretical and methodological bases of formation of poverty and inequality in the received incomes of Ukraine.
At the beginning of the third millennium, the problem of overcoming poverty is considered by the world community as key in the socio-economic policy of any country where this phenomenon is widespread. Poverty is defined as the inability due to lack of funds to maintain a way of life inherent in a particular society in a particular period of time. The poor include those who are not voluntarily deprived of basic necessities: adequate housing, food, clothing, and health. Poverty is also a fear of the future, due to a person's insecurity in their ability to protect themselves and their loved ones. Poverty is an extreme manifestation of poverty. Poverty and the poor in post-socialist countries are significantly different from other parts of the world. In the imagination of most of the so-called "new poor" the transformation period is associated with material deprivation, the destruction of ordinary life, the collapse of traditional social structures.

Modern science defines poverty as the inability due to lack of funds to maintain a way of life inherent in a particular society in a particular period of time. The point is that due to material deprivation, the poor cannot eat according to local standards, cannot pay for housing and utilities based on their needs, cannot be treated and rested, ensuring the recovery of health lost due to illness or overload, and finally, cannot provide education for themselves and their children.

Thus, having an economic background, poverty is a much broader phenomenon in various aspects of life.

Another definition of poverty is the inability to maintain a minimum level of consumption determined on the basis of physiological, social and cultural norms. The difference in these definitions, in fact, is that the first poor are all those who live below a certain actual average standard of society, and the second - only those who live below the minimum set by society [2, p. 41-48].

The poverty line is a tool for determining the prevalence of poverty in Ukraine and the degree of impoverishment of the population. People are considered poor if their income or consumption is below a certain level, which is defined as the poverty line. Theoretically, according to the interpretation of poverty, there are two main ways to determine the poverty line - normative and relative (statistical). The normative method, by definition, involves focusing on a particular social norm. To determine the poverty line, it is the subsistence level (sometimes called the minimum consumer budget or the minimum consumer basket). It includes the cost of consumption of food, non-food products and paid services sufficient to maintain the individual, the family of all social ties inherent in this social stratum.
It is clear that the subsistence level is a dynamic socio-economic category that changes with social development and not only under the influence of rising prices and inflation. Its level depends on the complex of consumer goods (consumer basket), which is determined by society under certain socio-economic conditions at least material security and is calculated in the prices of real purchases. Naturally, the consumer basket will be different for people who differ in age, health status, marital status, place of residence and so on.

Within the concept of human development, new approaches to interpretation and a new method of measuring “multidimensional” poverty were proposed. Accordingly, today poverty is interpreted as a multifaceted phenomenon, with the following forms:

- objective and subjective;
- absolute and relative;
- by income and opportunities;
- temporary and chronic (congestive).

Objective poverty is determined by the country’s accepted criteria for income and access to certain material and spiritual goods: opportunities to educate children, acquire vocational training, receive quality treatment, have housing that meets accepted standards, and so on. In contrast to this interpretation, subjective poverty is understood as one that is determined by self-esteem; that is, a person is poor when he identifies himself in this way. The subjective concept involves establishing a poverty line based on the analysis of the population’s perceptions of the amount of resources (income) needed to meet minimum needs.52 On a sample survey of the population or determines what income level provides a living wage and prevents poverty, or classifies their financial situation. This method was proposed in the 1970s by experts at the University of Leiden in the Netherlands [2, p. 41-48].

The problem of dividing poverty into “absolute and relative” is one of the most controversial aspects of the whole theory. Based on the definition of poverty as a level of well-being that does not meet the standard material and spiritual needs of the population, it is necessary to recognize the fundamentally relative nature of this category. According to the level of social welfare, to the existing living standards in society, the idea of standard needs, ie poverty, changes. If we add the practice of providing state aid to groups in poverty, the practice associated with significant budget expenditures, it becomes clear the political basis of this category. The level of poverty is determined, first of all, in accordance with the political guidelines and economic potential of each country. There can be no single standard of poverty worldwide: those who are undoubtedly poor, say in the United States or Switzerland, will be considered quite wealthy in third world countries.

Depending on their duration, poverty can be temporary (short-term or seasonal) or stagnant (long-term). Stagnant poverty, as a rule, leads to more serious consequences and is often the result of the simultaneous action of a whole range of factors. It is also associated with the fundamental impossibility for a family or an individual to solve their own problems and overcome financial difficulties. Temporary poverty can be the result of one or more factors:

- a continuous decline in the welfare of the population due to sudden socio-political, economic or natural changes;
- long-term arrears of salaries, pensions, scholarships, etc.;
- seasonal fluctuations in prices and, accordingly, seasonal fluctuations in food security of certain segments of the population (only in countries with a generally low standard of living) [27, p. 181-190].

Today, it is advisable to conduct a study of poverty in Ukraine on the basis of an integrated approach that will determine the extent of absolute and relative poverty. This conclusion is especially relevant at the current stage of development of poverty research, as discussions on the choice of a single evaluation criterion are becoming increasingly acute. Discussions between proponents of the relative and absolute approaches arise from the presence of positive and negative characteristics for both criteria. The unsuitability of a criterion for modern conditions is mainly explained by the specifics of the transition period and the peculiarities of the socio-economic situation in the country [29, p.70-79].

The essence of income inequality and features of its manifestation in Ukraine

The modern interpretation of inequality presupposes going beyond purely economic parameters - economic, social, political and ethnocultural inequality are distinguished. Some groups of the population, due to the restriction of their rights, may suffer from a particular type of inequality, but their combination is the most acute. It is through cumulative influence that such extremely negative and threatening to national security phenomena as the rejection of certain groups of the population from public life, polarization and marginalization of society are formed [10, p.91-96].

The most obvious manifestation of economic inequality is income inequality, which can cause (and usually causes) inequality of access to the basics! Social benefits (quality medical care, quality education, comfortable housing), resources (financial, including loans, land, etc.), to the realization of their basic rights in general (rights to health, life, security). But at the same time, income inequality itself is at the same time a consequence of other types and manifestations of inequality [10, p.91-96].

Thus, the lack of access to quality education dooms children from poor families to poverty in their adult lives, because even in Ukraine, where a large part of the population with higher education does not work in a specialty or in jobs that do not require high qualifications, Since 1999, there has been a steady direct relationship between the level of education and the level of income. This fully applies to inequality in life expectancy - children from poor families face a higher risk of premature death or disease and are less likely to realize their potential [18, p. 40-44].

High-income people usually live longer than the poor; in turn, good health is the foundation of proper economic competitiveness. Deep inequality has a very negative impact on economic growth opportunities. Low living standards often result in morbidity and low levels of education, which undoubtedly reduces the
economic activity of the respective groups of the population, affects the country’s overall labor potential, and thus leads to a slowdown in economic growth as a whole. Conversely, an increase in the income of the poor leads to an increase in demand for domestically produced goods, while the affluent are more likely to focus on imports or even buy a significant part of clothing, footwear, machinery, etc. abroad.

Thus, it is the growth of demand from the poor that most stimulates the development of the national economy, which, in turn, causes an increase in demand for labor. Finally, a fairer distribution of income is a significant stimulus (both material and psychological) for increasing the participation of all segments of the population in economic development, while increasing inequality threatens social tensions and resistance from those who have lost hope of improving their lives.

We suggest to consider the following table. 2.1. consolidated budget was to have a picture for summarizing data.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National functions (without debt service)</td>
<td>2.1</td>
<td>2.2</td>
<td>2.1</td>
</tr>
<tr>
<td>Public debt service</td>
<td>3.3</td>
<td>3.6</td>
<td>3.2</td>
</tr>
<tr>
<td>Defense</td>
<td>2.7</td>
<td>2.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Public order, security and the judiciary</td>
<td>3.3</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Economic activity</td>
<td>4.0</td>
<td>4.3</td>
<td>4.4</td>
</tr>
<tr>
<td>- agriculture, forestry and fisheries;</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>- coal industry;</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>road management;</td>
<td>1.7</td>
<td>1.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Environmental protection</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.9</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Health care</td>
<td>3.3</td>
<td>3.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Spiritual and physical development</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Education</td>
<td>5.9</td>
<td>6.2</td>
<td>5.6</td>
</tr>
<tr>
<td>Social protection and social security</td>
<td>8.7</td>
<td>8.3</td>
<td>7.0</td>
</tr>
<tr>
<td>- transfers of the Pension Fund</td>
<td>4.2</td>
<td>4.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Housing subsidies</td>
<td>2.0</td>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Net loans provided by the state</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Budget balance</td>
<td>-1.9</td>
<td>-3.2</td>
<td>-2.1</td>
</tr>
</tbody>
</table>

Thus, looking at the table you can see the percentage change in budget expenditures to GDP, which for three years fluctuates within +/- 5%. These dynamics do not play a special role, but if you pay attention to the level of this percentage, you can see how low its value is. Differences in income and opportunities provided to certain groups often reflect inequalities in political power. Vulnerable layers on! Settlements remain so largely due to weak political influence on government decisions, and weak influence is determined primarily by their vulnerability. Thus, economic inequality is an obstacle to democratic transformation and a factor in weakening the legitimacy and corrosion of political institutions.

Income inequality often leads to macroeconomic instability: significant population stratification is a factor in poverty (especially defined by the so-called relative criterion) and, consequently, large-scale secondary redistribution of income through social transfers; large social transfers lead to high budget expenditures and, consequently, a budget deficit, the need to cover which provokes inflation. Inflation has a much stronger impact on the living standards of the poorer sections of the population, so it provokes increasing inequality, you! carrying it to a new turn of the spiral. The circle closed. The growing inequality in the distribution of wealth in the world is one of the greatest social and economic political challenges of our time. Income inequality is common to all economic systems.

For modern Ukraine, poverty has become not only a chronic phenomenon, determining the way of life of the majority of the population, but also a factor in the polarization of society, its division into very rich and very poor with a catastrophic decline in the middle class.

According to research, today the ratio of income of rich Ukrainians to the poorest is 30: 1. Such differentiation of incomes arises under the influence of various factors that are related to personal achievements or independently of them, having an economic, demographic and political nature. The state regulates the income of the population through fiscal (taxation) and social policy (system of benefits and social assistance).

The level of efficiency of the economy depends on the state policy of income redistribution through the budget. It is no secret that the stability of government policy in the long run depends on a reasonable balance between fairness and efficiency, and an adequate income tax system can be an important element in this balance. In this sense, taxes are "bread and butter of politics." Any public policy is a game of fighting some counterbalances (for example, fair distribution or fair
distribution of public spending) against others (such as economic growth or administrative capacity).

It is generally acknowledged that the degree of social inequality in Ukraine has no analogues among Eastern European countries, primarily due to the merger of government and business, redistribution of national wealth in favor of high-income groups, amid declining incomes and opportunities for self-realization of the poorest. According to the latest opinion polls, only 2% of the adult population of Ukraine consider themselves wealthy, up to 40% - the middle class, and the rest - 58% identify themselves as poor. In the case of maintaining excessive social differntiation of the population, we can expect increased tensions in society in the near future [6, p. 15-18].

Ensuring equality of social opportunities and equality of social results is important for Ukrainian society. Equality of social opportunities presupposes, first of all, equality of all members of society before the law, in receiving education, health care and social security services. Equality of social opportunities is regulated by Art. 43-53 of the Constitution of Ukraine, according to which every citizen of the state has the right to freely chosen work, protection from illegal dismissal, guaranteed remuneration for work, paid annual leave, social security in case of complete, partial or temporary disability, loss of breadwinner, unemployment due to circumstances beyond their control, as well as in old age. However, judging by the Ukrainian realities, the legislative and executive bodies of government and administration are not able to bring the proclaimed rights of citizens in line with the real capabilities of the country, and even more so to international social standards.

An indicator of population differentiation by income level is also considered to be the Gini coefficient (K_J), which reflects the nature of the distribution of the total amount of income of the population between individual groups. With a uniform distribution of income K_J approaches 0, the higher the uneven distribution of income in society, the closer K_J to 1.

The Gini coefficient in 2019 was 0.238, while in 2020 its value was 0.242, i.e. the fall of these coefficients in recent years shows that they do not reflect the real picture of population stratification in income.

The reasons for this phenomenon can be considered shortcomings in the formation of the sample of household surveys, taking into account only estimates of income from legal employment, without shadow, while the shadow labor market in Ukraine, according to various estimates, is about 50%, which significantly distorts the results; most of the population has been living below the poverty line for a long time. The low level of income of this part determines the situation of gradual reduction of the uneven distribution of income of the whole population due to the impoverishment of the poor, the transition of the middle class to the poor, the presence of the working population. This conclusion is confirmed by a comparative analysis of K_J in Ukraine and the EU, which shows a significantly lower level of inequality in income distribution compared to the vast majority of European countries.

Therefore, it is not surprising that Ukraine is in the group of countries with a low degree of inequality, along with EU countries such as Slovenia, Norway, the Czech Republic and Finland (0.20-0.26) in the distribution of income according to the classification of economies for OECD countries. Most EU countries are characterized by medium (France, Croatia, Germany, Ireland, Poland, etc.) or a high degree of inequality in income distribution (0.33-0.35) - Portugal, Greece, Latvia, Spain, Romania and Bulgaria.

Assessments of social inequality and poverty in Ukraine

The fight against poverty is one of the most important global problems of our time. But in Ukraine it has become relevant relatively recently, with the beginning of market transformations. Therefore, in the current socio-economic conditions in Ukraine, one of the most urgent tasks is to increase the efficiency and targeting of social support, improving social governance at all levels - from state to local communities. The practical solution of these problems requires the improvement of appropriate statistical support, in particular the improvement of data sources in order to conduct in-depth studies of the financial situation of the population, identify and assess risks and factors that determine the welfare and social stability [1, 61-68].

Absolutely poor are also those who spend more than 60% of their income on food (the share of food expenditures in total household expenditures is called the Engel coefficient), or whose caloric intake is less than 2100 kcal per day [4]. The poor also include people deprived of the ability to consume certain goods, i.e. who, for example, do not have a set of the three most common durable goods (color TV, washing machine and refrigerator) or deprived of normal living conditions (with central gas, water and sewerage)) [4].

Poverty levels can also be assessed indirectly through income distribution indicators. Usually, the more unevenly distributed incomes within society, the more the population will consider themselves poor [2]. The main source of timely, complete and reliable information on the level of income, expenditures and available resources of households necessary for comprehensive surveys of the population's well-being is the results of a survey of living conditions of households conducted by the state statistics bodies of Ukraine. This sample observation allows the analysis of various spheres of household life depending on the level of their income (expenses), composition, availability of children, place of residence and other characteristics. The annual sample size is about 10 thousand households.

The integration into the survey program of some additional blocks of sociological questions with the use of subjective assessments of the moods, expectations and expectations of certain groups, their problems and levels of needs is significantly enriched. Self-assessment of the level of their well-being [4].

These thematic surveys provide an opportunity to combine information on the actual financial situation of each surveyed household with subjective assessments of its members. Household self-assessment of their well-being is carried out by subjectively determining the level of income adequacy to meet basic needs, providing information on consumer restrictions, oppor-
tunities due to lack of funds, as well as social self-identification. This self-assessment involves the choice of answers to questions about: - the level of adequacy of annual household income; - consumer opportunities of certain groups of households; - identification of households themselves as representatives of different segments of the population (wealthy; middle class; non-poor, but not yet middle class; poor) [6, p. 15-18].

The main poverty profiles in terms of socio-demographic and socio-economic groups remain stable. Regardless of the criterion chosen, poverty levels among people of working age and among people of retirement age are below the national average, and vulnerable groups include children and “old” retirees. The most vulnerable are traditionally large families, households with children under 3 years of age and with a double demoeconomic burden (with children and the unemployed).

Poverty profiles differ depending on monetary and non-monetary approaches: high risks of monetary poverty are inherent in children, and non-monetary poverty is much higher among older age groups. When using monetary approaches, the highest risks of poverty are for large families and children without children. Households with two or more children, as well as children under 3 years of age, also have an increased risk. When using non-monetary criteria, the group with the highest risk of poverty are households consisting exclusively of older age groups (75 years and older) [10, p. 91-96].

Thus, it can be noted that the manifestations of human activity and the needs of people differ significantly, and therefore it is impossible to create a single universal indicator to assess the living standards of the population. This requires a system of characteristics, indicators and parameters, which in their unity are able to reflect the degree of satisfaction of individual and social needs, to assess the level of life guarantees. The formation of such a system requires the first solution to a complex problem - the choice of a limited number of indicators that would not only fully characterize the living standards of the population, but also provide an opportunity to carry out its comparative analysis by population and individual areas. The results of the analysis should determine the most significant factors population, and assess the closeness of their relationship in order to identify priority measures, the implementation of which should reduce social inequality [20, p. 84].

The main types of income of economic entities in a market economy are wages, profits, income from land ownership, real estate, securities, intellectual property, and non-competitive members of society - social benefits, payments, maintenance and other transfers. The market economy is characterized by uneven distribution of household income, which encourages the latter to increase employment, more productive and intensive work, and the state - to regulate income inequality in order to avoid their sharp differentiation [3, p.108].

Thus, income differentiation can be considered as a stimulus for economic growth, intensification of business activity. Uneven distribution of resources and money income among the population is associated with the influence of economic causes and factors - the situation on the labor market, the level of economic development of the industry, region, individual characteristics, marital status and more. People differ in hard work, activity, abilities, education, property ownership, ability to spend income productively, etc. Based on this, they cannot work, earn and live the same, so they have incentives to work more.

It should be noted that reaching a certain limit, socio-economic inequality begins to play a negative role, destroying the motivation of economic entities, suppressing incentives for development, creating social tension, and acts as an anti-stimulus, brake on economic development and social justice, increasing social tensions in society. [4].

Uneven distribution of income undermines the moral values of workers, destroys the moral regulation of their economic behavior, their individual ability to "relatively independently determine and direct their behavior in society without external control, which crystallizes in such concepts as conscience, honor, self-esteem" [1, with. 61-68].

The structure of household income also has a significant impact on the assessment of social inequality and poverty, so I propose to review it in the following figure. 2.3.

Analysis of the state of income distribution in the domestic economy shows the negative dynamics and deepening of inequalities caused by a number of economic, social, foreign economic reasons. The latter were supplemented by the proliferation of economically inactive enterprises, the bankruptcy of business and its shadow component, military aggression by a neighboring state, inaction of public authorities, and so on. In order to clarify the real state of income inequality, there is an urgent need to expand and improve domestic income statistics, widely apply world experience, improve methods of analyzing living standards, relevant indicators, criteria that characterize the differentiation of poverty, minimum wage, minimum wage, consumer basket, etc. The state needs to actively implement the strategy of employment growth for the economically active population in combination with the provision of social protection of non-competitive categories of the population. In further research, attention should be paid to the formation of monetary and value individual share of households in the total product, which is formed under the influence of the relations of distribution and redistribution.

It should also be noted that the application of different methods of assessing poverty and social inequality in practice gives different results, which may differ significantly from each other. This is due to the existence of methodological differences in approaches to poverty assessment. In particular, the adequacy of research results using the approach of comparing household income or expenditure with the standard largely depends on the validity of the standard itself. Overestimation or underestimation of the latter affects the assessment of poverty in the country. In addition, as we have already noted, the level of shadowing of the domestic economy is quite high, so it does not allow to objectively and realistically assess the income of
households, their comparative analysis, to trace the dynamics of income inequality.

It is known that in Ukraine the low efficiency of economic reform and the ineffectiveness of the legislative mechanism of social orientation have led to stratification of the population in terms of material security, led to poverty, marginalization, exacerbation of the employment crisis, narrowing human reproduction, deteriorating health and vitality, which became a threat to the development of human, labor and intellectual potential of Ukrainian society. In a country with a relatively homogeneous population in a short time formed a narrow stratum of rich and very rich people at the same time with the mass impoverishment of citizens. Most people do not even have the level of income and social guarantees that were before, which produces physical degradation and moral disorientation of the people [4].

In the distribution of social benefits and real access to them there is a violation of the principles of equality of rights. There is a general tendency of non-fulfillment of constitutional guarantees regarding free social services in state institutions of health care, education, provision of social housing, etc. According to the results of sociological research [3, 33], more than two thirds of the population of Ukraine lack stability in society and social guarantees that provide a sense of confidence in the future. The existing system of social protection, in particular, social assistance and social compensations do not protect the poor from poverty.

Inefficient redistribution of income and unfair distribution of state transfers aimed at social support of citizens provoke inflated expectations from the state. The state policy on overcoming poverty through mechanical equalization of incomes of socially vulnerable groups of the population is not complex and gives only a temporary effect, which ultimately leads to large social expenditures from the state budget, but does not solve the problem of large-scale poverty. Thus, in Ukraine it is important to create a system of social protection that is able to adequately respond to socio-economic risks and contribute to poverty reduction in all groups [12, p. 3-6].

To solve specific practical problems of overcoming poverty in Ukraine, it is necessary to analyze the main risks of poverty and the composition of the poor, to investigate the causes of the current situation and to predict the consequences and prospects for the future. Ukrainian society is characterized by a high level of poverty among the economically active population, which is associated with both high unemployment and low wages or long delays in its payment.

Today 79% of the poor are households in which at least one working person lives [1, p. 61-68]. Large-scale poverty has developed among those working in the public sector and in stagnant industries. Poverty remains a common phenomenon among families with children with both working parents - almost a third of families with children are poor, which is 1.7-2.0 times higher than poverty in households without children [1, p. 61-68]. Among households without children, the worst situation is traditionally observed in households where all persons are older than 75 years, as persons of older age groups can not earn additional income to retirement. The differentiation of the population by income is also influenced by the region of residence and the size of the settlement.

The highest level of poverty is observed in rural areas, in the capital the poverty level is traditionally the lowest. The problem of poverty also has an infrastructural dimension - residents of villages and small towns are significantly limited in access to quality medical, cultural, educational and household services. Against the background of stabilization of relative poverty of the entire Ukrainian population, the level and depth of poverty of peasants is growing [20, p. 84].

If in 1999 the level of poverty, the depth of poverty and the level of poverty did not differ significantly between urban and rural areas, in 2008 the poverty rate in rural areas was 38.2%, which is almost twice the poverty rate in the city; poverty rate in rural areas 22.2% against 9.5% in urban areas; the depth of poverty in rural areas is 26.3%, in the city - 20.9% [7, p. 38-58]. In addition to the problem of monetary poverty, Ukraine is characterized by significant scales of deprivation, i.e. poverty in terms of living conditions. The most relevant aspects of deprivation of different categories of the population experts [1, p. 38] identify inadequate living conditions, high cost of health services, the impossibility of full recreation, lack of social infrastructure [4].

The impact of cash costs for healthcare on paying capacity in Ukraine

The proliferation of paid medical services, combined with the rapid rise in the cost of medicines, necessitates the isolation of the impact of these factors on poverty and the identification of their “burden” on the population, including the most vulnerable.

The composition and structure of cash expenditures on health care is determined by the Household Living Conditions Survey questionnaire, the only source of information that allows to obtain fully representative results on a systemic basis. In contrast to the composition of cash expenditures in economically developed countries, where the total costs of health services and the purchase of medical goods (excluding insurance payments), which combine the payment of medical advice, purchase of medicines, hospital bills, gifts, etc., in Ukraine it is possible to single out the following items: costs of medical supplies, devices and equipment; costs of outpatient and outpatient services; payment for hospital services [5, p. 3-9].

The first group of costs mainly accumulates funds for the purchase of drugs. The second group combines the costs of doctor’s consultations, diagnostic services, outpatient treatment, including dental treatment. The third group includes all the costs associated with inpatient treatment.

Thus, the available information base allows you to analyze:

Cash expenditures of the population on health care: their level in the country as a whole and by individual groups of the population, which differ in the amount of income, their distribution and structure;

Catastrophic health care costs and their impact on the impoverishment of the population, in particular, the
distribution of catastrophic costs by type of cash payments, by different groups of the population, determining the determinants of catastrophic costs [15, p. 21-27].

Specialists of the World Health Organization have developed a special methodology 100, which allows to compare these costs with the solvency of the population, identify households for which they have catastrophic - in the context of impoverishment - consequences and assess the fairness of financial burden distribution.

In one form or another, the majority of households are forced to spend on health care (75.9% according to 2006 data), but on average only 2.3% of all household expenditures do not spend it. Basically, the funds are directed to the purchase of drugs and other medical products, due to the traditional desire of the population to maintain their health through medical treatment (either by prescription or by purchasing freely sold drugs) [24, p. 22-31].

However, the share of this component in the total "medical costs" is almost steadily declining. In total, 70.3% of the population incurred such expenses during the year.

Instead, the lowest of this group is the cost of outpatient services. This is due to the fact that most outpatient services are provided free of charge in the system of state-funded public health facilities. In most cases, the population pays only the so-called voluntary contributions or reimburses the cost of materials during analyzes or surveys. Pensioners, children, the disabled and other categories of the population are even exempt from this. Thus, in 2018, only one in three households paid for outpatient and outpatient services. It is probable that along with the official contributions, this item of expenditure also included informal gifts [24, p. 22-31].

According to the results of a study on certain types of households, quite naturally the most vulnerable to catastrophic "medical costs" group of the population are retirees, and for households with two retirees, this risk is significantly (though not twice) higher.

In contrast to other characteristics of poverty, the relatively low risk of catastrophic "medical costs" is typical of families with children, including families with children under 3 years of age. This gives grounds to conclude that medical care for children in Ukraine is still more or less provided by budget allocations. However, falling into the main risk group of large families in 2006, which previously had consistently low rates of catastrophic costs, necessitates monitoring of this indicator [28, p. 20].

Despite the more widespread practice of paying for medical services among urban residents (78.4% of urban households compared to 70.6% of rural households in 2006), such costs are more burdensome for the rural population. Thus, in 2006 they spent 5.5% of their solvency (a similar figure for urban residents was 5.0%), and the share of households with catastrophic medical expenses in rural areas was 1.5% versus 1.1 % in the city.

Conclusions and suggestions

Thus, given the above, the priority of the state in Ukraine is to determine the economic assessment of the trade-off between efficiency and justice, to create a reliable measurement of economic inequality and poverty at the state and regional levels, to introduce adequate assessments of poverty and social programs. In recent years, there has been an intensive process of redistribution of total monetary income in favor of high-income groups against the background of reducing the share of income of the poorest sections of the population. In Ukraine, the degree of income inequality has no analogues among Eastern European countries implementing economic reforms.

The current situation in the field of income in Ukraine is characterized by a large accumulation of social tensions, the reduction of which is possible by creating conditions for proper quality of life. The official assessment of inequality in Ukraine does not reflect the real state of affairs, insofar as it does not take into account undeclared cash income, the informal economy and informal income. Namely, informal employment is a significant source of income and consumption for a large part of the population. The deepening of social stratification is also influenced by the lack of state efforts to reduce social inequality.

It is especially important to establish a single mandatory state standard of the minimum wage in accordance with the subsistence level. In modern conditions, the minimum wage should be set at a level not lower than the value of the poverty line per able-bodied person.

References


АЗЕРБАЙДЖАНО-ГРУЗИНСКОЕ ЭКОНОМИЧЕСКОЕ СОТРУДНИЧЕСТВО

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Аннотация

В статье рассматриваются вопросы экономического сотрудничества между Азербайджанской Республикой и Грузией, как стратегических партнеров; проанализированы основные сферы сотрудничества и достигнутые результаты; показаны возможности региональных интеграционных процессов с их участием; освещены перспективы развития азербайджано-грузинских отношений.
Abstract
The article examines the issues of economic cooperation between Republic of Azerbaijan and Georgia as strategic partners; analyzes the main areas of cooperation and the results achieved; shows the opportunities of regional integration processes with their participation; highlights the prospects for the development of Azerbaijani - Georgian relations.

Ключевые слова: экономического сотрудничество, внешняя торговля, интеграционных процессов, Азербайджан, Грузия.
Keywords: economic cooperation, foreign trade, integration processes, Azerbaijan, Georgia.

Сотрудничество между Азербайджанской Республикой и Грузией имеет длительную историю, однако после восстановления суверенитета (1991 г.) оно перешло на новый этап развития. Дипломатические отношения между Грузией и Азербайджанской Республикой (далее Азербайджан) установлены 18 ноября 1992 года, после чего они друг друга рассматривают в качестве стратегических партнеров и союзников. Межгосударственные отношения строятся на основе рыночной экономики и либеральной внешней политики, в которых главное место отводится соблюдению принципов равенства, добрососедства, взаимного уважения и взаимопонимания [16].

Для развития экономического сотрудничества у них имеются хорошие предпосылки: оба государства относятся к числу небольших стран и являются постсоветскими республиками; уровень экономического развития и степень зрелости рынка примерно одинаковы; имеют общую границу и исторически сложившиеся хозяйственные связи; характеризуются совпадением геополитических и экономических интересов; имеют примерно одинаковые экономические, политические и другие проблемы; являются участниками проектов TRACECA, Баку-Тбилиси-Джейхан, Баку-Тбилисис-Супса, Баку-Тбилис-Эразум, Баку-Тбилис-Карс, китайской инициативы «Пояс и путь»; имеют традиционные конкурентные характеристики, усиленные геополитическими факторами; не являются конкурирующими странами и их сотрудничество дает синергетический эффект; могут играть активную роль в развитии региональных интеграционных процессов и укрепить позиции в международных организациях, а также совместными усилиями занять достойное место в мировом экономическом и политическом пространстве [17].

Несмотря на тяжелое советское наследие и постсоветские проблемы, Азербайджан и Грузия смогли преодолеть кризис и продвинуться по пути процветания [8, 9]. В экономическом развитии суверенных государств можно выделить два основных этапа: первый охватывает 1991-1995 годы и характеризуется резким спадом производства и хаосом, второй этап, начавшийся в 1996 году, продолжается по сей день. Это период относительной макроэкономической стабильности, хотя и наблюдаются определенные спады. Второй этап в экономике Грузии можно разделить на 2 подпериода: до революции роз и после революции роз, а в Азербайджане – до освобождения оккупированных армянами территорий (Карабах и прилегающие к нему районы) и после их освобождения.

Одной из старейших и в то же время динамичных форм сотрудничества Грузии с Азербайджаном является торговля. Внешняя торговля для обеих стран основной источник бюджетных доходов. В 2019 году объем внешнеторгового оборота Грузии составил 13315.4 млн USD, экспорт – 3798.4 млн USD и импорт – 9516.9 млн USD [1]. У Азербайджана эти показатели соответственно составляют 33302.8, 19635.6 и 13667.2 млн USD [11] (рис.2).
Внешняя торговля Грузии характеризуется постоянным отрицательным балансом (рис. 1), а Азербайджан – положительным (рис. 2). В 2019 году внешнеторговый оборот Азербайджана в 2.5 раза превышал внешнеторговый оборот Грузии, экспорт – в 5.2 раза и импорт – в 1.4 раза.

По данным Всемирной торговой организации, в 2019 году Грузия заняла 121-е и 101-е места в мировом экспорте и импорте товаров, а Азербайджан – 71-е и 92-е места. В мировом экспорте и импорте услуг Грузия находится на 83-ей и 106-ой позициях [14], Азербайджан – на 94-ой и 74-ой позициях [13]. Почти половину экспорта (48.8%) Грузии составляет промышленная продукция. За ней следует продукция сельского хозяйства – 29.1%, топливо и минеральные продукты – 23.1% [14]. Основной товарной группой азербайджанского экспорта является топливо и минеральные продукты – 84.0 %, а в импорте промышленная продукция – 73.5 % и продукция сельского хозяйства – 18.0 % [13].


Таблица 1

<table>
<thead>
<tr>
<th>Годы</th>
<th>Доля Азербайджана в Торговом обороте</th>
<th>Места Азербайджана в Торговом обороте</th>
<th>Доля Азербайджана в Экспорте</th>
<th>Места Азербайджана в Экспорте</th>
<th>Доля Азербайджана в Импорте</th>
<th>Места Азербайджана в Импорте</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>12.8</td>
<td>2</td>
<td>26.4</td>
<td>1</td>
<td>8.7</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>12.6</td>
<td>2</td>
<td>24.4</td>
<td>1</td>
<td>8.3</td>
<td>2</td>
</tr>
<tr>
<td>2014</td>
<td>10.3</td>
<td>2</td>
<td>19.0</td>
<td>3</td>
<td>7.4</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>7.9</td>
<td>3</td>
<td>10.9</td>
<td>4</td>
<td>7.0</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>6.9</td>
<td>3</td>
<td>7.2</td>
<td>5</td>
<td>6.8</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>7.7</td>
<td>4</td>
<td>9.9</td>
<td>4</td>
<td>7.0</td>
<td>2</td>
</tr>
<tr>
<td>2018</td>
<td>8.8</td>
<td>4</td>
<td>15.0</td>
<td>1</td>
<td>6.5</td>
<td>3</td>
</tr>
<tr>
<td>2019</td>
<td>8.0</td>
<td>5</td>
<td>13.4</td>
<td>5</td>
<td>5.9</td>
<td>1</td>
</tr>
</tbody>
</table>

В 2019 году грузино-азербайджанский товарооборот составил 1067.4 млн USD. Грузия в Азербайджан экспортировала товаров на сумму 508.7 млн USD и импортировала – 558.7 млн USD. В 2012 году эти показатели соответственно составляли 1317.1, 626.9, 690.2 млн USD и превышали уровень 2019 года [1]. При этом Грузия с Азербайджаном имеет отрицательный торговый баланс (рис.3).
Грузия и Азербайджан тесно сотрудничают в области энергетики и транспорта [10]. Этому способствует их уникальное географическое положение: обе страны являются естественным транспортным коридором и поэтому в первую очередь выполняют транзитную функцию. Через Грузию и Азербайджан проходит самый короткий транзитный маршрут для транспортировки сырья, товаров, нефти и газа с востока на запад и с юга на север, и наоборот – с запада на восток и с севера на юг. Они выполняют роль связывающего звена между Европой и Азией и это является их конкурентным преимуществом.

Сотрудничество Грузии и Азербайджана в области энергетики и транспорта связано с различными региональными и международными проектами (нефтепроводы Баку – Тбилиси – Джейхан, Баку – Тбилиси – Супса, газопровод Баку – Тбилиси – Эрзерум, INOGATE , транспортный коридор TRACECA, Пояс и путь, Баку-Тбилиси-Карс и др.) [15, 16], но кроме того Азербайджан занимает весьма сильные позиции в экономике Грузии благодаря Азербайджанской компании SOCAR, которой принадлежит сотни расположенных на территории Грузии бензозаправочных станций и множество объектов газораспределительной системы страны. В последние годы SOCAR пытается закрепиться также на грузинском рынке недвижимости.

Азербайджан и Грузия обладают уникальным туристическим потенциалом и страны интенсивно сотрудничают в области туризма. В 2019 году вклад путешествий и туризма в ВВП Грузии составил 10.3 % [12], однако пандемия COVID-19 привела к серьезному упадку этой сферы. Мы надеемся, что после открытия границ имеющиеся туристические ресурсы будут способствовать развитию фактически всех основных видов туризма.

С момента обретения независимости Азербайджан и Грузия активно участвуют в интеграционных процессах [2]. Обе страны являются членами Организации Черноморского экономического сотрудничества (ОЧЭС) и ГУАМ (Грузия, Украина, Азербайджан, Молдова). Перспективы развития экономического сотрудничества между Азербайджаном и Грузией в определенной степени связаны с сотрудничеством в рамках этих интеграционных групп. Следует отметить, что все четыре страны ГУАМ являются членами ОЧЭС и, следовательно, ряд аспектов их сотрудничества дублируется в рамках этих союзов. Поэтому, на наш взгляд, членство в нескольких организациях нецелеобразно, поскольку в этом случае тратится больше ресурсов на достижение одних и тех же целей и решения задач.

Помимо сотрудничества в рамках региональных группировок ОЧЭС и ГУАМ, перспективы развития грузино-азербайджанских отношений следует рассматривать с точки зрения интеграционных возможностей региона. Этот процесс начался в рамках трех государств – Азербайджана, Грузии и Турции, однако его надо интенсифицировать с привлечением других заинтересованных сторон.

Мы считаем, что региональная интеграция Кавказа должна основываться на кластерном подходе [17], т. к. именно путем объединения ресурсов можно достичь максимальной эффективности. Исходя из современного уровня и направлений экономического сотрудничества Грузии, и Азербайджана, можно выделить следующие категории кластеров:

1. «Сильные кластеры», в число которых должны входить добыча и производство нефти и газа, энергетика и транспорт;
2. «Устойчивые кластеры», в которые должны быть включены химическая промышленность, строительство, агропромышленный комплекс, легкая и пищевая промышленность, туризм;
3. «Потенциальные кластеры»: машиностроение, металлургия, здравоохранение, образование, средства массовой информации, бизнес-услуги.

Несмотря на возможность создавать кластеры в различных отраслях и сферах, мы считаем, что сначала надо определить то ядро, на котором будут основаны все кластеры. Таким ядром следует рассматривать инновационный кластер [4-7]. В настоящее время инновации в Грузии и Азербайджане характеризуются низким уровнем развития, поэтому правительствам обеих государств необходимо kompleksno подходить к их развитию.
Должны быть разработаны национальные и межгосударственные программы развития инноваций и поддержки инновационной деятельности, необходимо создать единое научное пространство, а также единую систему управления инновациями [7].

Экономическое сотрудничество между Грузией и Азербайджаном развиваются динамично. Несмотря на это, в обеих странах имеется большой потенциал для углубления стратегического партнерства. Это может быть создание новых совместных предприятий, увеличение грантового потенциала и особенно включение в оборот территорий Азербайджана, освобожденных от армянской оккупации.

В заключении следует отметить, что стратегическое партнерство Грузии и Азербайджана, основанное на принципах равенства, добрососедства, взаимного уважения и взаимопонимания, взаимоигровимо и способствует устойчивому развитию обеих стран.

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ФИНАНСОВАЯ ОЦЕНКА БИЗНЕСА КАК ИНСТРУМЕНТ ПОВЫШЕНИЯ ЕГО ЭФФЕКТИВНОСТИ

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FINANCIAL BUSINESS ASSESSMENT AS A TOOL FOR INCREASING ITS EFFICIENCY

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Аннотация
Успешное управление бизнесом основано на четком понимании всех бизнес-процессов, анализе слабых и сильных сторон деятельности компании и постоянном мониторинге положения конкурентов. Одним из важнейших показателей успешности предприятия является его стоимость, так как именно она определяет доходы собственников предприятия. Оценка компании позволяет определить ее текущую рыночную капитализацию. Для собственников компании-это возможность оценить качество ведения бизнеса, определить сильные и слабые стороны деятельности. Для третьих лиц эта оценка позволяет определить привлекательность инвестиций в данную компанию. В данной работе рассматривается оценка стоимости бизнеса.

Abstract
Successful business management is based on a clear understanding of all business processes, analysis of the strengths and weaknesses of the company and constant monitoring of the position of competitors. One of the most important indicators of the success of an enterprise is its value, since it is it that determines the income of the owners of the enterprise. The valuation of a company helps determine its current market capitalization. For the owners of the company, this is an opportunity to assess the quality of doing business, to identify the strengths and weaknesses of activities. For third parties, this assessment helps to determine the attractiveness of investments in a given company. This paper deals with the assessment of the value of a business.

Ключевые слова: бизнес, оценка, стоимость бизнеса, методы.

Keywords: business, appraisal, business value, methods.

Оценка бизнеса – это общий процесс определения экономической стоимости всего бизнеса или подразделения компании. Оценка бизнеса может быть использована для определения справедливой стоимости бизнеса по целому ряду причин, включая стоимость продажи, установление права собственности партнера, налогообложение и даже бракоразводный процесс. Владельцы часто обращаются к профессиональным оценщикам бизнеса за объективной оценкой стоимости бизнеса [2, 5].

Оценка бизнеса определяет экономическую стоимость бизнеса или бизнес-единицы.

Оценка бизнеса может быть использована для определения справедливой стоимости бизнеса по целому ряду причин, включая стоимость продажи, установление права собственности партнера, налогообложение и даже бракоразводный процесс. Существует несколько методов оценки бизнеса, таких как анализ его рыночной капитализации, мультипликаторов прибыли или балансовой стоимости [4, 6].

Тема оценки бизнеса часто обсуждается в корпоративных финансах. Оценка бизнеса обычно проводится, когда компания хочет продать всю или часть своей деятельности или хочет сливаться с другой компанией или приобрести ее. Оценка бизнеса – это процесс определения текущей стоимости бизнеса, использования объективных показателей и оценки всех аспектов бизнеса.

Оценка бизнеса может включать анализ управления компанией, структуры ее капитала, перспектив ее будущей прибыли или рыночной стоимости ее активов. Инструменты, используемые для оценки, могут варьироваться в зависимости от оценщиков, предметов и отраслей. Общие подходы к оценке бизнеса включают анализ финансовой отчетности, дисконтирование моделей движения денежных средств и аналогичные сравнения компаний [2].

Оценка также важна для налоговой отчетности. Служба внутренних доходов (IRS) требует, чтобы бизнес оценивался на основе его справедливой рыночной стоимости. Некоторые связанные с
налогообложением события, такие как продажа, покупка или дарение акций компании, будут облагаться налогом в зависимости от оценки.

Оценка справедливой стоимости бизнеса можно рассматривать как искусство и науку одновременно [8]. Принято использовать несколько формальных моделей, но выбор правильной модели и интерпретация соответствующих исходных данных может быть несколько субъективным.

Существует множество способов оценить компанию.

1. Рыночная капитализация – самый простой метод оценки бизнеса. Он рассчитывается путем умножения цены акций компании на общее количество акций, находящихся в обращении. Например, по состоянию на 3 января 2018 года Microsoft Inc. торговалась на уровне $86,35,1 с общим количеством акций в обращении 7,715 млрд, тогда компания могла быть оценена в $86,35 × 7,715 млрд = $666,19 млрд.

2. Метод Кратного Дохода. В соответствии с методом оценки бизнеса times revenue поток доходов, генерируемых в течение определенного периода времени, применяется к мультипликатору, который зависит от отрасли и экономической среды. Например, технологическая компания может быть оценена в 3 раза больше выручки, в то время как сервисная фирма может быть оценена в 0,5 раза больше выручки [1].

3. Мультипликатор прибыли – вместо метода times revenue можно использовать мультипликатор прибыли, чтобы получить более точную картину реальной стоимости компании, поскольку прибыль компании является более надежным показателем ее финансового успеха, чем выручка от продаж. Мультипликатор прибыли корректирует будущую прибыль по отношению к денежному потоку, который может быть инвестирован по текущей процентной ставке в течение того же периода времени. Другими словами, он корректирует текущее соотношение P/E с учетом текущих процентных ставок.

4. Метод Дисконтированных Денежных Потоков (DCF) – аналогичен мультипликатору прибыли. Этот метод основан на прогнозах будущих денежных потоков, которые корректируются для получения текущей рыночной стоимости компании. Основное отличие метода дисконтированных денежных потоков от метода мультипликатора прибыли заключается в том, что он учитывает инфляцию при расчете приведенной стоимости [7].

5. Балансовая стоимость – это стоимость собственного капитала предприятия, показанная в балансовом отчете. Балансовая стоимость определяется путем вычитания совокупных обязательств компании из ее совокупных активов.

6. Ликвидационная стоимость – это чистые денежные средства, которые получит предприятие, если его активы были ликвидированы, а обязательства погашены.

Это далеко не полный перечень используемых сегодня методов оценки бизнеса. Другие методы включают восстановительную стоимость, стоимость расхода, оценку активов и многое другое [3].

В США Аккредитация в области оценки бизнеса (AVB) – это профессиональное звание, приносимое бухгалтерам, таким как CPAS, которые специализируются на расчете стоимости бизнеса. Сертификация AVB контролируется Американским институтом сертифицированных бухгалтеров (AICPA) и требует, чтобы кандидаты завершили процесс подачи заявки, сдали экзамен, соответствовали минимальным требованиям к бизнес-опыту и образованию и заплатили регистрационный взнос (по состоянию на 2018 год ежегодный сбор за аккредитацию AVB составлял 380 долларов).

Поддержание учетных данных AVB также требует от тех, кто имеет сертификат, соответствия минимальным стандартам опыта работы и обучения на протяжении всей жизни. Успешные кандидаты получают право использовать обозначение AVB вместе со своими именами, что может улучшить возможности трудоустройства, профессиональную репутацию и оплату труда. В Канаде Chartered Business Valuator (CBV) – это профессиональное обозначение для специалистов по оценке бизнеса. Его предлагает Канадский институт дипломированных оценщиков бизнеса (CICBV) [10].

Смит определяет оценку бизнеса как «процесс определения оценочной стоимости хозяйствующего субъекта». Оценка бизнеса, проводимая в соответствии с руководящими принципами AICPA, требует понимания и анализа бизнеса, и соответствующей отрасли, а также связанных с ними экономических условий. Цель состоит в том, чтобы обеспечить оценку, которая представляет собой цену, о которой согласились бы покупатель и продавец, если бы оба знали соответствующие факты.

Терминология AICPA, связанная с оценкой бизнеса, проводит различие между «выводом стоимости» и «расчетом стоимости». «Заключение о стоимости» требует, чтобы оценщик рассмотрел все подходы и методы оценки, чтобы определить, какие методы являются наиболее подходящими.

«Расчет стоимости» основан на конкретных методах оценки, связанных с оценщиком и клиентом, а не на рассмотрении всех подходов и методов.

Согласно Смиту, существует три основных подхода к оценке бизнеса, как указано в таблице ниже. Наиболее подходящий подход и метод зависят от фактов и обстоятельств. Активный подход используется для холдинговых компаний и компаний с небольшим или нулевым доходом и основан на стоимости активов компании за вычетом обязательств. Как указано в таблице, существует несколько вариантов, основанных на рыночной стоимости. Доходный подход применим для компаний, находящихшихся в тесном владении, где отсутствуют рыночные ценности. Методы, связанные с доходным подходом, основаны на дисконтированном чистом денежном потоке. Вопрос о том, является ли бухгалтерский доход или чистый денежный поток более подходящим, является спорным. Рыночный подход применим к публичным компаниям, в которых публичные документы SEC или слияний и поглощений
могут быть использованы в качестве основы для определения стоимости бизнеса.

При оценке бизнеса или актива можно использовать три различных метода или подхода. Затратный подход рассматривает стоимость восстановления или замены актива. Метод стоимостного подхода полезен при оценке недвижимости, имущества или инвестиционной ценной бумаги. Он обычно не используется финансовыми специалистами для оценки компании, которая является постоянно действующей.

Далее следует Рыночный подход, который является формой относительной оценки и часто используется в промышленности. Она включает в себя Сопоставимый Анализ Прецедентных Сделок.

Наконец, подход дисконтированного денежного потока (DCF) является формой внутренней оценки и является наиболее детальным и тщательным подходом к моделированию оценки. Ниже мы опишем методы, используемые на рынке, и подход DCF.

Сопоставимый анализ компаний (также называемый «торговым мультипликатором», «анализом групп сверстников», «анализом акционерного капитала» или «мультплитикатором публичного рынка») - это метод относительной оценки, при котором вы сравниваете текущую стоимость бизнеса с другими аналогичными компаниями, рассматривая торговые мультипликаторы, такие как P/E, EV/EBITDA или другие коэффициенты. Наиболее распространенным методом оценки является показатель, кратный EBITDA.

Анализ претендентных сделок - это еще одна форма относительной оценки, когда вы сравниваете вашу компанию с другими компаниями, которые недавно были проданы или приобретены в той же отрасли. Эти значения сделок включают премию за поглощение, включенную в цену, за которую они были приобретены.

Эти ценности представляют собой совокупную стоимость бизнеса. Они полезны для сделок слияний и поглощений, но с течением времени могут легко устареть и перестать отражать текущий рынок. Они используются реже, чем Компьы или рыночные торговые мультипликаторы.

Анализ дисконтированного денежного потока (DCF) - это подход внутренней стоимости, при котором аналитик прогнозирует неосвоенный свободный денежный поток бизнеса в будущем и дисконтирует его обратно на сегодняшний день по средневзвешенной стоимости капитала фирмы (WACC).

Анализ DCF выполняется путем построения финансовой модели в Excel и требует обширной детализации и анализа. Это самый подробный из трех подходов и требует большего времени и усилий. Однако усилия, необходимые для подготовки модели DCF, также часто приводят к наиболее точной оценке. Модель DCF позволяет аналитику прогнозировать значение на основе различных сценариев и даже выполнять анализ чувствительности [9].

Для более крупных предприятий значение DCF обычно представляет собой анализ суммы частей, при котором различные бизнес-единицы моделируются индивидуально и складываются вместе.

Инвестиционные банкиры часто составляют диаграмму футбольного поля, чтобы суммировать диапазон значений для бизнеса на основе различных используемых методов оценки.

Другой метод оценки для компании, которая является действующим предприятием, называется анализом платежеспособности. Этот подход рассчитывает максимальную цену, которую покупатель может заплатить за бизнес, все еще достигая определенной цели.

Если компания не будет продолжать свою деятельность, то ликвидационная стоимость будет оцениваться на основе ликвидации и продажи активов компании. Эта стоимость обычно весьма дисконтирована, поскольку предполагает, что активы будут проданы как можно быстрее любому покупателю.

Таким образом, не стоит воспринимать оценку стоимости бизнеса как лишенные и необоснованные затраты. Любая, даже незначительная, ошибка на любом этапе оценки приведет к некорректному представлению о бизнесе. А от этого зависит будущее компании.

Список литературы
KNOWLEDGE MANAGEMENT AS THE BASIS OF HUMAN RESOURCE MANAGEMENT IN INNOVATIVE ORGANIZATIONS

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Abstract
The article examines the main theoretical approaches to the definition of the concept of "innovation", "innovative process", identifies the problems that require additional research during the study, substantiates the existing models of innovative activity of enterprises in the construction industry.

Keywords: innovation, construction enterprises, innovation process, innovation activity

Within the framework of the knowledge-based economy in modern organizations, a new category of management is being formed, aimed at accumulating intellectual capital, identifying and disseminating available information and experience, and creating conditions for the dissemination and transfer of knowledge. In practice, the fulfillment of this function is expressed in the formation, updating and use of knowledge in order to maximize the company's efficiency, as well as the profit from knowledge-based assets. The term “knowledge management” was first used in scientific practice by the famous American researcher in the field of artificial intelligence Carl Vieg in 1986. At first, knowledge management was considered as an area that only relates to those industries that are characterized by high technology. But practice has shown that there are no industries that do not need intellectual capital when making management decisions, providing services or manufacturing products.

The European Commission has classified knowledge as follows [6]:
- scientific knowledge: this knowledge is formed in educational institutions, as well as in research institutes;
- technical (technological) knowledge: this knowledge is formed in companies that conduct their own research and development, in the institutions of the entrepreneurial sector and state scientific institutions, as well as exploratory activity in new companies that arises when creating a new business;
- innovations carried out in companies in the entrepreneurial sector and newly created enterprises;
- intellectual capital: is formed in universities that train highly qualified specialists, in the process of research in the business and public sectors;
- qualifications (competencies): formed in the course of training in professional courses, or are the result of the professional experience of a specialist in all sectors of the economy, including the research sector;
- information and communication technologies (ICT): created in the corporate sector and disseminated through their use in the activities of network structures.

As a function and as a category of management activity, knowledge management solves the following tasks:
- to add value to the information already available through the discovery, selection, synthesis, preservation and distribution of knowledge;
- to impart consumer knowledge to knowledge, for the possession of all the information necessary and accessible to the user;
- transform knowledge into new products, services, documents, database and software;
- contribute to the growth of knowledge (dissemination within the company, exchange with other specialists);
- create an interactive learning environment in which employees regularly exchange information, as well as all conditions for assimilating the acquired knowledge;
- evaluate the knowledge gained, measure and use the intangible assets of the organization.

Using intellectual capital, and with it the professional competence of personnel, ensures the survival and economic success of organizations. It is knowledge that is the basis of innovation, high productivity and competitive advantages of organizations.

Nevertheless, despite the fact that the concept of "knowledge management" has become quite widely used in scientific literature and management activities,
it should be noted the diversity of the proposed methods, applied technologies and approaches, the lack of a unified view of this category of management practice. Corporate knowledge management strategies aim to create new value embodied in products through the creation, accumulation and application of knowledge in organizations. Implementation of knowledge management strategies increases the efficiency of using all existing resources in the organization, reduces losses from untapped intellectual assets, improves customer service, increases innovation, etc. When developing a knowledge management strategy, it is important to identify which knowledge-based capabilities and resources are significant to the company, how much these capabilities and resources support the company's market position. By introducing different strategies, they constantly compete and achieve the best results when, in the process of building and implementing a knowledge management strategy, they compare it with the main aspects of the overall corporate strategy and with their strategic goals, as well as with innovation, marketing, financial and all the rest of the strategies that are being implemented in the organization. This highlights the need to focus knowledge management efforts in areas that support strategic objectives. Depending on the priorities and activities of the organization, priorities in knowledge are established.

If an organization is aimed at achieving a competitive advantage by achieving a high level of customer service, then efforts should be directed to gaining knowledge about customers, their preferences, knowledge about competing companies; in order to create an intracorporate information system, with the aim of its widespread use by the company's employees; on the forms of work with consumers. In this case, such methods of implementing the knowledge management strategy can be systematic customer surveys, the creation of databases about consumers and their preferences. The acquired knowledge is then applied to product upgrades and customer service, becoming a factor in high competitiveness.

On the scale of a strategy, based on data on individual preferences stored in a specific database, an organization can individually serve customers, transfer them additional information about the product for more effective use of it. Access to the knowledge of competitors, methods of carrying out their business and working with consumers, transferring this knowledge into corporate memory and further use is essential for the implementation of this strategy. In addition to the generally accepted collection of marketing information about competitors, it has recently become widespread to create a variety of strategic groupings that can access the knowledge of competitors. Many companies focus on specific types of intellectual capital, or on specific knowledge management approaches, by implementing a related strategy. Some companies, with an emphasis on human capital, implement a specific knowledge management strategy, which is aimed at training personnel, developing thinking and creative abilities, skills and abilities, sharing knowledge, experience, etc. Others consider the formation and development of corporate management methods based on the use of modern information technologies to be key, emphasizing the development of procedures, software and hardware. Still others focus on intellectual property and create corporate strategies for managing the following intellectual assets: licenses, patents, trademarks, copyrights. Many organizations place an emphasis on customer capital, the knowledge that an organization acquires as a result of strong relationships with customers and consumers.

Speaking about the formation of a unified organizational knowledge management system, one should investigate the entire intellectual capital of the organization in aggregate, implement integrated management strategies and all methods of knowledge management. The goal of knowledge management can be considered the formation of economic value. It is not enough just to increase the amount of knowledge, because this knowledge should also become a trigger for activity. Knowledge cannot be valuable until it is used. In addition, they should be used where knowledge will have the maximum economic potential. Knowledge management should be applied in those areas of the business that, thanks to the introduced improvements, will provide the maximum return on investment. Many important processes create very clear value for customers or strengthen the bond between buyer and seller knowledge. At some points, the return on investment in knowledge can be a rapid increase in efficiency or productivity. In other circumstances, when investments in training and innovation do not pay off in the short term, they can form the basis for further success and economic improvement of the company.

Carrying out functions related to knowledge, they often encounter specific problems of a technological nature, among which the following can be noted. Integration of the use and dissemination of knowledge in ongoing activities. Achieving this goal has not only a cultural, but also a technological nuance. The exchange of knowledge and the daily practice of this exchange is likely only in the cultural environment of the company, where this type of activity is recognized and encouraged. The optimal result is the transformation of training into a constituent element of the work of employees. Collaboration technologies must be readily available, resilient, and linked to the software that employees use. Keeping knowledge in an acceptable form. An essential task of knowledge management is considered to be the codification of knowledge in a special form, which will allow preserving its characteristic properties, which often give extraordinary value to knowledge.

Despite the successful assimilation and preservation of knowledge, companies are faced with the task of maintaining this database. Separate employees are allocated specifically for this. The clash between the compulsory standardization and the preservation of the peculiarities of knowledge. The power of knowledge lies in its specificity - in private experience and specificity of the situation. But the systems that make knowledge available in large companies must be based on traditional terminology and boilerplate procedures. Return on investment in knowledge. Solving the prob-
lem of return on investment in knowledge is closely related to the creation of clear characteristics for determining the value of knowledge. Quantitative characteristics, such as the number of calls to the information base, are an unsatisfactory characteristic of the cost of knowledge. Investing in short-term (short-term return on investment) plans is likely to undermine the value of those plans that promise maximum long-term return. If organizations insist on immediate tangible results, then they are likely to cut themselves off from future opportunities. It takes time to understand and master new knowledge.

It should be emphasized that the models, processes and knowledge management systems that are currently used in various organizations differ in considerable variety and mainly depend on strategic goals, existing knowledge, skills and abilities of personnel. The study of existing practice makes it possible to highlight in the work of knowledge management the key processes that exist in each model. These basic processes are the formation - exchange and dissemination - use of knowledge. We can consider as additional those processes that are to some extent integrated into all the main processes, permeate them, guarantee their course. These processes include collection (storage) - formation - protection - audit - assessment - knowledge control. If the key knowledge management processes can be symbolically called horizontal, then the incremental processes are, therefore, vertical.

Each knowledge management process can be designed as a separate business process, or can be integrated as part of the main business processes of the organization. With all this, it is necessary to solve the problems of their technical, financial and structural support. The basis for managing the organization’s knowledge is the process of its formation, the task of which is to establish what knowledge the company needs, how and from what sources it will be acquired, what the cost will be, who will do it and when. In addition, the management task includes the analysis of the information received, its structuring and transformation into organizational knowledge. The creation process begins with the identification and acquisition of knowledge stages. Then the formation of knowledge is supplemented by the processes of their accumulation and development, which involve the constant renewal of knowledge, their transformation from secret to explicit, the use of training programs, as well as other ways of discovering new knowledge, entering it into corporate memory. At the stage of definition (identification) it is necessary to establish what key knowledge is essential for the implementation of the strategy and the success of the organization. Core Key Knowledge is the sum of the expertise, methods and tools needed to implement the right strategic opportunities. This knowledge must reflect, support the goals of the organization.

References

STRATEGIC DIRECTIONS OF SOCIAL POLICY IMPLEMENTATION IN UKRAINE

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Abstract
The article examines the state and prospects of social policy development in Ukraine. The article analyzes new trends in social policy in the modern world. The essence of social policy as an activity of the state and other public institutions in the social sphere is considered. The article reveals the principles, priorities and goals of social policy. The modern tendencies in realization of social policy are investigated, the basic problems of its realization are defined. The priority of social policy as a factor in increasing the economic growth of the national economy is substantiated.

The main attention is paid to the study, analysis and generalization of the experience of social state policy in Ukraine, as well as its priorities and goals. The influence of social policy of other countries on the development of domestic policy in the social sphere is analyzed. The experience of developed countries shows that in the conditions of innovative development the increase of social and individual wealth, as well as the development of society itself is impossible without an active, systematic social policy. The relevance of this topic is that improving the quality of life of the population is an urgent need for modern Ukraine, due to the need to consolidate society, unite efforts of all its strata to achieve social development goals with a focus on achieving high social standards and norms. It is necessary to critically rethink the world experience of forming a new socio-economic space in accordance with national needs and demands, providing for the replacement of old ways of solving social problems with fundamentally new, more effective ones. The main directions of social policy at both state and regional levels are part of the ideology of state building, which aims to ensure human rights and freedoms, integration of society around the national idea, reproduction of social values, social partnership, development of democratic institutions of self-government in society. Strategies to stop the trend of moral and spiritual degradation of society. Priority is given to economic development to the detriment of the goals of human development, which in turn has a negative impact on the socio-economic development of the country.

Keywords: decentralization, economic growth, socio-economic development, social policy, social sphere, standard of living, social life.

Formulation of the problem. The development of large socio-economic territorial complexes of the subnational level must always be coordinated with the policy of the state implemented by public authorities in various spheres of social life: economic, scientific and technical, social, humanitarian and environmental protection. As in any social state [10] in Ukraine, the most attention is paid to the implementation of social policy, the implementation of which is aimed at the employment of those capable and wants to work, protect the rights and freedoms of man, creating available health and education systems, development. Systems of social support of low-income population, struggle against poverty, crime, prevention of social conflicts, etc. It is undeniable that social policy should be based on knowledge of social development laws, identifying in all spheres of public life of deep trends, which determine the processes of self-realization of a person of their own social potential, affect its social security, as well as the feasibility of the purposeful influence of subjects of the regulatory substances. activity [10]. Such subjects primarily include public authorities (public administration and local self-government), which at present are in the stage of reform on the principles of decentralization. In a socio-oriented market economy, the establishment of justice principles is carried out through the implementation of social policy measures.

Social policy is the activities of state and public institutions, social groups and individuals (social policy subjects) aimed at realizing the social needs of a person that ensure its livelihoods and development as a social being based on the principle of social justice for unconditional compliance with its civil rights and freedom. In concrete definition, social policy is a complex of socio-economic measures of the state, local authorities, enterprises, organizations aimed at protecting the population from unemployment, rising prices, depreciation of labor savings. Its goal - to provide a decent standard of living, which is expressed in a certain number of consumer goods and services, starting with the "primary", satisfying the needs of workers in food, clothing, means of movement, health support and ending with the most complicated needs, to Based with the pleasure of spiritual, moral, aesthetic requests. [5].

The main in social policy is the duty of the state to guarantee legislative, socially and economically normal for this historical period, which ensure independent life, freedom to choose life path, sphere of activity, responsibility for their actions, "fee" for the level of personal well-being and position in the society. Social policy should be built on the basis of mutual responsibility and mutual responsibilities of the state and the population. In the conditions of unstable development of the economy, it should be adequate to the state of development of the economy, contribute to stabilizing production and provide minimally necessary standard standards of the population. The general strategic goal of modern social policy is to improve the
quality of life of the population. The activities of the entire system of public administration should be directed to its implementation. The organization of vital activity of the population is closely linked to the problem of the work of the bodies of all levels of management, and first of all local self-government bodies, so the results of studies of quality of life give an opportunity to provide management decisions specific spatial-temporal parameters.[1]. An important mechanism for the formation of social policy is to determine measures to improve the quality of accepted managerial decisions, ensuring the implementation of Ukraine's legislation with a high level of organization of work of power structures. To ensure this direction, a scientific analytical approach to the adoption of managerial decisions should be used to compile schemes of reduction of bureaucratic mechanisms that ensure the implementation of the decisions taken, to take care of the technical support of all executive bodies (e-mail, facsimile communication, computer equipment).

Real social success is achieved only subject to compliance with the goals and tasks of the interests and expectations of the general population, public consensus on the basic principles of the development strategy and mechanisms for its implementation achieved on the basis of consolidation of the entire society. In a globalized economy, it is necessary to constantly update the existing models of social policy, taking into account historical traditions, socio-cultural identification of the population, as well as places in Ukraine in the world economy. In the process of analyzing the situation in society there is an opportunity and the need to formulate peculiar indicators, orientation to which makes it possible to clearly and qualitatively form a social policy of a particular region, identify its main strategic directions. These indicators include: physical condition and quality of life of the working age population; demographic ratio of working and non-working population; Opportunities (index) of the working part of the population to maintain the non-working part of the population; average salary level in Ukraine; level of latent unemployment (in general and with distribution by regions); The ratio of the subsistence minimum established by de jure and de facto (the more difference between them, the lower quality of life); The poverty level (the percentage of population affiliates to different levels of poverty is absolute, relative, potential). Social indicators determine the state of society, they are the most important benchmark in the formation of social policy and determining its main strategic directions. Receiving data focused on these indicators, and their further analysis will allow to predict the development of the socio-political situation in the country, taking into account the time factor, that is, to compile short-term, medium-term, long-term forecasts of the development of socio-political situation. This will make it possible to develop and begin the necessary measures in the socio-economic sphere, in order to prevent the growth of social tensions and political instability in society. The state of social tension in society is an important characteristic of the situation in terms of determining the prospects for the development of social relations, the degree of possibility of social conflicts. The big problem of the present is a low standard of living of our citizens. [3]. It should be noted that a significant impact on the level of development and directions of social policy has a global global economic crisis, through which, above all, there were significant negative changes in the monetary, credit, fiscal, currency sphere in Ukraine. It is with the development of these areas with the establishment and development of the social policy of the state [8].

This gives an opportunity to argue that the failure of the state, in this case of Ukraine, to achieve all the strategic goals of its social policy occurs not only due to national reasons among which one of the main places occupies a problem of political instability. But despite obstacles, today the country sets themselves in the following strategic directions of social policy development:
- to increase attention to the demographic policy of the state, which will carry out the function of regulating the psychological propensity of people to one or another demographic behavior, which will require social protection and will help solve a number of social policy issues;
- creation of environmentally friendly living conditions;
- protection of citizens from inflation through timely income indexing;
- restriction of unemployment and stimulation of employment;
- repayment of wage arrears and social benefits;
- development of social infrastructure, creation of conditions for education, education, spiritual development of children, young, etc. [2].

The main directions of social policy in this area should be:
- ensuring social direction of state budget expenditures;
- rationalization of the structure of budget expenditures of all levels with the direction of budget funds for the implementation of priority social development measures; definition of the principles of financing state social programs, taking into account the peculiarities of national priorities in regional social programs and ensuring the mechanism of their implementation;
- formation of priorities and mechanisms of accumulation and spending of currency funds for the development of the social sphere;
- creation of conditions for expanding the construction of housing by raising funds and preferential lending;
- increase in the share of paid services in the social sphere with the provision of minimum guarantees of free medical and domestic services, education, etc.;
- development of an actual state mechanism for attracting financial resources to create new promising industries in areas of mass closure and liquidation of enterprises.

Thus, the progressive and dynamic development of Ukraine, today, must focus on socialization of the economic system with the most complete, taking into
account the needs, interests of the population, its incentives to productive labor activity in order to realize its own professional qualification potential, comprehensive development, obtaining a decent remuneration for labor results. The priority of solving social tasks logically follows from the objective need to create conditions for dynamic, balanced socio-economic development of the regions of Ukraine, their optimal integration into the global economic space, which puts forward new requirements for the process of reproduction of the population, the formation of social and labor relations, the development of all spheres Life support of the population and its main component - labor force. In this regard, it is necessary to transform the functions of the state in the management of social development: The evolution of modern methods of state regulation should take place in the direction of increasing their flexibility, displacement of emphasis on regulatory and limiting measures for purely stimulating. The success of economic reforms in the crisis situation will depend on conducting effective social policy. [8]. After all, without improving the standard of living of people it is impossible to form a massive and, most importantly, reliable social base of economic development on the paths of market reforms. The social policy of the state should be active in nature, not to be reduced only to social protection measures at the expense of budget funds. The state should contribute to the expansion of the circle of persons capable of personal responsibility for the results of their own economic actions, that is, in other words, to contribute to reducing the number of social groups that require external care. The state social policy should not go beyond the provision of assistance only to those who really need it. People have always lived better when they rely on themselves and market than to the state. This indicates the experience of many countries that have managed to significantly raise a folk welfare bar exactly when politics began to activate the market forces and the dismissal of the state from economically unreasonable social functions. Moreover, all directions of social policy should be developed. In the formation of social policies, the quality of life and the level of human potential are very rarely taken into account.

The main directions of social policy in Ukraine at the present stage of development are:

- policies in the field of incomes, which provides for the establishment of social standards of life, living parameters, to ensure wage growth;
- employment and occupational safety policy, which provides for the legislative establishment of occupational safety, types and forms of social insurance, providing full productive employment, prevention of unemployment;
- social protection, which provides for the definition and establishment of parameters of pension provision and other types of social insurance, social assistance, social services, as well as social benefits and guarantees;
- demographic policy that involves stimulating reproductive population growth, state aid of the family, regulation of migration processes;

Policy of development of social sphere: cultural, linguistic, religious, youth, recreational policy, health care, in the field of education, science, etc.

The priority is the economic development to detrimental to the development of human potential, which in turn negatively affects the country's socio-economic development. [thirteen]. The state should pay more attention to the development of human potential of the country, direct efforts to improve the quality of education, cultural level of the country, advertise and promote a healthy lifestyle, but it should also be noted that in addition to state propaganda should be present and public mood. The society should consider this way of life acceptable and necessary for its existence. Many problems cannot be solved purely economically, these are such problems as a problem of social inequality, poverty, improving the quality of life and others. Therefore, they have a socio-cultural component, and it is necessary to make an emphasis not only on the economy, but also on other basic resources of human development: culture, education, physical health. The main elements of living standards are: the level and structure of consumption of material goods (food and non-food products); The level of consumption of services of household service institutions, health care, education, culture, social SAR Especification, physical education; Level of housing. [12]. To determine the main directions, tasks and principles based on the implementation of social policy of Ukraine, it is necessary to guide the thesis laid in the Sustainable Development Strategy "Ukraine-2020" (document that defines the directions and priorities of Ukraine's development for the period until 2020. The strategy was developed on the initiative President of Ukraine Petro Poroshenko and presented to him on September 25, 2014. On January 12, 2015, President Petro Poroshenko signed a decree "On the Strategy of Sustainable Development" Ukraine - 2020 "[9]), which is a“ ideological doctrine “of Ukraine's social policy realization for the next 4 years ». The Sustainable Development Strategy of Ukraine is a software document for long-term action, which is based on the modern international principles of coexistence of humanity and the environment and which determines the purpose, tasks and priority directions of progressive development of Ukrainian society in the path to ensuring the balance of economic, social and environmental factors [9].

Conclusions from the study. Consequently, a priority direction of social policy is not so much expansion of social assistance and population support, but the development of human potential, improving the quality of human capital as the basis of economic growth and public dynamics for a long prospect. The directions of social policy both in the state and regional levels are an integral part of the state-building ideology, which is aimed at ensuring the rights and freedoms of man, integration of society around the national idea, reproduction of social values, social partnership, development of democratic institutions of self-government in society, the formation of a state strategy to stop the trend of moral and spiritual degradation of society [10].
References


ОЦЕНКА УСЛОВИЙ РАЗРАБОТКИ НЕФТЯНОГО МЕСТОРОЖДЕНИЯ С ЦЕЛЬЮ ПЛАНИРОВАНИЯ ГЕОЛОГО-ТЕХНИЧЕСКИХ МЕРОПРИЯТИЙ

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ESTIMATION OF THE CONDITIONS OF DEVELOPMENT OF THE OIL FIELD FOR THE PURPOSE OF PLANNING GEOLOGICAL AND TECHNICAL MEASURES

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Аннотация
Истощение активных запасов углеводородов на открытых и осваиваемых месторождениях обусловливает необходимость ввода в разработку новых сложно построенных залежей, постоянного совершенствования технологий строительства и освоения скважин, непрерывного контроля и управления состоянием разработки уже освоенных месторождений с целью максимального использования потенциальных возможностей каждой скважины, каждого продуктивного пласта. В призабойной зоне происходит снижение проницаемости и значительные потери пластовой энергии при движении флюида к скважине. Одним из радикальных технических решений для восстановления проницаемости прискважинной зоны в продуктивной толще является газодинамический разрыв пласта, который на сегодняшний день относится к наиболее перспективным технологиям по эффективности и экономической рентабельности.

Abstract
The depletion of active hydrocarbon reserves in discovered and developed fields necessitates the commissioning of new, complexly constructed deposits, continuous improvement of well construction and development technologies, continuous monitoring and management of the state of development of already developed fields in order to maximize the potential of each well, each productive formation. In the bottomhole zone, there is a decrease in permeability and significant losses of reservoir energy when the fluid moves to the well. One of the radical technical solutions for restoring the permeability of the near-wellbore zone in the productive strata is gas-dynamic fracturing, which today is considered to be one of the most promising technologies in terms of efficiency and economic profitability.

Ключевые слова: месторождение, добыча нефти, добывающий фонд, разработка месторождений.
Keywords: oil field, oil production, production fund, field development.

Актуальность.
Оосновой экономической стабильности и энергетической независимости страны еще долгое время будут служить запасы углеводородного сырья и их эффективное использование. Сегодняшнее неблагоприятное состояние большинства крупных нефтегазовых месторождений Российской Федерации обусловлено значительным сроком их эксплуатации.

В структуре остаточных извлекаемых запасов по значительной доле месторождений активные составляют менее 20%, трудно извлекаемые – более 80%.

Последние 20 лет нефтедобыча в России характеризовалась отсутствием сколько-нибудь значительного прироста сырьевой базы с одновременным ухудшением структуры извлекаемых запасов.
При этом существенно возросла степень выработанности активных запасов (до 70%) с ростом доли трудноизвлекаемых запасов (до 67%) и низкой степенью их выработки (до 30%). Продолжалась многолетняя тенденция снижения коэффициента извлечения нефти. В настоящее время средний КИН по России не превышает 30% и является одним из самых низких в мире.

Истощение активных запасов углеводородов на открытых и осваиваемых месторождениях обусловливает необходимость ввода в разработку новых сложно построенных залежей, состоящих из отдельных однородных горизонтов. Коллекторами, вмещающими залежь, являются преимущественно кварцевые песчаники, аркозы, песчанисты с пропластками алевролитов и аргиллитов. Коллекторами, вмещающими залежь, являются преимущественно кварцевые песчаники, аркозы, песчанисты с пропластками алевролитов и аргиллитов.

Основная причина, обусловливающая возникновение данной проблемы, — это процессы взаимодействия между скважинами и искривленными проницаемыми пластами при их строительстве, освоении и эксплуатации, которые в значительной степени определяются геолого-геомеханическими условиями, характеристиками насыщающего пласт флюида, технологиями и техническими средствами, использованными на всех этапах активной жизни скважины.

Общезвестно, что именно в призабойной зоне происходит снижение проницаемости и значительные потери пластовой энергии при движении флюида к скважине. Одним из рациональных технических решений для восстановления проницаемости прискважинной зоны является создание неразрушающей проницаемости, которая на сегодняшний день относится к наиболее перспективным направлениям по эффективности и экономичности.

Цель работы — анализ и систематизация научно-технической информации по теме исследования, оценка перспектив и возможностей использования достижений научно-технического прогресса в инновационном развитии отрасли. Скважина № 12 в интервале вскрытия верхнего продуктивного горизонта дает возможность оценить перспектив и возможности реализации задачи «интеллектуализации» нефтедобывающих объектов.

В геоморфологическом отношении район месторождения, расположенного в Калининградской области, представляет собой слабовсхолмленную равнину с абсолютными отметками 30-32 м над уровнем моря. По состоянию на 01.01.2014 год на месторождении пробурено шесть скважин, пробуренных в палеозойском комплексе, где дебит представляет собой слабовсхолмленную равнину с абсолютными отметками 30-32 м над уровнем моря. По состоянию на 01.01.2014 год на месторождении пробурено шесть скважин, пробуренных на палеозойском комплексе, где дебит представлен нефтью. Скважины, пробуренные по палеозойскому комплексу, дебиты низко извлекающейся нефти. Скважины, пробуренные на палеозойском комплексе, дебиты низко извлекающейся нефти.

Продуктивный пласт характеризуется своей выдержанный по площади и представлен песчаниками с пропластками алевролитов и аргиллитов. Коллекторами, скважинами залежи, являются преимущественно кварцевые песчаники. Тип коллектора поровый.

Максимальная эффективная нефтенасыщенная толщина (скважина № 2) составляет 20,4 м. Средневзвешенное её значение по залежи — 8,0 м. Коэффициент песчанистости в нефтенасыщенной части разреза изменяется от 0,76 (скважина № 6) до 1, составляя в среднем для залежи 0,93, коэффициент расчлененности 2,13.

Литологическая разрез представлен песчаниками с пропластками алевролитов и аргиллитов. Песчаники мелко и среднезернистой структуры, квадратного состава, темно-серые, бурье и буро-серые при насыщении нефтью или при содержании битумного вещества. Сцементированы обложившиеся, представляющие собой слабовсхолмленную равнину с абсолютными отметками 30-32 м над уровнем моря.

Таблица 1.1

<table>
<thead>
<tr>
<th>Пласт</th>
<th>Тип залежи</th>
<th>Размеры залежи, м×м</th>
<th>Площадь, км²</th>
<th>Коэффициент нефтенасыщения, %</th>
<th>Коэффициент проницаемости, мД</th>
<th>Абсолютная отметка кровли, м</th>
<th>Абсолютная отметка ВНК, м</th>
<th>Высота залежи, м</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>массивная</td>
<td>2500×100</td>
<td>2160,0</td>
<td>2288,0</td>
<td>2311,0</td>
<td>-2288,0</td>
<td>-2311,0</td>
<td>23,0</td>
</tr>
</tbody>
</table>

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мочевые зерна в песчаниках, в основном, кварцевым, кальцитовым и глинистым материалом. В целом освещенность керном продуктивного пласта весьма высока и объем выполненных работ по анализу кернового материала представлен в достаточном количестве для обоснования фильтрационно-емкостных свойств. Коэффициент открытой пористости по керну по нефтенасыщенной части пласта изменяется от 0,06 до 0,204 по 117 образцам из четырёх скважин, среднее значение составляет 0,131. Коэффициент начальной нефтенасыщенности определен по керну по семи образцам из двух скважин, изменяется от 0,896 до 0,932 и составляет в среднем величину 0,914. Проницаемость изменяется по керну по нефтенасыщенной части пласта в диапазоне от долей до 5,426 мкм² по 105 образцам из четырёх скважин, составляя в среднем величину 0,479 мкм². Статистические ряды распределения проницаемости коллектора по 105 образцам керна по нефтенасыщенной части пласта позволяют провести сопоставление обобщённой зависимости проницаемости от его пористости (рисунок 1.1).

Коэффициент остаточной нефтенасыщенности определялся прямым экстракционно-дистилляционным методом на 104 образцах герметизированного керна. Содержание остаточной нефти в керне продуктивной части колеблется от 0,5 до 35,2 % и в среднем для нефтенасыщенных пород-коллекторов составляет 12,94 %. Связь между остаточной нефтенасыщенностью и коэффициентом открытой пористости не установлена.

На основании данных экспериментов по определению коэффициента вытеснения построены характеристики вытеснения и динамика обводнения составных образцов (рисунок 1.2, 1.3).
Из графиков видно, что практически во всех случаях процесс вытеснения носит поршневой характер. При этом на момент прорыва воды безводный коэффициент вытеснения составляет более 0,5.

Относительные фазовые проницаемости определялись в 2006 году ООО «ВНИГНИ-2» на тех же моделях пласта, что и коэффициент вытеснения. Усреднённые по четырём экспериментам ОФП приведены на рисунке 1.4.

По состоянию на 01.01.2014 на месторождении пробурено 16 добывающих скважин, в том числе две скважины переведены в контрольный фонд после достижения предельного обводнения (скважина 3 – наблюдательная, скважина 6 – пьезометрическая). 14 скважин находится в действующем фонде, из них три оборудованы ШГН и 11 – ЭЦН.

Проектный фонд скважин полностью реализован. На месторождении реализована трёхрядная система размещения скважин с расстоянием между скважинами – 200-350 м. Плотность сетки – 13,5 га/скв.

Месторождение находится на третьей стадии разработки и характеризуется прогрессирующим обводнением продукции. Динамика основных показателей разработки по месторождению представлена на рисунке 1.8.
В течение последних четырёх лет в связи с увеличением отборов жидкости за счёт перевода четырёх скважин на механизированную добычу и проведения оптимизации режима работы скважин, наблюдается рост обводненности с 60 до 79,4 %.

В 2013 году добыча нефти составила 29,6 тыс.т жидкости – 143,8 тыс.т. Средний дебит одной скважины по жидкости составляет 28,8 т/сут, по нефти – 5,9 т/сут, среднегодовая обводненность продукции – 79,4 %.

По состоянию на 01.01.2014 из 14 действующих скважин пять скважин работает со среднегодовой обводненностью выше 90 %, из них три (скважины № 7, 10, 14) работают с обводненностью на уровне 97-98 % и дебитом нефти менее 1 т/сут (таблица 1.5). Две скважины (№ 4, 12) работают с дебитом нефти более 10 т/сут и обводненностью порядка 40 %.

Энергетическое состояние месторождения характеризуется незначительным падением пластового давления, что закономерно для месторождений Калининградской области, разрабатываемых при водонапорном режиме без поддержания пластового давления. Пластовое давление, замеренное в скважине № 6 в феврале 2013 году, составило 23,7 МПа или 96 % от первоначального, что свидетельствует о возможности дальнейшей разработки без использования методов ППД. Динамика пластового давления приведена на рисунке 1.9.
Реализованная система разработки достаточно эффективна. Отбор от НИЗ составляет 81,1 % при среднегодовой обводнённости 79,4 %, текущий КИН 0,526 при утверждённом 0,649.

Заключение
Одной из важных задач, возникающих при анализе разработки в поздней стадии разработки, является выявление характера распределения оставшихся запасов нефти в пределах начального нефте- содержащего объема залежи. [2,35]

Совершенствование систем разработки должно идти по пути повышения охвата пласта воздействием, ликвидации зон и участков, где слабо распространяется влияние нагнетания.

Поскольку основным способом разработки нефтяных месторождений является заводнение пластов, вполне закономерно, что в первую очередь необходимо применять гидродинамические методы увеличения нефтеотдачи - это усиление систем за- воднения, применения способов регулирования (цикличная закачка и изменение направления фильтрационных потоков ИНФП и т.д)

Кроме того, в условиях прогрессирующего обводнения нефтяных залежей на поздних стадиях разработки и опережающей выработки наиболее продуктивных пластов для достижения коэффициента нефтеотдачи КИН, необходимо широко внедрять методы увеличения нефтеотдачи пластов - массового применения геолого-технических меро- приятий (ГТМ).

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PHYSICS AND MATHEMATICS

FORMATION OF HUMAN SUPERCIVILIZATION

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Abstract
The article proves that the existing version of the special theory of relativity (STR), based on the postulated principle of non-exceeding the speed of light, is incorrect. Therefore, an alternative version of STR, based on the experimentally proven principle of the physical reality of imaginary numbers, is proposed. And from the alternative version of STR follows the existence of invisible universes with their own super-civilizations. Therefore, attempts to establish contacts with extraterrestrial super-civilizations of our visible universe as a result of flights to the Moon and Mars or as a result of the detection of their activity in other star systems thousands of light years from Earth are unnecessary, since the inhabitants of super-civilizations are also on Earth. They even send us messages, for example in the form of so-called ‘crop circles’. But since we were not intellectually advanced enough to read these messages, our human civilization did not interest them. And any of our contacts with them, apart from their desire, are impossible. Therefore, the way out of this situation is to transform the existing human civilization into super-civilization through the creation and use of human-computer super-intelligence.

Keywords: imaginary numbers, special theory of relativity, dark matter, dark energy, dark space, invisible universes, Multiverse, Hyperversion, super-civilization, super-intelligence, technological singularity

1. Introduction
Established at the beginning of the last century by Joseph Larmor [64], the Nobel Prize winner Hendrik Antoon Lorentz [65], Jules Henri Poincaré [67], the winner of the Nobel Prize Albert Einstein [52] and other eminent scientists, special theory of relativity (STR) [53], [45], [60] is nevertheless flawed despite all of its universally recognized merits. Its second postulate [20] undergoes especially a lot of criticism, having in addition to offered original formulation [52] in the form of principle of the constant velocity of light, the other supposedly identical to or following from it (that was not proved anywhere) formulations in the form of the principle of non-exceeding the speed of light and approval of the physical unreality of the imaginary numbers.

Since modern physics is largely founded not on experimentally obtained data, but on those or other postulates, the corresponding theories can be refuted only by means of experiments. And so in the early twenty-first century attempts of refutation of the principle of non-exceeding the speed of light in STR were made by collaboration of MINOS [3] on the US Tevatron collider and collaboration of OPERA [2] on the European Large Hadron Collider. However, MINOS experiment has been ignored by the physics community as not sufficiently reliable, and OPERA experiment has been refuted in six months by ICARUS experiment [5]. What is more, during those six months several dozen scientific publications have been devoted to the search for OPERA experiment refutation options. Some of them even claimed that, since the principle of non-exceeding the speed of light is fundamental in STR, then, if OPERA experiment had proved successful, its authors would have deserved the Nobel Prize.

However, as the author of the concept of ‘open society’ Sir Karl Raimund Popper noted [68]: ‘... the struggle of opinions in scientific theories is inevitable and is a necessary prerequisite for the development of science’. And, as it turned out, the problem of proving the physical reality of imaginary numbers at the same time had already been successfully solved, but using other experiments [6], [7], [10], [11], [12]. And from the experimentally proven principle of physical reality of imaginary numbers followed the fallacy of the principle of non-exceeding the speed of light. However, oddly enough, in this event, in contrast to the OPERA experiment, the physical community over the past years did not show interest and did not remember the Nobel Prize.

This circumstance involuntarily suggests itself the simple explanation that the physical community did not need scientific truth, but the maintenance of an erroneous public opinion about the alleged infallibility of STR. And in this capacity, the long-term very expensive and unique experiment OPERA, which failed to refute the principle of not exceeding the speed of light, turned out to be very useful, and the irrefutable alternative simple experiments described below, which managed to prove the fallacy of STR, on the contrary, were very inappropriate.

2. Why in STR the Principle of Non-Exceedance the Speed of Light is Fundamental
Why is the principle of non-exceeding the speed of light was so necessary in STR? Why the generally accepted at the present time version of STR would not be a success without it?

And the thing is that the corresponding to relativistic formulas of STR – for example, the formula of Lorentz-Einstein

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\[ m = \frac{m_0}{\sqrt{1 - (v/c)^2}} \]  

where \( m_0 \) is the mass of the moving body rest (for example, an elementary particle);

\( m \) is relativistic mass of the moving body;

\( v \) is the speed of movement of the physical body;

\( c \) is the speed of light;

- the physical values on the hyper light speeds when \( v > c \) are taking imaginary values. And the authors of \( \text{STR} \) did not know how to explain this result. Just as 400 years before them, none of the most authoritative physicists and mathematicians could prove the physical reality of imaginary numbers. So they were forced either to confess that they do not fully understand their theory, or in some way to avoid the need for such confession. Otherwise, \( \text{STR} \) would look unfinished and unconvincing.

In order to avoid such a situation, the authors of \( \text{STR} \) needed a principle of not exceeding the speed of light that was not proven (in other words, postulated), since in accordance with this principle at subluminal velocities at \( v < c \) the corresponding relativistic formulas, the quantities took on completely explainable and interestingly interpreted real values. And at hyper-light speeds \( v > c \), it would seem that it was no longer necessary to explain anything, since such a situation was supposedly impossible.

And this postulate was substantiated at first glance even quite clearly as follows. Since the magnitude of the relativistic mass \( m \) in formula (1) depends on the velocity \( v \), then at near-light velocities when \( v < c \), the mass \( m \) takes values approximating infinitely large real values, i.e. \( \lim_{v \to c} m(v) = +\infty \). But then to overcome the point of astrophysical singularity \( v = c \) infinitely large energy becomes necessary. Consequently, it was impossible to overcome the speed light barrier. And so it was concluded that nothing exists behind this barrier, i.e. we live in a Moniverse.

But the given justification is refuted even at the everyday level. Indeed, the impossibility of getting into the next room of our dwelling through the barrier in the form of a wall separating them does not mean at all that the next room does not exist and that we cannot get into it through the door. But nature is much more complex than our home and therefore no one can claim that it is fully cognized and that there are no opportunities to overcome the astrophysical singularity in it.

3. The Proof of Principle of the Physical Reality of Imaginary Numbers

In order not to overload this article repeating the proofs of physical reality of imaginary numbers set forth in the publications mentioned above, we only note that they state the following:

- Analysis of oscillatory transient processes made it clear that if the principle of light speed non-exceedance implying the \( \text{STR} \) statement about physical unreality of imaginary numbers were true, then there would be no tsunami, church bells and musical instruments would not sound and even children’s swing wouldn’t sway after being pushed by parents;

- Analysis of oscillatory resonant processes made it clear that if the principle of light speed non-exceedance implying the \( \text{STR} \) statement about physical unreality of imaginary numbers were true, then we would not know such exact sciences as radio engineering and electrical engineering, television and radiolocation, telecommunication, radio navigation and many others;

- Analysis of forced oscillatory processes made it clear that if the principle of light speed non-exceedance implying the \( \text{STR} \) statement about physical unreality of imaginary numbers were true, then even Ohm’s law would not exist for electric circuits.

But in the 21st century this is still not understood in the existing physics of real numbers, since it still assumes that the principle of light speed non-exceedance is true.

It is interesting to note that the current version of \( \text{STR} \) could be refuted even before its creation. Indeed, the main works of the authors of \( \text{STR} \) [64], [65], [67], [52], were published in 1897-1905, and in 1897 an engineer and inventor Charles Proteus Steinmetz has offered his interpretation of Ohm’s law applied to the linear electric circuits of alternating current [70], which allowed to prove the physical reality of imaginary numbers the simplest and most convincing way. Thus, with its help, the uselessness in \( \text{STR} \) of the erroneous principle of not exceeding the speed of light could have been proven already at that time, if someone would need it.

At that time the Internet had not yet existed, and it was excusable to the creators of \( \text{STR} \) not know about Steinmetz’s theory. But after a hundred plus years it is already unforgivable for the physicists not to know of established by Steinmetz theory, which is now is used by all electrical and radio engineers.

And not to be unfounded, let’s give a simple proof of the physical reality of imaginary numbers [24], [25], [33], [34], [41], which made the costly MINOS, OPERA and ICARUS experiments unnecessary. In contrast to discovered in 1826 Ohm’s law, which was formulated for electric DC circuits, Steinmetz suggested the wording of this law for electric AC circuits. In accordance with the theory he proposed, not only resistors have the electrical resistance (or conductivity) whose resistance is measured by real numbers, but also capacitors and inductance coils, the resistance of which are measured by imaginary numbers with different polarities. Moreover, the value of imaginary resistance of capacitors and inductance coils depends on the frequency. Therefore, resistance of any LCR-, RL-, RC- and LC-circuit is measured by complex numbers, the value of which also depends on the frequency applied to electrical voltage circuit.

This said, the resistance of capacitors and inductance coils measured by imaginary numbers is often also called imaginary. And under the dominant influence of \( \text{STR} \) they are still understood as imaginary, that is, really physically not existing. But this is not true. If the resistance of the capacitors and inductance coils were
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actually imaginary, then from the change in their values
when the change of frequency of the applied voltage the
value flowing through LCR-, RL-, RC-, LC-circuit of
the electric current would have been independent. But
the engineers have known for a long time that it de-

pends on the frequency. This is confirmed by the exist-
ence of mass-produced for several decades instruments
for measuring the frequency characteristics of electrical
circuits, which confirm the presence of the mentioned
dependence.

Moreover, if the imaginary impedance of capaci-
tors and inductance coils were not physically real, in
electrical circuits could not be a resonance phenome-
non discovered in 1602 by Galileo di Vincenzo Bonaiuti
de’Galilei [57]. And then there would be no such sci-
ence as radio engineering, telecommunications, radar,
television, and many others.

Consequently, since mathematics is the universal
language of all exact sciences, the physical reality of
imaginary resistance of capacitors and inductors clearly
shows the physical reality of imaginary numbers which
measure the parameters of corresponding physical ob-
jects. Therefore, the principle of the physical reality of
imaginary numbers is general scientific and also appli-
cable in special theory of relativity, quantum mechan-
ics, optics and the rest of the exact sciences.

There is other, equally compelling, evidence of the
physical reality of imaginary numbers [6], [7], [10.],
[11], [12], [35], [40].

4. Refutation of the Principle of Non-Exceed-
ing the Speed of Light

But from the principle of the physical reality of
imaginary numbers, it follows that according to Lo-
rentz-Einstein formula (1) relativistic mass $m$ at the
hyper light speeds when $v > c$ as well as imaginary
physical values corresponding to the rest of the relativ-
istic formulas when $v > c$ are physically real. And
the principle of non-exceeding the speed of light turns out
to be unnecessary. And then it becomes necessary to do
what the creators of STR were unable to do - to explain
the meaning of these imaginary physical values [21].

$$m = \frac{m_0(i)^q}{\sqrt{1 - (\frac{v}{c}-q)^2}} = \frac{m_0(i)^q}{\sqrt{1 - (\frac{w}{c})^2}}$$

where $q = \frac{v}{c}$ is discrete function “floor” (see
Fig. 2a) from the argument $\frac{v}{c}$.

Figure: 1. Graphs of functions corresponding to formulas (1) and (2)

But this cannot be done, since the physical process
corresponding to them is unstable (see Fig. 1a) and
therefore cannot exist in nature. Consequently, formula
(1), as well as other relativistic formulas of the existing
version of STR, are incorrect. Therefore, the Lorentz-
Einstein formula should be corrected as follows (see
Fig. 1b):

Figure 2. Graphs of functions $q(v)$ and $w(v)$
\[ w = v - qc \] is its own for each local universe speed (see Fig. 2b), which can only take values in the range \( 0 \leq w \leq c \);

\( v \) is the speed, measured from our universe, which can therefore be called an total speed;

\( c \) is the speed of light;

\( i = \sqrt{-1} \) is an imaginary unit.

The rest of the relativistic formula can be corrected in a similar manner.

It should be noted that Albert Einstein did not exclude STR correction in the future. He wrote: "No single idea, which I would be sure that it will stand the test of time".

5. Hidden Multiverse

5.1. The Structure of the Hidden Multiverse

Then it is necessary to explain the physical meaning of formula (2). And in this formula the parameter \( q \), as you can see (see Fig. 1b), corresponds to the fourth spatial dimension. But such a four-dimensional space has nothing to do with the four-dimensional Minkowski space. In this four-dimensional space, different parallel universes will correspond to the integer values of the parameter \( q \). The value of the parameter \( q = 0 \) will correspond to our visible universe, since in formula (2) \( i^0 = 1 \), and the value of the parameter \( q = 1 \) will correspond to another universe, as for it \( i^1 = i \). For this second universe \( c \leq v < 2c \). Therefore, it contains tachyons [71], [56] and it is invisible to us, because it is beyond the event horizon. For the sake of certainty, we will call it tachyon. Then, for similar reasons, we will call our universe tardyon.
Consequently, formula (2), in contrast to formula (1), corresponds to the Multiverse formed by mutually invisible universes, which we will call the hidden Multiverse [29]. But from formula (2) it does not at all follow that there are only two universes in the hidden Multiverse. So let’s continue. The parameter \( q = 2 \) will correspond to the tardyon antiverse (since \( i^2 = -1 \)), the parameter \( q = 3 \) will correspond to the tachyon antiverse (since \( i^3 = -i \)), the parameter \( q = 4 \) will correspond to another tardyon universe (since \( i^4 = 1 \)), the parameter \( q = 5 \) will correspond to another tachyon universe (since \( i^5 = i \)), etc.

Thus, the mutually invisible parallel universes (since, despite their infinity, they do not intersect anywhere) of the hidden Multiverse in four-dimensional space form a screw structure shown in Fig. 3. And these parallel universes in multidimensional space, drifting continuously, sometimes touch each other (as the people in the crowd), and sometimes even partially immerse in each other, while forming a certain transition zones, through which parallel universes can exchange their material content. These numerous transition zones between adjacent universes are often referred to in the fiction as portals or stellar gates [32], in which the value of the parameter \( q \) changes smoothly (while in the parallel universes the value of the parameter \( q \) is constant), are shown in Figure 3 by means of single bidirectional arrows.

5.2. Explanation of the Dark Matter and Dark Energy

However, any structure of the Multiverse cannot be considered satisfactory in any way, if it is does not explain the phenomenon of dark matter and dark energy [55], [66]. Not only astrophysical, but general scientific worldview importance of this problem is caused by the facts that:

- mass-energy of the dark matter and dark energy exceeds the mass-energy of our entire visible universe more than twenty times;
- none of the known chemical elements, and even any subatomic particles, are found in the composition of dark matter and dark energy, which raises doubts about the correctness of understanding of notion “matter” and presumably pushes science in its development on thousands of years back.

This phenomenon has not been explained up until very recently. Moreover, its explanation failed to even come close in the past decades. The reason for that is just the wrong statement of the search task of explaining the phenomenon certainly in Monoverse corresponding to the existing incorrect version of STR. But as Albert Einstein claimed: “Insanity: doing the same thing over and over again and expecting different results”.

But if we abandon this restrictive condition and will seek a solution to the problem in the hidden Multiverse, we won’t even have to look for it. It is obvious [22], [23], [26], [27], [28], [36], [37]:

- dark matter and dark energy are gravitational images of the rest, except for our visible universe, invisible parallel universes of the hidden Multiverse;
- dark matter is a gravitational image of the invisible parallel universes of the hidden multiverse adjacent to our visible universe;
- dark energy is a gravitational image of the rest, except for our visible universe and its neighboring invisible universes, invisible parallel universes of the hidden Multiverse;
- it is impossible to determine the chemical composition of the contents of dark matter and dark energy, since it is simply absent in any image, either in the optical or in any other electromagnetic, or in the gravitational one.

5.3. Antimatter, anti-time and anti-space

No less important and incomprehensible problem in cosmology than the phenomenon of the dark matter and dark energy is the explanation of antimatter location [4], [54].

Indeed, the Big Bang which occurred 13.8 billion years ago had to create matter and antimatter in equal amounts. But our universe consists of the matter only. The scientists were able to synthesize antimatter, as well as to discover it in some natural phenomena only in minute amounts, which, however, confirms the possibility of its existence.

So the logical question is - where the antimatter is located in large quantities? Clearly, there’s no place for it in the Monoverse. Otherwise, as a result of the annihilation of matter and antimatter the visible universe would have been destroyed.

And in the hidden Multiverse, as a result of the alternation in the multidimensional space of universes and antiverses, both tardyon and tachyon, it can stably exist in the antiverses - both tardyon and tachyon. Moreover, as shown in Fig. 3, there may even be several pairs of universes and antiverses in it [38].

But the most interesting thing is that, according to the same logic, the time and space existing in the antiverses, according to the relativistic formulas of the alternative version of STR, are anti-time and anti-space.

5.4. Quaternion Structure of the Hidden Multiverse

Extremely valuable data obtained by the spacecraft WMAP [61], launched in 2001, and Planck [1], launched in 2009, allow to significantly clarify the structure of the hidden Multiverse.
According to the measurements of Planck the whole universe (in fact, the whole hidden Multiverse) is made up of baryonic matter by 4.9\% (and according to the previous measurements of WMAP - by 4.6\%), by 26.8\% (according to WMAP measurements - by 22.4\%) of the dark matter, and by 68.3\% (according to WMAP measurements - by 73.0\%) of dark energy.

On the basis of these data it is safe to assume that as a result of mutual exchange through the portals of micro- and mini-content of the parallel universes, their mass-energy has the largely averaged out (even if, for some reason, immediately after the Bing Bang their mass-energy in different universes would have been different), and it is with great accuracy equal to the mass-energy of our universe.

Therefore:
- According to Planck data the hidden Multiverse contains 100\%/4.9\% = 20.4 (and according to WMAP - 100\%/4.6\% = 21.8) parallel universes. I.e. the most probably 20 ... 22 parallel universes.
- According to Planck data the hidden Multiverse contains 26.8\%/4.9\% = 5.5 (and according to WMAP 22.4\%/4.6\% = 4.9) parallel universes. I.e. the most probably 5 ... 6 parallel universes.
• According to Planck data the hidden Multiverse contains 68.3%/4.9 = 13.9 (and according to WMAP 73.0%/4.6% = 15.9) parallel universes. I.e. the most probably 14 ... 16 parallel universes.

However, it is not difficult to note that these results do not correspond to the structure of the hidden Multiverse, as shown in Figure 3. In fact, in the structure of the hidden Multiverse shown above our tardyon universe had only two neighboring universes, rather than 5 ... 6 universes. Consequently, some important facts when configuring this structure had not been taken into account.

And what kind of circumstances are those, which may have conditioned the emergence of 5 ... 6 tachyon neighboring universes and antiverses in our tardyon universe?

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Figure 5. The six-dimensional space of the hidden Multiverse.

Figure 6. Hypothetic structure of the hidden Multiverse, corresponding to the physical reality of quaternions.
To answer this question, let us recall that the tachyon universes and antiverse in the above structure of the hidden Multiverse were a consequence of accounting in the formulas (2) of the physical reality of only one imaginary unit, which is typical for complex numbers, and statement of the existence of one additional spatial measurement. Therefore, in this situation it is logical to assume that for the existence of 5 ... 6 neighboring tachyon universes and antiverse requires three additional spatial dimensions and accounting for physical reality of hyper complex numbers [62], containing three imaginary units \( i_1, i_2, i_3 \). And these three imaginary units \( i_1, i_2, i_3 \) in quaternions are interconnected by the co-relations

\[
i_1^2 = i_2^2 = i_3^2 = 1
\]

\[
i_1 i_2 i_3 = i_2 i_3 i_1 = i_3 i_1 i_2 = -1
\]

\[
i_1 i_2 i_3 = i_2 i_3 i_1 = i_3 i_2 i_1 = 1
\]

Consequently, Lorentz-Einstein formula should be corrected once more as follows

\[
m = \frac{m_0 (i_1)^q (i_2)^r (i_3)^s}{\sqrt{1 - (v/c)^2 - (q + r + s)c}} = \frac{m_0 (i_1)^q (i_2)^r (i_3)^s}{\sqrt{1 - (w/c)^2}}
\]

where \( q \) is the total number of parallel universes, penetration to which with the distance from our tardyon universe is realized via portals corresponding to the imaginary unit \( i_1 \);

\( r \) is the total number of parallel universes, penetration to which with the distance from our tardyon universe is realized via portals corresponding to the imaginary unit \( i_2 \);

\( s \) is the total number of parallel universes, penetration to which with the distance from our tardyon universe is realized via portals corresponding to the imaginary unit \( i_3 \);

\( w = v - (q + r + s)c \) is its local to the respective universe speed, which can take values only in the range of \( 0 \leq w \leq c \);

\( v \) is the speed, measured from our tardyon universe, that is why let’s call it the total speed;

\( c \) is the speed of light.

Other relativistic formulas in the alternative version of STR [42] can be corrected in a similar way.

The quaternion structure of the hidden Multiverse [30] corresponding to the formula (2) is shown in Figure 4. There the single bilateral arrows indicate numerous bidirectional portals corresponding to the ratio (3), and the single unilateral arrows indicate numerous one-way portals, corresponding to the ratios (4) and (5).

The structure of the six-dimensional space, in which such a hidden Multiverse exists, is illustrated in Figure 5. However, given in Figure 4 structure of the hidden Multiverse is still not fully in line with the results of calculations given above, as it contains not 20 ... 22 parallel universes but 24 universes. Therefore, some 2 ... 4 parallel universes should be excluded out of it, as shown for example in Figure 6. However, the structure of the hidden Multiverse thus obtained has edges, which give rise to the question - what is behind these edges? And the most natural response to this question would be a statement that there are other Multiverses behind them that do not fall under our observations not only by electromagnetic but also by gravitational manifestations. In other words, it can be affirmed that there is not only our hidden Multiverse, but also other Multiverses, which together form the Hyperverser.

5.5. Verifiability of the Hidden Multiverse

Currently a large number of various implementations of the Multiverses are offered. The most interesting of them are set forth in [49], [58], [69], [73], [46], [59], [50], [72]. However, all of them are unverifiable, i.e. even in the distant future they can neither be experimentally confirmed nor refuted. And that is why so many scientists are skeptical to the idea of the Multiverse - why study what actually does not actually exist.

According to them (and the author agrees with them) the efforts aimed at solving the real secrets of nature are much more important.

But the idea of the hidden Multiverse outlined above is verifiable [39], because:

- it has experimental confirmation in the form of dark matter and dark energy, since they are gravitational images of all other universes, except for ours, forming the our Multiverse;
- it has also a confirmation in the form of those experiments on particle accelerators, as a result of which there was a mass defect which was explained by the tachyons formation and their passage through the microportals to the neighboring universes;
- it can be experimentally confirmed by astronomical observations of the starry sky in portals, which are the so-called anomalous zones on Earth [47].

Of the listed options for experimental confirmation of the existence of non-visible universes, the latter is the most reliably evidential, since the existence of previously unknown constellations of the starry sky in them can be checked, and the most interest, since it allows you to get a lot of additional information about invisible universes. In particular, it will allow us to determine exactly how many adjacent invisible universes our visible universe has. And this, in turn, will allow us to clarify the structure of the hidden Multiverse and, possibly, experimentally prove the existence of the phenomenon of dark space.

Therefore, this option deserves at least a small additional explanation. So how can astronomical observations in portals be interesting? And by the fact that they will make it possible to see [43], [44] invisible universes and thereby unambiguously prove (or disprove)
their existence. Indeed, since the constellations of our visible universe are visible at the entrance to the portal, and at its exit – constellations of one of the neighboring invisible universes that are extremely different from them, then some intermediate images of them will be visible in the portal itself. Therefore, when moving along the portal, it will seem that the stars in the sky are moving, and also sometimes disappear or, conversely, appear. Those the differences between the constellations observed inside the portal and the constellations observed outside the portal will be noticeably greater than the differences recorded in the 1919 observations by Sir Arthur Stanley Eddington [51].

Figure: 7. Scheme of an experiment to detect invisible universes

But astronomical observations in portals are difficult to make, since portals are invisible labyrinths in which you can get lost. And this situation is saved by the fact that to detect changes in constellations in portals do not need to go far. Even at the very entrance to the portals (i.e. in anomalous zones), small changes in constellations by modern measuring means can be safely detected. And therefore it may be that some astronomical observatories are already in anomalous zones. As, for example, the main astronomical observatory of the National Academy of Sciences of Ukraine in the Goloseevsky Forest is only 12 km away from the center of Kiev. This observatory was created in 1949 and no one has disappeared in the portal adjacent to it. This proves that attempts to detect invisible universes using observatories located in anomalous zones can be quite safe. But since this observatory is located at the very entrance to the portal, the differences between the images of the starry sky observed in it and the images of the same section of the starry sky observed by other observatories are so small that no one noticed them. But they may not have been noticed also because it simply did not occur to anyone that such differences could be. And now you need to pay attention to this circumstance.

A corresponding experiment aimed at detecting universes invisible outside the portals is very simple (Fig. 7). It is only necessary to compare the images of the same area of the starry sky observed by several observatories located close to each other in the computing center, at least the one of which is in the anomalous zone. This experiment, as you can see, is very low-cost, as well as quickly and easily implemented.

The Problem of Contacts with the Inhabitants of the Hidden Multiverse

6.1. Types of civilizations

Since it follows from the foregoing that the neighboring with our universe other parallel universes are actually physically exist and that the portals connecting our universe with them actually physically exist, including those located at the Earth, it is useful to consider the problem with contacts inevitably existing around us other civilizations as well.

And for this, first of all, let us clarify the corresponding basic concepts on this problem.

By civilization we mean the hierarchical structure of living beings united for the common good and able to mutually coordinate their activities, exchanging the information necessary for this, i.e. possessing the language. And by super-civilization we mean a more developed civilization than our human civilization.

Currently, it is generally accepted that there is only one civilization on Earth - human. And that only people know how to talk to each other. However, it is not. Firstly, humanity itself is not a single civilization, but is divided according to territorial, economic, cultural, religious, linguistic, racial and historical characteristics on subcivilizations. And these subcivilizations correspond to different levels of their development.

Secondly, according to the proposed definition, many biological communities are also civilizations - monkey and wolf packs, herds of elephants, and even anthills and bee swarms. But they differ significantly from human subcivilizations. And their main difference from the most developed human subcivilizations is the absence of industrial production. Therefore, they, unlike human industrial subcivilizations, can be called non-industrial subcivilizations. But one should not think that any industrial civilization is always more de-
veloped than any non-industrial civilization. For example, there is reason to believe that the feline civilization on Earth does not think so, because in the family that has sheltered it, sometimes cats establish the rules of relationships that people accept. People also do not understand dog barking, and some breeds of dogs understand more than a hundred human words [48].

Finally, on Earth, of course, there is also super-civilization unknown to us, whose habitat extends beyond the boundaries of our planet, the entire solar system and even our visible universe.

Indeed, according to modern estimates, the number of galaxies in our visible universe alone is about 2E11. And in each galaxy there are about 1E8 stars. Of these, at least 8E9 contain planets similar to Earth, on which life is possible. Moreover, the age of the stars is very different. For example, the star HE 1523-0901 is 13.2E9 years old, the Sun is 4.6E9 years old, Sirius is 2.3E8, and the recently discovered Swift J1818.0-1607 star is only about 240 years old. For comparison, we recall that the age of our visible universe is about 13.8E9.

Therefore, the super-civilization present on the Earth is certainly both terrestrial and extraterrestrial. And it is unknown to us because it is reliably protected from human attention in the same way as people are protected from the penetration of animals, snakes, insects and other unwanted living inhabitants of the Earth into their homes.

And this super-civilization perceives us nearly the same way as we perceive cat, dog and other non-industrial sub civilizations living next to us as intelligence tests, for example, we have not passed in the form of crop circles. In the order to further explain how you can improve the human intellect, it is necessary to clarify this concept as well, by which we will mean the individual and collective ability to detect the patterns in the initial data array (in particular, to read encrypted messages) and to use received information.

6.2. The Problem of Contact with the Super-Civilization

The scientists have been unsuccessfully trying to solve the problem of contacts with extraterrestrial civilizations that exist in outer space since 1959 within the framework of SETI project (Search for Extraterrestrial Intelligence), which from 1971 is carried out under the auspices of NASA. And in 2015, Professor Stephen William Hawking, and billionaire Yuri Borisovich Milner announced that for Breakthrough Listen initiative for the same purpose they have allocated another $100 million [31].

However, the formulation of the problem of searching for other civilizations in deep space until now, obviously, made sense only insofar as, within the framework of the hypothesis of a Monoverse corresponding to the existing version of STR, there was no alternative to it. But, as shown above, the existing version of STR turned out to be erroneous. Therefore, the discovery of the really existing hidden Multiverse and Hyperverse, the search for extraterrestrial civilizations in deep space made unnecessary. Such searches do not make sense because one can simply go to neighboring universes on foot through the numerous portals that are in the territory of almost all countries, the entrances to which are anomalous zones. But since the portals are still completely unexplored anomalous objects, their visits and research will need to be carried out extremely carefully with the obligatory use of special portal navigation equipment (similar to a navigator’s compass, which allows you to determine the correct direction of further movement), so as not to get lost in the portals.

Therefore, the problem for us is not in the search of super-civilizations, and not even not in search of contact with them, because to be or not to be of our contacts with super-civilizations - it is not us who decide, but they are. Therefore, such contacts could take place only if our human civilization will be of interest to the Earth’s super-civilization. To do this, obviously, human civilization must be harmless for them, useful, and have a sufficiently high intelligence. Therefore, we still have to pass the test in the form of crop circles.

And in order to better understand the problem of contacts, it would be useful for us to learn how to establish meaningful contacts with terrestrial non-industrialized sub civilizations - communities of monkeys, dogs, cats, elephants, dolphins, etc. and understand them, since they may have knowledge unknown to us.

6.3. Creation of Human Super-Intelligence

That is why now the main task of mankind in space is not the search for extra-terrestrial super-civilizations and not attempts to establish contact with them, but much more difficult problem of self-perfecting of our human civilization to a level of extraterrestrial super-civilizations. A scientific component of this problem, which we would consider further, is, first of all, to find ways of creating human super-intelligence. It should be solved by scientists and engineers specializing in the field of information technology.

To understand how this problem can be solved, first we need to clarify what is human intelligence, what is artificial intelligence and what is super-intelligence. And also to remember what is technological singularity.

And let’s start with technological singularity by which the point of time is understood “according to various estimates within 2018 or at the latest 2030 or at the latest 2045 year after which as a result of Moore’s law computers and the Internet allegedly will become so sophisticated that there will be computer civilization at the Earth (or computer super-intelligence) that can enslave people. But this is just an interesting fiction of talented writers of science fiction, which made a great impression on readers, including some scientists and engineers [63] [74].

But this is what one of the most authoritative experts in the field of information security, Evgeny Valentinovich Kaspersky states: “The intelligence of a mosquito is more complex than that of any man-made development ... What is called artificial intelligence today? Self-learning programs, algorithms designed to perform a specific job. Let's say face recognition. It's smart, complex, but program. The human intellect has motivation and randomness of choice, but here it is not yet.” And further: “Sooner or later people will create artificial intelligence, but I think this will not happen
soon. AI is not a problem for us, not even for our children and grandchildren. If a human brain is assembled on a modern hardware base, the product will be larger than the planet Earth”.

So at present, artificial intelligence is actually not even intelligence, since it does not choose tasks for itself, but solves the tasks assigned to it by a person.
The concept of technological singularity is generally unrealistic, since it does not take into account the fact that humanity is already widely using a large number of dangerous technologies, over which it has learned to maintain reliable control. Moreover, as a result of scientific and technological progress, such dangerous technologies will inevitably be used more and more. And, therefore, the possibilities for inventing horror stories will also become more and more. And not only computer ones. But people will be able to maintain reliable control over computers.
The weak link of technological singularity concept is the assertion that it is possible to create super-intelligence on the basis of artificial intelligence and the Internet. In [9], [13], [14] it explains that this assertion is erroneous, since it does not take into account:
• nor degree of perfection of the human intelligence, which uses a different set of very useful (but poorly studied) forms of human thought, including the powerful subconscious multi-factor mind used, in particular, at the decision of creative tasks;
• nor degree of imperfection of artificial intelligence, which only imitates the most primitive type of human thinking - low-factor rational thinking (and without the support of multi-factor thinking);
• nor degree of imperfection of the Internet, which has many flaws, making it virtually unusable (except for e-mail and the World Wide Web WWW) in business, in scientific research and in other types of creative activities of people.

But on the basis of multi-factor thinking the human super-intelligence, capable of solving creative problems that are now unsolvable in science (including medicine), in business, in the administration management and other kinds of human activity can be realized. For the implementation of the human super-intelligence the existing computers need other software, it is quite feasible, and special network support, for which, however, the Internet is fundamentally not capable. Using of computer networks [8], [15], [16] for the same purpose, which instead of the packet communication will use anti-noise coding will allow to solve such problems successfully [17]-[19]. At the same time, this will make computer super-intelligence guaranteed unrealizable.

Finally, the danger of technological singularity is most incontrovertibly re-futed by the fact of the existence of super-civilizations themselves.

Human civilization, which has mastered new informational super-intellectual technologies as a result of the creation of human-computer super-intelligence, will have at its disposal a new extremely powerful tool of cognition, as a result of which it can, ultimately, turn into a super-civilization.

Conclusions

The article explains that the worldview foundation of our human civilization, in accordance with which the cognition and exploration of outer space is currently being carried out, is very imperfect. Really:
• For more than a hundred years, studies have been carried out that correspond to the existing version of the workshop. But what is dark matter and dark energy, where there is anti-matter, which does not annihilate with matter, where there are tachyons that do not violate the principle of causality, how to prove physical reality and explain the physical essence of imaginary numbers, and much more is still not known. And the alternative version of the STR, which has already solved all these problems, is simply ignored with perseverance worthy of better application. Even though the fairness of the existing version of the STO is confirmed only by postulates, and the fairness of the alternative version of the STO is confirmed by experiments.
• It is proved that the relativistic formulas of the existing version of STR are incorrect, incorrectly explained using the principle of non-exceeding the speed of light, which does not exist in nature, and from them an incorrect conclusion was made about the existence of our only visible universe in nature. At the same time, the predicted by the alternative version of STR the possibility by direct astronomical observations in portals (or at least in anomalous zones) to see invisible outside the portals universes is ignored. Therefore this ignores the opportunity to make sure that the existing version of the STR, which is the basis of modern physics, is incorrect.
• It was explained that the generally accepted opinion in cosmology about the low probability of the existence of civilizations other than human is incorrect. In fact, there are many of these civilizations in space, but they are effectively protected from the curiosity of the inhabitants of less developed civilizations in the same way as human civilization is protected from snakes, insects and other living inhabitants of the Earth harmful to people. Therefore, on the moon and on Mars and on Venus - in short, everywhere - they will be able to protect themselves from the importunity of people. After all, on Earth, people could not find them. And the fact that astronomers are bewildered by the fact that in space they do not observe the spacecraft of inhabitants of extraterrestrial civilizations is explained by the fact that they do not move in open space, but along much less extended routes through portals (like people in the subway, without leaving it).

Acknowledgements

Many famous scientists – Albert Einstein, Max Planck, Ernest Rutherford and others – argued that if the author of a scientific theory is not able to explain it to his wife, mother, and other non-specialists, then he himself does not fully understand it. Therefore, the author of this article, who set himself the task of setting out the pro-posed in it an unconventional approach to solving the problem of knowing how to make human civilization much more perfect and ultimately turn it into a supercivilization in the most understandable way even for non-specialists, used the help of his wife to solve it. And for this help, the author thanks Olga Ilyinichna Antonova, who, being an economist scientist, nevertheless, took part in the discussion of this
problem and, with her critical remarks, as well as valuable advice, contributed to its more understandable presentation for the general reader.

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ABOUT SETTING UP A MODIFIED PROBLEMS FOR THE SPATIAL ANALOGUE OF THE EULER-DARBOUX EQUATION

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Abstract

The authors suggest setting up a modified Cauchy problem for one of the spatial analogues of the Euler-Darboux equation with the data on the coefficient singularity line.

Problem C₁: \( \alpha = \beta = \frac{1}{2} \) (problem C₁)

Problem C₂: \( \alpha = -\frac{1}{2}, \beta = \frac{1}{2} \) (problem C₂)

Problem C₃: \( \alpha = \beta = -\frac{1}{2} \) (problem C₃).

Problem C₁ was solved by the Riemann method. Problems C₂ and C₃ were solved by constructing a general solution of the equation in question whose formula provided the solutions to the problems.

Keywords: equation of hyperbolic type, general solution, boundary value problem.

Annotación

Para uno de los analógicos espaciales del ecuación de Euler–Darboux–Poisson con parámetros iguales al módulo de una mitad, se sugieren la formulación y las soluciones de problemas modificados del tipo Cauchy con datos sobre la línea de singularidad de los coeficientes de la ecuación para valores de los parámetros:

1. \( \alpha = \beta = \frac{1}{2} \) (problema C₁)
2. \( \alpha = -\frac{1}{2}, \beta = \frac{1}{2} \) (problema C₂)
3. \( \alpha = \beta = -\frac{1}{2} \) (problema C₃).

Para la solución del problema C₁ se utilizó el método de Riemann. En los casos 2) y 3) se construyó una solución común de las ecuaciones consideradas, de la cual se obtuvieron las soluciones a los problemas C₂ y C₃ correspondientemente.

Archivos: equación de tipo hiperbólico, solución general, problema de valor en la frontera.

Keywords: ecuación de tipo hiperbólico, solución general, problema de valor en la frontera.

Аннотация

Для одного из пространственных аналогов уравнения Эйлера – Дарбу – Пуассона с параметрами, равными по модулю одной второй, предлагаются постановки и решения видоизмененных задач типа Коши с данными на плоскости сингулярности коэффициентов уравнения при значениях параметров:

1) \( \alpha = \beta = \frac{1}{2} \) (задача С₁)
2) \( \alpha = -\frac{1}{2}, \beta = \frac{1}{2} \) (задача С₂)
3) \( \alpha = \beta = -\frac{1}{2} \) (задача С₃).

Для решения задачи С₁ применен метод Римана. В случаях 2) и 3) построено общее решение рассматриваемых уравнений, из которого получены решения задач С₂ и С₃ соответственно.

Abstract

The authors suggest setting up a modified Cauchy problem for one of the spatial analogues of the Euler-Darboux equation with the data on the coefficient singularity line.

Problem C₁: \( \alpha = \beta = \frac{1}{2} \)

Problem C₂: \( \alpha = -\frac{1}{2}, \beta = \frac{1}{2} \) (1)

Problem C₃: \( \alpha = \beta = -\frac{1}{2} \)

Problem C₁ was solved by the Riemann method. Problems C₂ and C₃ were solved by constructing a general solution of the equation in question whose formula provided the solutions to the problems.

Keywords: equation of hyperbolic type, general solution, boundary value problem.

При всем многообразии большинство вырождающихся уравнений гиперболического типа в характеристических координатах сводятся к уравнению Эйлера – Дарбу – Пуассона

\[ U_{xy} + \frac{\beta}{y-x} U_x - \frac{\alpha}{y-x} U_y = 0. \]  

Основные результаты по постановке и исследованию краевых задач для уравнения (1°) получены при условиях, налагаемых на параметры уравнения: \(0<|\alpha|, |\beta|, |\alpha+\beta|<1\). Это связано с тем, что задача Коши в классической постановке при \(\alpha=\beta\) некорректна при \(1<2\alpha=2\beta=\frac{1}{2}\), так как либо само решение, либо его нормальная производная обращаются в бесконечность.

В работах [13, 14] опубликованы исследования по постановке и решению ряда краевых задач для уравнения (1°) при \(1<2\alpha=2\beta=\frac{1}{2}\). В настоящей работе рассмотрен один из пространственных аналогов уравнения Эйлера – Дарбу:

§1 Задача С1
Уравнение

\[L_1(U) = U_{xyz} + \frac{U_{xz}}{2(z-x+y)} - \frac{U_{yz}}{2(z-x+y)} = 0\]  

рассмотрим в области \(H_1 = \{(x,y,z) | z<x-y, y<x, -\infty<y<+\infty\}\) трехмерного евклидова пространства.

Задача С1

В области \(H_1\) найти решение \(U(x,y,z)\) уравнения (1), удовлетворяющее условиям:

\[U(x,y,x-y) = \tau(x,y), x \geq y;\]

\[\lim_{z \to x-y} (x-y-z)(U_{xz}-U_{yz}) = \mu(x,y), x > y;\]

\[\lim_{z \to x-y} \left[ \frac{\partial U}{\partial z} + (U_{xz} - U_{yz})(x-y-z) \left[ \psi(1) - \psi\left(\frac{1}{2}\right) - \ln\sqrt{x-y-z} \right] \right] = \nu(x,y), x > y;\]

где \(\psi(z) = \frac{\Gamma'(z)}{\Gamma(z)}\) [15].

Заданные функции \(\tau, \mu, \nu\) имеют непрерывные частные производные \(\tau_{xy}, \mu_{xy}, \nu_{xy}\) в своих областях определения.

Для решения задачи С1 применяем метод Римана. Для этого в области \(H_1\) возьмем произвольную точку \(M_0(x_0, y_0, z_0)\) и рассмотрим область \(H_\varepsilon\) ограниченную плоскостями \(x = x_0, y = y_0, z = z_0, z = x - y - \varepsilon (\varepsilon > 0)\). В предположении, что решение задачи С1 существует, проинтегрируем тождество Грина, полученное в работе [9, стр. 12],

\[VL_1(U) - UL_1^*(V) = \frac{1}{3} \left[ \frac{\partial P}{\partial x} + \frac{\partial Q}{\partial y} + \frac{\partial H}{\partial z} \right] \] по области \(H_\varepsilon\). (G)

Для уравнения (1) имеем:

\[P = VU_{yz} + UV_{yz} - V_y U_z + 3U_z a V, \quad a = -\frac{1}{2(x-y-z)}\]

\[Q = V(U_{xz} + 3Ub_z) + UV_{xz} - V_z U_x - 3bUV_z, \quad b = \frac{1}{2(x-y-z)}\]
\[ H = V\left( U_{xy} - 3U_{a_x} + 3bU_y \right) - V_x U_y - 3aUV_x + V_{xy} U. \]

У – решение уравнения (1), \( V \) – функция Римана [9, стр. 22]

\[ V(x, y, z; x_0, y_0, z_0) = \frac{(x - y - z)}{(x_0 - y - z)^2(x - y_0 - z)^2} F\left(1, \frac{1}{2}, 1, \sigma\right), \]

(5)

\[ \sigma = \frac{(x_0 - x)(y - y_0)}{(x_0 - y - z)(x - y_0 - z)}, \]

(6)

где \( \sigma \) – гипергеометрическая функция Гаусса [15].

Применим к интегральному тождеству (G) формулу Гаусса – Остроградского, получим

\[ \sum_{i=0}^{3} \int \int \int (P \cos \alpha + Q \cos \beta + H \cos \gamma) ds = 0, \]

Ди – грани пирамиды \( H \), лежащие соответственно в плоскостях \( x = x_0, \ y = y_0, \ z = z_0, \ z = x - y - \epsilon \).

Производя ряд преобразований, которые не приводим в силу их громоздкости, получаем:

\[ U(x_0, y_0, z_0) = U(x_0, y_0, x_0 - y_0 - \epsilon) - \frac{1}{2} \int_{x_0}^{x_0 - y_0 - \epsilon} [U_z(x_0, x_0 - z - \epsilon, z)V + \]

\[ + U_z(z + y_0 + \epsilon, y_0, z)V] dz - \frac{1}{2} \int_{y_0}^{x_0 - y_0 - \epsilon} dy \int_{z_0 + y_0 + \epsilon}^{x_0} \left[ U_{xz} - U_{yz} \right] V |_{z = x - y - \epsilon} \] dx

(7)

Вычислим подынтегральные выражения и перейдем к пределу при \( \epsilon \rightarrow 0 \), с учетом граничных условий (2)-(4).

Из вида функции Римана следует, что одномерный интеграл \( J_2 \rightarrow 0 \) при \( \epsilon \rightarrow 0 \).

При вычислении подынтегрального выражения в слагаемом \( J_4 \) воспользуемся формулой производной и формулой автотрансформации гипергеометрической функции (6):

\[ \frac{\partial}{\partial x} \sigma^a F(a, b, c, \sigma) = a \sigma^{a-1} F(a+1, b, c, \sigma) \sigma_x, \]

\[ F(a, b, c, \sigma) = (1 - \delta)^{c-b-a} F(c-a, c-b, c; \sigma) \]

Получаем в результате вычислений

\[ \frac{V}{x - y - z} + \frac{1}{2} \left( V_y - V_x \right) \mid_{z = x - y - \epsilon} = \frac{1}{2} \left( \frac{(x_0 - x + \epsilon)(y - y_0 + \epsilon)}{(x_0 - x)(y - y_0)} \right)^{\frac{1}{2}}. \]

(8)

где \( \alpha(\epsilon) \rightarrow 0 \) при \( \epsilon \rightarrow 0 \).

При вычислении подынтегрального выражения в \( J_3 \) используем представление функции Гаусса [15]

\[ F\left(\frac{1}{2}, \frac{1}{2}, 1, \sigma\right) = \frac{2}{\Gamma^2\left(\frac{1}{2}\right)} \left[ \psi(1) - \psi\left(\frac{1}{2}\right) - \ln \sqrt{1 - \sigma} \right], \]
а также значение её 

\[ F\left(\frac{1}{2}, 1, 1\right) = \frac{2}{\Gamma^2\left(\frac{1}{2}\right)} \] [15].

Тогда

\[ \frac{1}{2}\left[U_{xz} - U_{yz}\right] V \bigg|_{z=x-y-\varepsilon} = \frac{1}{\Gamma^2\left(\frac{1}{2}\right)} \left(U_{xz} - U_{yz}\right) \frac{\varepsilon}{\left(x_0 - x + \varepsilon\right)^2 \left(y - y_0 + \varepsilon\right)^2} \]

\[ \cdot \Psi(1) - \Psi\left(\frac{1}{2}\right) - \ln \sqrt{\varepsilon} + \frac{1}{\Gamma^2\left(\frac{1}{2}\right)} \left(U_{xy} - U_{yz}\right) \frac{\varepsilon}{\left(x_0 - x + \varepsilon\right)^2 \left(y - y_0 + \varepsilon\right)^2} \]

\[ \cdot \ln \left(\frac{x_0 - x + \varepsilon\left(y - y_0 + \varepsilon\right)}{y - y_0 + x_0 - x + \varepsilon}\right). \] (9)

С учетом полученных выражений (8), (9), условий (3), (4) имеем:

\[ \lim_{\varepsilon \to 0} \left[\frac{1}{2}\left(U_{xz} - U_{yz}\right)V + \frac{V}{x - y - z} + \frac{1}{2}\left(V_y - V_x\right)U_z\right]_{z=x-y-\varepsilon} = \]

\[ = \frac{v(x, y)}{\Gamma^2\left(\frac{1}{2}\right) \left(x_0 - x\right)^2 \left(y - y_0\right)^2} + \frac{1}{2\Gamma^2\left(\frac{1}{2}\right) \left(x_0 - x\right)^2 \left(y - y_0\right)^2} \]

\[ \cdot \ln \left(\frac{x_0 - x\left(y - y_0\right)}{y - y_0 + x_0 - x}\right). \] (10)

В формуле (7) перейдем к пределу при \( \varepsilon \to 0 \), переобозначим переменные, полагая \( x_0 = x, y_0 = y, z_0 = z \):

\[ U(x, y, z) = \tau(x, y) - \frac{1}{2\gamma^2\left(\frac{1}{2}\right)} \int_{y-s}^{x-s} ds \int_{y-t}^{x-t} \frac{\mu(t, s)}{(x-t)^2 (s-y)^2} \ln \frac{(x-t)(s-y)}{(x-t)+(s-y)} dt - \]

\[ - \frac{1}{\gamma^2\left(\frac{1}{2}\right)} \int_{y}^{x-s} ds \int_{y}^{x-t} \frac{v(t, s)}{(x-t)^2 (s-y)^2} dt. \] (11)

Непосредственная проверка показывает, что при непрерывности \( \tau, v, \mu \) функция (11) удовлетворяет уравнению (1) и условиям (2) - (4). Единственность решения задачи С1 следует из метода Римана.

**§2 Задача С2:**

Уравнение

\[ L_2(U) = U_{xyz} + \frac{U_{xz}}{2(z+y-x)} + \frac{U_{yz}}{2(z+y-z)} = 0 \] (12)

рассмотрим в области \( H_2 = \left\{(x, y, z) \mid y + z - x > 0, y > x, -\infty < y < +\infty\right\} \) трёхмерного евклидова пространства.

1°. Постановка задачи.

Задача С2. В области \( H_2 \) найти решение \( U(x, y, z) \) уравнения (12), удовлетворяющее краевым условиям:
\[ U(x, y, z) = \tau_2(x, y), \quad (x, y) \in D, \quad D = \left\{(x, y) \mid x < y < \infty \right\}; \]  
(13)

\[ \lim_{z \to x-y} U_z = v_2(x, y), \quad (x, y) \in D \]  
(14)

\[ U_{yz} - U_{xz} = \left( \frac{\partial v_2}{\partial x} + \frac{\partial v_2}{\partial y} \right) \left[ \ln(z + y - x) + 2\psi\left( \frac{1}{2} \right) - 2\psi(1) + 1 \right] = \mu_2(x, y), \quad (x, y) \in D, \]  
(15)

где \( v_2 \) определена условием (14), \( \psi(z) \) - логарифмическая производная гамма – функции.

На заданные функции налагаются условия:

2\textsuperscript{°}. Построение общего решения уравнения (12).

\[ \tau_2(x, y) \in C^{(2)}(D), \quad v \in C^{(3)}(D), \quad \mu \in C^{(2)}(D). \]  
(16)

В уравнении (12) сделаем замену \( U = V \), получим уравнение Эйлера – Дарбу с параметром \( z \)

\[ V_{xy} + \frac{V_x}{2(y + z - x)} + \frac{V_y}{2(y + z - x)} = 0. \]  
(17)

Подобно тому, как это было сделано в работе [6], находим общее решение уравнения (17) при каждом фиксированном \( z \), оно имеет вид:

\[ V(x, y, z) = \int_x^{y+z} \Phi_2(z, s)(s-x)^2(y+z-s)^{-1}dU + \]

\[ + \int_x^{y+z} \Psi_2'(z, s)(s-x)^2(y+z-s)^{-1} \ln \frac{(s-x)(y+z-s)}{y+z-x} ds + \]

\[ + \int_x^{y+z} \Psi_2(z, s)(s-x)^{-1} \ln \frac{(s-x)(y+z-s)}{y+z-x} ds. \]  
(18)

Делаем замену \( V = U_1 \), после чего интегрируем обе части полученного тождества в пределах от \( x - y \) до \( z \), предварительно переобозначив \( z = t \). Получаем функцию

\[ U(x, y, z) = \chi_2(x, y) + \int_{x-y}^z \int_x^{y+t} \Phi_2(t, s)(s-x)^{-1}(y+t-s)^{-1}ds + \]

\[ + \int_{x-y}^z \int_x^{y+t} \Psi_2'(t, s)(s-x)^{-1}(y+t-s)^{-1} \ln \frac{(s-x)(y+t-s)}{y+t-x} ds + \]

\[ + \int_{x-y}^z \int_x^{y+t} \Psi_2(t, s)(s-x)^{-1} \ln \frac{(s-x)(y+t-s)}{y+t-x} ds. \]  
(19)

Если производные функции \( \chi_2, \Phi_2, \Psi_2 \) таковы, что их производные \( \chi_{2xy}, \Phi_{2xy}, \Psi_{2yx} \) непрерывны в области \( D \), то функция, определяемая формулой (19) есть общее решение уравнения (12). Этот факт доказывается непосредственной проверкой, для чего в формуле (19) производится замена переменных \( t = x - y + (z + y - x)u, s = x + (z + y - x)uv. \)

В результате имеем:

\[ U(x, y, z) = (z + y - x)^2 \int_0^1 u du \int_0^1 \Phi_2 \left[ x - y + (z + y - z)u, x + (y + z - x)uv \right]. \]

\[ \cdot v^2 \left( 1 - v \right)^{-\frac{1}{2}} dv + (z + y - x)^2 \int_0^1 u du \int_0^1 \Psi_2' \cdot v^2 \left( 1 - v \right)^{-\frac{1}{2}} ln \cdot \]

\[ \left[ (z + y - x)uv \left( 1 - v \right) \right] dv + (z + y - x)^2 \int_0^1 u du \int_0^1 \Psi_2' \cdot u^{-\frac{1}{2}} \left( 1 - u \right) u^{-\frac{1}{2}} du + \chi_2(x, y). \]  
(20)
Далее находим производные $U_{xyz}$, $U_{xz}$, $U_{yz}$, подставляем их в уравнение (12), после ряда преобразований получаем, что функция (20) удовлетворяет уравнению (12). В силу громоздкости вычислений проиллюстрируем этот процесс на одном из слагаемых выражения (20).

Слагаемое $U_3(x, y, z) = (z + y - x)^2 \int_0^1 \int_0^1 \int_0^1 \Phi_2(t, s) v^2 (1-v)^2 \, dv$ продифференцируем по $x$:

$$U_3x = -2(z + y - x) \int_0^1 \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v)^2 \, dv +$$

$$+ (z + y - x)^2 \int_0^1 \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v)^2 \, dv.$$  

Во втором слагаемом создадим полную производную по $u$, затем проинтегрируем по частям, получаем

$$U_3x = -(z + y - x) \int_0^1 \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v)^2 \, dv +$$

Аналогично получаем

$$U_3y = (z + y - x) \int_0^1 \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v)^2 \, dv -$$

$$-(z + y - x)^2 \int_0^1 \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v)^2 \, dv;$$

$$U_3xz = (z + y - x) \int_0^1 \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v)^2 \, dv -$$

$$- \int_0^1 \Phi_2(z, x + (y + z - x)v) v^2 (1-v) \, dv;$$

$$U_3yz = (z + y - x) \int_0^1 \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v)^2 \, dv +$$

$$+ \int_0^1 \Phi_2(z, x + (y + z - x)v) v^2 (1-v) \, dv;$$

$$U_3xyz = -\frac{1}{2} \int_0^1 \int_0^1 \Phi_2'(t, s) v^2 (1-v) \, dv -$$

$$- \frac{1}{2} \int_0^1 \Phi_2'(t, s) v^2 (1-v) \, dv.$$  

Подставим выражения (21) – (23) в уравнение (12), убеждаемся, что $L_2(U_3) = 0$. Аналогичными вычислениями показываем, что остальные слагаемые функции (20) удовлетворяют уравнению (12).

3*. Решение задачи C2. Для решения поставленной задачи воспользуемся формулой (20). Очевидно при $\chi(x, y) = \tau_2(x, y)$ функция (20) удовлетворяет условию (13). Находим

$$U_2 = (y + z - x) \int_0^1 \Phi_2(z, x + (y + z - x)t) t^2 (1-t) \, dt +$$
\[(y + z - x) \sum_{0}^{1} \Psi'_{2s} (z, x + (y + z - x)t) \cdot t^2 (1-t)^{-\frac{1}{2}} \ln t (1-t) (y + z - x) dt +
\]

\[+ \sum_{0}^{1} \Psi_{2s} (z, x + (y + z - x)t) \cdot t^2 (1-t)^{-\frac{1}{2}} dt,
\]

полагаем \( z = x - y \), получаем \( \Psi_{2s} (x - y, x) B \left( \frac{1}{2}, \frac{1}{2} \right) = \nu_{2} (x, y) \) или

Подставим функцию (24) в формулу (20) и составим выражение

\[\Psi_{2s} (t, s) = \nu_{2} (s, s-t) \div \Gamma \left( \frac{1}{2} \right)
\]

\[J(x, y, z) = U_{yz} - U_{xz} - \left[ \frac{\partial \nu_{2} (x, y)}{\partial x} + \frac{\partial \nu_{2} (x, y)}{\partial y} \right] (\ln z + y - x) + 2 \Psi \left( \frac{1}{2} \right) -
\]

\[-2 \Psi (1)+1 = 2 \int_{0}^{1} \Phi_{2} (z, s) t^2 (1-t)^{-\frac{1}{2}} dt +
\]

\[+ \frac{2}{\Gamma \left( \frac{1}{2} \right)} \int_{0}^{1} \frac{\partial \nu_{2} (s, s-z)}{\partial s} \cdot t^2 (1-t)^{-\frac{1}{2}} \ln t (1-t) dt +
\]

\[+ \frac{2}{\Gamma \left( \frac{1}{2} \right)} \left[ \frac{\partial \nu_{2} (v, s-z)}{\partial v} + \frac{\partial \nu_{2} (v, s-z)}{\partial (s-z)} \right] \cdot t^2 (1-t)^{-\frac{1}{2}} \ln z + y - x dt -
\]

\[- \left[ \frac{\partial \nu_{2} (x, y)}{\partial x} + \frac{\partial \nu_{2} (x, y)}{\partial y} \right] \ln z + y - x - \left[ \frac{\partial \nu_{2} (x, y)}{\partial x} + \frac{\partial \nu_{2} (x, y)}{\partial y} \right] \left[ 2 \Psi \left( \frac{1}{2} \right) - 2 \Psi (1) +1 \right] +
\]

\[\left[ \frac{\partial \nu_{2} (v, s-z)}{\partial v} + \frac{\partial \nu_{2} (v, s-z)}{\partial (s-z)} \right] \cdot t^2 (1-t)^{-\frac{1}{2}} \alpha (z + y - x) = \sum_{k=1}^{8} J_{k},
\]

gде:

\[s = x + (y + z - x) t, \nu = s,
\]

\[\alpha (z + y - x) \] содержит все слагаемые, которые стремятся к нулю при \( z \to x - y \). Отметим, что при \( z \to x - y \) \( v = s \to x \), \( s - z \to y \).

Вычислим пределы при \( z \to x - y \) всех слагаемых, входящих в выражение \( J(x, y, z) \), определяемое формулой (25).

\[\lim_{z \to x - y} J_{1} = \lim_{z \to x - y} 2 \int_{0}^{1} \Phi_{2} (x, s) t^2 (1-t)^{-\frac{1}{2}} dt =
\]

\[= 2 \Phi_{2} (x - y, x) B \left( \frac{3}{2}, \frac{1}{2} \right) = \Gamma \left( \frac{1}{2} \right) \Phi_{2} (x - y, x).
\]
При вычислении следующих пределов воспользуемся формулами [16]:

$$\left\{ \begin{array}{l}
\int_0^1 \left( 1 - \frac{1}{x} \right) \ln x \, dx = \frac{1}{\tau^2} B \left( \frac{\mu + \nu}{\tau}, \psi \left( \frac{\mu}{\tau} \right) - \psi \left( \frac{\mu + \nu}{\tau} \right) \right);

\psi(1+z) - \psi(z) = \frac{1}{z};

\int_0^1 t^\alpha (1-t)^\beta \, dt = \frac{\Gamma(1+\alpha)\Gamma(1+\beta)}{\Gamma(2+\alpha+\beta)};

\lim_{z \to x-y} J_2 = \frac{2}{\Gamma^2 \left( \frac{1}{2} \right)} \lim_{z \to x-y} \int_0^1 \left[ \frac{\partial^2 v_2}{\partial x^2} + \frac{\partial^2 v_2}{\partial y^2} \right] \frac{t^2 (1-t)^{-1}}{2} \ln t (1-t) \, dt = \left( \frac{\partial^2 v_2}{\partial x} + \frac{\partial^2 v_2}{\partial y} \right) - 2 \Psi \left( \frac{1}{2} \right) - 2 \Psi (1);

\lim_{z \to x-y} \left( J_6 + J_7 \right) = \left( \frac{\partial^2 v_2}{\partial x} + \frac{\partial^2 v_2}{\partial y} \right) \frac{1}{\Gamma^2 \left( \frac{1}{2} \right)} \left[ \int_0^1 t^2 (1-t)^{-1} \, dt \right] - \frac{1}{2} \int_0^1 \frac{1}{t} (1-t)^{-1} \, dt = \frac{\partial^2 v_2}{\partial x} + \frac{\partial^2 v_2}{\partial y} - 2 \left( \frac{1}{2} \right) - 2 \Psi (1) + 1.
\end{array} \right.$$ (28)

В результате имеем

$$\lim_{z \to x-y} \left( J_2 + J_6 + J_7 \right) = \left[ \frac{\partial^2 v_2}{\partial x} + \frac{\partial^2 v_2}{\partial y} \right] - 2 \Psi \left( \frac{1}{2} \right) - 2 \Psi (1) + 1,$$

что уничтожается взаимно со слагаемым $J_3$ формулы (25), которое не зависит от $z$.

Покажем, что $\lim_{z \to x-y} \left( J_3 + J_4 \right) = 0$. Для этого разность производных функций $V_2 (v, s - z)$ представим формулой Тейлора для функции двух переменных, ограничиваясь только первым членом.

$$\lim_{z \to x-y} \left[ J_3 + J_4 \right] = \lim_{z \to x-y} \left[ (y + z - x) \ln (y + z - x) \right] \left[ \frac{\partial^2 v_2}{\partial x^2} t + \frac{\partial^2 v_2}{\partial y^2} (1-t) + \frac{\partial^2 v_2}{\partial x \partial y} \right] \left[ \frac{1}{2} \int_0^1 t^2 (1-t)^{-1} \, dt + 0(z - y - x) \right] = 0,$$

учитывая, что $\lim_{z \to x-y} \left( y + z - x \right) \ln (z + y - x) = 0$.

В выражении (25) перейдем к пределу при $Z \to x - y$, с учетом проведенных выше вычислений и условий задачи (15), получаем $\mu_2 (x, y) = \Gamma^2 \left( \frac{1}{2} \right) \Phi_2 (x - y, x)$, откуда

$$\Phi_2 (t, s) = \mu_2 (s, s - t) = \Gamma^2 \left( \frac{1}{2} \right).$$ (30)

Подставим найденные выражения $\chi_2, \Psi_2, \Phi_2$ в формулу (20) общего решения уравнения (12), получим решение задачи $C_2$:

$$U(x, y, z) = \tau_2 (x, y) + \frac{1}{\Gamma^2 \left( \frac{1}{2} \right)} \int_{x-y}^{z} \, dt \int_{x}^{y+t} \mu_2 (s, s - t) (s - x) \frac{1}{2} (y + t - s) \, ds +$$
Выполнение условий (13) – (15) легко проверяется вычислением.

§3 Задача C3
В области H2 рассмотрим уравнение

\[ L_3(U) = U_{xyz} - \frac{U_{xz}}{2(z+y-x)} + \frac{U_{yz}}{2(z+y-x)} = 0. \]  

(31)

Задача C3 В области H2 найти решение \( U(x, y, z) \) уравнения (31), удовлетворяющее условиям:

\[ U(x, y, x-y) = \tau_3(x, y), \quad (x, y) \in \mathbb{D}; \]  

(32)

\[ \lim_{z \to x-y} U_z = v_3(x, y), \quad (x, y) \in \mathbb{D}; \]  

(33)

\[ \lim_{z \to x-x-y} \left( U_{yz} - U_{xz} \right) (z+y-x)^{-1} - \left[ \frac{\partial^2 v_3}{\partial x^2} + 2 \frac{\partial^2 v_3}{\partial x \partial y} + \frac{\partial^2 v_3}{\partial y^2} \right] \cdot \left\{ \ln \sqrt{z+y-x} + \frac{1}{4} + \psi \left( \frac{1}{2} \right) - \psi \left( 0 \right) \right\} = \mu_3(x, y), \quad (x, y) \in \mathbb{D}. \]  

(34)

Условия, налагаемые на заданные функции:

\[ \tau_3 \in C(2) \left( \mathbb{D} \right); \quad v_3 \in C(4) \left( \mathbb{D} \right); \quad \mu_3 \in C(2) \left( \mathbb{D} \right). \]

Рассуждениями, подобными тем, что проводились при построении общего решения уравнения (12), показано, что функция

\[ U(x, y, z) = \chi(x, y) + \int_{x-y}^{x} dt \int_{x}^{y+t} \Phi(t, s)(s-x)^{1/2}(y+t-s)^{1/2} ds + \]

\[ + \sum_{x-y}^{z} dt \int_{x}^{y+t} \Psi_{ss}''(t, s)(s-x)^{1/2}(y+t-s)^{1/2} \ln \frac{(s-x)(y+t-s)}{y+t-x} ds + \]

\[ + \int_{x-y}^{z} dt \int_{x}^{y+t} \Psi_s'(t, s)(s-x)^{-1/2}(y+t-s)^{-1/2} \left[ (y+z-x) - 2(s-x) \right] ds + \]

\[ + \int_{x-y}^{z} dt \int_{x}^{y+t} \Psi(t, s)(s-x)^{-1/2}(y+t-s)^{-1/2}, \]  

(35)

где произвольные \( \chi, \Phi, \Psi \) имеют частные производные \( \chi_{xy}, \Phi_{xy}, \Psi_{yux} \), непрерывные в области D, является общим решением уравнения (31).

Подчиняя функцию (35) условиям (32) – (34), находим функции \( \chi, \Phi, \Psi \), как это делалось при решении задачи C2. Подставляя результат в формулу (35), получаем решение задачи C3:

\[ U(x, y, z) = \tau_3(x, y) + \frac{2}{\Gamma^2 \left( \frac{1}{2} \right)} \int_{x-y}^{z} dt \int_{x}^{y+t} \mu_3(s, s-t)(s-x)^{1/2}(y+t-s)^{1/2} ds + \]
\[ + \frac{1}{\Gamma^2} \int_{x-y} \frac{\partial^2 \nu_3 (s, s-t)}{\partial s^2} (s-x)^2 (y+t-s)^2 \ln \frac{(s-x)(y+t-s)}{y+t-x} ds + \]
\[ + \frac{1}{\Gamma^2} \int_{x-y} \frac{\partial \nu_3 (s, s-t)}{\partial s} (s-x)^{-\frac{1}{2}} (y+t-s)^{-\frac{1}{2}} [(y+z-x) - 2(s-x)] ds + \]
\[ + \frac{1}{\Gamma^2} \int_{x-y} \nu_3 (s, s-t) (s-x)^{-\frac{1}{2}} (y+t-s)^{-\frac{1}{2}} ds. \]

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