European Science Review

№ 5–6 2021
May – June

PREMIER
Publishing

Vienna
2021

European Science Review

Scientific journal

№ 5–6 2021 (May – June)

ISSN 2310-5577

Editorial office

Premier Publishing s.r.o. Praha 8 – Karlín, Lyčkovo nám. 508/7, PSČ 18600

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Typeset in Berling by Ziegler Buchdruckerei, Linz, Austria.
Printed by Premier Publishing s.r.o., Vienna, Austria on acid-free paper.

Section 1. Biology

https://doi.org/10.29013/ESR-21-5.6-3-8

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PHARMACOLOGICAL CORRECTION OF ECDISTEN OF HYPERGLYCEMIC STATES, MORPHOLOGICAL CHANGES IN THE PANCREAS AND IMMUNOBIOLOGICAL STATUS OF THE ORGANISM OF RATS WITH ALLOXAN DIABETES

Abstract. The preparation of ecdisten, created on the basis of the phytoecdysteroid ecdysterone, widespread in nature, exhibits a pronounced antidiabetic influence in rats with alloxan diabetes. Under its influence, there is a noticeable decrease the content of sugar in blood, regardless of the severity of hyperglycemia, the morpho-functional state of the islet apparatus of the pancreas are normalized, and sharply suppressed immune responses are stimulated.

Keywords: Phytoecdysteroids, ecdisten, alloxan diabetes, hypoglycemic action, stimulation of immunogenesis.

The medicinal preparation of ecdisten was developed at the Institute of Plant Chemistry of the Academy of Sciences of the Republic of Uzbekistan on the basis of the natural phytoecdysteroid of ecdysterone, which it is widely distributed in the plant world [6]. Similar to other ecdysteroid-containing agents: ecdiphite, exumide, serpisten [2; 3; 9], ecdisten has a high metabolic activity, increases the adaptive capabilities of the organism to stressful environmental factors, it has a general strengthening, antitoxic and immunomodulatory effect [6; 8].

In this work, it was analyzed its hypoglycemic activity, its effect on the state of the pancreas in rats with experimental diabetes, and the possibility of eliminating the developing secondary immunodeficiency state in this case, since for some substances containing phytoecdysteroids, the optimizing effect on carbohydrate metabolism and immune processes in the organism is also a characteristic feature of their biological action [1; 5; 7; 10].

The aim of the research: to determine the effectiveness of the use of ecdisten as an antidiabetic agent.

Materials and methods: experiments to evaluate the effectiveness of the use of ecdisten as an antidiabetic agent were carried out on mongrel white male rats weighing 160–180 g. Experimental diabetes in them was caused by the introduction of alloxan (once subcutaneously at the rate of 150 mg/kg in the form of a 5% freshly prepared solution). Ecdisten was administered orally at a dose of 5 mg/kg simultaneously with alloxan and then daily until the end of the experiment. Sugar in the blood was determined in the dynamics of the development of the pathological process after 3, 7, 15 and 21 days by using the enzyme-colorimetric method by Cypress diagnostics (Belgium) set on biochemical analyzer of Secomam Basic (France). Blood for analysis was taken from the tail vein. At the end of the observation period, some of the rats were decapitated under light ether anesthesia, the pancreas was extracted, fixed in Buena fluid, and after appropriate treatment was poured into paraffin. Paraffin sections were stained with hematoxylin and eosin, as well as aldehyde fuchsin on Homori. In histological preparations of the pancreas, the number of islets of Langerhans and β-cells was calculated. In another part of the rats immunized 5 days before slaughter with sheep red blood cells (at a dose of 2×104^8 per animal, intraperitoneally), the number of antibody – forming cells in the spleen was determined [11] and the cellular content of the central (thymus, bone marrow-the femur was used) and peripheral (spleen, mesenteric lymph nodes) immune organs.

All obtained data were processed by the method of variation statistics using the Student's t-test.

Results and discussion: As shown by the researches of conducted in the control group of rats that survived 3 days after the administration of alloxan, according to the severity of the developed hyperglycemia and the subsequent course of diabetes, three groups can be conditionally distinguished. As can be seen from (Table 1), mild diabetes developed in 8 rats. The blood sugar content in this case did not exceed 11.0 mM/l during the observation period. In 12 rats, the blood sugar level exceeded to 11.0 mM/l, but throughout the experiment it remained below to 16.2 mM/l – this is a form of moderate diabetes. And 10 animals developed a severe form of alloxan diabetes with an increase in blood sugar above 16.2 mM/l. In all cases, the hyperglycemia that occurred after the administration of alloxan was persistent and practically persisted for three weeks of the experiment. Animals that were administered ecdisten simultaneously with alloxan and further throughout the experiment were characterized by a less significant increase in blood sugar levels. In 12 animals, only short-term severe hyperglycemia was observed, and diabetes did not develop at all. In 28 experimental animals, an increased concentration of sugar in the blood was detected. According to our definition, the corresponding mild form of diabetes, but due to the continued administration of ecdisten on days of 3, 7 and 14, was 12.8; 14.3 and 28.6% lower than in the control, and on day of 21, the hypoglycemic effect was 43.6%. In 14 experimental rats, judg-

ing by the concentration of sugar in the blood in the first week, it was possible to state the development of moderate diabetes. However, in contrast to the control group, blood sugar in these animals was significantly lower in the subsequent periods and on the 21st day exceeded the initial level by only 21.4%. If, in this case, we compare the concentration of sugar in the blood of the experimental group with the corresponding control, we can see that it was 14.5–12.2% lower by days of 3 and 7, and 47.7–58.1% lower by day of 14 and 21 (Table 1). The severe form of diabetes in rats that were injected with ecdisten was not detected.

The revealed changes in the blood sugar content in rats with alloxan diabetes, treated with ecdisten, we have correlated with the data obtained during the histological study of the pancreas of animals. Thus, in control animals (in this case, rats with moderate diabetes were taken into the experiment), there was a significant decrease in large and predominance of small islets of Langerhans, degranulation of beta-cells and a decrease in their secretory activity.

The revealed structural features of the islets of Langerhans in experimental animals convincingly testified to the presence of a morphological substrate for the favorable action of ecdisten on the pancreas. The total area of the islet tissue in these experiments was 94.7% larger than in the control and did not differ from the intact level. It is important to note that large and medium-sized islands predominated. The quantity of β-cells was 50.3% higher than in the control; histochemically, an increase of aldehyde fuchsin granularity was observed in their cytoplasm, which indicated the presence of insulin in them. Another side of the beneficial effect of ecdisten on the course of alloxan diabetes can be considered its ability to stimulate immunogenesis in animals under these conditions, given that diabetes often develops a secondary immunodeficiency state. So, the introduction of ecdisten for 3 weeks to rats with developing diabetes, it increases the process of primary antibody production, increasing the number of antibody-forming cells in the spleen that secreting IgM in response to immunization of animals with sheep erythrocytes. This can be clearly seen when calculating the quantity of antibody-forming cells for the entire spleen and for 1 million splenocytes, the level of which also had a clear tendency to increase (Fig. 1).

In addition, there was an increase in the total cellular content of the thymus, bone marrow and mesenteric lymph nodes. This is especially clear in rats whose diabetes did not develop after the administration of alloxan. In this case, the quantity of nucleated cells of the spleen, as well as the total cell content of the thymus, bone marrow, and mesenteric lymph nodes increased in relation to intact animals by 25.0, 42.6, 40.5, and 47.5%. The quantity of antibody-forming cells per spleen increased by 57.4%, and when calculating the quantity of antibody-forming cells per 1 million splenocytes, its increase was 25.8%. In rats, treated with ecdisten and which developed mild diabetes (in this case, a significant suppression of immune responses was observed in the control), the preparation practically maintained the immunological reactivity of the organism at the level of intact control. In rats with moderate diabetes, when all the considered indicators characterizing the state of the immune system in the control were significantly suppressed, ecdisten continued to have an immunostimulating effect.

As a result, the quantity of nucleated cells of the spleen, the quantity of cells of the thymus, bone marrow and mesenteric lymph nodes was in almost all cases, significantly higher than in the control, respectively, by 35.0, 23.6, 60.9 and 54.9% (lower than the indicators of intact animals on the 17,7; 6,2; 10,8; 20,2%). The number of antibody-forming cells for the entire spleen and for 1 million splenocytes was higher than the control by 104.3 and 51.5% (lower than the indicators of intact animals by 22.9 and 6.6% (Fig. 1).

Thus, the obtained results in the experiments showed that ecdisten has a pronounced antidiabetic effect. Under its influence, there is a noticeable decrease in blood sugar, due to the normalization of the morpho-functional state of the pancreatic islet apparatus, which does not exclude the previously identified

ability of phytoecdysteroids to increase the reactivity of organism tissues to insulin [4]. The elimination of the secondary immunodeficiency state in diabetes with ecdisten, which develops when alloxan is administered to animals, significantly expands the possibilities of using ecdisten in diabetological practice.

Conclusion. Ecdisten exhibits a pronounced hypoglycemic effect regardless of the severity of the course of alloxan diabetes, normalizes the morpho-functional state of the pancreas, and stimulates at level of suppressed in condition of diabetes of immunogenesis.

Table 1.– The influence of ecdisten on glucose content in blood in rats with alloxan hyperglycemia and alloxan diabetes (M±m)

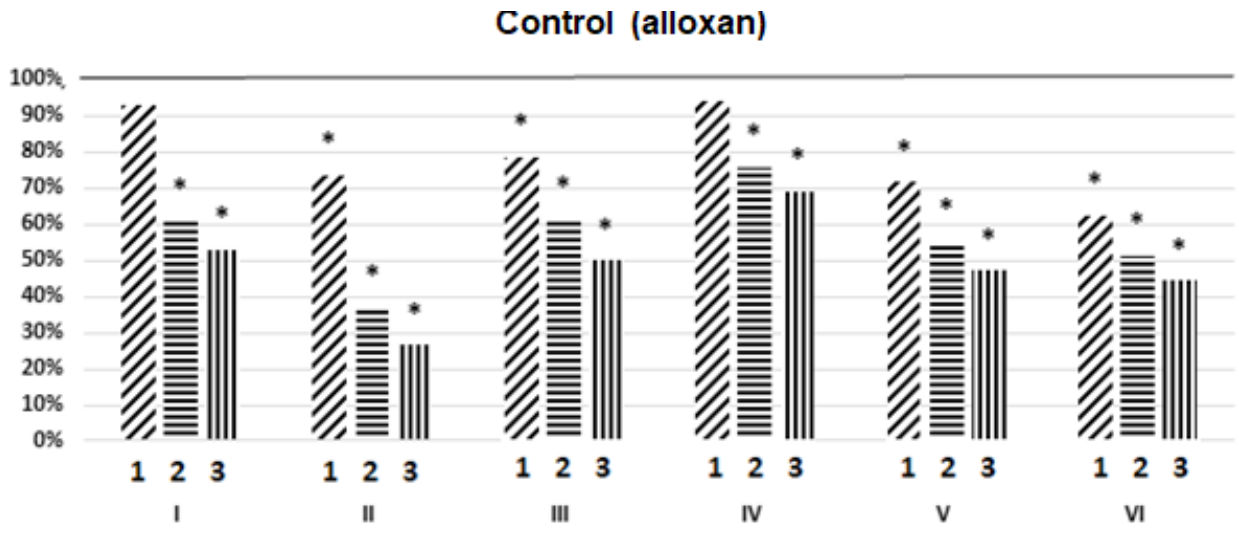
Experimental conditions	Number of animals		Advanced forms of diabetes with the number of animals in each of them	Content of sugar in the blood mM/l				
	total	dead		Original	In 3 days	In 7 days	In 14 days	In 21 days
Intact rats	10	–	–	5,2±0,18	4,8±0,12	5,2±0,20	4,6±0,10	5,4±0,22
Control (alloxan)	60	30 (50%)	Mild diabetes (8)	5,4±0,22	8,6±0,48*	9,1±0,24*	9,8±0,18*	11,0±0,25*
			Moderate diabetes (12)	5,2±0,18	13,8±0,58*	14,0±0,78*	14,9±0,80*	16,2±0,68*
			Severe diabetes (10)	5,3±0,20	20,9±2,4*	20,1±1,18*	19,3±0,96*	20,4±1,20*
Experience (alloxan + ecdisten)	60	6 (10%)	Diabetes has not developed (12)	5,3±0,18	6,4±0,26[1]	6,8±0,42[1]	5,8±0,48[1]	5,6±0,44
			Mild diabetes (28)	5,4±0,20	7,5±0,30*	7,8±0,45*,[1]	7,0±0,38*,[1]	6,2±0,36[1]
			Moderate diabetes (14)	5,6±0,22	11,8±1,00*	12,3±2,6*	7,8±0,36*,[1]	6,8±0,42*,[1]

*Note: Here, in Table 2 and in the figure – * – reliable on relation to the indicators of intact animals; [1]– reliable on relation to the corresponding control ($p < 0.05$)*

Table 2.– The influence of ecdisten on the morphometric parameters of the pancreas in rats with moderate alloxan diabetes (M±m, n= 6)

Experimental conditions	The number of islets of Langerhans in the pancreas per 10 mm²				Quantity of β-cells
	Major	Middle	Shallow	Total	
Intact rats	4,2±0,4	5,3±0,6	5,0±0,3	14,5±1,4	682±36,4
Rats with alloxan diabetes	0,8±0,04*	3,2±0,3*	3,6±0,5*	7,6±0,8*	382±26,4*
Rats with alloxan diabetes, treated with ecdisten	4,4±0,5[1]	4,8±0,4[1]	5,6±0,7[1]	14,8±1,2[1]	574±28,2*,[1]

*Note: *– reliable on relation to the indicators of intact animals; [1]– reliable on relation to the corresponding indicator ($p < 0.05$)*



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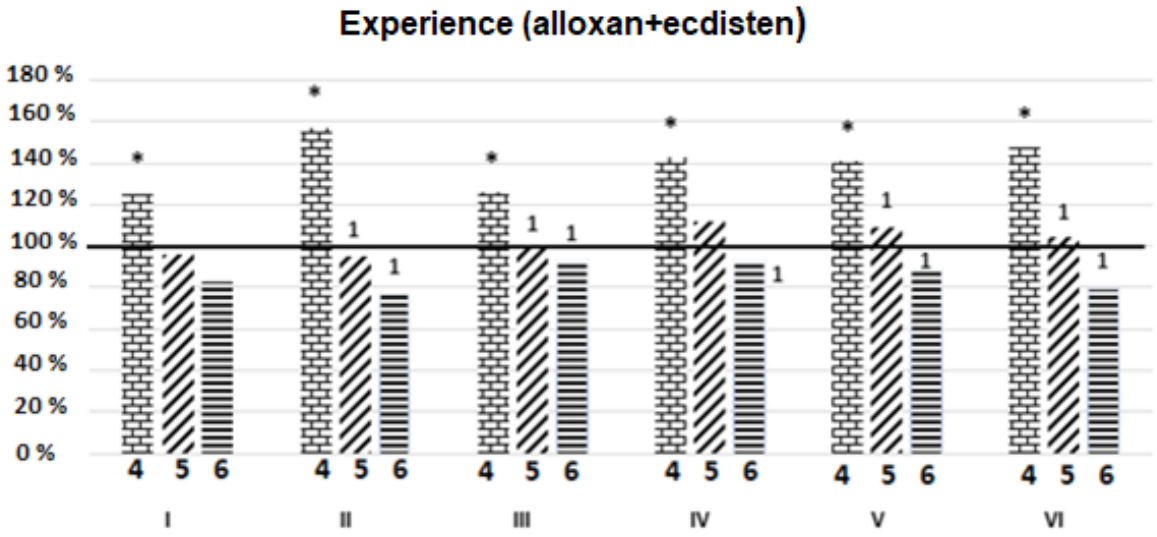

B.

Figure 1. (a and b). The effect of ecdisten on the parameters of the immunological status of rats with alloxan diabetes (n = 6) as a percentage of the corresponding indicators of intact animals (accepted as 100%). Control (alloxan): 1 – mild diabetes; 2 – moderate diabetes; 3 – severe diabetes. Experience (alloxan + ecdisten): 4 – diabetes did not develop; 5 – mild diabetes; 6 – moderate diabetes. I-the quantity of nucleated cells of the spleen; II-the quantity of antibody-forming cells per spleen; III-the quantity of antibody-forming cells per 1 million splenocytes; IV-the quantity of thymus cells; V-the quantity of bone marrow cells; VI – the quantity of mesenteric lymph node cells

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Section 2. Geography

https://doi.org/10.29013/ESR-21-5.6-9-16

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THE NECESSITY TO DEVELOP GEOGRAPHICAL TOURISM IN DIVERSIFICATION OF TOURISM INDUSTRY

Abstract. Diversification of the tourism industry, a comprehensive study of the tourist potential of certain geographical areas, the identification of periodic (seasonal) aspects, encourages the systematization of tourist types. Geography is a branch of science that studies the above features. Geographical tourism allows for the systematic development of its new species in order to comprehensively cover the tourist potential of a particular region.

Keywords: geography, tourism, geographical tourism, diversification, tourist diversification, tourist zoning, tourist region, tourist zone, tourist cluster.

1. Introduction

The Concept of Tourism Development in the Republic of Uzbekistan for 2019–2025, approved by Decree No. 5611 of the President of the Republic of Uzbekistan, adopted on January 5, 2019, sets the task to diversify and improve the quality of tourism industry services and improve tourism infrastructure [14].

This encourages the diversification of the tourism industry, i.e. comprehensive study of the tourism potential of certain geographical areas, the identification of periodic (seasonal) aspects, the systematization of tourism types. The subject matter of research in the sphere of "Geography" is aimed at studying the territorial, complex, periodic and systemic features of nature-society – economy, including the provision of tourist services in a particular geo complex or geosystems.

The problem and its solution. In recent years, there has been a growing interest and demand from travelers to visit complex tourist facilities in a particular area (administrative or natural) rather than belonging to the same type of tourism (eco, agro, historical, religious, etc.). Based on these requirements, the issue of diversification of tourism, for instance, reconsideration in terms of sustainable development of types and services of tourism in the regions are on the agenda.

In accordance with these requirements for the tourism industry in Uzbekistan, a number of normative legal acts have been adopted in recent years to develop

the industry. In particular, the Law of the Republic of Uzbekistan "On Tourism", adopted on July 18, 2019, and the task " On Organization of tourist zones and tourist clusters" specified in Chapter 4.

Based on the experience of other countries such as Japan has the largest number of tourist zones in the world (30 tourist zones) [6] and China (45 tourist zones) [1], in the organization of tourist zones in certain areas, taking into account, first of all, the impact on the nature, population and economic activity of the region [11].

A number of scientists [5; 7; 8; 15; 16] researched the scientific and theoretical aspects of the division of regions into tourist zones or districts. However, in the research of the above-named scientists, different views have been expressed on the division of certain areas into tourist areas and zones. For example, A. G. Manakov divided the land part of the planet into 6 tourist regions (macroregions) (Europe, the Middle East, Asia-Pacific, South Asia, Africa, America) [8]. For some reason, from a political point of view, it did not include the territory of the CIS countries in the separation of tourist areas and did not meet the unique geosystem law of geography. A. N. Nigmatov and his students Sh. Yakubjanova visited 15 agro-tourism zones and N. Shomuratova divided into 14 ecotourism districts. M. Mahmudov divided the Andijan region into 5 districts. Thus, the zoning of a particular area can be manifested in different scales and forms, depending on the goals and objectives set by the researcher. It should be noted that the division into regional tourist areas is different from tourist zoning. This is because the zoning is divided into hierarchical parts, and these parts are strictly scaled. On the basis of the Law of the Republic of Uzbekistan "On Special Economic Zones", adopted on February 17, 2020, and a number of normative legal acts, tourist and recreational zones such as "Charvak" and "Zomin" have been established in the country by 2021.

Tourist zones have a positive or negative impact on the economic, social, cultural life of a particular country or region, as well as on the relationship between nature and society. These effects can be grouped into three main groups: economic impacts, socio-cultural impacts, and natural-environmental impacts [4, 184].

As a result of the establishment of tourist zones, it will be possible to identify new tourist resources and other necessary conditions for the development of the tourism industry in underdeveloped areas, which in turn will affect the economic activity in the region. The establishment of tourist zones allows people to use certain areas for recreation and development of their culture. To do this, it is important to have a minimal impact on nature in the first place [15, 58–64].

Geography deals with tourism tourist zones, resources, favorable and unfavorable environmental factors, development of tourist routes and the above-mentioned influences [7, 10–15]. Because the object of study of geography is the nature, population and economy of a particular area. The subject is a regional, periodic, systematic and, of course, complex study of events. Geographers are not only successful in the sphere of tourism but also have an advantage over others in this sphere. The geographer sees the area and the tourist sees the destination [7, 10–15].

With this in mind, we are promoting geographical tourism from a geographical point of view. However, there is no scientific and practical basis for the development of geographical tourism in any country in the world, in the CIS, as well as in Uzbekistan. Therefore, there is a sufficient need to define the concept, purpose and object of geographical tourism.

Research goals and tasks. In order to develop the scientific and practical basis of geographical tourism for the diversification of tourism in Uzbekistan, the following tasks are set: to reveal the concept, content and essence of geographical tourism; determine the role of geographical tourism in the diversification of the tourism industry; make suggestions and recommendations on the future plan of geographical tourism

2. Method

Geographical tourism research consists of the selection and systematization of research methods

related to geography and tourism in terms of the real political and environmental situation, economic opportunities, social status.

As a result of the integration of research methods of geography and tourism, the research methodology of geographical tourism is formed (Figure 1) and they are listed as follows.

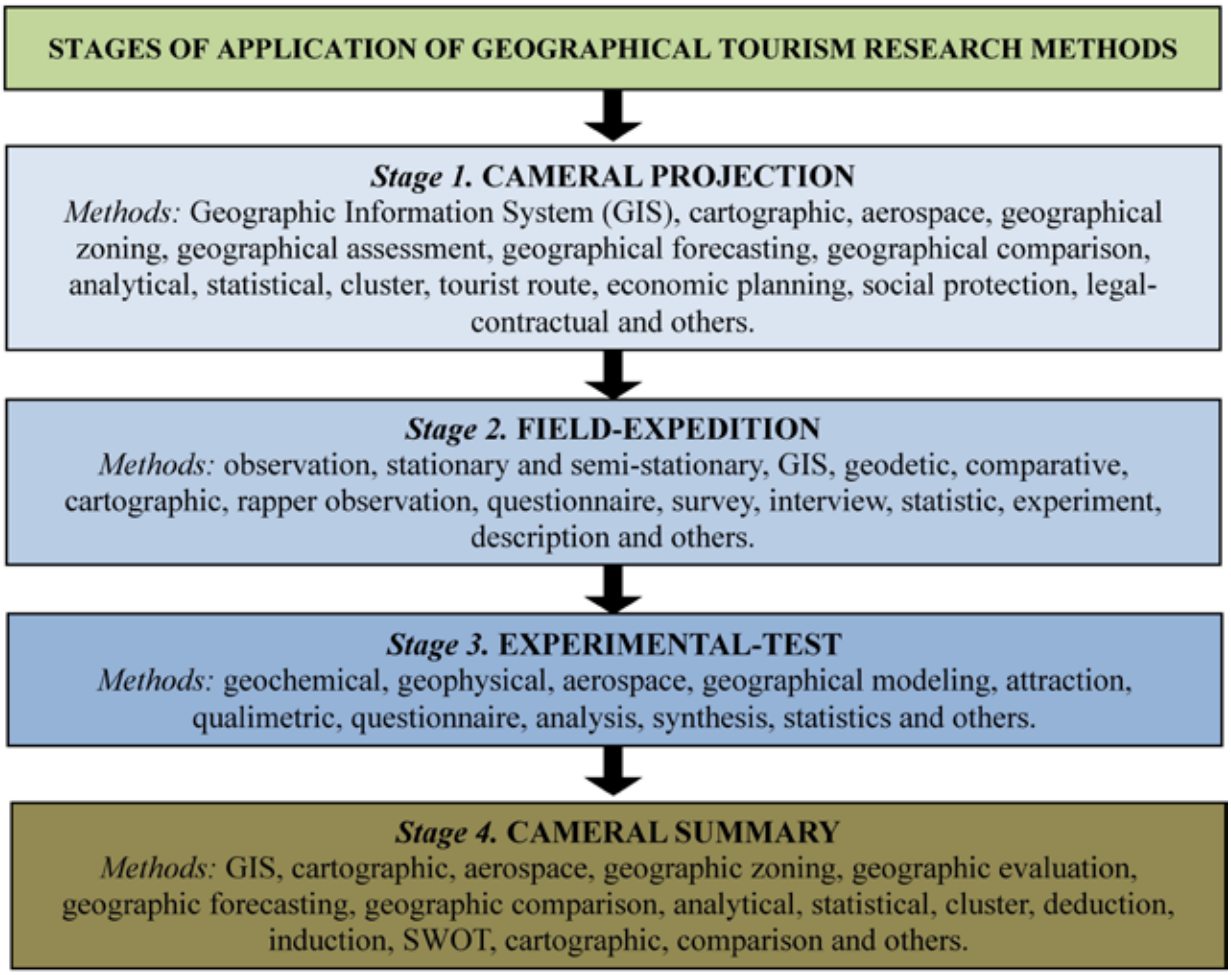

Figure 1.– Methodology of systematic application of geographical tourism research methods in practice

Geographical tourism provides a positive effect on the geographical assessment of the tourist potential of the region and the organization of tourist zones through the systematization of scientific research methodology and the effective use of methods in this system.

3. Results

Tourism is an area that is constantly changing under the influence of various external and internal processes, especially globalization. As the motivational attitudes of tourists change. This means the need to develop new routes for travelers through the modernization and improvement of traditional routes.

Today, there are a number of types of tourism in the world (historical, ecological, agro, religious, educational, ethnographic, gastronomic, business, sports, medical, youth tourism, etc.), and new ones are being added.

This, in turn, creates new areas of scientific research. This is called "tourist diversification" in the language of science. The term diversification (lat. diversificatio – change, diversified development) was first used by economists in the sense of expansion, renewal of the spheres of activity of enterprises (associations) and the type of products they produce. It

is done for the purpose of achieving high efficiency, economic gain, elimination of bankruptcy [2, 1].

In the tourism literature, diversification is the systematic integrated development of new species to meet the growing needs of tourists, to increase the tourist attractiveness of the region, to comprehensively cover the types of tourism in a particular area in order to attract tourists to tourist facilities throughout the year. To achieve these goals, there is a need to develop a comprehensive type of tourism. This, in our opinion, makes sense to download "Geographic Tourism". After all, if the object of study of geography is certain regions, the subject matter of his research is the complex properties of regions.

As a result of the integration of the concepts of geography [10] and tourism [13], the direction of geographical tourism has emerged. **Geographic tourism** can be considered – *as a type of tourism industry, which deals with the definition, organization, conduct and accounting of policy in terms of territoriality, complexity, periodicity and structure in certain geocomplex or geosystems* [3, 1–10]. **The purpose** of "Geographical Tourism" is to study the tourist potential of geosystems to diversify the tourism industry in terms of the subject matter of geography**.** This goal sets the following **tasks** for "Geographical Tourism": Creating a scientific and theoretical basis for "Geographical Tourism"; Clarification of issues such as the specific object of "geographical tourism", the subject of research, methodological framework, principles, the role of geographical and tourism-related disciplines; coordination and ordination of research methods in geographical and tourism sciences; development of the concept of introduction of "Geographical tourism" education in the national education; defining the practical aspects of "geographical tourism", etc.

In order to form geographic tourism as a new tourist destination, it is first necessary to determine its object of study. Unlike geotourism, it studies all types of tourism in terms of territoriality, periodicity, structure and complexity, rather than underground and surface geological objects. In geographical tourism, from a practical point of view, it is expedient to hierarchically divide geotisms into tourist regions, zones and clusters.

Tourist region – is an area consisting of tourist zones and clusters covering specific natural-socio-economic indicators in which tourist services are provided. ***Tourist zone*** – is an area with certain boundaries, where one or more tourist resources are located, consisting of tourist clusters established for the development of the tourism industry, protection and rational use of tourist resources [13]. ***A tourist cluster*** – *is* a set of independent organizations and individual entrepreneurs providing comprehensive tourist services and other additional services necessary to meet the needs of tourists and excursionists [13]. The subject matter of geographical tourism is based on the study of regional, periodic, systemic and complex features of the tourism industry in the objects listed above.

4. Discussion

At present, the most pressing issue is to improve the economic situation of the regions, along with the effective and full use of their potential. This is the most effective solution to the problem in recent years, and the tourism industry is playing a role. For the development of the economy of our country on the basis of the principles of sustainable development, the tourism sector stands out, among many other areas. Today, one of the main tasks is to increase the flow of tourists visiting our country (Figure 2) and create favorable conditions for them. In doing so, special attention should be paid to the following features.

It is necessary to eliminate the concentration of tourists in a particular area (Samarkand, Bukhara, Khiva, Kashkadarya, Tashkent). These are expressed on the one hand by a large number of tourist facilities in the region (Samarkand, Kashkadarya) [9] (Figure 3), on the other hand by the popularity of tourist facilities (Samarkand, Bukhara, Khiva) represented by It is advisable to create tourist zones to increase the tourist potential of other regions.

It is necessary to soften the seasonality of the tourism industry of our country. Currently, in July, August, September and October, the flow of tourists to our country is high [12]. To change this feature for the better, the most important task is to develop the diversity of tourism species in the regions (Figure 4).

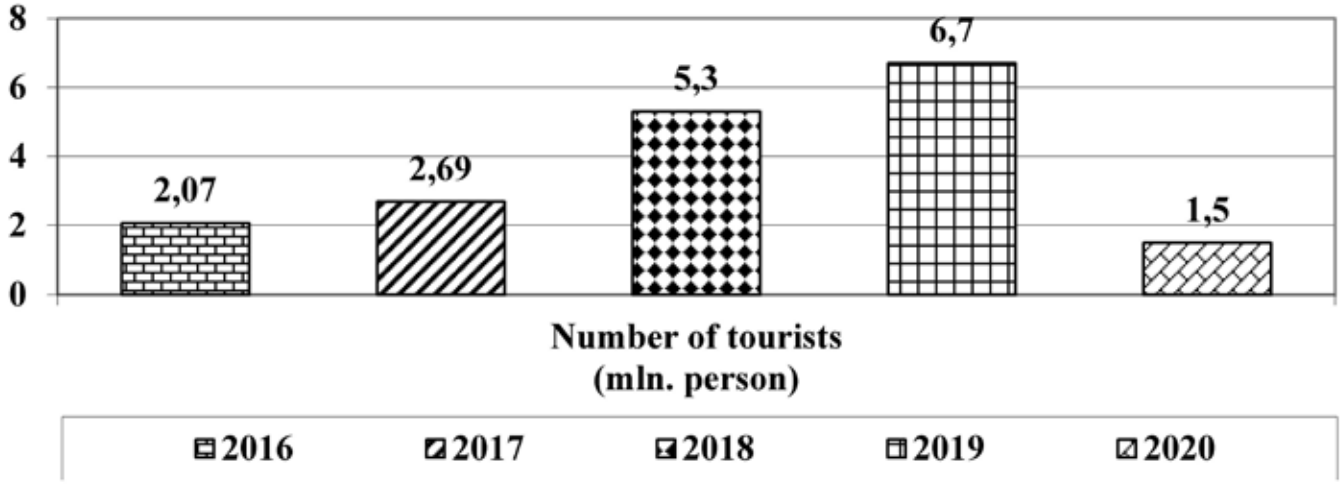

Figure 2. – Dynamics of number of tourists visiting Uzbekistan in 2016–2020

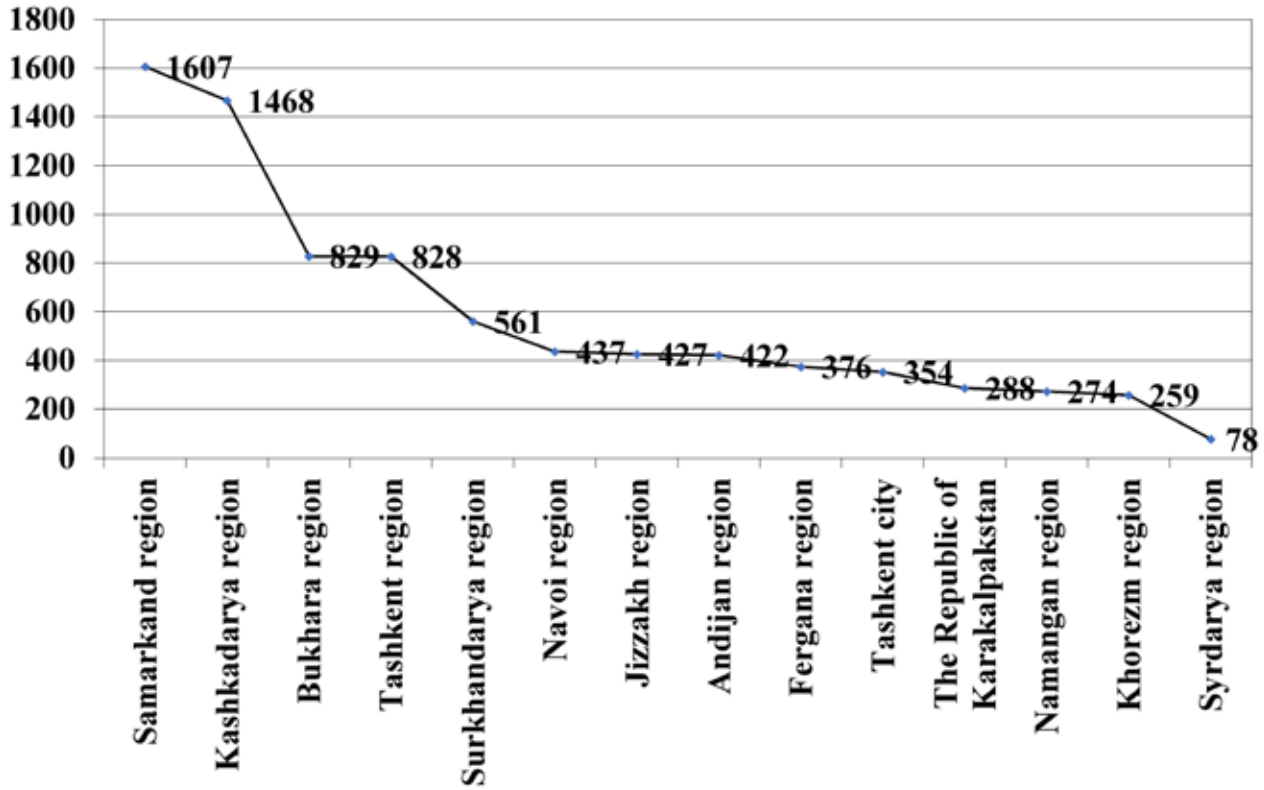

Figure 3. – Distribution of tourist facilities throughout the administrative-territorial units of Uzbekistan

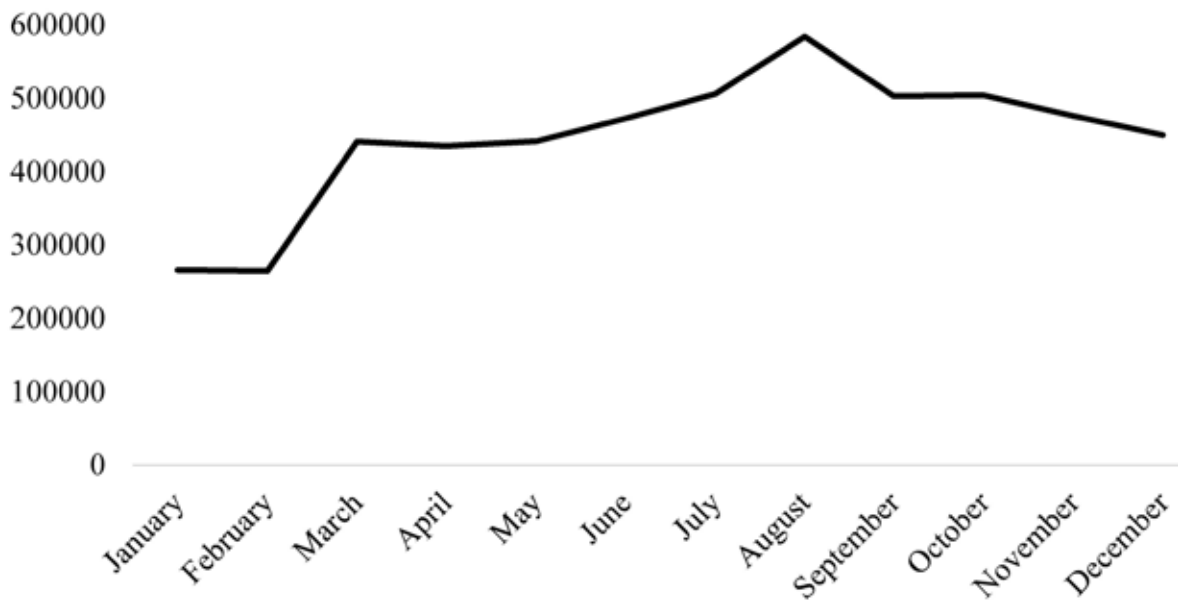

Figure 4.– Distribution of the number of tourists visiting Uzbekistan by months

Figure 5.– Integrated tourism sectors in geographical tourism

It is necessary to follow the principles of structure in the organization and placement of types of tourism. It is also necessary to develop the remaining types of tourism on the basis of known and popular tourist facilities. Tourist clusters serve as a basis for this (Figures 5–6).

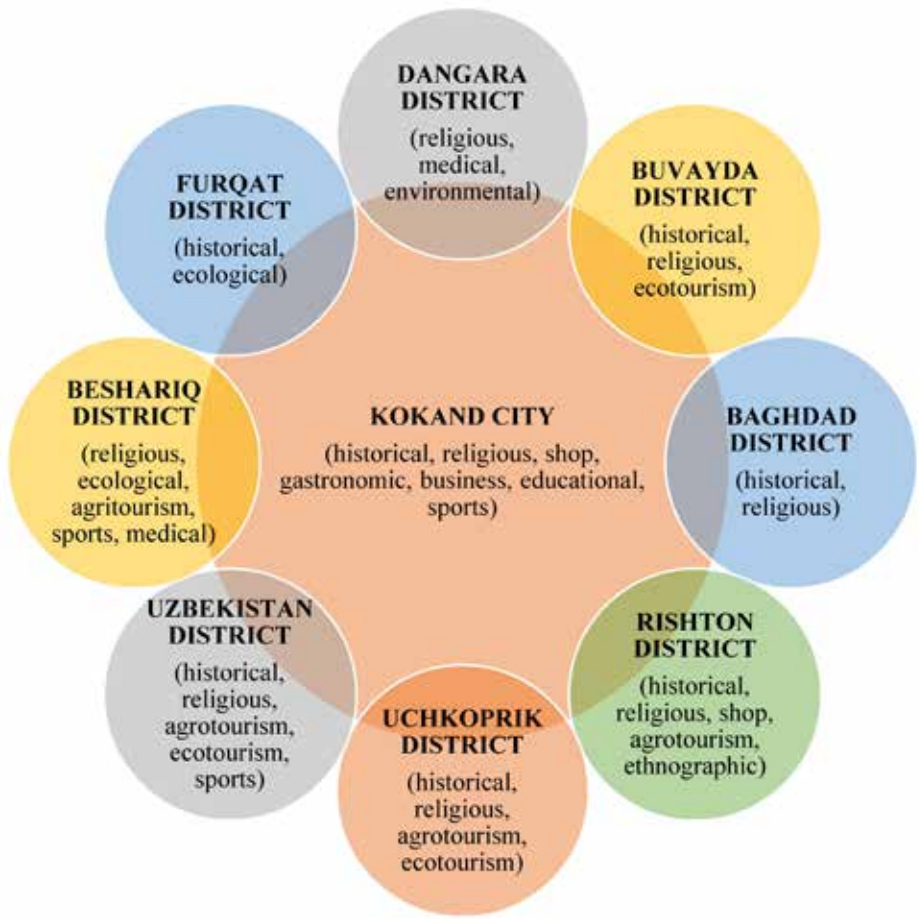

Figure 6.– Introduction of tourism cluster for tourism development among Kokand group districts

The main issue is the integrated development of existing types of tourism in the region. Geographical tourist areas, which are the object of geographical tourism, can be a solution to the problem. When choosing tourist areas, several tourist zones should be considered as a single tourist area. For instance, Fergana Valley is a tourist region. The only and new type of tourism that combines all the above features are geographical tourism.

5. Conclusion

To diversify the tourism industry, the study of the tourism potential of certain regions through geographical tourism can be considered as a key factor contributing to the sustainable development of all countries.

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Section 3. Study of art

https://doi.org/10.29013/ESR-21-5.6-17-21

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ORIENTALIST VESTMENTAL ACCESSORIES IN WOMEN'S ATTIRE DURING THE FIRST EMPIRE

Abstract. The relevance of the research, first of all, is conditioned by enormous character of the upheavals caused by the period of the First Empire and Napoleonic wars which have mainly predetermined the image of modern Europe in many respects. The events of 1804–1815 attracted attention not only to the foreign and domestic policy of the Emperor Napoleon, but also to the changes in women's costume associated with it. The formation of the costume of the era fully reflected the various events of the First Empire's politics.

Keywords: fashion, France, Napoleon, empire, turban, shawl, protectionism.

France during the First Empire was a state that fought wars in the East. Before coming to power and being crowned, Napoleon visited Egypt and Syria. The states of the East had an impact on the lives of the French, who found themselves in Africa, because France traded with the Levant via Marseille.

The art that made Napoleon's trips to Egypt famous brought a new and exotic style to French life. In 1802 the La Description De L'Égypte was published. The unfamiliar concept of the mysterious region's new architectural elements gradually found its way into the interiors of France. This Egyptian style in the interior was called the "retour d'Egypte". It is erroneous to claim that the style emerged at the time of the Egyptian campaign. Furniture with sphinxes designed by Richard Mique can be found in the chambers of Queen Marie-Antoinette in Versailles before the revolution. The chief architect of the Ancien Régime, Mique was able to enforce the neoclassical style that was to become the main style in the architecture of the reign of King Louis XVI. Furniture with sphinx heads, wings and palmettes became fashionable for a brief period. After 1798, the manufactory in Sèvres produced porcelain with Egyptian motifs. Sets with deciphered Egyptian hieroglyphs appear on the tables.

Considering that architecture, being one of the tectonic arts, influences the formation of fashion, the new aesthetic vision of clothing in France was based on Napoleon's campaigns in Africa. The new fashion exploited the shawls, turbans and fabrics brought to France, which in the First Empire became a free propaganda of state policy.

Turbans as part of eighteenth-century women's costume existed under Queen Marie Antoinette. According to the Boston Museum of Fine Arts dresses à la turque first appeared in July 1779. Borrowing Oriental art from the Ottoman Empire, the style became the basis for a style that sang the praises of Turkey. In Europe and in Russia, such a style was

known under the French word "turquerie". Turkish chambers designs, those of Queen Marie Antoinette and the Count d'Artois were a frequent occurrence in the upper echelons of society. For women's dress, the Turkish influence was expressed in special robe à la turque dresses. The base of such a dress was made by the haberdashery of a manteau different in colour from the sleeves, corsage, underskirt, which was long and with a trend. At the level of the skirt, the manteau did not fit at the front, making it look like the Duchesse de Pompadour's flared dress.

Sometimes the manteau was sewn with a seam around the neckline like a dressing gown. In the biweekly magazine Cabinet des modes, in which Parisian women could read about fashion, the January 1786 issue wrote the following about the Turkish dress: "Frenchwomen, fundamentally in the capital, which was the centre of taste, began to imitate even the costumes of all nations. From robes à la française to robes à la polonaise, from robes à la lévite to robes à l'anglaise and robes à la turque. In the latter, the beautiful woman achieves a triumph more precise and pleasing than the women in the harems of Constantinople. And there is not a single sultan who will not envy her elegance, grace, and the honours bestowed upon her" [1, 34]. Such dresses were accompanied by special head-dresses which were called "nakara". The Turkish dress required a special headdress, which looked like a turban with a big knot of ribbons. A feather or egret was attached to the centre of the turban. The corset and underskirt were made of the same coloured material, often white satin, sometimes with flowers.

The turban from a French Turkish gown, which caught the end of the reign of King Louis XVI, passed into the fashion of the Empire period. For Baroness Anne Louise Germaine de Staël-Holstein, daughter of Jacques Necker, Minister of Finance of the royal regime, the turban was part of the recognizable image (Il. 1).

A publicist and owner of a literary salon, Germaine de Stael was able to become one of Napoleon's most frequently cited opponents in terms of her politics and views on the administration of the state. Her influence on French fashion was not as great as that of Empress Joséphine in France. To Europe, Baroness de Stael looked like a prisoner of the regime which persecuted her, restricting her freedom of movement and action. "It was said in social circles of the time that if Napoleon persecuted Madame de Stael, it was not so much for her liberal way of thinking and oppositional spirit – that he could still excuse, but for the fact that she was intelligent and well-read, a quality which he believed unbecoming of women, something he could never forgive" [2, 152]. Given that de Stael's turbans were part of her image for many, they had a political role to play.

Figure II.1 Marie-Éléonore Godefroid Portrait of Anne Louise Germaine Necker, Baroness de Stael-Holstein. 1810. canvas, oil, 119 x 83 cm. Palace of Versailles. Paris

Unlike French women who wore small hats or turbans, Baroness de Stael chose large turbans for her portraits. In the portraits that show de Stael at various periods of her life, the turban is a major part

of her attire, sometimes theatrical. In addition to the turban, Eastern influences included the shawls brought back by the French from the Egyptian campaign at the end of the eighteenth century.

Until Napoleon Bonaparte's Egyptian campaign of 1798–1801, cashmere shawls were not in fashion in Europe. Shawls made from the fine wool of cashmere goats were common in Asia, mainly in India. The first shawls in France were brought in the 1790 s by Napoleon's generals and officers commanding troops in Egypt as trophies for their wives. While still in Egypt, Napoleon gave shawls to Joséphine, who became one of the first fashionable women in France to wear shawls. In the 1790s, Joséphine's attitude to shawls was neutral. In her letters to Eugène de Beauharnais she wrote: "I received the shawls. They may be of the highest quality, and so expensive, but they are rather unsightly. Their only advantage may be their lightness. I doubt if they can ever come into fashion" [3, 73].

In Antoine-Jean Gros's portrait Joséphine, shown standing full-length, wears two shawls: a white unbleached wool shawl and a red shawl. The first ecru shawl from which the dress was made echoes the red shawl in motifs along the hem. The second shawl is tied by Joséphine at the waist and left on her left shoulder. Gros was able to show the length of the red shawl that lies behind Joséphine's back, which speaks to the large size of the individual shawls in the Empire style period. Behind Joséphine, the artist shows a part of the shawl that resembles a dress trend. The portrait is symbolic and when viewed in detail gives an idea of the Empress. In a vase decorated with "J", which was the symbol of the Empress, the artist shows several hydrangea blossoms, alluding to the name of her daughter Hortense. At the level of Napoleon's wife's gaze is a bust of her son Eugène de Beauharnais, Viceroy of Italy, Napoleon's stepson. The portrait clearly shows the short sleeves as well as the undershirt under the fringe of a white cashmere shawl. With the density of cashmere shawls, the dresses that were made from them were not worn without undershirts (Ill. 2).

Figure II.2. Antoine-Jean Gros's Portrait of Empress Joséphine, 1809, canvas, oil, Musée Massena

Figure II.3. Illustration from the Journal des Dames et des Modes, Costume Parisien

Shawls could be of different colours, allowing dresses to be made with a variety of colours, which could be lilac, pink, green. The trend for shawl dresses continued until 1815, as seen in the pages of the Journal des dames et des modes. The dresses were sewed of two sections of shawl without decorative elements, however, there were some exceptions (Il.3).

A dress with a cut-off bodice and crossbars connecting the dress in the centre and sleeves. These dresses were very costly to make, as the pieces of detail cut out of the shawl had to be fitted to each other (Ill. 4).

Figure Il. 4. Illustration from the Journal des Dames et des Modes, Costume Parisien

Given the lightness of cambric dresses, such shawl dresses became an option for warming a woman's body. In 1810 an interesting variant of a dress cut appeared on the pages of the Journal des dames et des modes. The shawl dress was presented as a redingote. It had elements of a redingote, as well as a collar that had never been used for dresses. Similar collars were used for men's tailcoats, trench coats, but not for women's empire style dresses. The dark shades indicated practicality and that such dresses were worn for outings (Il. 5).

Figure Il. 5. Illustration from the Journal des Dames et des Modes, Costume Parisien

To summarise, a shawl dress could be an alternative to a gown, but not a shawl. In 1806, dresses that resembled gowns with a belt were in fashion. From the waist to the hem of the dress the gown diverged in two parts in the middle, which allowed for a silhouette that extended to the bottom. Dresses with short sleeves were worn with long gloves, contrasting with the colour of the dress. Shawls of pale shades were suggested to complement the dress, preferably light shawls similar in shape to stoles.

Excess shawls were used by Josephine to create dog cushions for her pets on the sofa and bedspreads for her personal use [4, 171]. In addition to dresses and shawl cushions, Josephine's individual tailors, like Leroy, could create mantos [5, 190].

It is truly difficult to determine the extent of fashion for shawls and turbans. They appeared in all

the fashion magazines as well as in many portraits. Besides cashmere shawls, large embroidered shawls from Smyrna in gold thread were also in vogue. The marchands of fashion were not limited to one kind of shawl or stole with oriental motifs. In the colour palette of fashion goods brought to France one could find: carmine red, amaranth colour, colour of Egyptian earth, indigo blue, canary yellow, red-brick, colour of field poppy. Oriental reminiscences were a reflection of Napoleon's policy with his wars in the East and his desire to consolidate the public's perception of the greatness of France.

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Section 4. Machinery constru

https://doi.org/10.29013/ESR-21-5.6-22-25

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FORMATION OF INTERNAL CRACKS DURING TWO-ROLL AND THREE-ROLL ROLLING

Abstract. The article discusses the main methods of modeling processes of skew rollers. Factors influencing the formation of internal cracks are discussed. The tendency of a material to crack in skew rolling processes decreases as the temperature of material increases, the number of rolling cycles decreases, and the number of rolls increases. In two-roll skew rolling, internal cracks appear around a central axial zone of a rolled specimen. The size and density of inclusions in a metal sample directly affect the formation of internal cracks.

Keywords: skew rolling processes, material fracture, four-roll skew, true deformations.

Introduction

The skew rolling process is a method for reducing the diameter of the round billet. It is widely used in industry for the production of seamless pipes, cylindrical bars, and balls. This process is performed using two or three rolls (barrel or tapered) that are set at an angle to the centerline of workpiece. In this process, the heated round billet rotates and moves with help of rollers [1]. However, since axes of rolls are offset from the rolling line, internal fracture or Mannesmann effect may occur in rolled metal. Since an internal crack causes a loss of strength in the finished products and is difficult to detect, the mechanisms of crack formation and ways to prevent its occurrence have been studied for a long time [2]. Reducing the number of metal rolling cycles is a more effective way of protecting against the internal fracture of a product than the number of rolls. It is believed that the formation of internal cracks is less likely with three-roll piercing than with two-roll piercing [3], since compressive stresses act on the central axis of rolled material more evenly during three-roll piercing. Internal cracks also occur during transverse rolling with the formation of axially symmetric fractures. It is believed that the shape of internal fracture changes significantly with decreasing number of rolls. Ring

fractures more often occur during three-roll transverse rolling [4], and cruciform fractures during two-roll transverse rolling. The influence of a number of rolls on the internal fracture of metal is still a matter of debate.

Although skew rolling has been in use for over a century, this forming method is so complex that to date no research has examined it comprehensively, especially in terms of internal cracking.

Today, the main pool of research devoted to skew rolling is computer modeling of material destruction processes in the axial zone of part deformed between two inclined cylindrical rolls [5; 6]. The mechanism of the metal forming process is analyzed using several fracture models: models of continuous fracture mechanics, models of porous solid mechanics, cohesive models, and phenomenological models [7; 8; 9].

When developing computer models, it is important to take into account such a parameter as a rotation of workpiece when simulating processes of transverse and skew rolling. This is not possible in all skew rolling simulation programs. The most popular program for modeling skew rolling processes among researchers is *Simufact.forming*. It is often used to simulate processes of rolling pipes [10], balls [11] and simulate processes of cross-wedge rolling [12]. In this program, when simulating processes of transverse and skew rolling, rotation of workpiece is taken into account, and simulation results correlate with experimental data.

In addition, it is often difficult to compare the results of the cross and skew rolling simulations due to different test conditions and criteria. This contributed to the development of a set of parameters for standardizing such tests. Thus, Zhou et al. [13] proposed a method for standardizing test conditions in cross-rolling. They used new approaches to determining constants of material fracture criterion. The results obtained by these authors demonstrate the correctness of this approach when trying to determine physical constants of material and the range of critical values when workpieces are damaged.

So, despite fact that three-roll bevel rolling has been used in metallurgy for a long time, there are not many studies on modeling processes of three-roll bevel rolling [14; 15]. In addition, in these studies, changes in the shape of workpiece, distribution of stresses, and deformations are mainly analyzed, and mechanisms of material destruction are not considered. There are very few studies where a comparative analysis of the physical influence of different numbers of rolls on workpieces is carried out. In one of these studies, a comparative analysis of cross-rolling processes using two-, three- and four-rolls was carried out [16]. They found that the best energy efficiency was obtained using the four-roll method. However, this constructive solution has not yet found application in the industry.

Currently, there are new structural models for use of bevel rolling in a mill. For example, a new process for the production of seamless pipes [17] was recently proposed by a tandem oblique rolling on a mill consisting of two drive parts, each of which has three rolls. However, the authors of the study limited themselves to an analysis of stresses and strains in workpieces and it also did not find application in industry.

Comparative analysis of research results demonstrates significant differences in the nature of stresses arising in forming zone during two- and three-roll skew rolling. They are mainly related to the shape and size of a contact zone between rolls and material. In two-roll skew rolling, the cross-section of the billet undergoes significant deformation in the impact zone of a roll. Deformation results in high shear stress acting in the circumferential direction, which causes tensile and shear stresses in the center of workpiece. In turn, the use of three-rolls dramatically reduces the contact area between materials and rolls and also reduces distortion of billet cross-section in the roll impact zone. As a result, three-roll bevel rolling is characterized by a predominance of compressive stresses. Due to the use of three-rollers, both areas of tensile stresses are not located on axis of workpiece, however, are offset from it to the surface of workpiece. This stress behavior

reduces the risk of material cracking in the center of workpiece. Comparison of stresses and strains in two analyzed processes shows that fracture is more likely in twin-roll rolling. The effective deformation is higher in two-roll rolls.

Predicting internal cracks is critical because internal cracks cause a loss in product strength and are difficult to detect. Various experiments have been carried out to understand internal fracture in skew rolling or cross rolling. It is believed that internal fracture occurs around a center axial portion of rolled stock in three-roll bevel rolling, while internal fracture occurs at center of rolled stock in two-roll bevel rolling. On the basis of such studies, various theories of fracture mechanism have been proposed: Siebel's theory of shear fracture [18]; Smirnov's theory of brittle destruction [19]; the theory of viscous fracture by Teterin and Lyusin [20]; and type of fatigue fracture according to Pater et al. [21] and others. Since these theories of 30–60s of the XX century are based on a qualitative assessment of experimental results, they require not only rethinking, however also confirmation using computer modeling of mechanisms of internal destruction, which are still difficult to predict.

The presence of voids and inclusions in the composition of a metal workpiece is of great importance in predicting internal cracks [22]. A number of properties of inclusions in steel during hot working, such as the morphology of inclusions, size of inclusions, can influence void formation and crack propagation. In another study [23], the authors investigated the formation of voids and crack propagation between inclusions in heterogeneous metals. They showed that underlying mechanisms of damage change from decohesion of particle/matrix interface to cracking of particles as matrix hardens.

Conclusions

To date, there are no studies in the world whose authors have scientifically substantiated the mechanisms of material destruction during the skew rolling of a sample. This conclusion refers to the application of widely used phenomenological fracture models, which are implemented in many commercial computer simulation programs for metal forming processes. In addition, the "tendency" of material to crack in skew rolling processes decreases with increasing material temperature, decreasing the number of rolling cycles, and increasing the number of rolls. In two-roll skew rolling, internal cracks appear around the central axial zone of a rolled specimen. The presence and nature of inclusions in metal contribute to the appearance of various defects in the final product during two-roll rolling, and to a lesser extent during three-roll rolling. Their size and density in the sample affect formation of internal cracks.

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Section 5. Pedagogy

https://doi.org/10.29013/ESR-21-5.6-26-31

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TEACHERS' PROFESSIONAL COMPETENCES: PEDAGOGICAL EXPERIMENT (TRAINING STAGE)

Abstract. The article presents the professional competencies of teachers trained in the pedagogical experiment (training stage), such as managerial competence, relational competence, teaching-learning competence, design and planning competence, specialized cognitive competence, and the evaluation and monitoring competence. The professional competencies' training is focused on the assessment criteria, established for each area of competence. The concept of professional competencies is fundamental in the formation of a teacher and in order to obtain school results in the educational system.

Keywords: professional competencies, curriculum, teacher, evaluation criteria, pedagogical experiment.

Introduction. In the context of the analysis regarding the dynamics of the teaching profession, two *critical aspects* are identified: firstly, the increase of the attractiveness of other fields of activity and of other professions (for example: professions targeting new technologies), and secondly, the degradation of young people's perception related to the status of this profession, especially due to the countless criticisms brought to the educational system and the minimum salary of the people involved in this system. We are also witnessing the many challenges that teachers face (related to the teaching act and its effectiveness, the growing demands of society on education effectiveness), which require significant changes in the teaching profession and draw attention to teachers' continuous professional training activities.

The curriculum is the tool that organizes the instructive-educational process based on the formation of general competencies and specific competencies, based on the instructive-educational contents; and that organizes instructions and trainings to help trainees in their professional activity.

The domain of teachers' continuous professional training is part of the educational system, a domain aimed at teacher training which contributes to teachers' succeeding in implementing the curriculum in the subject they teach and to responding to all challenges in the context of social evolution.

The issue of the evolution of the concept of competence at international level is treated by several authors [7; 8; 10; 11; 12; 15; 16; 17; 19; 20; 21] and nationally [1; 2; 3; 5; 6; 14; 23; 24]. The pro-

fessional competencies developed in the teachers' continuous training (TCT) programs are assertions regarding the training results of the trainees, formulated in terms of finality to obtain at the end of the TCT program.

The issue of the evolution of the curriculum concept which is treated by several authors at the international level [7; 8; 15; 16] and the national level [1; 5; 6; 13; 22] deals with various aspects of the elaboration, implementation and monitoring of curriculum theory and practice, conducted either in the context of the initial professional training, or in the context of the school curriculum; but less in the context of the teachers' continuous professional training.

In the Republic of Moldova, the curriculum paradigm focuses on affirming the priority role of education goals at the level of any pedagogical project, based on which the other elements of the curricular-model approach to training are structured (teaching-learning methods, assessment strategies and contents).

Methods and tools used in research. In order to carry out the research and in the context of the mentioned epistemological landmarks, the following methods were applied:

- *Theoretical* – scientific documentation, analysis of pedagogical phenomena and regulatory documents (documentary analysis);
- *Empirical* – pedagogical experiment (training stage), experimental data processing.

The training experiment involved 441 subjects, divided into inhomogeneous groups, which included the implementation of several scientific products developed in the research: continuous education curriculum for: the Theory and Praxiology of Continuing Professional Education of Teachers, divided into two modules: Teachers' Continuous Professional Training in the Context of Competence Pedagogy and Management of Curricular and Extracurricular Educational Activities [2].

The experiment teachers' professional competencies tests and training actions varied depending on the degree of relevance in the professional development, on the nature of the information used to solve various theoretical and practical tasks. Within the training activities (three-week training internships, 2–3-day seminars on the implementation of educational policy documents, sections, round tables in scientific and theoretical-practical events, etc.), the subjects involved in the experiment performed a series of tasks, actions of choice, selection, formulation, definition, correlation, structuring, etc. The results were evaluated in percentage averages based on the scale developed for each of the proposed tasks. In this article we present the module *Teachers' Continuous Professional Training in the Context of Competence Pedagogy.*

Results and discussions. The values and attitudes needed to be promoted through the training activities designed and carried out must aim at:

- Self-respect and respect for others;
- Social responsibility and positive relationship with others;
- Physical and mental well-being;
- Lifelong learning and personal development;
- Active participation in cultural events;
- Active involvement in life and career planning.

The scope of the module aims at developing the competencies of teachers in general education in the domains: international and national educational policies, continuous professional training, school curriculum, career advancement, management of curricular and extracurricular educational activities.

Teachers' activity domains: The involved experiment subjects work in the position of teachers in general education institutions.

The development of teachers' professional competencies in the context of areas of competence is achieved [4; 9; 18]:

- At theoretical level:
  - delimitation of concepts: continuous professional training, permanent education, lifelong learning, professional development, personal development;

  - defining the concept of teacher's professional competence;
  - specifying the modern tendencies of the teachers' continuous professional training;
- At application level:
  - explaining the key notions by formulating learning situations;
  - elaboration of indicators for the implementation of the school curriculum;
  - sketching the lesson design models from a managerial perspective;
  - modeling teachers in the context of educational policy documents;
  - elaboration of the teachers' (self) evaluation form;
- At integrative level:
  - implementation of the school curriculum at the level of educational institution;
  - promoting values and attitudes in the continuous professional training of teachers;
  - professional and personal development of teachers in the context of modern trends.

The competence-area-based training activities were based on the Curriculum of Continuous Professional Training applied during the pedagogical experiment, which focused on the competence areas such as: managerial competence, relational competence, design and planning competence, specialized knowledge competence, teaching-learning competence, assessment and monitoring competence. Each competence was assessed based on the evaluation criteria.

The Module. Teacher's Continuous Professional Training in the Context of Competence Pedagogy

Table 1.– Modern trends in the continuous professional training of teachers

No.	Objectives	Content units	Didactic technologies
1.	Analysis of international and national policies with reference to teachers' continuous professional training	**International and national educational policies:** International regulations regarding the teachers/managers' continuous professional training. Normative regulations regarding the teachers/managers' continuous professional training in the Republic of Moldova.	Interactive lecture; LIST technique; Working with the course support
2.	Presentation of the domains, indicators and descriptors of managers' professional training	Standards of manager's professional competence: Domains. Standards. Indicators. Descriptors. Evaluation of management staff.	Interactive lecture; Ppt presentation; Reading through the BQADR model (browsing, questioning, actual reading, deepening of the message, recapitulation);
3.	Presentation of teacher training domains, indicators and descriptors	**Teachers' professional competence standards:** Domains. Standards. Indicators. Descriptors. Teachers' professional development plan.	Demonstration learning method; Ppt presentation; Concept map; Task-analysis learning method;

Table 2. – School Curriculum Management

No.	Objectives	Content units	Didactic technologies
1.	Analysis of the concept of competence, areas of teachers' competence; Identifying the teacher's profile; Analysis of teacher's competence training paradigms, models and theories	Teacher training competence – key element: Areas of teachers' competence. Teachers' competence categories. Teacher's competence profile: comparative visions. Paradigms, models and theories of teacher competence training.	Know-Want to know-Learn Heuristic conversation Problem-solving technique Situation Modeling, Simulation
2.	Examination of the National Curriculum normative framework; Identification of the value axes of the National Curriculum development;	**National curriculum: conceptual foundations and development guidelines:** National curriculum reference framework. Value axes of the development of the National Curriculum.	Heuristic conversation Questioning Situation Modeling, Simulation
3.	Delimitation of managerial approaches regarding the school curriculum implementation	School Curriculum implementation and monitoring: Conditions regarding the school curriculum implementation and monitoring. School curriculum implementation and monitoring managerial approaches.	Free associations Heuristic conversion Discussions
4.	Lesson management models analysis; Arguing the importance of doing the lesson from a managerial perspective.	Modern lesson management: Lesson leadership models. Communication-strategy-based lesson leadership models. Action;-strategy-based lesson leadership models. Computerised-strategy-based lesson management models. Interactional-strategy-based lesson leadership models.	Interactive lecture, demonstration Lotus method

Table 3. – Teachers' professional advancement

No.	Objectives	Content units	Didactic technologies
1	*2*	*3*	*4*
1.	Analysis of motivational theories; Application of employee motivation techniques to stimulate their performance; Awareness of the role of feedback in motivating and developing teachers.	Motivation of teachers: Theories regarding the motivation of human resources. Staff recruitment, employment and retention in the institution. Methods of recruiting employees.	Lecture Working with the course support Heuristic conversation, Problem-solving technique Case Study

1	*2*	*3*	*4*
2.	Educational policy and normative documents analysis on teacher's evaluation process; Arguing the need to carry out the process of evaluating the teachers' performance.	Teacher evaluation. Internal teachers' evaluation: Educational policy and regulations documents regarding the evaluation process of teachers.	Heuristic conversation Questioning Situations Modeling, Simulation
3.	Presentation of the case study, the pedagogical situation and the project /educational product; Identifying solutions to overcome difficulties in the evaluation process performance.	Teacher attestation: Teacher performance. Stimulating the institution staff's professional performance. Case Study. The pedagogical situation. The educational project / product.	Interactive lecture Free associations Group consultations Guided discussion Case Study

Conclusions

The curriculum of teachers' continuous professional training is the essential tool for developing the teachers' competence areas, namely: relationship with students, teaching – learning activity, class management, design and planning, assessment – monitoring, specialized knowledge in the subject they teach, correlated via attitudes, values and behaviors, achieved during the pedagogical experiment (training stage).

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https://doi.org/10.29013/ESR-21-5.6-32-37

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BEYOND POST COVID-19: PROACTIVISM, POST-TECHNOLOGY AND EXTREME SCIENCE FOR A STEP UP TO ZERO HUMAN CHALLENGES

Abstract. Even though human beings have learnt to live with pandemics, Covid-19 has been destructive. The pandemic revealed issues in the present human ideology and unveils how vulnerable human beings are to adversary invasion be it biological or natural and the need for a paradigm shift to proactive measures against known and unknown challenges to human existence. This paper discusses prospects of digital immortality, alternate habitation, existence of alternative life forms in space, preparing for the dooms day, extinction of the virus and thwarting allied phenomena.

Keywords: Covid-19, proactivism, post-technology, extreme science.

Introduction

COVID-19 is an acronym for Corona Virus Disease 2019 which ravaged the earth in the greater part of the year 2020. It began in 2019 and became a global pandemic in 2020. Actually, in December 2019, there was news of the outbreak of Corona virus epidemic in Wuhan, China. Justly, Corona virus is a common virus in bat, pigs, cattle, mice, chicken, civet, cat, raccoon, dogs, ferret, badgers, camels and human beings. It causes infection of the nose's sinuses or the upper respiratory system. Later, in January 7, 2020, the Chinese authority reported the outbreak of a deadly corona virus disease caused by SAR-COV-2 (severe acute respiratory syndrome coronavirus 2) a new strain of Corona virus. By then, all attempts to control it had proved abortive [1–3]. Presently more dangerous variants of the strain have been discovered.

Pandemics are not strange to humanity. The Spanish flu of 1918 to 1920 is a good historical example. This paper appreciates the global response to the ravaging virus, the effective use of non-pharmaceutical strategies and commends the medical stakeholders in their ability to come out with a vaccine in a very short time. What this paper does not accept is the fact that as intelligent as human beings are and as developed as they are, they could be caught unprepared by a virus infection. At least there ought to be no more attacks by viral or bacterial infections.

Proactivism, as used here, refers to the philosophy of putting up preventive measures or being cautious so as to avoid harm. Post technology is another or next level or the evolution of technological methods. Extreme science refers to going beyond our present science.

The Post Technology Era

The post-technology era is when the present technological advancement is replaced by more novel technological expedition. When humans become more rugged in inventions, when humans' old challenges are solved and creativity of humans become both intervening and proactive – a change to a more improved technological culture. Based on the experience gathered so far during the Covid-19 and now the new normal governed by public health Covid-19 guidelines the immediate target is to eradicate Covid-19. Presently the use of vaccines and drugs are attainable but it appears human beings are not considering further mutation of the virus or attack by a more deadly virus or are otherwise procrastinating

on things the human intelligence could handle. The post technology era is when some of these targets would have been realized. During such period the technological development of the present era would have been replaced by a more sophisticated technology. For instance, the negative effect of the current technology would have been overcome and some of the activities which look impossible now could have been overcome.

The society must have evolved to the extent that the mobility of that era is not even experimented in this era. 100 years ago, there were few cars. Then the cars we know now did not exist and will not exist in the upcoming 100 years. Consequently, in the post-technology era the pressures of today will no longer exist; they will be replaced by new ones and any survivor will be archived in the museum which will not even make meaning to the era just as the writings on the walls of the pyramids in Egypt make no meaning to the present era. They were carefully preserved experiences of their time. Apart from records of wars, most of the ancient preservatives make little sense in a world ordered by technology. In the Post-technology era the developmental dimension will make this era quite ancient even the present political, economic, social and engineering structures will become historical. Using an extreme illustration, it is a world one can come in from Andromeda, take breakfast at Mars, take lunch at Saturn, take dinner on earth and cool off in Venus.

The reality of the trend is as shown by China who is currently working on the project of producing the artificial moon and the sun [4–5]. This is the preamble of the incoming scientific and technological period. It depicts a revolutionary string of revolutions whose dimension cannot be fathomed nor predicted by the present time. The Abacus which gave birth to the adding machine the ancestor of computer and recently the ICT is not even qualified to be a kindergarten toy or baby's toy in the present day.

This work is based on extreme science exploit. Man should consider it and begin to contribute to or lay foundation for the post-technological era to match the inter galaxy competitiveness and not be found wanting or joining too late the inter-universal intelligence and the protecting project of the creativity of creation by other intelligent existence. It is all about survival beyond time and space. A paradigm shift to incredible and unlimited targets for human and environmental protection and sustainability for future millennia. It is the ultimate survival of man and the universe. It is Prepackaging an unlimited existence proposal or a meta-conceptualization conspiracy of zero protocol shifts to extreme science and total sustainability.

Beyond Post Covid-19

Post Covid-19 reveals the fact that human beings initially looked as if they could not discover a cure to virus infection or discover a vaccine for it at the advent of HIV/AIDS disease. If Covid-19 vaccine is discovered [6] then there is no limit to what human beings can do, if they do not do, it is not that they cannot do it but either need time or do not have it as a target.

Digital Immortality

Keric Drexler [7], one of the top founders of Nano Technology postulated that cell repairs devices could be used to treat ailments. Furthermore, Raymond Kurzweil brought up the theories of transhumanist which he believed that Nano-Robot could be used to remedy all ailments and could even be used to reduce the effect of aging. So also was the work of Richard Feyomal and that of Albert Hibbs [8], they suggested the use of micro machines to fight infection.

Over the years this area of research has been ignored. If one can recalled what Feynman posited that the machine will swallow the Doctor it is quite amazing that the medicine is rather developing in its traditional mode and not modelling itself to the revolutionary invention this scholar envisaged. If research has gone in this direction by now the clinical doctors would have been replaced by digital doctors so that instead of swallowing the tablet, they would have digital treatment [9–11].

Lockdown – Exploring alternative habitation on earth

During the lockdown, there was need to separate from neighbours to create physical distancing. This was not possible because characteristically humans live on the surface of the land. This must have been the mistake made by the dinosaurs who inhabited the earth (66,000,000) Sixty-Six Million years ago and where properly wiped out when the asteroids Chicxulub collided with the earth at angle just below 600 at a velocity of 20 km/s at the Coast Mexico [12]. The environmental changes it created resulted in an ecological collapse which lasted for a long time and wiped out the dinosaur. There are also fossils remain of other civilization that were wiped out by some other cosmic and environmental changes. If these earthly ancestors had discovered an alternative habitation, they would have survived the holocaust. Presently, the earth is having our wisest set of tenants who should think proactively in the event of cosmic hostility or biological savaging any opportunities warfare or environmental changes. There is need to innovate optimal use of the earth by making it possibly for the human beings to live everywhere.

Preservation of biological specie – Cosmic dispersal of life

Humans can think of living on other planets but first must learn to live in various conditions apart from living on the surface of the earth. For instance, man must first succeed to live under the ocean which constitutes 70% of the earth crust. Man should live in the air, under the ground, in the ice and in space. If this is conquered then man can live in the air in Venus and underground in the planet Mars. The moon should be provided with an ozone layer and the atmosphere such that man could plant a garden in the moon and send some people there.

To continue to live only on earth is no longer necessary. In Our Galaxy over 40 Billion Planets could Support Life. The Proceedings of the National Academy of Sciences reports that roughly 1 in 5 stars, like our own sun, have an Earth-like planet orbiting around it. That's about 40 billion planets that could support life in the Milky Way galaxy. It is ridiculous for man to think that they are alone in the universe. It is also amazing that man things the human language is a universal language and that some of the radio signals and even visits by cosmic bodies are inter-galaxy ballistic missiles instead as or coded information of some creatures elsewhere seeking to communicate. It is very intriguing that human still use the primitive life on the earth surface when they have the technology to create life in the air, underground and in the oceans. We need to go beyond the present technological state [8, 13–17].

Avoiding isolation – Improve cosmic communication

If human eventually visit another galaxy, it will take several probes and stress to find out if there is life there. It will be easier if coded signals could be sent to space which could be decoded at the other end. It is not quite certain if finally, human were to meet others from different cultures, they will understand each other. There is therefore need to develop a way of sending signal not limited to the radio signals to the other space until there is a reply. The scientists have occasionally reported of signals from the space, they could be sent from some other curious space neighbours or remain or leftovers of some civilization. Here is need to under study the cryptogram of the language and nomenclature on earth and try to see the possible success in understanding the language of the interspace signals. It is unfortunate that we do not even understand the language of the co-inhabitant of the earth which makes our communication poor and selfish [8].

Human should develop a higher communication to attract language users in the outer space. Radio and internet signals need to be upgraded for universal community. By communication it could be easier. Out present dependent on waves is delaying communication a medium more sophisticated than the present wave signals should be used. That which can travel through vacuum and space faster.

It will take several light years for the present radio signal to reach anywhere in space if ever possible in the enormous of space vacuum inter space by matter, anti-matter, black holes and other cosmic particles yet to be discovered.

Inter galaxy communication will be faster and easier to accomplish using the medium of communication. But first man must develop a universal code of communication and translation to make communication with universal citizens possible. There may be no need to go far but could invert a code that can be used on earth to communicate with all earth creation irrespective of the level of intelligence. After all in space we are going to meet with creatures at different level of evolutions. We should be able to communicate with them. So, such communications must start here on earth. If we finally meet with space creature and we cannot communicate with them it will make the present space exploration just for sports.

Preparing for the dooms day: The Sun's death rattle – (postponing the doomsday) Refuelling the Sun

There are various ways Earth's doomsday could come. The earth could be destroyed by man using nuclear holocaust, by alien attacks, smashed into another planet, be swallowed by a black hole, get bombarded to death by asteroids, be polluted by some other visiting particles, be overwhelm by ultraviolet radiation or some other powerful cosmic radiation, mergers, gas accumulation, collisions, getting devoured, or reprisal events elsewhere in the universe especially in the Milky way or within the Solar system [18–21].

Inevitably, the Sun's core could become saturated with this helium, causing it to shrink. This will result in causing the nuclear fusion reactions in the core to go faster. This will mean that the Sun releases more energy than before. At the rate of 10 percent increase in brightness every billion years at 3.5 billion years from now, the Sun will be 40 percent brighter. This will boil the Earth's oceans, melt its ice caps, evaporate water from the underground, dry up the soil and strip all of the moisture from its ecosystem. The earth will become unbearably hot, dry, and barren.

And one day, about 4 or 5 billion years from now, the Sun will burn all its hydrogen and start burning helium instead. With time the Sun's helium will be used up, it will then become unstable and start to pulse. In this state it shrugs off layers of its outer atmosphere until all that's left is a cold, heavy core, surrounded by a planetary nebula. With time, the core, known as a white dwarf, will cool and fade out of existence [22].

The issue is, are we going to wait helplessly for our fate to take this natural scheduled cycle? I do not think it wise. This generation should begin the task of refuelling the Sun. Man can source Hydrogen and provide supply to the Sun this will sustain it longer. The Helios probes, the fastest with a speed of 157,000 mph could reach the sun in 24.7 days. Hydrogen could be supplied to the sun to create sustainability. Moreover presently man can turn hydrogen into helium then man could initiate a simple chemical reaction in the sun to reverse the hydrogen helium system in the sun.

The other alternative is to create an escape site in a younger galaxy. Hence, in event of the precedence doom, man could relocate to the new home. This will mean carry his civilization elsewhere and will be able to do exploit thereafter. Man could equally create a universe and pack into it. If the big bang theory is right, then nothing will prevent the present man from creating the universe. Presently, man is creating the sun and moon. Next, man will create a planetary System after all the sun and moon has been successfully created. This is a precursor that man will one day create its own universe. After all the universe expands to form space and time.

Conclusion:

There is evidence so far to show that scientists should redirect their research into the areas which to them is amazing because very soon technologies will make their input. Moreover it is common to say that history will still repeat itself, so what we see today will re-surface tomorrow. It will therefore not be wise for the wise men which we say we are to suffer that

same way tomorrow how we are suffering now, we need to seriously research.

Suggestion/Recommendation

Researchers should look into the following areas:

1. Preventing virus infection from becoming pandemic.
2. Working together to develop vaccine of other virus infections.
3. Protecting the human race during crisis.
4. Replacing pharmaceutical drugs and medical treatment.
5 Alternative habitation for human beings.
6. Longevity and immortality of human beings.
7. Eradication of sulky aliens and malignant vectors from earth.

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Section 6. Physics

https://doi.org/10.29013/ESR-21-5.6-38-41

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EFFECT OF GADOLINIUM ATOMS ON DEFECT FORMATION IN SILICON DOPED WITH MOLYBDENUM IMPURITIES

Abstract. The processes of defect formation in n-silicon doped with molybdenum, preliminarily doped with gadolinium, have been investigated by the method of DLTS. It was found that the presence of an electrically neutral impurity of gadolinium in the silicon lattice significantly increases the solubility of molybdenum.

It is established that the presence of impurities of rare earth elements, in this case Mo in the volume of silicon, significantly increases the solubility of impurities of refractory elements and at the same time reduces the efficiency of the formation of thermal defects.

Keywords: silicon, doping, diffusion, molybdenum, gadolinium, deep level.

Introduction. It is known that the efficiency of formation and kinetics of annealing of certain defects in the bulk of silicon depend on the presence of various active and inactive uncontrolled impurities, their content and state in the silicon lattice, other specially introduced impurities, the presence of several impurities at once, and many factors [1–2].

Among the listed factors, the most interests are the impurities of rare earth elements introduced into silicon in the process of growing from a melt [3–4]. It is known that impurities of rare earth elements, which are chemically active and prone to complexation even at low concentrations, introduced into silicon during growth are in its lattice in electrically neutral states. In addition, impurities of rare earth elements, not showing electrical activity, interact with various uncontrolled impurities in silicon [5–6]. It follows from the results of numerous studies that doping of silicon with rare-earth elements significantly changes its properties, increases the stability of its basic electrophysical parameters to the action of ionizing radiation, which is associated with the presence of metallic inclusions of rare-earth elements, which are effective sinks for vacancies. It was

also found that rare earth elements also affect the thermal stability of silicon.

It is known that doping of Si with refractory elements significantly affects the performance of semiconductor devices [7–8], but the data on their electrical activity and interaction with other defects, as well as on the effect on the characteristics of silicon structures, are contradictory. But, despite the huge amount of experimental material, the issues related to the influence of various impurities with uncontrollable impurities and structural defects in silicon and their influence on the parameters of semiconductor devices still remain unclear.

In this regard, the purpose of this work was to study the processes of defect formation in n-silicon doped with molybdenum and the effect on these processes of one of the impurities of rare-earth elements – gadolinium. The studies were carried out using measurements of the spectra of non-stationary capacitive spectroscopy (DLTS).

Experimental technique. Monocrystalline silicon of n-type conductivity with a specific resistance r = 5 ÷ ÷ 10 Ohm × cm and an interstitial optically active oxygen content N^{O}_{opt} in the range = $1.2 \cdot 10^{16} \div 7.3 \cdot \cdot 10^{17}$ cm^{-3} was used as the samples under study. Silicon was doped with a rare earth element, gadolinium, while growing silicon from a melt.

Then silicon, pre-doped with gadolinium in the process of growing from the melt, was doped with molybdenum by the diffusion method in the temperature range 900–1200 °C for 2 hours from a layer of metallic Mo deposited on the Si surface. To measure the DLTS spectra in the samples under study after doping with molybdenum impurities on n-Si<Mo> plates with <100> orientation and resistivity $\rho = 5 \div 20$ Ohm·cm, diode structures were fabricated according to a well-known technique [8]. Measurements and processing of spectra are also described in detail in [8; 9]. From the CV characteristics, the dependences $\frac{1}{c^2} = f(V_{rev})$ were determined, which were linear in all studied diodes.

Results and discussion. Analysis of the DLTS spectra shows that the introduction of gadolinium into silicon during the growth of Si from the melt does not lead to the formation of any deep levels in the band gap of silicon, although, according to neutron activation analysis, Gd atoms are present in the bulk of silicon in a sufficiently high concentration (cm^{-3}). This fact indicates that the gadolinium atoms introduced during growth are electrically neutral.

From measurements of the DLTS spectra of Si samples preliminarily doped with Gd, then diffusion-doped with Mo, as well as control samples subjected to heat treatment, the energy spectrum of the formed deep levels was determined. Figure 1 shows the DLTS spectra of n-Si samples doped with molybdenum at 1200 °C followed by rapid cooling (curve 1) and n-Si preliminarily doped with gadolinium in the process of growing silicon from the melt, then additionally doped with molybdenum at 1200 °C (curve 2) and control n-Si (curve 3).

The analysis of the measured DLTS spectra of n-Si <Mo> samples (Fig. 1, curve 1) shows that the diffusion introduction of Mo into Si at 1200 °C followed by rapid cooling leads to the formation of two deep levels in the upper half of the band gap with fixed ionization energies E_c-0.20 eV and E_c – 0.29 eV. In the lower half of the band gap of these samples, one deep level with an ionization energy E_v+ 0.36 eV was found.

Analysis of the DLTS spectra of the control heat-treated n-Si samples showed that only a level with an ionization energy E_c-0.20 eV (peak A) is observed in them, and its concentration is much higher than in the samples doped with Mo. Hence, we can conclude that only levels with ionization energies E_c –0.29 eV, E_v + 0.36 eV are associated with molybdenum atoms in n-Si <Mo>, and the level E_c-0.20 eV is probably a defect of heat treatment.

Comparison of curves 1 and 2 in the DLTS spectra of n-Si<Mo> samples (Fig. 1) shows that the presence of rare earth elements impurity in the silicon lattice, in this case Gd, leads to the transformation of the DLTS spectra: the concentrations of levels associated with

molybdenum atoms increase by 1,5 times in n-Si<Gd, Mo> compared to n-Si<Mo>. It should be noted that the concentration of deep level E_c-0.20 eV, caused by thermal defects, significantly decreases in the presence of gadolinium atoms, that is, the atoms of rare-earth elements prevent the formation of thermal defects.

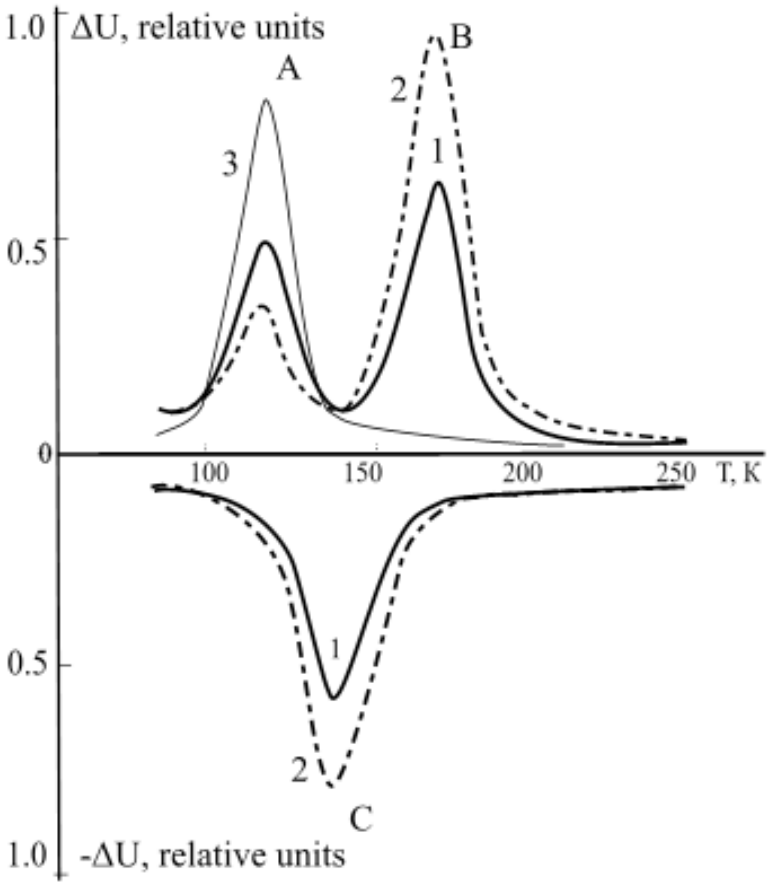

Figure 1. Typical DLTS spectra of samples n-Si <Mo> (1) and n-Si < Gd, Mo> (2),$T_{dif.}$, ^{o}C: 1200, n-Si (3) – control sample

As can be seen from the analysis of this figure, the presence of gadolinium atoms in the bulk of silicon increases the solubility of molybdenum atoms, while the concentration of E_c-0.20 eV levels associated with thermal defects decreases.

Conclusion. Thus, it can be concluded that the presence of rare-earth impurities in the bulk of silicon significantly increases the solubility of impurities of refractory elements, in this case, Mo in silicon, and simultaneously reduces the efficiency of formation of thermal defects. This indicates that rare-earth impurities in Si act as internal getters for various defects in the bulk of silicon, as well as for uncontrolled technological impurities.

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https://doi.org/10.29013/ESR-21-5.6-42-46

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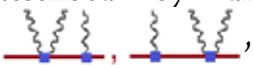
LINEAR-CIRCULAR DICHROISM OF INTERBAND THREE-PHOTON ABSORPTION IN CRYSTALS (PART 1)

Abstract. Interband three-photon optical transitions in crystals of the InSb and type are classified, and the spectral dependence of some optical transitions is analyzed. The coefficient of linear-circular dichroism of interband three-photon absorption in a crystal in the Kane model is calculated.

Keywords: interband three-photon optical transitions, spectral dependence, crystal.

The first works devoted to the research of two-photon interband transitions in crystals were carried out in the early 1960 s, shortly after the appearance of lasers [1–3]. In calculating the matrix elements of two-photon transitions in crystals, perturbation theories were used in the field of an unpolarized electromagnetic wave [2; 3], where the two-band Kane model was used.

In [4–7], both theoretically and experimentally, linear-circular dichroism (LCD) of two- and three-photon absorption of light in crystals of cubic symmetry in the region of the center of the Brillouin zone was investigated. However, the question of spectral and temperature researches of multiphoton interband absorption of polarized light in narrow-gap crystals in the three-band Kane approximation remained open.

Three-photon interband light absorption can be described by diagrams of type  ,  , where  describes one photon absorption,  describes the successive absorption of two photons, and  describes the simultaneous absorption of two photons. Then three-photon optical transitions from the valence band ($|V_l, m_l\rangle$) to the conduction band ($|c, m_l'\rangle$) generally have four types, which can be represented as the sum of the following optical transitions depending on the initial state of electrons participating in optical transitions: a) the initial state of electrons is in the subband of heavy holes

$$\sum_{m_l,m_l'=\pm1/2,\pm3/2}\Big\{\big|V_{hh},\pm3/2\big\rangle\Rightarrow\big|V_l,m_l\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\pm3/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\pm3/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\pm3/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\pm3/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\pm3/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\pm3/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\pm3/2\big\rangle\to\big|SO,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\pm3/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|SO,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\pm3/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|c,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle\Big\},$$
$$\sum_{m_l,m_l'=\pm1/2,\pm3/2}\Big\{\big|V_{hh},\mp3/2\big\rangle\Rightarrow\big|V_l,m_l\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\mp3/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\mp3/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\mp3/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\mp3/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\mp3/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\mp3/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\mp3/2\big\rangle\to\big|SO,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{hh},\mp3/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|SO,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{hh},\mp3/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|c,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle\Big\};$$

b) the initial state of electrons is in the subband of heavy holes

$$\sum_{m_l,m_l'=\pm1/2,\pm3/2}\Big\{\big|V_{lh},\pm1/2\big\rangle''\Rightarrow''\big|V_l,m_l\big\rangle''\to''\big|c,\pm1/2\big\rangle+\big|V_{lh},\pm1/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\pm1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\pm1/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\pm1/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\pm1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\pm13/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\pm1/2\big\rangle\to\big|SO,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\pm1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|SO,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\pm1/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|c,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle\Big\},$$
$$\sum_{m_l,m_l'=\pm1/2,\pm3/2}\Big\{\big|V_{lh},\mp1/2\big\rangle\Rightarrow\big|V_l,m_l\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\mp1/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\mp1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\mp1/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\mp1/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\mp1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\mp13/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\mp1/2\big\rangle\to\big|SO,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|V_{lh},\mp1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|SO,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|V_{lh},\mp1/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|c,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle\Big\};$$

c) the initial states of electrons are in the subband of heavy holes

$$\sum_{m_l,m_l'=\pm1/2,\pm3/2}\Big\{\big|SO,\pm1/2\big\rangle\Rightarrow\big|V_l,m_l\big\rangle\to\big|c,\pm1/2\big\rangle+\big|SO,\pm1/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|SO,\pm1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|SO,\pm1/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|SO,\pm1/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{c},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|SO,\pm1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|SO,\pm13/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|\mathrm{SO},m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|SO,\pm1/2\big\rangle\to\big|SO,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$
$$+\big|SO,\pm1/2\big\rangle\to\big|\mathrm{c},m_l\big\rangle\to\big|SO,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+\big|SO,\pm1/2\big\rangle\to\big|\mathrm{SO},m_l\big\rangle\to\big|c,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle\Big\},$$

$$\sum_{m_l,m_l'=\pm1/2,\pm3/2}\Big\{\big|SO,\mp1/2\big\rangle\Rightarrow\big|V_l,m_l\big\rangle\to\big|c,\pm1/2\big\rangle+\big|SO,\mp1/2\big\rangle\to\big|V_l,m_l\big\rangle\to\big|V_l,m_l'\big\rangle\to\big|c,\pm1/2\big\rangle+$$

$$+\left|\mathrm{SO},\mp 1/2\right\rangle \to \left|\mathrm{c},m_l\right\rangle \to \left|\mathrm{c},m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle + \left|SO,\mp 1/2\right\rangle \to \left|\mathrm{SO},m_l\right\rangle \to \left|\mathrm{SO},m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle +$$
$$+\left|\mathrm{SO},\mp 1/2\right\rangle \to \left|V_l,m_l\right\rangle \to \left|\mathrm{c},m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle + \left|SO,\mp 1/2\right\rangle \to \left|\mathrm{c},m_l\right\rangle \to \left|V_l,m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle +$$
$$+\left|\mathrm{SO},\mp 1/2\right\rangle \to \left|V_l,m_l\right\rangle \to \left|\mathrm{SO},m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle + \left|SO,\mp 1/2\right\rangle \to \left|SO,m_l\right\rangle \to \left|V_l,m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle +$$
$$+\left|SO,\mp 1/2\right\rangle \to \left|\mathrm{c},m_l\right\rangle \to \left|SO,m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle + \left|SO,\mp 1/2\right\rangle \to \left|\mathrm{SO},m_l\right\rangle \to \left|c,m_l'\right\rangle \to \left|c,\pm 1/2\right\rangle\Big\},$$

where each component differs from each other in the order of virtual states, which can appear both in the subbands of the valence band ($\left|V_l,m_l\right\rangle$) and in the conduction band ($\left|\mathrm{c},m_l'\right\rangle$) or in the spin-split band ($\left|SO,m_l'\right\rangle$), $m_l,m_l' = \pm 3/2$ for subbands of heavy holes, $m_l,m_l' = \pm 1/2$ for subbands of light holes, conduction bands and spin-split-off bands, m_l or m_l' the eigenvalue of the total momentum operator. $\left|A,m_a\right\rangle \Rightarrow \left|B,m_b\right\rangle$ characterizes the optical transition from state $\left|A,m_a\right\rangle$ to $\left|B,m_b\right\rangle$, occurring by the simultaneous absorption of two photons (see, for example, [5–7]), $\left|A,m_a\right\rangle \to \left|B,m_b\right\rangle$ characterizes a one-photon optical transition from the $\left|A,m_a\right\rangle$ to $\left|B,m_b\right\rangle$ state.

Note that some of the above matrix elements may turn out to be equal to zero in the zero, linear, and quadratic approximation in the wave vector in the energy spectrum (in the effective Hamiltonian).

In what follows, we choose the following Luttinger Cohn basis functions [8]. Then the effective Hamiltonian in the above sequence of basic functions takes the form

$E_c+\frac{\hbar^2k^2}{2m_c}$	0	$\frac{iP}{\sqrt{2}}k_+$	$-i\sqrt{\frac{2}{3}}Pk_z$	$\frac{-iP}{\sqrt{6}}k_-$	0	$\frac{-iP}{\sqrt{3}}k_z$	$\frac{-iP}{\sqrt{3}}k_-$
0	$E_c+\frac{\hbar^2k^2}{2m_c}$	0	$\frac{iP}{\sqrt{6}}k_+$	$-i\sqrt{\frac{2}{3}}Pk_z$	$\frac{-iP}{\sqrt{2}}k_-$	$\frac{-iP}{\sqrt{3}}k_+$	$\frac{iP}{\sqrt{3}}k_z$
$\frac{-iP}{\sqrt{2}}k_-$	0	F	H	I	0	$\frac{H}{\sqrt{2}}$	$\sqrt{2}I$
$i\sqrt{\frac{2}{3}}Pk_z$	$\frac{-iP}{\sqrt{6}}k_-$	H^*	G	0	I	$\frac{G-F}{\sqrt{2}}$	$-\sqrt{\frac{3}{2}}H$
$\frac{iP}{\sqrt{6}}k_+$	$i\sqrt{\frac{2}{3}}Pk_z$	I^*	0	G	$-H$	$-\sqrt{\frac{3}{2}}H^*$	$\frac{F-G}{\sqrt{2}}$
0	$\frac{iP}{\sqrt{2}}k_+$	0	I^*	$-H^*$	F	$-\sqrt{2}I^*$	$-\frac{H^*}{\sqrt{2}}$
$\frac{iP}{\sqrt{3}}k_z$	$\frac{iP}{\sqrt{3}}k_-$	$\frac{H^*}{\sqrt{2}}$	$\frac{G-F}{\sqrt{2}}$	$-\sqrt{\frac{3}{2}}H$	$-\sqrt{2}I$	$\frac{F+G}{2}-\Delta$	0
$\frac{iP}{\sqrt{3}}k_+$	$-\frac{iP}{\sqrt{3}}k_z$	$\sqrt{2}I^*$	$-\sqrt{\frac{3}{2}}H^*$	$\frac{F-G}{\sqrt{2}}$	$\frac{H}{\sqrt{2}}$	0	$\frac{F+G}{2}-\Delta$

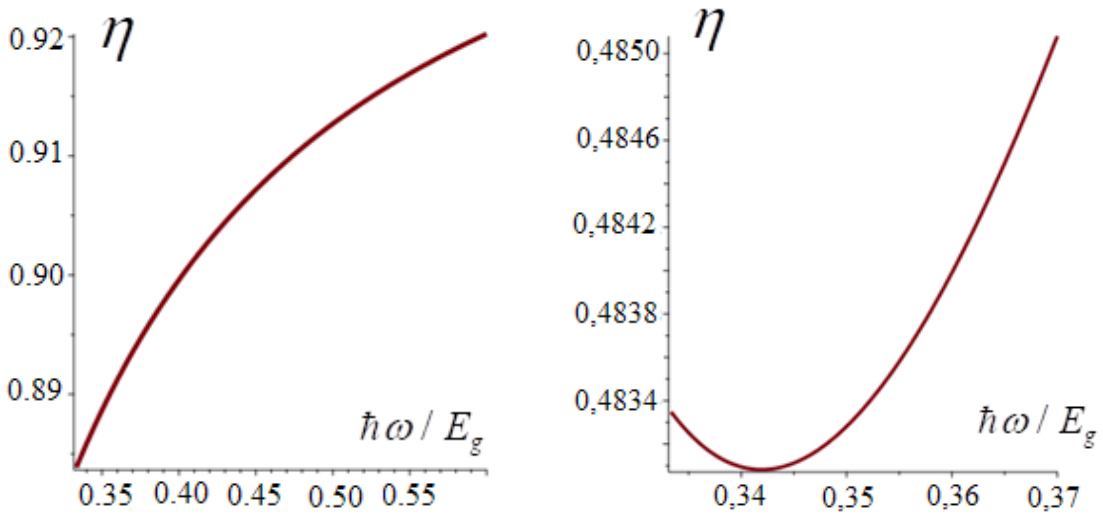
where each component differs from each other by the order of the band parameters [8]. In particular, the dimensionless Luttinger constants $\gamma_1,\gamma_2,\gamma_3$ are related to the band parameters *A, B, D* as $\frac{\hbar^2}{2m_0}\gamma_1 = A$, $\frac{\hbar^2}{2m_0}\gamma_2 = \frac{B}{2}$, $\frac{\hbar^2}{2m_0}\gamma_3 = \frac{D}{2\sqrt{3}}$, the numerical values of which are given in [9]. Then the energy spectrum of light and heavy holes takes the form $E_{lh}(\vec{k}) = E_v - (A+B)k^2$, $E_{hh}(\vec{k}) = E_v - (A-B)k^2$, where the effective masses of light and heavy holes do not depend on the direction of the wave vector and are determined by the relations: $\frac{\hbar^2}{2m_{lh}} = A+B = \frac{\hbar^2}{2m_0}(\gamma_1+2\gamma_2)$, $\frac{\hbar^2}{2m_{hh}} = A-B = \frac{\hbar^2}{2m_0}(\gamma_1-2\gamma_2)$. In this case, the matrix elements of

the pulse operator are determined by $\vec{e}\cdot\vec{\nabla}H(\vec{k})$, where $\vec{e}$ is the vector of the polarization of the light.

Note that there are 16 types of optical transitions that differ from each other in virtual states. Therefore, below we will consider individual optical transitions. For example, the matrix element of an optical transition described by the following diagrams is determined by the relation, and for transitions of the type $|V,-3/2\rangle\rightarrow|\mathrm{V},-3/2\rangle\rightarrow|\mathrm{V},-3/2\rangle\rightarrow|c,-1/2\rangle$, $|V,-3/2\rangle\rightarrow|\mathrm{V},-3/2\rangle\rightarrow\rightarrow|\mathrm{V},-1/2\rangle\rightarrow|c,-1/2\rangle$, $|V,-3/2\rangle\rightarrow|\mathrm{V},-1/2\rangle\rightarrow\rightarrow|\mathrm{V},-3/2\rangle\rightarrow|c,-1/2\rangle$, $|V,-3/2\rangle\rightarrow|\mathrm{V},-1/2\rangle\rightarrow\rightarrow|\mathrm{V},-1/2\rangle\rightarrow|c,-1/2\rangle$ we have

$$\frac{i}{\sqrt{2}}P_c B^2 k^2 e'_+\left\{\frac{1}{(-2\hbar\omega)}\left[\frac{\left(4(\frac{A}{B}-1)^2 e_z'^2\right)}{(-\hbar\omega)}+\frac{3|e'_-|^2}{(E_{lh}-E_{hh}-\hbar\omega)}\right]+\frac{2e_z'^2}{(E_{lh}-E_{hh}-2\hbar\omega)}\left[\frac{2(\frac{A}{B}-1)}{(-\hbar\omega)}+\frac{2(\frac{A}{B}+1)}{(E_{lh}-E_{hh}-\hbar\omega)}\right]\right\}.$$

Then the spectral dependences of the coefficients of the linear-circular dichroism of these optical transitions, determined using the probabilities of these transitions, are shown in Fig. 1. Figure 1 shows that the spectral dependence of the linear-circular dichroism coefficient $(\eta(\omega))$ depends on the type of optical transitions. In particular, for the first type of optical transition, it increases with an increase in the frequency of light, and for the second type of optical transition, with an increase in the frequency of light, it first decreases and, passing through the minimum, increases.



a) b)

Figure 1. Spectral dependence of the linear-circular dichroism coefficient for three-photon interband light absorption in crystals of cubic symmetry for two cases

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https://doi.org/10.29013/ESR-21-5.6-47-50

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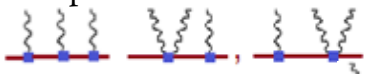
INTERBAND THREE-PHOTON ABSORPTION IN CRYSTALS IN THE THREE-BAND KANE MODEL (PART 2)

Abstract. The spectral dependences of the coefficients of interband three-photon optical transitions for InSb and for some optical transitions are calculated and a numerical analysis of the coefficient of interband three-photon absorption of light is carried out, which taken into account the contribution to the three-photon absorption of optical transitions occurring during the simultaneous absorption of two photons in the Kane model.

Keywords: light absorption coefficient, photon, crystal, electron, holes.

In the first part of this work, interband three-photon optical transitions in crystals of the In Sb type are classified and the spectral dependence of some optical transitions is analyzed. Next, we investigate the spectral dependence of the coefficient of three-photon interband absorption of polarized light in narrow-gap crystals in the three-band Kane approximation. As in the first part of this work, the three-photon interband light absorption will be described by diagrams of the type  , where  – describes one photon absorption,  – describes the successive absorption of two photons, and  – describes the simultaneous absorption of two photons [1–5]. Then three-photon optical transitions from the subband of heavy holes in the valence band ($|V_l, m_l\rangle$) to the conduction band ($|c, m_l'\rangle$) generally have two types, which can be represented as a sum of different optical transitions depending on the initial state of electrons participating in optical transitions: if the initial state of electrons is in subband of heavy holes, then there are 16 different optical transitions, if the initial state of electrons is in the subband of light holes, then there are 22. Therefore, below we calculate the spectral dependence of the coefficient of three-photon absorption of light, let us consider for some of them.

The coefficient of interband three-photon light absorption is calculated as

$$K_{summ}^{(N)}(\omega,T)=\sum_{c,m_c';\mathrm{V},m_V'}K_{c,m_c';\mathrm{V},m_V'}^{(N)}(\omega,T)=\frac{N\hbar\acute{\mathrm{E}}}{I}\sum_{c,m_c';\varsigma,m_\varsigma';\mathrm{V},m_V'}W_{c,m_c';\varsigma,m_\varsigma';\mathrm{V},m_V'}^{(N)}\,. \qquad (1)$$

Here $K^{(N)}_{c,m_c;\mathrm{V},m_V}(\omega,T)$ is partial interband three-photon absorption coefficient of light at which when calculating it is necessary sum over the intermediate states (at a fixed ($|\varsigma,m'_\varsigma\rangle$) and final states ($|c,m'_c\rangle(m'_c\pm1/2)$); $K^{(N)}_{summ}(\omega,T)$ is total three-photon absorption coefficient of light, $W^{(N)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}$ is the probability of the optical transition between the valence band and the conduction band, defined as

$$W^{(N)}_{c,m_c;\varsigma,m_\varsigma;\mathrm{V},m_V}=\frac{2\pi}{\hbar}\sum_{\varsigma,m_\varsigma}\left|M^{(N)}_{c,m_c;\varsigma,m_\varsigma;\mathrm{V},m_V}(\boldsymbol{k})\right|^2\cdot\left[f_c(\boldsymbol{k})-f_{V_l}(\boldsymbol{k})\right]\cdot\delta\left(E_c(\boldsymbol{k})-E_{V_l}(\boldsymbol{k})-N\hbar\omega\right),\qquad(2)$$

where $|\varsigma,m'_\varsigma\rangle$ is the virtual state can be located both in the conduction band and in the subband of heavy holes $|\mathrm{V}_{hh},m'_{hh}\rangle(m'_{hh}=\pm3/2)$ or in the subband of light holes $|\mathrm{V}_{lh},m'_{lh}\rangle(m'_{lh}=\pm1/2)$, as well as in the spin-split subband $|SO,m'_{SO}\rangle(m'_{SO}=\pm1/2)$ of the valence band, $M^{(N)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}(\boldsymbol{k})$ is the composite matrix element of the optical transition under consideration, $f_c(\boldsymbol{k})\left[f_{V_l}(\boldsymbol{k})\right]$ are the distribution functions of current carriers, $E_c(\boldsymbol{k})\left[E_{V_l}(\boldsymbol{k})\right]$ is the energy spectrum of electrons (holes), is the eigenvalue of the total angular momentum operator in the band with number $\nu(c,V_l,SO)$. The matrix element of the electron-photon interaction is defined as $H_{ll'}=\frac{e}{im_0\omega}\left(\frac{2\pi I}{n_\omega c}\right)^{1/2}(\vec{e}\cdot\vec{p})_{ll'}$, where $\vec{p}$ is the operator is the momentum, $\vec{A}$ is the vector potential of the electromagnetic wave, I is the intensity of light, and n_ω is the refractive index of the medium at the frequency ω.

Since the probability of a multiphoton optical transition, which is used to determine the coefficient of multiphoton light absorption, is expressed as

$$W^{(N)}_{c,m'_c;\mathrm{V},m'_V}=\frac{1}{\pi\hbar}\left(\frac{e}{m_0\omega}\right)^{2N}\left(\frac{2\pi I}{nc}\right)^N\left(k^{(N\omega)}_{c,m_{V_l}}\right)^3(N\hbar\acute{\mathrm{E}}-E_\mathrm{g})^{-1}\left|\Re^{(N)}_{c,m'_c;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2\times$$
$$\left[f\left(E_c\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right)-f\left(E_{V_l}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right)\right],\qquad(3)$$

where $k^{(N\omega)}_{c,m_{V_l}}=\left[\frac{2m_cm_{V_l}}{m_c+m_{V_l}}\right]\left(N\hbar\omega-E_g\right)$, $m_c\left(m_{V_l}\right)$ is effective mass in the zone $c(\mathrm{V}_l)$, $\left|\Re^{(N)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2$ the quantity determined by the integral of the type $\int_{-1}^{1}d\cos(\theta)\int_0^{2\pi}d\varphi\int_0^\infty kdk^2\sum_{\varsigma,m_\varsigma}\left|M^{(N)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}(k,\theta,\varphi)\right|^2$, $f_c\left(k^{(3\omega)}_{c,m_{hh}}\right)\left[f_{hh}\left(k^{(3\omega)}_{c,m_{hh}}\right)\right]$ is the distribution function of electrons (holes with energy $E_c\left(k^{(3\omega)}_{c,m_{hh}}\right)\left[E_{hh}\left(k^{(3\omega)}_{c,m_{hh}}\right)\right]$). Let us consider the specific case. Let $M^{(N)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)$ is the composite matrix element consist of two terms, i.e. $M^{(N)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)=M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)+$ $M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)$, where $M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)$ is the matrix element of the optical transition of the type "A", and $M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)$ is the matrix element of the optical transition of the type "B"

$$\left|M^{(N)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2=$$
$$=\left|M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)+M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2=$$
$$=\left|M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2+\left|M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2+$$
$$+\left[M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right]^*M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)+$$
$$+M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\left[M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right]^*.$$

Whence we have that the total light absorption coefficient consists of the sum of the partial light absorption coefficients, determined by the quantities $\left|M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2$ and $\left|M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2$, as well as the contributions to the total light absorption

coefficient, determined by the quantity $\left[M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right]^* M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)$, i.e.

$$K^{(\mathrm{A,B,C})}_{c,m'_c;\mathrm{V},m'_V}(\omega,T)=\frac{N\hbar\acute{\mathrm{E}}}{I}W^{(A,\mathrm{B,C})}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}, \qquad (4)$$

where

$$W^{(\mathrm{A},B)}_{c,m'_c;\mathrm{V},m'_V}=\frac{1}{\pi\hbar}\left(\frac{e}{m_0\omega}\right)^{2N}\left(\frac{2\pi I}{nc}\right)^{N}\left(k^{(N\omega)}_{c,m_{V_l}}\right)^3(N\hbar\acute{\mathrm{E}}-E_{\mathrm{g}})^{-1}\left|M^{(A,B)}_{c,m'_c;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right|^2\times$$

$$\left[f\left(E_c\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right)-f\left(E_{V_l}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right)\right],$$

$$W^{(\mathrm{C})}_{c,m'_c;\mathrm{V},m'_V}=\frac{1}{\pi\hbar}\left(\frac{e}{m_0\omega}\right)^{2N}\left(\frac{2\pi I}{nc}\right)^{N}\left(k^{(N\omega)}_{c,m_{V_l}}\right)^3(N\hbar\acute{\mathrm{E}}-E_{\mathrm{g}})^{-1}\left[f\left(E_c\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right)-f\left(E_{V_l}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right)\right]\times$$

$$\times\left|\left[M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right]^* M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)+M^{(A)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\left[M^{(B)}_{c,m'_c;\varsigma,m'_\varsigma;\mathrm{V},m'_V}\left(k^{(N\omega)}_{c,m_{V_l}}\right)\right]^*\right|^2,$$

calculating them separately, one can consider that the numerical contribution of the partial absorption coefficients of light. Therefore, we will consider specific optical transitions. For example, for an optical transition of the type $|V,-3/2\rangle\Rightarrow\Rightarrow|\mathrm{V},-3/2\rangle\to|c,-1/2\rangle$, $|V,-3/2\rangle\Rightarrow|\mathrm{V},+1/2\rangle\to\ \to|c,-1/2\rangle$, $|V,-3/2\rangle\Rightarrow|\mathrm{V},-1/2\rangle\to|c,-1/2\rangle$, the coefficient of three-photon interband absorption of light for crystals of cubic symmetry is determined by the relation

$$K^{(N=3)}_{c,hh,1}=\frac{3}{4}K^{(3)}_g(0)\frac{m_c m_{hh}}{(m_c+m_{hh})m_0}I^2\frac{E_g^2}{B^2k_{\mathrm{g}}^4}\left[f_c\left(k^{(3\omega)}_{c,m_{hh}}\right)-f_{hh}\left(k^{(3\omega)}_{c,m_{hh}}\right)\right]x_\omega^{-5}r^{(3\omega)}_{c,m_{hh}}\times$$

$$\times\left[\left(\frac{2\left(\frac{A}{B}-1\right)}{x_\omega}\right)^2 a^{(N=3)}_{c,hh,1}+2\frac{2\left(\frac{A}{B}-1\right)}{-x_\omega}\frac{b^{(N=3)}_{c,hh,1}}{x_{lh}-x_{hh}-2x_\omega}+\frac{c^{(N=3)}_{c,hh,1}}{\left(x_{lh}-x_{hh}-2x_\omega\right)^2}\right], \qquad (5)$$

and for transitions of type $|V,-3/2\rangle\to|\mathrm{V},-3/2\rangle\to|\mathrm{V},-3/2\rangle\to|c,-1/2\rangle$, $|V,-3/2\rangle\to\ |\mathrm{V},-3/2\rangle\to\ \to|c,-1/2\rangle$, $|V,-3/2\rangle\to|\mathrm{V},-1/2\rangle\to|\mathrm{V},-3/2\rangle\to\ \to|c,-1/2\rangle$, $|V,-3/2\rangle\to\ \to|\mathrm{V},-1/2\rangle\to\ \to|\mathrm{V},-1/2\rangle\to|c,-1/2\rangle$ we have

$$K^{(N=3)}_{c,hh,2}=6K^{(3)}_g(0)\frac{m_c m_{hh}}{(m_c+m_{hh})m_0}\times$$

$$\times I^2\left[f_c\left(k^{(3\omega)}_{c,m_{hh}}\right)-f_{hh}\left(k^{(3\omega)}_{c,m_{hh}}\right)\right]\left(x_\omega^{-5}\right)\left(r^{(3\omega)}_{c,m_{hh}}\right)^5\times$$

$$\times\left(a^{(N=3)}_{c,hh,2}\Re_1^2+b^{(N=3)}_{c,hh,2}\Re_1\Re_2+c^{(N=3)}_{c,hh,2}\Re_2^2\right)E_g^4$$

where $K^{(3)}_g(0)=\pi m_0\left(\frac{2\pi e^2}{n_\omega c\hbar}\right)^3 k_{\mathrm{g}}^5E_{\mathrm{g}}^{-9}P_c^2B^4$, $x_\omega=\hbar\omega/E_g$, $k^{(3\omega)}_{c,m_{V_l}}=\frac{2m_cm_{V_l}}{m_c+m_{V_l}}\frac{3\hbar\omega-E_g}{\hbar^2}$, $x_l=E_l(k_\omega)/E_g$, $l=lh,hh,SO$, $r^{(N\omega)}_{c,m_{V_l}}=\frac{2m_cm_{V_l}}{m_c+m_{V_l}}\frac{N\hbar\omega-E_g}{m_0E_g}$, k_ω – is wave vector of current carriers, determined by the energy conservation law $E_{lh}(k)-E_{hh}(k)-3\hbar\omega=0$, for linearly polarized light $a^{(N=3)}_{c,hh,1}=\frac{90}{135}$, $b^{(N=3)}_{c,hh,1}=\frac{180}{135}$, $c^{(N=3)}_{c,hh,1}=\frac{488}{135}$ $a^{(N=3)}_{c,hh,2}=\frac{1}{15}$, $a^{(N=3)}_{c,hh,2}=\frac{1}{15}$, for circularly polarized light $a^{(N=3)}_{c,hh,1}=\frac{70}{105}$, $b^{(N=3)}_{c,hh,1}=\frac{133}{105}$, $c^{(N=3)}_{c,hh,1}=\frac{396}{105}$, $a^{(N=3)}_{c,hh,2}=\frac{8}{105}$, $b^{(N=3)}_{c,hh,2}=\frac{13}{105}$, $c^{(N=3)}_{c,hh,2}=\frac{18}{105}$,

$$\Re_1 = \frac{2(\frac{A}{B}-1)^2}{(\hbar\omega)^2} - \frac{2(\frac{A}{B}-1)}{(E_{lh}-E_{hh}-2\hbar\omega)(\hbar\omega)} + \frac{\frac{A}{B}+1)}{(E_{lh}-E_{hh}-2\hbar\omega)(E_{lh}-E_{hh}-\hbar\omega)},$$

$$\Re_2 = -\frac{3}{2\hbar\omega(E_{lh}-E_{hh}-\hbar\omega)}.$$

The spectral dependences of the coefficients of three-photon interband absorption of light for the above optical transitions are shown in Fig. 1. It can be seen from (Fig. 1) that the spectral dependence of $K_{c,hh,2}^{(N=3)} / K_g^{(3)}(0)$ depends on the type of optical transitions. In particular, for the first and second types of optical transitions, with an increase in the frequency of light, it increases and passing through a maximum decreases for both linearly polarized light and circularly polarized light, but the maxima of the dependence differ from each other in value. The numerical values of the band parameters of In Sb were taken from [6]

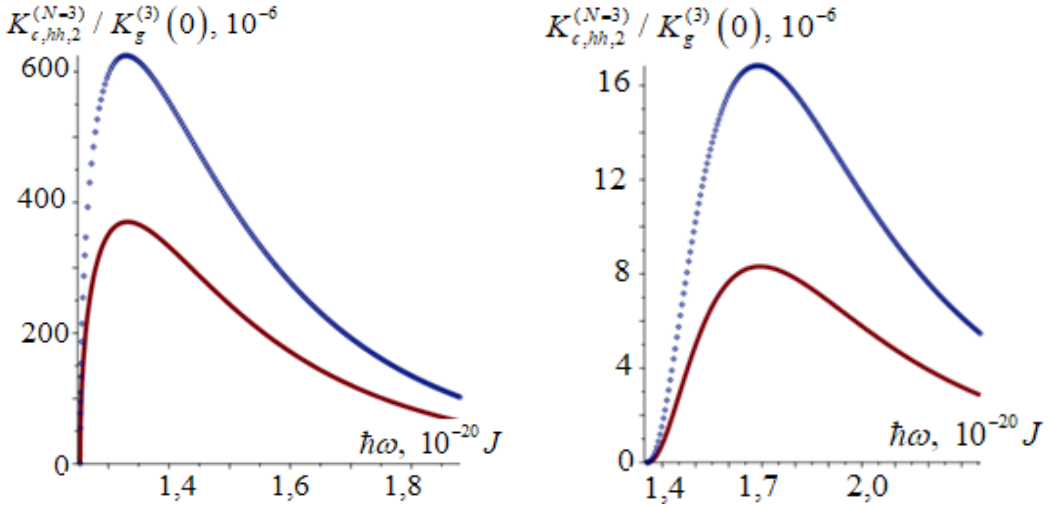


Figure 1. Spectral dependence of the coefficient of three-photon interband light absorption in InSb crystals for the two cases considered in the text

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Section 7. Philology and linguistics

https://doi.org/10.29013/ESR-21-5.6-51-54

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GENERAL–LINGUISTIC ASSESSMENT OF THE CONCEPT OF NEO-GRAMMARIANS IN THE GEORGIAN LINGUISTICS

Abstract. This article analyzes the concept of neo-grammarians (A. Leskin, K. Brugman, H. Osthof, H. Paul…) related to the key issues of theoretical linguistics: the problem of the subject of linguistics, the question of the existence of language, methods of language learning, the study of living languages. Here are the opinions and assessments about this linguistic school in Georgian linguistics (Arnold Chikobava, Konstantine Chrelashvili, Besarion Jorbenadze, Svetlana berikasvili, Levan Menabde…). Linguistic assessment of the concept of neo-grammarians by Georgian linguists is relevant to modernity.

Keywords: Neo-grammarians, Georgian linguistics, Conception. Hermann Paul, Carl Brugmann, Dialectology, Phonetic, Linguistic geography.

I. Intruduction

An important period in the history of linguistic thinking is the 70–80 s of the XIX century. A new generation came to the field of action with original theoretical principles, who with their different views opposed the comparativists (Franz Bopp, Rasmus Rask, August Schleicher, Jacob Grimm ...). This new linguistic school has been called "neo-grammarians" in Georgian linguistic literature. The formation of this current took place independently and was connected with the names of such great linguists as in Germany: August Leskin, Hermann Ostof, Hermann Paul, Carl Brugmann, Bertold Delbrück. Carl Werner, Wilfelm Thomsen worked in Denmark, Graciadio Isaiah Ascoli in Italy, Ferdinand de Saussure in Switzerland. The formation of this movement was moving independently and was connected with the names of such great linguists as in Germany: August Leskin, Hermann Ostof, Hermann Paul, Carl Brugmann, Bertold Delbrück. Carl Werner, Wilfelm Thomsen worked in Denmark, Graciadio Isaiah Ascoli in Italy, Ferdinand de Saussure in Switzerland. In Russia, the linguistic schools of Moscow and Kazan were distinguished: under the leadership of Phillip Fortunatov and Ivan Baudouin de Courtenay.

The general linguistic assessment of the concept of neo-grammarians is given in the works of Georgian linguists: Arnold Chikobava, "The Problem of Simple Sentences in Georgian" (1968), "General Linguistics" (1983); Levan Menabde "Focuses of Old Georgian Writing" (1980); Konstantine Chrelashvili "History of Linguistic Doctrines" (1990); Svetlana

berikasvili "The Principles of Classification of the Declension system in Ancient and Modern Creek".

II. Method of research

Traditional methods of linguistics were used in working on the scientific paper: historical-comparative and descriptive. Problems and ways to solve them were raised for linguistic evaluation of the research issue. Diachronic and synchronous analyzes were performed.

III. Main part

The scientific views of neo-grammarians were not uniform. The difference was observed in a number of theoretical issues. For example, a substantial difference was observed between the theoretical views of Italian and Russian neo-grammarians. This new movement was founded by the linguists of the University of Leipzig (A. Leskin, K. Brugman, H. Osthof, H. Paul, B. Delbrück …), so they were often called the Leipzig School. It was here where the theoretical-methodological principles were developed and formed in its classical form, which founded neo-grammarian concept [1, 107].

The linguistic concept of neo-grammarians was formed by: K. Brugman and H. Osthoff's "Introduction to Morphological Studies" ("Morfologische Unter sungen") and P. Paul's "Principles of the History of Language" ("Prinzipen der Sprachgeschichte"). Young scholars paid great attention to the study of language development. In their opinion, linguistics is a historical linguistics and cannot be different. They do not deny the existence of descriptive linguistics, but point out that description must also involve attitudes towards language events [2,42–43].

Arnold Chikobava analyzes the linguistic concept given in Herman Paul's paper. For Paul, the principle of historicism represents the basis of the whole theoretical concept. For him, linguistics is the same as the history of language. In his view, the non-historical is unscientific. Among the historical sciences he distinguishes the natural sciences and the cultural sciences. Linguistics belongs to the cultural sciences. A significant feature of objects of cultural sciences is the participation of mental factors [3, 70].

According to Paul, "the conditions for the development of any field of culture can not be studied with such precision as the conditions for the development of language; Therefore, there is no other cultural science whose method is as perfect as that of linguistics " [2, 42–43].

Arnold Chikobava notes: "From the second half of the nineteenth century, linguistics, as far as the case concerned to the descriptive methodology, changed its orientation: the orientation to logic gave way to the orientation to psychology… The influence of this psychology is also evident in Paul's definition: he, as a psychologist, had to establish a proposition on psychological reasoning " [4, 29].

Paul then asks the question: What is language? Language is a mental phenomenon. What causes language changes? Linguistic changes are caused by: terminological, grammatical rules … Here the term linguistic habit (usus) comes in. Paul's concept is based on psychologism and individualism [5, 131].

From Ferdinand de Saussure's concept, it is important to introduce the concept of value into theoretical linguistics. According to one of the founders of modern linguistics Ferdinand de Saussure, value is a feature of a sign – to be that, what distinguishes it from another sign.Even the signs of the same events and objects in different language systems always have different values [6, 31; 7, 49].

"The factors such as estabilishing the territorial boundary and territorial and religious unifications can have the influence for the development of the language. The language can be developed within the groups of different structure; meanwhile any form of the human society similar to the social forms known up to now can be kept only within the people with the common language" [8, 40].

Other researchers give a similar qualification to the theoretical concept of neo-grammarians. V. Zvegintsev notes: "According to the concept of neo-grammarians, language is a psychophysical

(or psychophysiological) action. According to these grammarians, every linguistic change occurs during the ordinary performance of the individual" [9, 145].

According to N. Kondrashov: "Individualism and psychologism are the premise of neo-grammarians in determining the essence of language" [10, 75].

According to neo-grammarians' opinion, understanding of complex historical processes of mechanism of language is possible only by relying on psychology. "If historical linguistics and psychology are more closely linked to each other than it has been uccured until present, then we must assume that this connection will reveal many important provisions of linguistics" [9, 148].

Neo-grammarians have aimed one of the major tasks of linguistics the study of living dialectical speech. "A thorough study of dialects is a prerequisite for a deeper understanding of the language, a thorough presentation of its history and development " [11, 2].

"it is possible only by this way to observe the natural development of languages and draw appropriate historical conclusions. They saw well that in terms of grammatical structure, pronunciation and vocabulary, dialects are as systematic and as useful for communication as literary language" [12, 52].

S. Berikashvili discusses K. Brugman's "Greek Grammar" ("Griechische Grammatik"), which first published in 1885 [1, 107–110]. From the phonetic phenomena during declining we must pay special attention to the ablaut, the alternation of vowels [13, 25].

They were the first to raise the question of the creation of precise linguistic methods. The new methods of research introduced by them are undoubtedly progress in the history of the development of historical-comparative linguistics. There are many important discoveries related to their work. The most notable of these are: 1. Phonetic law is unexceptional; 2. The principle of analogy; 3. The advantage of studying living vernacular languages and their dialects [5, 140].

It is unacceptable for neo-grammarians to think about two stages of language development. They resolutely reject the separation of two periods in the development of languages: the "youth" or previous historical period and the "old age" or the historical period of the degradation of the structure of language. Therefore, they deny the existence of an era of the decline or collapse of languages [5, 140].

IV. Conclusion

Thus, the general linguistic concept of neo-grammarians has a great importance for theoretical linguistics. Neo-grammarians have collected innumerable factual material from many languages; They processed and arranged them. This kind of work contributed to the development of the applied aspect of linguistics, which gave impetus to the creation of new fields. The diachronic method of genetic comparison of languages reached its peak even in the works of neo-grammarians. It was also their merit that they shifted the emphasis of their research from ancient languages to modern languages. Due to neo-grammarians, dialectology and linguistic geography were originated, phonetics achieved great success.

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Section 8. Philosophy

https://doi.org/10.29013/ESR-21-5.6-55-59

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SOCIOCULTURAL PRACTICES OF INFORMATION MODERNITY

Abstract. The article is devoted to the transformation of social reality cultural practices in the context of informational modernity. The main social contradictions arising from the global spread of virtual and network cultures are highlighted.

Keywords: social space, information technology, the network culture, virtual culture, socio-cultural practices.

Formulation of the problem. The intensive development of information technologies in the late XX – early XXI century led to a significant transformation of social reality. As M. Castells notes, humanity has entered a new era, where the revolution in information technology is the main factor in the formation of a new economy, society and culture [1]. First of all, this is a consequence of the active spread of personal computers and their association within the global Internet and indicates the emergence of a new social space: there is a virtualization of knowledge, art, love, power, cost, etc. At the same time, the bifurcation of reality into objective and virtual not only changes the usual social practices, new interests, motives, values, new types of socio-cultural and psychological activity are formed.

Analysis of current research. In this context, scientific interest is aroused by works that analyze the phenomenon of the formation of information society, transformation of culture and personality. These are the works of Z. Bauman, M. Castells, F. Fukuyama, M. McLuhan, D. Rashkoff, E. Toffler, and others.

The purpose of the article is to analyze sociocultural practices that are undergoing significant transformations in the context of information reality.

Presentation of the main material. When assessing the mutual correlation between the technological and social development of society, it should be borne in mind that the main innovations relate to significant modifications of social forms of space and time (the feeling of "everything is here and now"), as well as the mechanism of personal self-determination. From now on, the focus on recreating the previously established social structures and lifestyles, norms and stereotypes is increasingly ignored by culture. M. Castells also points to the indefinite nature of modern culture, because information, as a result of the parallel broadcasting of many messages through various communication channels, creates a collage combination, is formed in hypertext flows, in accordance with which culture becomes continuous, but on the other hand – changeable. The system "man – society – social interaction" is replaced by the artificial "man – computer – interactivity".

The formation of virtual culture is taking place, which becomes the modus of modern culture. This was noted in his time by J. Baudrillard, emphasizing that, in fact, virtual realities involve a person in new forms of existence [2]. The main principle of virtual culture is associativity, which allows modeling. Simulation, passing off absence for presence, simultaneously eliminates the difference between the real and the imaginary / illusory. However, virtuality as a plurality of images can be actualized as a space of new value orientations that meet the needs of not only virtual, but also objective reality.

This doubling allows us to state the splitting of a person into two hypostases – real and virtual, where the latter has every chance to realize the most fantastic desires of a person. Virtual culture provides a person with opportunities to implement their projects, with a new name, face, age. The personality tries to correspond to the image that is not subject to it in life. There is an opportunity to embody the ideal of beauty, strength, power, belonging and the like. Virtual culture provides unlimited possibilities for constructing both play activities and the person himself due to variability, contextuality, polysemy, and simulation. An arbitrary choice of any set of parameters expands the mental topology of a person. As a result of virtualization, the validity of not only space and time, but also identity are being questioned. A person receives opportunities for design and his own moral criteria in accordance with the created virtual reality. This is emphasized by J. P. Barlow in the "Declaration of Independence of Cyberspace", where a person is freed from external control [3]. The personality presents itself as its character in the virtual world, and virtual culture becomes the general sociocultural practice of the subject, giving rise to a plurality of sociocultural worlds and models of subjectivity.

A kind of human consciousness modification takes place, which changes the psychological qualities of a person. The blurring of the boundaries between objective and virtual reality leads to an individual's uncritical appropriation of someone else's experience of representing everyday life, while playing with simulacra – until the devaluation of basic values and norms of society, deformation of spirituality, weakening of cultural traditions, turns people's lives into a game and entertainment based on the latest information technologies. In a virtual environment, the boundaries between life and death disappear. The emergence of "thanatophilia" (romanticization of death) deserves attention, which replicates the image of death within the limits of free play as the fate of the strongest, creative and independent individuals.

Thanks to the global spread of information technologies, a network culture is emerging, which gives interpersonal contact the appearance of a permanent polylogue. The network character is embodied with the help of hypertext, which exists as a new textual paradigm focused on a large number of simultaneous information flows. Hypertext can be considered as a way of communication in society. Hypertext provides an instant transition from one text to another, and there is no need to leave the space of the original text field: you need to point to a word or sentence indicated by hyperlinks – and the associated text appears.

The idea of a modern person about the originality and innovativeness of processes depends on how quickly and fully these changes are presented on the World Wide Web. At the same time, the verification of the received news occurs – again and only – via the Internet. Thus, the Internet has reduced the value of an information resource – now everyone knows, but inaccurately. The growth in the format value as opposed to the quality leads to the deconcentration of human attention. A person turns into a kind of "navigator" whose task is to search for and design new information in conditions of its constant mixing. The speed of information search, which is growing, imposes a prohibition on the desire and technologies for solving problems that require a slower mode of operation. Landmarks and symbols that do not meet these requirements are washed out, deleted.

Under the influence of the Web, not only the perception of information is changing, but also the possibilities of its processing. Today, a situation has

arisen where the discussion of experts is more important than the text itself. In the context of the electronic space, the news itself may have less meaning for a person than the comments with which the news is overgrown. When this phenomenon shifts into the real world, it not only leads to a decrease in the rating of news, but also to the formation of a general skepticism about the perception of information broadcast in one direction. News without the possibility of comment causes a feeling of pressure in the viewer or reader, which is compensated by a feeling of distrust.

Hypertext and multimedia innovations not only provided an opportunity for instant high-speed information exchange, but also created a kind of intellectual environment on the Web: contests for online literature appear, virtual poetry clubs appear, various scientific interactive conferences are held, and new opportunities for distance learning are opening up. There are global around-the-clock literary salons, where the text of the "guest book" is directed to an active reader who can take part in its creation. Regardless of the distance, the user can join intense creative communication. Now it is possible to express feelings using various emoticons, replacing the manifestation of one's own emotions with a specific image. However, more and more people appear who try to attract attention to themselves by offensive statements in the chat or on the forum. The main goal is to force people to communicate with them, because in real life these are most often quiet and silent persons, for whom the Network appears as a saving oasis, where they can demonstrate their emotions as openly as possible, getting true pleasure.

Despite free access to any information, researchers note such a problem as the presence of a lack of information. This is due to the fact that the huge amount of information produced annually has long exceeded a person's ability to assimilate this information. An individual, having received hundreds of thousands of links from a search engine in response to his own request, finds everything except the directly needed materials. This situation is accompanied by confusion and testifies to the information overload of the modern user. The problem arises not so much of learning and memorizing the new, but of forgetting the old, because information is constantly being updated and changed [4].

Due to the growing chaos and unpredictability of the choice of ways to obtain information on the Internet, a person increasingly begins to use random phenomena and processes as the basis for drawing conclusions. The idea of the irreversibility of the processes that occur in everyday life is being violated. The active user is convinced that any action can be undone, that any action has the opposite effect. In addition, subjectivism becomes absolutized – for a person who is immersed in new practices, his own opinion becomes more significant and important than logical evidence and objective reasons. Man himself appears as an object and subject.

The use of free time is a kind of indicator of needs and socio-cultural orientations, both for a specific individual and for society as a whole. M. Castells points to the possibility of providing "options of choice" not only for interpersonal communication, but also options for new leisure, can take on a deviant look [1]. Note that one of the essential features of the Internet space is that it is devoid of observers, which previously were social institutions. The Internet space has approved the principle of permissiveness, having received the ability to broadcast uncontrolled information, offering unlimited opportunities for users to independently obtain the data they need, regardless of the center's censorship. It becomes possible to demonstrate views that are impossible in reality to express even to relatives, pleasure of forbidden drives, the realization of control over other people, and the like. Finally, the person got the opportunity to get rid of the intrusive question about the reaction of the social environment to their actions, because the anonymity of the Internet space eliminates the problem of compromise. Investigating this phenomenon, M. Castells came to the conclusion that the possibility of ethics in the network exists as an ethical foundation of network production, where ethics is, first of all, the absence of generally defined

norms and obligations [1, p. 353]. However, the situation concerns only achieving success in the network and is variable depending on the task, cooperation strategy, and is defined by it as a positive phenomenon.

Virtual and network cultures, as modes of modern culture, change the established system of interactions, lead to oddness, information fragmentation, discreteness of the worldview picture; the translation of sociocultural experience is disrupted. These cultures offer many identification grounds, and one really begins to believe that identity is only a phantom. Modernity shows us a culture where descendants teach their parents, as opposed to traditional and configurative cultures. Socialization, which is deprived of heredity and traditions, occurs according to the principle of a puzzle "it / not fit". The individual increasingly assimilates social norms and values of modern society thanks to network and virtual cultures. So, secondary socialization is accompanied by a significant influence of the virtual space.

Expanding the boundaries of communication and reducing distance with the help of high-speed technologies, as it turned out, does not guarantee an improvement in social well-being. On the contrary, we are talking about a state of deprivation (lat. *Deprivatio* – loss, deprivation), which manifests itself in the lack of performance of social functions and social roles. As a result, the satisfaction of important social needs is excluded, the social contacts of the individual are narrowed. As studies of sociologists and psychologists show, among people who use the Internet pathologically without measure, there are often individuals who suffer from various sexual disorders, experience obsessive thoughts, feelings of fear or loneliness.

The consequence of immersion in the network and virtual culture is the so-called "computer addiction" / "Internet addiction" [5]. This term characterizes a person whose socio-cultural activity is increasingly shifting to the Internet, because in the Internet space a person is comfortable: he is strong, courageous, successful. However, in real life, more often than not, he becomes neither stronger, nor bolder, nor more successful. This situation is indicative of cognitive dissonance. The term "cyberadict" reflects a person's desire to get away from their problems, more and more often resembles drug addiction. In real life, a cyberadict experiences discomfort, is constantly in a state of frustration, accompanied by irritability, disappointment, anxiety and, finally, despair.

Conclusions and prospects for further research. Thus, in the conditions of technologization and informatization of our time, the process of human representation of the external world objects acquires significant changes. Virtual and network cultures, displacing the usual socio-cultural practices and forms of interaction, leisure, cognition, change the type of communication, expand the communication space. They create new images and meanings, become the content of a new social reality, the patterns of development of which have not yet been determined. On the one hand, these modes allow the individual to construct his own individual world, on the other hand, the orientation towards entertainment changes the character of human thinking; mosaic, fragmented perception of objective reality casts doubt on the importance of live communication and preservation of existing social ties.

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https://doi.org/10.29013/ESR-21-5.6-60-64

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SOLUTIONS TO PROMOTE THE ROLE OF THE GRASSROOTS POLITICAL SYSTEM IN NORTHWESTERN VIETNAM IN PREVENTING AND FIGHTING AGAINST TRANSNATIONAL CRIME

Abstract. The border lines of localities in the North-western region adjoining Laos and China are determined by the authorities of the Party and State as a route with many complicated movements in the situation of transitional criminal activitiess, especially illegal nacrotic trafficking and transporting, smuggling and human trafficking. Therefore, preventing and combating transnational crime activities in the area is an urgent issue to ensure political security, social order and safety for socio-economic development, and improvement of material and spirital life for the citizen in the area. This is a matter of concern and responsibility for not only the political system but also the entire society. Ffirst of all, the responsibility should be taken by the grassroots political system in the Northwest.

Keywords: Grassroots political system, role, transnational crime.

1. Introduction

According to the governing scope of the Resolution No. 37 – NQ/ TW, dated July 1, 2004 of the Politburo of the Communist Party of Vietnam, the northwestern region of Vietnamm is defined as 12 northern mountainous and midlands provinces and 21 western districts of Nghe An and Thanh Hoa provinces; including 09 border provinces locating adjacent to Laos and China. This is known as the "gold triangle" region, where many different types of crimes take place with very sophisticated and dangerous activities. Hence, The security and order situation in the area always have hidden instability, complexity and unpredictable factors. Recognizing the strategic position of the North-western region over the past years, oour Party and State have always paid special attention, prioritized resources, and issued many specific policies for socio-economic development and national defence – security here. The local authorities at all levels in the North-western area have paid attention to propaganda, education and raising awareness for the citizen at all classes. They have made use of available resources and advantages to promote socio-economic development, therefor the people's material and spiritual life in the area have been step by step improved with priority given to remote and border areas Thanks to that, it has brought into play the synergy from these forces and obtained important achievements in the work of transnational crime prevention. Many serious cases, through "ears and eyes" of the people, have been discovered and handled in accordance with the law.

However, due to the influence of geographical and social factors, especially the negative impacts from the market mechanism as well as the crime situation in neighbouring countries, the crime situation in the Northwest has very complicated movements, with significant increase in scale, and more sophisticated and dangerous properties. More dangerously, criminals publicly commit crimes, challenges the functional forces of the State, and makes the local political system paralyzed and operated ineffectively. More remarkably, a minority of the citizen, due to improper perception, has been attracted by criminal objects. As a result, they have concealed criminals or made it difficult for functional forces in the course of performing their tasks, … Meanwhile, the legal basis for organizing the implementation of transnational crime prevention and fighting has not been complet-

ed. The committees and authorities in some localities have not yet seriously taken the leadership and direction of transnational crime preventionn. Furthermore, coordination among organizations and forces under the grassroots political system was not consistent and tight. And lastly, the results of implementation of preventive measures and struggles are not commensurate with the reality of the situation, and have not mobilized the participation of a vast number of people in the area.

From the issues memtioned above, it can be seen that promoting the role of the grassroots political system in the north-western Vietnam in the prevention of this type of crime is extremely urgent, in order to ensure a stable environment for socio-economic development of localities in the area, as well as contribute to maintaining national security.

2. Some feasible solutions

Firstly, raising awareness and responsibility of the core political system in north-western Vietnam for the fight against transnational crime.

This is the most important, inclusive, transparent and deeply meaningful solution to improve the quality and efficiency of transnational crime prevention of the local political system in north-western Vietnam. The reason is that the right perception is the premises leading to high responsibility and proper action. The fight against transnational crimes in the Northwest is very difficult and complicated, related to the responsibilities of many levels and branches solving many sensitive issues of national defence, security and social order and safety. Therefore, the unity of awareness and responsibility of the people and forces of the local political system in the Northwest is especially important. In order to create a strong change in awareness and responsibility of the core political system in the northwest of Vietnam in the fight against transnational crime, it is necessary to focus on a number of basic issues such as: to adequate and correct awareness of the strategic position of the North-western region; to educate and thoroughly grasp the subject members of the political system at the base of the views and guidelines of the Party and the State on the fight against transnational crimes, as well as the current situation and difficulties of this work; to promote education to make all levels, branches and forces clearly recognize their responsibilities and obligations in transnational crime prevention.

Secondly, improving the capacity of transnational crime prevention for all subjects of the grassroots political system in the North-western region of Vietnam.

The capacity of transnational crime prevention of socio-political organizations, forces and mass organizations in the grassroots political system in the Northwest of Vietnam includes the overall qualities of physiology and professional qualifications mobilized and realized in the implementation of specific contents on the fight against transnational crime. These factors are in a close relationship impacting each other, directly deciding on the quality and efficiency of completing the contents of the fight against transnational crime in each defining situation. Therefore, implementing the content of this solution is extremely urgent and considered as a basic and long-term solution throughout the process of organizing the implementation of preventing and fighting against transnational crime. In particular, special attention is given to implementing a number of key contents: regularly updating and supporting equipment and information for all organizations, forces and socio-political organizations of the local political system in north-western Vietnam to grasp the situation in the area, especially details about the organization and operation of transnational crimes; fostering professional skills of fighting against transnational crimes for socio-political organizations, forces and organizations of the grassroots political system in the north-western region of Viet Nam; promoting the role of cadres in socio-political organizations, forces and organizations of the basic political system in north-western Vietnam to actively self-study and improve their capacity in transnational crime preventing and fighting.

Thirdly, building a strong political system in north-western Vietnam to meet the requirements in order to fight against transnational crime.

The basic political system in the Northwest consists of institutions with specific functions and tasks that have existed and operated in the general political system of the country. Therefore, construction activities here need to be broadly identifying that it should includee building a new one with rectification, repairing, and getting rid of limitations and weaknesses, in order to make the perfect political system. The facilities in the Northwest region, as a result, will be stronger and will operate effectively. In that sense, "construction" will be a regular job for the grassroots political system in the Northwest.

It can be said that building a strong base political system in the Northwest is the overall positive, self-conscious and planned policies and measures of the owners and forces in strengthening and contributing to the organization, operation mechanism and mode of operation of the basic political system suitable for the view, the Party's line, the Constitution and the Law of the nation, in accordance with the actual conditions of the Northwest, ensure that the basic political system is always strong, well performing its roles, functions and tasks to meet the requirements of maintaining political stability, economic, cultural and social development, promoting mastery, ensuring and improving people's lives, strengthening national defense, security and social order and safety, contributing to the victory of the task of combating transnational crimes in the Northwest.

As a whole system of constituent organizations, the content of building a basic political system in the Northwest includes building organizations of a strong base political system; develop regulations and instructions to ensure the operation of the basic political system in the Northwest area to operate smoothly and strictly. Therefore, building a strong basic political system should focus on a number of main contents and major measures such as: building a strong base political system; improving the management and administration capacity of the government apparatus, focusing on building a real government of the people, by the people and for the people; building the Fatherland Front and people's organizations at a strong base, operating in accordance with their functions and tasks; promoting the propagation of transnational crime prevention and fighting, associated with the socio-economic development, gradually improve people's lives in the area.

Fourthly, promoting the positive of the basic political system in northwestern Vietnam in transnational crime prevention and fighting.

The quality of all activities is always governed by objective and subjective factors, in which the internal subjective factors are considered to play the decisive role. Therefore, in the fight against crime in general, the fight against transnational crime particularly requires the subject of the basic political system in the Northwest to promote the positiveness and activeness in the fight against crime, in learning and training in all aspects. The higher the activeness, initiative and creativity in the work of the basic political system in the Northwest, the higher the quality of crime prevention and fighting activities, the more the capacity of transnational crime prevention and fighting capacity is constantly strengthened, developed and perfected.

The practice has proved that if the subject is a cadre at the party committee level, party organization, local government, Fatherland Front, socio-political organizations; commune police officers, ... who is not active, doesn't take pain in learning, training in the practice of crime prevention and fighting; knowledge and skills are not strengthened and perfected, even if they are invested in modern facilities and technical equipment, they are sent for professional training and qualifications, the capacity to fight crime prevention and fighting cannot be developed. Therefore, promoting the positive and proactive of the subject of the basic political system is a very important issue.

Fifthly, completing the mechanism of coordination and cooperation between socio-political organizations of the basic political system and between the basic political

system and the specialized forces standing in the area in the fight against transnational crime.

Mechanisms for coordination and cooperation between subjects in the performance of transnational crime prevention and fighting tasks in the Northwest are specific principles and regulations to ensure the leadership, direction and organization of the implementation of the entire basic political system for this work to be carried out smoothly; at the same time, it also serves as a legal basis to guide the activities of organizations and forces participating in the implementation effectively, especially in solving complex situations arising in the practice of work, creating general strength, contributing to the successful implementation of objectives, requesting the task of fighting defense., against transnational crime.

For each socio-political organization, force and group of the basic political system in Northwestern Vietnam, the completion of coordination mechanisms and remuneration policies in the fight against transnational crime is a particularly important measure, ensuring a solid legal corridor as well as other favorable conditions to promote the role which is active, proactive and creative for each subject in the fight against transnational crime. The practice of fighting against transnational crime in the Northwest over the years shows that this is always an important issue, it contains a difficult, complex and sensitive nature with the participation of many organizations, forces, and political systems in the area. Therefore, the inevitable problem is the need for legal mechanisms, clearly defined responsibilities, tasks and powers of each organization, force and socio-political organizations of the basic political system in northwestern Vietnam to participate in this work.

Sixthly, fully implementing the remuneration policy for organizations and forces of the political system in the Northwest region in the prevention and fight against transnational crimes.

Crime prevention and fighting in general, transnational organized crime in particular is effective, in addition to completing the operation mechanism and management mechanism, the good implementation of remuneration policies for organizations and forces of the political system in the Northwest now plays a very important role., the impact of policies and the implementation of policy work, taking care of material and spiritual life is the basis and motivation to ensure the staff of the basic political system, especially the staff directly performing the task of combating transnational crime with peace of mind., successfully fulfilling the assigned duties and duties.

The regime and policies for organizations and forces of the basic political system in the Northwest are all provisions on the incentives of the Party, State, ministries, central branches and functional agencies for organizations and forces of the basic political system in the Northwest; both show the interest of the Party and the State, ensure fairness for the contributions of organizations and forces working in the Northwest; and also a driving force for the positiveness and self-enlightenment of cadres, employees and soldiers in transnational crime prevention and fighting activities, contributing to the firm protection of the political security situation and social order and safety of the Northwest region in particular and the whole country in general.

The basic requirements in supplementing and finalizing the regime and policies for organizations and forces of the basic political system in the Northwest region today are to ensure the close combination of the need for state management for the Northwest region with the development of mobility., autonomy of northwestern localities; combining social justice with encouraging organizations and forces of the basic political system in the Northwest region to work with peace of mind and perform their assigned tasks.

3. Conclusion

The fight against transnational crime in northwestern Vietnam is an important political task, the responsibility of all levels, branches, organizations and forces of the basic political system and of each citizen. In the new developments of the practical situation, especially the increasing tendency of transnational

crime activities in size, nature and intensity has been placing increasing requirements for the implementation of prevention and control work of organizations and forces, socio-political unions belonging to the basic political system in Northwestern Vietnam.

Therefore, it is required that the subject of this task always have to stick to the practice to promptly add appropriate and effective solutions. This is a difficult, complex, long-term task that needs to be further studied in depth on both a reasoning and practical side.

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https://doi.org/10.29013/ESR-21-5.6-65-68

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THE MANIFESTATION OF THE EASTERN ROMANTIC SPIRIT IN MINIATURE ART

Abstract. This article describes the romantic features of miniature art, which is considered an aesthetic treasure of the peoples of the East and has great potential to give romance to literary images – on the example of a miniature work.

Keywords: miniature art, aesthetic perception, manuscripts, romantic spirit, "Layli and Mejnun".

The role of miniature art in the aesthetic perception, study and understanding of the world and being around us is great. Reflecting life in literary images, giving it an aesthetic value, is a powerful tool for seeing miniature beauty. He accurately expresses not only the truth of yesterday, but also the life of tomorrow. By revealing the world of beauty to people through its fairy-tale-fantastic, romantic and aesthetic features, it develops their aesthetic tastes, encourages them to acquire knowledge and reason, nurtures their desire to accept everything around them more beautifully.

It is known that Movarounnahr has long been a center for compiling and collecting books. Historical sources indicate that this country has a rich tradition of collecting books and preserving them skillfully. Until the 15th century, the collection of mostly scientific literature was a priority, but from the 15th century onwards, the collection of manuscripts of poetic collections decorated with miniature paintings gradually began to dominate. The patronage of the Great Amir Temur and his successors played an important role in this. Many written sources testify to Temur's special love for books and their creators, and therefore brought to the capital Samarkand not only many rare manuscripts, but also masters of handicrafts, calligraphers, artists, covers from the conquered lands. Unfortunately, these ornate manuscripts, created by masters working in Temur's palace, have not reached us. In the Middle Ages, the fate of manuscripts and libraries was as threatening and often tragic as the fate of people. Apart from the testimonies written by medieval authors, there is not a single name left from Temur's famous library. One can only assume that the level of art of the manuscripts collected here is very high, because these are the best works selected from the libraries of the defeated rulers, as well as unique books prepared by the leading masters of their time from the conquered lands in Samarkand was Temur Palace [1; 10]. Based on these sources, we can say that the fine arts of Central Asia developed in two streams – monumental and miniature color painting. From the 16th century onwards, the only field of applied art was book miniatures. The reason for this was the great importance of fiction in the spiritual life of the peoples of the Middle East. From this period onwards, poetry, fiction, chronicles of historical events began to be expressed not in the form of a dry list of events, but in the colorful language of works of art.

In Islamic teaching, although the depiction of living images and beings is forbidden (this is not explicitly stated in the Qur'an), such a prohibition was applied in accordance with manuscripts with a religious meaning. Literary works, on the other hand, are decorated with various paintings, in spite of such restrictions.

Accordingly, in revealing the romantic world of Oriental literature (especially in poetry), the mood of the miniature painting, within the whole process of decorating manuscripts, could be answered [2; 4].

In fact, romanticism is one of the most important aspects of Central Asian poetry, music, dance, and painting. In the poem, "The peculiarity of the poetic thinking, which is characteristic of the romantic style, is that the poet seeks to integrate the phenomena of nature and the universe into the realm of his world to the extent that the imagination can cover the imagination as well as his closest confidant and companion. There is also a degree of abstraction and generalization, but this commonality manifests itself in the form of an expression of some profound philosophical thought, view, or experience. Depending on the poet's abilities, personal and individual image possibilities, the concepts of nature, life, man, people, history and legends will be different and radiant" [3; 2].

"As with any artistic method, romanticism has mysterious wonders that will fascinate future generations. In an era when Romanticism reigned as a creative method and direction, poetry received extraordinary attention, and even in prose and drama, lyricism grew exponentially and became one of the only means of perception. In the same way the worship of the poet's personality and of poetry, of poetic creation, began. This has led to an increase in the role of poetry. As a result, the main direction, such as the reflection and affirmation of the poetic basis of life, the extraordinary romantic uplift at a higher point, has intensified" [4; 4]. In the fine arts, as in literature and music, the symbols of a particular period are manifested, which are common to all branches of creation and art. Romanticism, as a source of vitality and beauty, also gifted a lot to miniature art. Among the artistic styles used in Oriental miniatures, special attention is paid to romanticism. The themes of Love and Beauty as a branch of Sufi aesthetics served not only the development of poetry but also of the fine arts.

The manuscripts "provide miniature art with many themes and plots, and are decorated by representatives and artists from Tabriz and Shirvan to Herat and Bukhara schools." Nizami's "Khamsa" and Firdavsi's "Shohnoma" were the most decorated literary works with miniatures [5; 19].

In addition, we have received invaluable miniature works by Amir Khusrav Dehlavi, Abdurahmon Jami, Alisher Navoi and Saadi, which are among the treasures of world masterpieces. This, in turn, testifies to the fact that literature had a great influence on the formation of miniature art and laid the foundation for its development.

The theme of love in art has also played an important role in Oriental painting (miniatures depicting Farhod and Shirin, Layli and Mejnun, Yusuf and Zuleyha, etc.). In the Eastern miniature, which depicts Sufi poetry through images, the romantic feelings of the heroes, their Sufi interpretation are depicted using figurative means, colors, lines, metaphors, symbols and symbols, so that only those who are aware of the outward and inward teachings of Sufis can understand [6; 5].

Kamoliddin Behzod, the incomparable artist who brought the Herat miniature school to its peak, as a painter, deeply understood the beauty of the world. He was able to see the uniqueness and beauty around him because of the tenderness of his heart. Behzod worked on thousands of miniature images during his lifetime. He created an art school in the fine arts with his own style and style. Well-known orientalist A. Yakubovsky expressed the following opinions about Behzod: "The value of Behzod's work is determined by the brightness of the colors in his works and the proportionate elegance. The value of an artist's work is determined, first of all, by his serious approach to the subject. He not only created wonderful portraits (photo by Hussein Boykaro), beautifully depicted the ceremonies in the palace ("Reception in the Garden of Timur", "Zafarnoma"), depicting the battles, but also accurately reflected the life of ordinary people" [7; 29–30]. The delicate lyricism and romantic spirit inherent in the artist's work are especially evident in Nizami's Hamsa (late 15th century;

British Museum) and Amir Khusrav Dehlavi's Layli and Mejnun (Saltikov-Shchedrin Library) [8; 12].

In the XV–XVI and later centuries, Kamoliddin Behzod's students could be found in Herat, Tabriz, Bukhara, Samarkand, Sheroz, Isfahan, Istanbul, India, as well as in many other cities of the great East. More than a dozen famous artists, such as Sultan Muhammad, Qasim Ali Chehrakushoy, Darvish Muhammad, Ustad Muhammadi, Muzaffar Ali, Yusuf Mullo, Rustam Ali, Shaykhzoda Khurasani, Shah Muzaffar, Mir Said Ali, Mahmud Muzahhib, Abdullo, who continued with great success [9; 232].

Continuing the creative traditions of Kamoliddin Behzod, some of the artists in their miniatures addressed the themes of folk life, fairy tales and instructive plots, while others, in a slightly modified form, continued his romantic style and followed exactly the classical creative norms of Behzod. But for all it was customary to adhere to the perfection of line and color, and to use vibrant colors in their miniatures like Behzod.

When we compare the miniatures created by the artists with the poetic lines of the literary works, we see that they not only revealed the content of the work, but also showed great artistic fantasy and creativity. In doing so, they "added an abundance of live observations in addition to the real reliability side of the painting style" [10; 181]. Miniature artists not only narrated the details of the text, but also tried to make it a complete story, continuing it logically, creatively processing the situations depicted. As an example here is a miniature of Mir Said Ali, a student of the genius of the Herat miniature school Kamoliddin Behzod, "In front of the tent of Mejnun Layli." In his work, Nizami skillfully conveys the madness of Madonna and the feelings that surround her to Layla, while the artist describes in detail the life and lifestyle of the nomads, as well as the image of a shepherd playing a flute, giving the story a romantic meaning. filled in the way. It should be noted that researchers, in particular, K. Kerimov, described this feature of miniatures as "animation of miniatures with additional characters that are not provided in the literary plot" [11; 17].

Much of the spacious space in the miniature is filled with white tents adorned with luxurious curtains and ornaments. At the top of the miniature, on a distant hill, is an old man leaning on his cane and a shepherd playing a flute. This view, combined with the image of a flourishing landscape and white clouds in the blue sky, creates a wonderfully colorful landscape. The fact that the image in the miniature is not directly related to the literary plot, but at the same time vivid and detailed, further enriches the main content and romantic spirit of the work.

It is known that some musical instruments have a special place in the lives of members of the Sufi order. In particular, the flute was considered to be a symbol of purity, justice, righteousness, and at the same time the anguish of the soul that was suffering the loss. For example, the image of a shepherd playing the flute, depicted at the top of Mir Said Ali's miniature "In front of the tent of Mejnun Layli", has a special aesthetic meaning. "In this composition, a madman with a heart full of love and a shepherd playing the flute are depicted in the same sky, in the same place. The flute, a symbol of the soul suffering from separation, tells the story of a mad lover in love" [12; 12]. The environment depicted in this miniature, the "flute" instrument, which has a certain symbolic meaning, is important not only for gaining knowledge about the musical world of a certain period, but also for understanding the romantic spirit of the work.

In short, Eastern Romanticism is known to the whole world, to the whole world of scientific thought, to the world of art for its miraculous, powerful poetics and mysteries rich in hidden depths, and has amazed with its rich experience for centuries. This great miracle, which fascinates the whole world of humanity with its magical world, is the great contribution of the peoples of Central Asia, artists, poets and writers, and, of course, artists, to such a powerful and artistic and aesthetic power.

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Section 9. Chemistry

https://doi.org/10.29013/ESR-21-5.6-69-74

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INFLUENCE OF INTERNAL PROCESSES IN AQUEOUS SOLUTIONS OF SURFACTANTS ON THEIR TECHNOLOGICAL PROPERTIES

Abstract. It is known that the ability of surfactants to remove impurity is associated with their adsorption activity at the corresponding phase boundaries.

In this work, it is suggested that the achievement of conditions conducive to an effective purification process is realized under the influence of adsorption and micelle formation processes, which simultaneously occur in aqueous surfactant solutions, when a certain concentration of the latter is reached.

A number of experimental data are presented that confirm this assumption.

Keywords: adsorption, micelle, surface-active agent, critical micelle formation concentration, surface tension, micelle formation, adsorption capability.

Detailed study of the processes occurring in aqueous solutions surface-active agents (surfactants) is very important for predicting their technological properties, such as their detergent.

In work [1], the possibility of correlation between the processes of adsorption and micelle formation, occurring in aqueous solutions of surfactants. The suggestion was made that such a relationship can affect the technological properties of surfactant solutions and, in particular, their effect of washing.

According to [2], the ability of aqueous surfactant solutions to eliminate contamination is associated with their adsorption activity at the corresponding interface. Consequently, as follows from the well-known Young's equation [3], the required value of the contact angle is achieved and the subsequent removal of contamination (oil) due to the sedimentation force takes place [4]. As defined in [2], the realization of such a state, like other technological properties (emulsification, dispersion, solubilization), depends on the ratio of water- and oil-soluble parts of the surfactant, that is, their hydrophilic-lipophilic balance. Also worthy of note are works [5; 6], which relate the surfactant adsorption at oxidized solid (for instance, cleanable) surfaces with the ionization potentials of the adsorbed surfactant.

In our view, except for the specified factors, account should be taken of the circumstance that the washing process is carried out in a surfactant solution, where adsorption and micelle formation processes

occur simultaneously. As shown in [1], this affects such features as the amount of surfactants in the surface layer and the surface tension at the interface, which, therefore, forms the thermodynamic conditions necessary to eliminate contaminants from the surface to be cleaned.

It can be assumed that the simultaneous occurrence of adsorption and micelle formation impacts not only on thermodynamics, but also the kinetics of technological processes in surfactant solutions. Let us assume that, as a result of numerous collisions with each other, large aggregates (micelles), and other components of the solution, some surfactants acquire a certain storage of energy. Hence, they will not just accumulate at the interface, but also actively influence the state of the latter, thereby destroying the continuous film of contamination and accelerating the transition of the oil droplet to the equilibrium value of the contact angle. The number of such collisions depends on the nature and concentration of the surfactant, the number, size, and type of micelles.

Taking into account the kinetic factor seems to be important, since all technological processes have strict time limits. This explains the use of external factors increasing their speed. Such factors, leading to an increase in the energy storage in surfactants, include, for example, stirring the washing solution and increasing its temperature. This can also be associated with the use of an electric field and ultraviolet radiation in the cleaning process (in addition to the effects of gas release, cavitation, etc.).

The suggested approach is identical to one of the basic laws of chemical kinetics, according to which only the so-called "active" molecules with a sufficient supply of energy participate in the chemical process [7]. The same approach is used when describing diffusion, where particles must have enough energy to move in a stationary medium [7].

It follows from the above considerations that washing solutions having similar adsorption characteristics, but differing in the energy storage of the surfactant, can provide different cleaning rates, that is, differ in their effectiveness.

The quantitative assessment of the effectiveness of washing solutions is carried out mainly by two methods: as regards the mass of removed oils to their initial amount (effect of washing, EW) [8] or in terms of the part of the surface cleaned in a given time (active surface, S_{act}) [9]. The second method seems to be preferable, since the main purpose of cleaning is precisely to free the surface from contamination, to carry out further technological operations on it (painting, applying a phosphate film or electroplating, etc.).

It is known from the chemical kinetics that the process rate (W) is defined as the change in the amount of the reactant for a certain period of time [7]. By analogy, the decontamination rate can be calculated as the change in the part of the cleaned surface, in a given time (τ):

$$W = dS_{act}/d\tau \qquad (1)$$

From the dependency graph of S_{act} on τ, the process rate is determined by the tangent of the angle of inclination between the segments characterizing the change in the part of the cleaned surface for the corresponding time interval [7].

According to the law of mass action, the rate of a chemical process depends on the amount of reactants [7]. By analogy, the rate of the cleaning process should depend on the size of the cleaned surface:

$$W = K(S_{act})^n \qquad (2)$$

where K is the process rate constant (a value dependent only on temperature), n is the order of the process.

In chemical kinetics, to describe activity of molecules, such feature as the activation energy (E) is used, that is, the additional energy that particles need to participate in the process [7]. According to [7], the value of E can be calculated using the following equation:

$$\ln (K_2/K_1) = E(T_2 - T_1)/RT_1T_2 \qquad (3)$$

where K_2 and K_1 are reaction rate constants at temperatures T_1 and T_2, respectively, R is the gas constant.

Assuming that the rate of the washing process obeys the laws of chemical kinetics, one can use the equations given earlier to characterize the effect of

surfactants on the treatment efficiency. For instance, having data on the change in S_{act} dependent on time, obtained in a solution of the surfactant under study at temperatures T_1 and T_2, it is possible to calculate the cleaning rate (W_1 and W_2) corresponding to the same value of S_{act}, using (1).

Further, using (2), we obtain the ratio of the rate constants at two temperatures:

$$W_2/W_1 = K_2/K_1 \quad (4)$$

The obtained value of K_2/K_1 is substituted into (3) to determine the activation energy.

However, it should be noted that the washing process takes place in multicomponent systems containing, in addition to surfactants, a solvent (e.g., water) and, if necessary, a number of inorganic compounds. An aqueous solution of inorganic substances cannot be generally considered as an inert medium in which surfactants are dissolved. For example, in the case of degreasing metal surfaces, one should take into account the processes occurring on the surface of the substrate to be cleaned when it comes into contact with inorganic components of the solution.

In this connection, it is known that metal surfaces undergo oxidation when exposed to water and solutions of inorganic electrolytes [10; 11]. We also note the possibility of particular adsorption of ions of inorganic compounds on the substrate (for instance, OH^-, Cl^-, PO_4^{3-}) [12].

The electrostatic factor associated with the presence of an electric double layer at the metal-solution interface should also be taken into account. According to [12], in some cases this contributes to the removal of organic oils from the substrate surface.

In addition, we note the possibility of direct interaction of inorganic compounds with components of contamination (for example, saponification of fats in alkaline solutions).

The listed spontaneous processes are accompanied by a decrease in free surface energy at the substrate-solution interface, which creates the prerequisites for removing contaminants.

Therefore, despite the fact that water and aqueous solutions of inorganic compounds do not exhibit surface activity at the oil-solution interface, they, along with organic surfactants, can have a certain detergency effectiveness. This is confirmed by the data shown in (Figure 1).

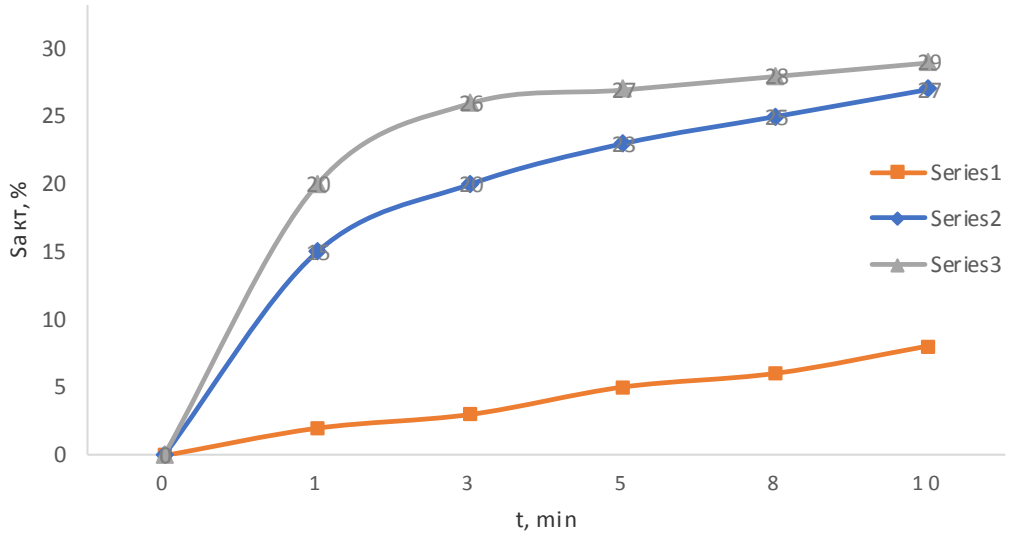


Figure 1. Dependence of the steel cleanliness level on the time of degreasing in inorganic solutions (mod. Contamination – paraffin, temperature 333 K) Series 1 – H_2O; Series 2 – NaOH (0.1M); Series 3 – NaCl (0.1M)

Consequently, the degree of purification achieved in an aqueous surfactant solution results from the mutual action of all components. And it is incorrect to relate the activation energy value obtained according to (3)

only to the surfactant additive. Nevertheless, taking into account that water has a relatively low cleaning ability, it is possible, as a first approximation, to apply (3) to analyze the detergent properties of various surfactants.

To illustrate this effect, we have chosen two molecular surfactants having the general formula $C_nH_{2n+1}O(C_2H_4O)_mH$: synthanol DS-10 (n = 10–18, m = 8–10) and OS-20 (n = 14–18, m = 20). Furthermore, we followed the fact that these surfactants have almost the same effect on the state of the oil-solution, metal-oil, and metal-solution interfaces.

The state of the oil-solution interface was studied by the decrease in interfacial tension as a result of adsorption (the stalagmometry method was applied).

To study the effect of a surfactant on the state of the substrate-oil interface, weighed portions of the surfactant were dissolved in oil. Then, a water drop was applied to the steel substrate, the sample was immersed in a glass cell filled with sample contamination, and the contact angles (θ) were measured in the steel-water-oil system.

The data on the effect of surfactants on the state of the substrate-solution interface were obtained by measuring the contact angles in the three-phase steel-solution-air system. Taking into account that the free surface energy of the metal-air interface is constant, with reference to Young's equation, we can write:

$$s_1 Cos\theta_1 - s_0 Cos\theta_0 = DG_{met/sol} \quad (5)$$

where s_0, s_1 are the surface tension of water and surfactant solution, respectively; θ_0, θ_1 are the contact angles in water and surfactant solutions; $D G_{met/sol}$ is the change in the surface free energy during the adsorption of surfactants at the metal-solution interface.

As evidenced by the data given in Table 1, micellar solutions of the selected surfactants almost equally reduce the interfacial tension at the oil-solution interface. In addition, they are not adsorbed from the oil on the substrate surface (the contact angle changes insignificantly after the introduction of these surfactants into the oil); their adsorption from an aqueous solution on the substrate surface has almost the same effect on the interface energy state.

Table 1. – Values of parameters characterizing the adsorption of aqueous solutions of the surfactants under study at different interfaces

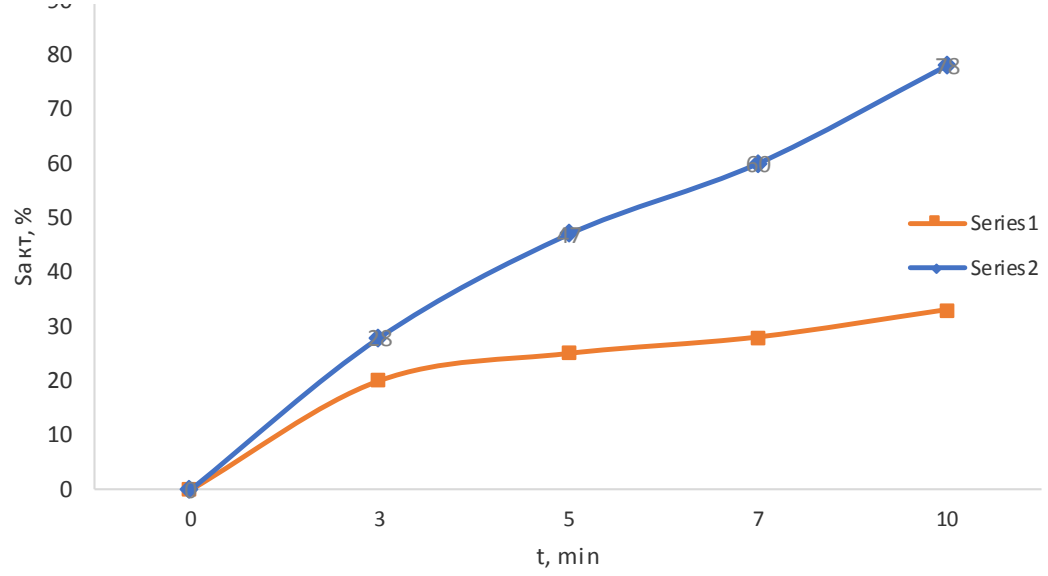
Item	$g_{met/sol}*10^3$, J/m²	θ	$DG_{met/sol}*10^3$, J/mol
Water	51.1	–	0
Oil (decane)	–	66.6^0	–
Synthanol DS-10	9.3	67.5^0	–14.3
OS-20	10.8	67.2^0	–14.5

Moreover, as evidenced by the data shown in (Figure 2) (a and b), the purification efficiency in solutions of these surfactants (achieved within the same time frame) differs significantly.

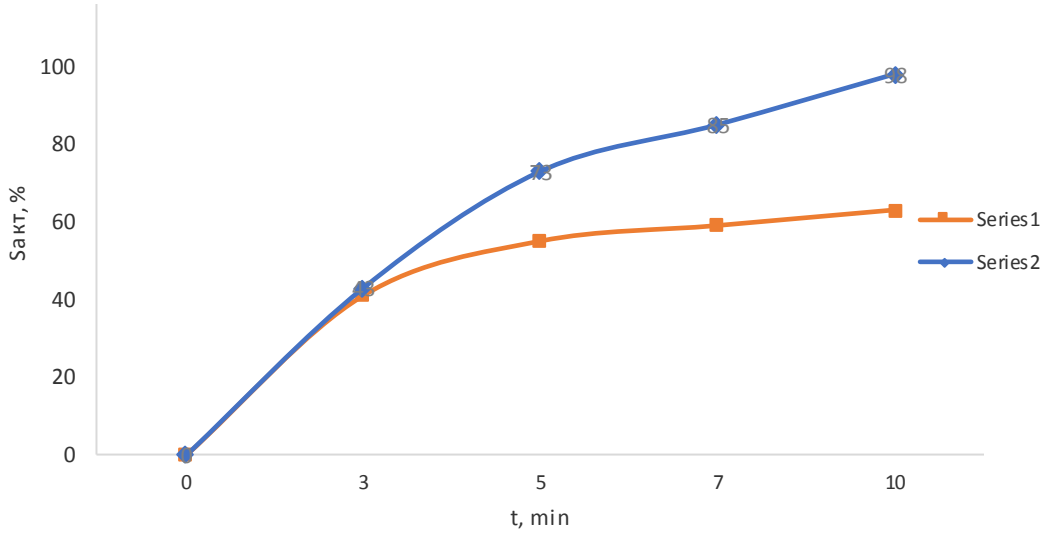
Calculations carried out using equations (1–4) showed that in the case of synthanol DS-10, the value of activation energy is approximately 35 kJ/mol, and when using OS-20–109 kJ/mol, i.e., molecules of the first surfactant have a larger energy level. According to the previously stated considerations, this probably explains a higher rate of purification in a solution containing synthanol DS-10.

The data given in [1] demonstrate that the adsorption of molecular surfactants from their micellar solutions is often accompanied not by the heat release, as it follows from the condition of a spontaneous process, but by the heat absorption. It can be assumed that the effective impact of synthanol DS-10 on the washing process results from the fact that the composition of this technical agent includes $C_{10}H_{21}O(C_2H_4O)10H$, $C_{12}H_{25}O(C_2H_4O)8H$, $C_{14}H_{29}O(C_2H_4O)10H$ fractions, the adsorption of which proceeds exothermically, with the release of some supply of energy.

It is likely that this energy contributes to the intensification of the removal of contaminants from the substrate surface due to an increase in the energy storage of surfactant molecules. Let us stipulate that the stated hypothesis needs further experimental verification.



а)



б)

Figure 2. Dependence of the steel cleanliness level in aqueous surfactant solutions on time (contamination – paraffin; surfactant concentration – 2.5 g/l; a) – temperature 333K; b) – 353K): series 1 – OS-20; series 2 – synthanol DS-10

It is also worth mentioning that the effectiveness of the surfactant in the cleaning solution depends on the type of contamination to be removed. As follows from (Figure 3), an aqueous solution of synthanol DS-10 has a low detergency effectiveness when removing sample contamination from the steel surface (a mixture of I-50 industrial oil and solid oil). An increase in temperature has little effect on the cleaning efficiency. Probably, the energy storage of this surfactant molecules is not sufficient to destroy the oil layer.

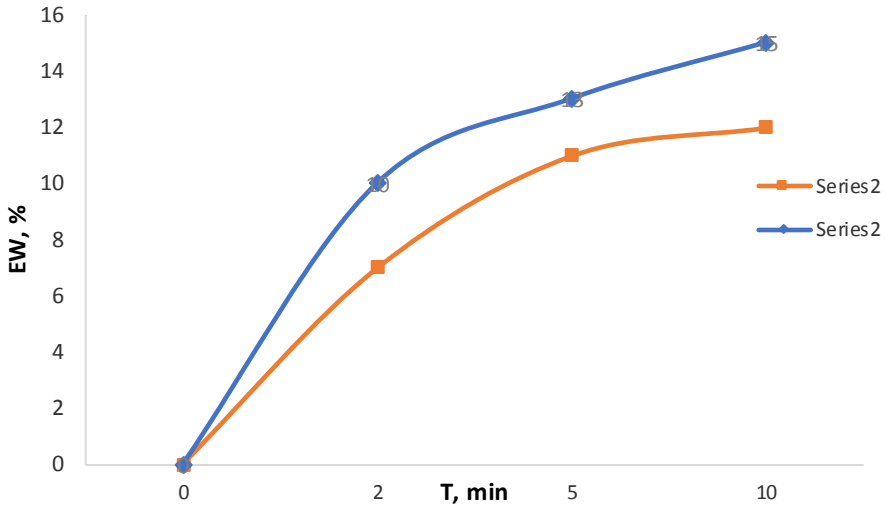


Figure 3. Dependence of the effect of washing of an aqueous solution of syntanol DS-10 on time (surfactant concentration – 2.5 g/l; the composition of the sample contamination (% vol.): solid oil – 4, industrial oil I-50–96) series 1–333K, series 2–353K

As can be seen above, the joint occurrence of adsorption and micelle formation in aqueous solutions of surfactants affects the efficiency of the washing process, which should be taken into account when developing new cleaning compositions.

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Section 10. Economics and management

https://doi.org/10.29013/ESR-21-5.6-75-78

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PROBLEMS OF STATE DEBT MANAGEMENT OF GEORGIA IN THE PANDEMIC

Abstract. The COVID-19 pandemic caused the economic crisis in Georgia, as well as in many other countries of the world, and aggravated economic, social, cultural, educational, and other problems. Due to the pandemic, the restrictions and regulations introduced by the state sharply hindered economic activity, increased unemployment, aggravated inflation, and made the social problems of the population even more unbearable.

The Georgian government has been forced to increase public debt, which has been growing in recent years and is a heavy burden on the country's population.

The paper analyzes the measures taken by the Government of Georgia to overcome the crisis caused by the pandemic and expresses views on the potential challenges of the post-pandemic period, the tendency of public debt growth, the peculiarities of management.

Keywords: COVID-19 pandemic, public debt, public debt management.

The advent of COVID-19 has changed the agenda of the whole world. The pandemic has significantly affected the Georgian economy. According to the National Statistics Office of Georgia, in

November 2020, compared to the same period of the previous year, the decline in the real gross domestic product(GDP) was 7.7 percent, while the average for the first eleven months of 2020 is –5.9 percent [1].

On September 15, 2020, according to a preliminary assessment by the International Monetary Fund (IMF) mission, the impact of the pandemic on healthcare in Georgia was successfully controlled, although Georgia's foreign policy deteriorated as tourism revenues virtually disappeared. In March 2020, compared to March 2019, the number of tourists decreased by 56.1%, and the income from tourism – by 26.1%; There was a 9% decrease in the number of remittances. In 2020, the foreign trade turnover of goods in Georgia amounted to 11347.7 million USD, which is 14.8 percent less than the corresponding figure of the previous year. At the same time, prices have risen significantly. Annual inflation was 6.3%, and core inflation was 4.2% [1].

To reduce the social and economic impact of the pandemic, with significant support and funding from the international community, the government was able to implement significant fiscal support measures: the government increased social spending, introduced temporary tax breaks for residents and businesses, to maintain its activities, subsidies were allocated to the pandemic-affected sectors, the National Bank of Georgia eased capital and supervisory requirements, etc.

To limit the spread of the epidemic, emergency regulations were enacted in many countries around the world, including Georgia: movement was restricted, municipal services, educational institutions, and trade facilities were moved to remote operation mode, crowded events were banned, social distance protection became mandatory, etc. Although a comprehensive social and economic assessment of the effects of these measures has not yet been made, studies indicate that strict measures may have managed to control the spread of the virus but almost completely halted economic activity, further aggravating the living conditions of the income-poor population.

Given the negative impact on certain sectors of the economy in the face of restrictions, employment is expected to decline in Georgia. According to the PMCG forecast, according to the optimistic scenario, the total number of employees in Georgia will decrease by 6.3%, according to the less pessimistic scenario – by 9.8%, and in case of a very pessimistic scenario – by 14.4%. Naturally, the unemployment rate will increase; The negative impact of the pandemic will change the structure of employment in Georgia and make the self-employed group, which according to 2019 data constitutes 44% of the labor force [2].

Mobilization of funds has been put on the agenda to take measures to stop the spread of the pandemic across the country, to optimize the health sector and improve the infrastructure, to provide the population with vaccines, to provide social support, to help entrepreneurs, to promote economic recovery. Due to the crisis in the country, the Government of Georgia has mobilized two billion GEL in the state budget for 2020, which was aimed at supporting the country's economy. In addition, GEL 351 million was allocated to the budget for the challenges related to the COVID-19 pandemic in the health sector [3].

Government debt consists of two parts: government debt and the National Bank's external debt. Public debt can be seen as one of the tools to stimulate economic growth. However, inefficient public debt management may lead the country to crisis instead of economic growth. Therefore, prudent management of public debt is important to ensure the sustainable development of the country. The debt of the Government of Georgia includes domestic and foreign debts. Government domestic debt as of 30–04–2021 amounts to 5 billion 871 million GEL. External debt – 25 billion 949 million GEL [4].

By 2021, public debt will increase to a total of 33.7 billion GEL, and GDP is expected to exceed 60%. Debt increased by +1.4 billion GEL and +7 billion GEL in 2019 and 2020, respectively in 2021, it is expected to increase by +2.5 billion GEL. In 2021, the cost of debt service will increase to 7.2% of the

budget. The debt service burden on the budget will increase to 918 million GEL in 2021 (+314 million GEL compared to 2019). Under the depreciation of the GEL exchange rate, the debt burden is expected to increase even more [5].

Undoubtedly, taking on external debt is an important way to attract financial flows. The Georgian government has been using foreign loans since 1992. In the 1990s, Georgia had virtually no choice but to turn to foreign governments and international financial and credit organizations to solve the problems of the transition to a market economy. External debt consists of government sector debt, as well as commercial and National Bank foreign debt and intercompany loans. Over the years, Georgia has accumulated a considerable amount of foreign debt. At the end of 2019, gross external debt increased by 3.9 percentage points compared to the previous year and amounted to 105.1 percent of GDP [6]. The increase was mainly due to the increase in the government sector and bank debt. According to the data of January 2021, the state foreign debt of Georgia is almost 7 billion 800 million dollars, which is more than 25 billion GEL. External debt plays a key role in financing Georgia's economic development and infrastructure projects.

Foreign debt for any country is determined by the ratio of external debt to the country's gross domestic product. According to the recommendations of the International Monetary Fund, the debt ratio of developing economies to GDP should not exceed 40–50%, as the increase of this indicator threatens the stability of the country's macroeconomic indicators and makes the country more vulnerable to the expected economic shocks.

Another indicator of the country's external debt burden is the number of liabilities per capita. In 2019, this figure is about 5600 GEL, and in 2020, this figure has increased to 7400 GEL. Georgia owes its foreign debt in dollars, so the depreciation of the lari makes the foreign debt more expensive and the burden on each population increases even more. It is also important that a large number of dollars flow out of the country at payment, which directly affects the value of the national currency and the exchange rate. It should be noted that in the fourth quarter of 2020, the nominal effective GEL exchange rate depreciated by 3.3% quarterly and by 3.0% annually. As for the exchange rate adjusted for price level differential, in the fourth quarter of 2020, the real effective exchange rate depreciated quarterly and annually by 3.4% [7, 12].

It should be noted that before the pandemic, Georgia was a country of medium debt and also met the recommended limit of international financial institutions. The country borrowed an additional 10.2 billion GEL in 2020, and as of December 31, 2020, Georgia's foreign debt amounted to 30.9 billion GEL. According to the draft government budget for 2021, the country plans to take on 2 billion 174 million foreign debts and at the same time plans to repay the foreign debt with 2 billion 640 million GEL. Particular importance is attached to the efficient spending of finances and the reduction of corruption risks [8, 18].

We think that with the gradual easing of restrictions, economic activity in the country will improve. However, the start of the vaccination process has created positive expectations for the end of the pandemic. According to the International Monetary Fund (IMF) forecast for January, if the global economy shrinks by 3.5% in 2020, global growth of 5.5% is expected in 2021. As for developing countries, their real economies will shrink by 2.4% in 2020, while growth is projected to grow by 6.3% in 2021 [7].

Conclusion. We think the gradual lifting of restrictions will significantly reduce the economic and social losses that each day of restrictions would cause. It is important to reduce government spending not only in the pandemic, but also in the post-pandemic period, and to make rational use of budget allocations for them in public institutions; In addition, the transparency of this process should be ensured. The government should fully provide the population with vaccines, tests, and appropriate

equipment. Georgia, like the rest of the world, faces the greatest challenge, the government needs to draw up a detailed plan to reduce public debt to rebuild its economy and effectively manage its public debt; Plan tax revenues taking into account post-pandemic risks.

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https://doi.org/10.29013/ESR-21-5.6-79-82

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THE POST-PANDEMIC WORLD TOURISM REVIVAL EFFORTS

Abstract. The pandemic crisis is creating a great hardship for local communities of low-income and developing economies like of Georgia, since they considerably depend on tourism and therefore face a serious risk of higher poverty. Policy action at national and international levels, as well as heightened coordination, are essential across sectors and borders. Key policy priorities include: restoring traveler confidence; supporting tourism businesses to adapt and survive; promoting domestic tourism and supporting safe return of international tourism; providing possibly clear information to travelers and businesses limiting uncertainty; evolving response measures to maintain capacity in the sector and address gaps in supports; strengthening co-operation within and between countries, building more resilient, sustainable tourism; taking steps to learn from the crisis to perform a coordinated action across governments at all levels and the private sector.

Keywords: tourism, pandemic, measures, policies, crisis, shifts, recovery.

Introduction: Tourism generates foreign exchange, supports jobs and businesses, drives regional development and underpins local communities. Before the pandemic, the sector directly contributed 4.4% of GDP, 6.9% of employment, and 21.5% of service exports in OECD countries; and 6.5% of global exports [1]. The UN World Tourism Organization now foresees a decline in international arrivals close to 70%, with recovery to pre-crisis levels not expected before 2023 [2].

UNCTAD, estimates that global GDP losses due to the crisis in tourism could amount to 2.8% of the world's GDP (USD1.2 trillion), if international tourist arrivals drop by 66%, with the consequences most marked in countries like Croatia (potential drop in GDP of 8%), Portugal (6%), Morocco (4%), Greece (4%), Ireland (3%) and Spain (3%). This could rise to a fall of 4.2% of world's GDP (USD3.3 trillion) if international tourism flows are at a standstill for 12 months [3].

The World Travel and Tourism Council calculates that up to 174 million jobs were at risk globally in 2020. The European Commission's Joint Research Centre forecasts that between 6.6–11.7 million jobs in businesses operating and/or dependent on tourism-related activities could be at risk of reduction in working hours or permanent losses in 2020, representing between 3.2% and 5.6% of the total active population in the European Union [4].

Policies undertaken by countries: Tourism continues to be one of the sectors hardest impacted by the

coronavirus pandemic. Encouraging news on vaccines has accelerated hopes for recovery but challenges remain and the sector is still trying to survive in 2021. International tourism requires global co-operation and evidence-based solutions to truly and completely restore and reactivate the sector. Governments have taken impressive immediate action to build a more resilient tourism economy post COVID-19. For example: [5] **Thailand** allocated $700 million to spur domestic tourism, while **Vanuatu** offered grants to small and medium-sized enterprises. In **Jamaica**, the government gave free online training certification classes to 10,000 tourism workers to help improve their skills. In the same country an online platform was launched that allows buyers in the hotel industry to directly purchase goods from local farmers. In **Costa Rica**, national holidays have temporarily been moved to Mondays to boost domestic tourism by extending weekends. **Barbados** introduced a 'Welcome Stamp' visa – a one-year residency permit that allows remote employees to live and work from the country. Similarly, **Fiji** launched a Blue Lanes initiative that allows yachts to berth in its marinas after meeting strict quarantine and testing requirements [5].

Tourism businesses of **Singapore** have displayed immense resilience and adaptability throughout the difficult period, reinventing their business models and leveraging technology to find solutions in a COVID-19 world. As of the first month of 2021, 45 attractions, 270 hotels, and 1,686 tour itineraries have received approval to resume operations; Singapore Tourism Board (STB) has issued more than 1,390 SG Clean Quality Mark certificates to tourism-related premises; 33 cruises carrying over 42,000 passengers have been completed with no reported incidents of COVID-19 transmission on board; there were 1,145 promotions offered by 213 merchants: STB launched the S$ 320 million SingapoRediscovers Vouchers scheme in December 2020; over 300,000 Singaporeans had used the scheme to make bookings with Singapore hotels, attractions and tours, spending S$ 35.9 million in redemptions and out-of-pocket payments. STB also forged new partnerships with e-commerce players, banks, payment gateways and online travel agents to promote Singapore tourism offerings, exchange insights and enhance visitor experiences. STB partnered with technology, media and tourism industry players in key source markets to jointly promote Singapore as an attractive destination for future travelers. To build new digital capabilities, STB united with digital players such as Facebook, LinkedIn, Airbnb Experiences and Amazon Explore to conduct online Masterclasses or workshops for the tourism industry [6].

[7] On May 14, 2021 **Greece** opened its borders in a safe and attainable manner with strict requirements for travelers before and upon arrival proving ready to welcome visitors applying advanced health protection protocols. In 2021, Greek Tourism is settled to operate with the maximum safety possible, for tourists, employees and every person involved in the provision of tourist services.

The protocols have proved effective, and will be updated according to epidemiological conditions. The Ministry of Tourism and the Hotel Chamber of Greece will provide certification to all lodgings that apply these protocols. Moreover, training material will be provided to the employees of these businesses, in order to ensure the correct application of all health and safety measures against Covid-19 [7].

Turkey – a host of millions of tourists every year offers the "Tourist Protection Support Insurance" and "Extra Accommodation Cost Guarantee" in a single package for a more enjoyable and safe vacation. The project, implemented by Turkey Sigorta under the leadership of the Republic of Turkey, enables tourists enjoy their holiday with the mentioned policies whilst leaving the fear of Covid-19 that took over the whole world behind [8].

EC Measures: [9] The European Commission has put in place a number of measures to support the travel and tourism sector:

1. In May 2021, it adopted the tourism and transport package of initiatives and common cri-

teria. The package aims to help member states lift travel restrictions within the EU and allow tourism businesses to reopen respecting necessary health precautions.

2. In June 2021, a dedicated website and a mobile application REOPEN EU with an interactive map was launched, to provide tourists and travelers with relevant information on safe travel in the EU.

3. 100,000 small businesses hit by the crisis were financed up to €8 billion through the European Investment Fund.

4. To allow companies to safeguard jobs, the SURE program is helping member states cover the costs of national short-time work schemes and similar measures. The Commission supporting partnerships between employment services, social partners and companies to facilitate reskilling, especially for seasonal workers.

5. In July 2021, the European Council will have reached an agreement on the EU's recovery plan and budget between 2021–2027. It authorizes the Commission to borrow up to € 750 billion on financial markets, € 672.5 billion going to the 'Recovery and Resilience Facility' [9].

Urgent shifts to be implemented: As borders start reopening and interest in leisure rebounds in some regions, governments could take the opportunity to rethink their role within tourism, thereby potentially both assisting in the sector's recovery and strengthening it in the long term. The following basic aspects to be addressed urgently are [10]:

a) Strengthened multilateral co-operation and robust support, collaboration and consistency of travel regulations at bilateral, regional and international levels; safety and security for travelers and workers facilitating safe cross border travel; building more resilient destinations; reinforcement of global co-operation and aid;

b) Governments must approach tourism recovery in a more integrated manner – involving all levels of government, private sector and civil society in a practical and actionable plan.

c) Tourism needs to be reshaped towards responsibility and inclusion. Engagement in a collective reflection on the future of tourism and on the sensitive links between tourism and the environment, more investment in technology, green infrastructure and value-added jobs will lead to a more sustainable, inclusive and resilient tourism sector [10].

The crisis has brought challenges for the sector, but also opportunities to encourage innovation, drive new business models, explore new niches/markets, open up new destinations, and move to more sustainable and resilient tourism development models. Potential shifts on tourism policy involve the following [11]:

1. The environmental impact of tourism will lower;

2. Domestic tourism will benefit;

3. Traveler confidence owing to the crisis may result in a decline in demand and tourism consumption;

4. Traveler behavior will be completely changed. Safety and hygiene will become essential factors to select destinations and tourism activities;

5. Skills shortages in the tourism sector may worsen, as many jobs are lost and workers will redeploy to different sectors;

6. Digitalization in tourism services, including a higher use of automation, contact-less payments and services, virtual experiences, real-time information provision will continue to accelerate;

7. Crisis management will be a particular area of focus based on the integrated tourism policy to support recovery.

Conclusion: The tourism sector risks being among one of the last to recover, with the ongoing travel restrictions and the global recession. This has consequences on many other sectors that support, and are supported by tourism. Regardless some resumption, international tourism activity still remains very limited. Recovery will depend on the evolution of the pandemic, availability of a vaccine (or alternative control measures), and the lifting of travel restrictions, as well as the survival and readiness of businesses throughout the tourism ecosystem to meeting demand, impacts on consumer confidence and travel behavior.

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https://doi.org/10.29013/ESR-21-5.6-83-85

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PROBLEMS OF LAND REUSE

Abstract. A land is an important factor of the social production. In a certain sense, it impossible to produce without a land. In the literal sense, land is the soil of the land, and in terms of social production, land resources include not only the soil of the land, but also other resources created by nature: Forests, water, minerals, flora, fauna, etc.

Land resources can be divided into exhaustive and inexhaustible, limited and unlimited recovery and non-recovery and other signs.

In the terms of reuse, its resources are divided into the following: Renewable (flora, fauna, etc.) And non-renewable (coal, metallurgic ore, etc.) resources. Stocks of non-renewable land resources are defined, their protection implies diligence and finding alternative sources.

Keywords: Land resources, renewable resources. Simple, expanded, reduced reuse. Land resources management, land resources planning. The principle of protection of land resources.

It is known that there is a simple, expanded and reduced reuse of land resources (as a factor of production the reuse of land resources as a production resource and the reuse of land resources as a factor of production differ from each other).

In the case of simple reuse of land resources as a factor of production, the participation of land resources in the production process remains unchanged both quantitatively and qualitatively. Production is repeated at previous fertility levels. Reduced reproduction of land resources as a factor of production implies a reduction in the quantitative and qualitative involvement of land resources in the production process and Reducing the effectiveness of the production.

Extended reuse of land resources as a factor of production is the inclusion of additional land resources in the production process, i.e. increasing production based on the inclusion of additional resources, both extensively and intensively, which increases production efficiency.

In modern conditions, scientific-technical progress, negative natural processes, natural phenomena, drought, etc. increased urbanization and other events, negatively affect the reproduction of land resources. According to the United Nations, 52% of the world's soil is degraded, 2–4 billion hectares of fertile soil are degraded annually, and 32 million hectares of land are lost to drought each year; Due to soil degradation, biodiversity is damaged, 27,000 species disappear every year, 13 million hectares of forest area are lost every year, etc. [2, 15]. The similar situation is here, in Georgia. The total land area in

Georgia is 76284 thousand hectares. 43.4% of which is considered to be agricultural land; Natural disasters damaged 1.5 million hectares of land between 1967 and 2009; 2.5 million hectares of agricultural land were divided into small plots [7, 30] Most of them became unusable for commercial production In the number of regions, especially, in the mountainous ones. Agricultural lands have been deforested for many years due to lack of cultivation and will soon lose their pasture function, etc.

Since in agriculture land is the subject of labor and the main means of production, it is also the basis for the existence of all the resources of the land, without which the existence of human beings is impossible. Therefore the protection of land and land resources must be given special attention, Taking into account the laws of nature. This should be reflected in the constitution of the state, a number of legislations and legislative acts. Unfortunately, the Georgian legislation is not at the appropriate level in this regard. For example, "Forest Code of Georgia" (Art. 24) Allows forest use in the event of a slope of 30–35 degrees, which is the basis for the production of obvious erosion that will turn into landslides. All this has been confirmed by facts in Adjara in recent years.

In today's conditions, the impact of human activities on land resources has acquired such a large scale and danger that the balances in nature are disturbed and the development of productive forces is hindered. Thus, we reiterate that the protection of land resources and nature is essential. It concerns all the nations. The purpose is to develop production, science, culture; to create the desired conditions for the existing and new generations.

Land resources protection is a set of measures of rational use and restoration of land, soil, flora, fauna, minerals, waters, etc.

Land protection is a scientifically based system of international, state and public measures aimed at the rational production and reuse of land resources, keeping the potential of land resources, its improvement and efficient use.

Measures of protection of land resources are as follows: Land re-cultivation, control of soil erosion, restoration and protection of flora and fauna, prudent use of minerals and mineral resources, etc.

The establishment of state management of land resources is the only guarantee that balances the priorities of land resources protection and economic development. This management should develop a program for rational regulation of land resources and implement appropriate measures based on such tools as: prevention, expertise, licenses, law enforcement, monitoring, etc.

Based on these levers, land management and use planning should be done in accordance with the recommendations of the UN Economic Commission for Europe. In particular, an economic policy for the management of land resources should be developed at the state level, and a strategy and coordination for the regulation of land resources at the regional level; at the local level – territorial planning of land resources and granting of priorities.

At the same time, the following principles and rules for the protection of land resources must be taken into account:

- all land resources are of special importance to human beings, which is why they must be thoroughly evaluated. We must approach each event in a way that protects the interests of different industries and the restoration of land resources. For example, forests are a source of timber and chemical raw materials. At the same time, the forest regulate water, protect soil and define the climate. It is a place where people can rest. In such a case, as a matter of priority, the industrial importance of the forest shifts to second place. The same is true of rivers and other land resources.
- Local conditions must be taken into account when protecting and using land resources. This is called a Regional Rule. This especially concerns water and forest resources. Forests are intensively cut out; where there

is little forest, there is a need for forest restoration measures. The same is true for fauna etc.

- The land resources are interrelated. Therefore, the protection of one resource protects another, or even the protection of one resource can adversely affect the existence of another. In particular, the protection of reservoirs is, at the same time, the protection of fish and other inhabitants; forest protection protects the soil from erosion, etc. The opposite situation occurs when the protection of forest-bearing animals hinders forest reproduction, etc.

All of the above mentioned should be taken into account in the process of reproduction of land resources, the main requirements of which should be reflected in the legislation of Georgia, in the economic policy of land resources.

Not to mention this policy, Georgia still does not have a widely developed state economic policy, which negatively affects the reproduction of land resources and the economic development of the country in general.

Conclusion

The presented paper discusses the problems of land resources reuse in terms of land resource protection. Despite the multifaceted division of land resources (exhausted and inexhaustible, limited and unlimited, restored and non-restored, etc.), the reuse of land resources is represented by well-known forms of reuse: simple, extended and reduced.

It shows the greatest negative impact of the modern scientific-technical revolution, the growth of urbanization, negative natural processes, etc. on the reuses of land resources, which ultimately affects the development of society. All this is an indication of the need to protect land resources through land re-cultivation, measures against soil erosion, restoration of flora and fauna, etc. For this purpose, it is necessary to establish appropriate state governance and legislation. Based on it, the management and use of land resources should be planned, taking into account the rational principles and rules for the protection of land resources. Land resource protection legislation has not yet been properly developed in Georgiaб not to mention the state socio-economic policy of land resources protection.

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https://doi.org/10.29013/ESR-21-5.6-86-89

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DEVELOPING COUNTRIES UNDER GLOBALIZATION: ECONOMIC GROWTH AND COUNTRY RISKS

Abstract. The article reflects the outcomes of a quantitative study of the relationship between the processes of globalization and economic growth. It covers 29 countries in Asia and Africa and the period from 2001 to 2019. Hypotheses about the relationship between the level of globalization, country's investment risk premium and economic growth are considered. Based on the results of the regression analysis of the panel data for the mentioned above period, it was concluded that the relationship between economic dynamics and the degree of inclusion of Asian and African countries in the global economy was negative.

Keywords: globalization, globalization index, country investment risk premium, economic growth, complementary policy effects, regression analysis.

Introduction. The impact of globalization processes on the dynamics of economic development has been the object of attention of scientists since the early 90s of the last century [1, 523–544]. In a broad sense, according to Stiglitz's definition, globalization refers to the process of economic integration of countries by increasing the flow of goods, services, capital and labor between them [2]. However, the consequences of the integration of previously relatively isolated national markets for goods and factors of production into a world economy for different countries and groups of countries are ambiguous.

Critical literature review and the theoretical framework of the research. It is possible to talk about three main directions that have historically developed in the course of studying the impact of globalization processes in their various manifestations on the economic growth and economic development of a country or groups of countries. The first direction is represented by works that prove the positive impact of globalization on economic growth [3,1–118]. However, as research deepens, new methods of data processing are applied, and quantitative information about an ever-wider range of countries is drawn into circulation, a second direction is being formed, whose supporters believe that the consequences of integration into the world economy for a country can be both positive and negative. It is important to distinguish between the forms of a country's involvement in the world economy, the level of market development, and many other factors [4,289–321; 5, 55–65]. A special milestone in the study of the impact of globalization on the economic development of countries was the new integral index of globalization (abbreviated KOF) proposed in 2006 by A. Dreher [6,1091–1110], which is currently the most common indicator of the level of globalization of a country. Finally, the third direction in the study of the problem of the impact of globalization on economic growth is represented by works proving the nonlinear relationship between the variables under study. As the main reason for this, supporters of this trend consider the effects of complementary policies, which are manifested in different ways in different countries [7, 151–173; 8]. It should be noted that if for

developed countries there is a fairly extensive range of publications on the problem under consideration, then the array of developing countries, as well as countries with a transitional market economy, has not yet been sufficiently studied, especially at the country level. The range of studies in the countries of Asia and Africa is completely limited to just a few works, which makes this area very relevant [9, 795–805; 10, 1106–1123].

Research methodology. The theory of international economics assumes, that the country's involvement in the world economy should contribute to its economic growth by being able to take full advantage of the benefits of the international division of labor. On the other hand, the high country's premium for investment risk reflects certain difficulties: lack of guaranteed return on investment, fears of potential investors and, as a consequence, relatively less mobility of production factors. It can be assumed that in this case, a negative relationship between the country's economic growth rate and the country investment risk premium will be expected. Main research question could be formulated as follows: how the level of globalization and the investment risk premium affect the country's economic growth? The quantitative parameters of the simplified model are the GDP growth rates (dependent variable), the globalization index, and the country investment risk premium (regressors). Naturally, the economic growth itself is determined by a number of factors, which are not considered here. In order to neutralize the possible shifts of the estimates of the regression due to a small range of parameters, the model was tested within three types of effects – fixed, random and temporary ones. Of course, such an extension cannot fully compensate the lack of the qualitative variables and imposes certain restrictions on the results obtained. Nevertheless, it seems interesting to check the assumption that there is a relationship between the economic growth of Asian and African countries and the country's openness, meaning involvement in the world economy, on the one hand, and the existing risks for investors, on the other.

Assumption 1: low country investment risk premium encourages countries to join the globalization process.

Assumption 2: the dynamics of a country's GDP is determined both by the degree of involvement in the global economics and the size of the risk premium in the national economy.

Hypothesis testing was carried out on the basis of panel data from 2001 to 2019 for the above indicators for 29 countries of Asia and Africa. The World Bank databases [11], regular statistics on the globalization index [12] and the quantitative estimates of the investment risk premium by A. Damodoran [13] were used.

Main findings and outcomes. The results of the regression analysis for a sample of 29 countries are shown in Table 1. The columns are separately constructed regressions. The dependent variable is the same for all models; the models use two regressors. 7 modifications of the model that were described above are considered. For the group of countries in Asia and Africa (29 countries) it is possible to talk about a statistically significant relationship between the economic growth, the level of globalization and the country risk premium with 99% probabilit. The coefficient of determination in all cases are so low that they indirectly allow to expect a nonlinear relationship between the variables of the simplified model despite any modification.

Table 1. – The impact of globalization and country risk premium on economic growth in Asian and African countries. regression analysis outcomes

Dependent variable: economic growth							
Regressor	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
1	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Globalization	–0.25 * (0.07)	–0.17 * (0.04)	–0.25 (0.17)	0.0007 (0.07)	–0.06 (0.09)	–0.06 (0.04)	–0.07 (0.04)

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Country investment risk premium	–38.70 (39.25)	–42.35 *** (15.29)	–6.73 (46.88)	–11.18 (12.47)	13.41 (15.04)	–15.79 (–15.7)	–0.25 (12.42)
Constant	19.37 * (4.58)	16.38 * (2.53)	2.24 (1.06)	5.68 (4.61)	–3.67 (0.92)	9.71 * (2.59)	9.20 (2.87)
Time period	Only 2001	Only 2019	Difference 2001–2019	2001–2019	2001–2019	2001–2019	2001–2019
Individual effects				Yes	Yes		
Time effects					Yes		Yes
Random effects						Yes	Yes
Resistant to heteroskedasticity and autocorrelation standard errors				Yes	Yes		
F-statistic / chi-squared test (p-value)					0.29 (0.75)	chi2: 2.32 (0.12)	
$\underline{R}^2$	0.29	0.42	0.01	0.30	0.45	0.29	0.35

*Notes: Statistical significance ***(10%), **(5%), * (1%)*

Within the considered model specifications, statistically significant results were obtained for versions 1 and 2 with a probability of 99%. It is interesting to note that within the sample for 2001 only the globalization had a negative impact on the economic growth. Country risk did not affect the economic development of the above-mentioned countries. But in 2019 the country risk premium together with the globalization have negatively influenced on the economic development of Asian and African countries:

2001: GR = 19.37–0.252GLOB ($p \geq 0.01$)

2019: GR = 16.38–0.167GLOB – 42.35 CRP

($p \geq \geq 0.01$)

The degree of sensitivity of economic dynamics to the globalization indicator has noticeably decreased over 18 years, while the relative importance of the risk premium has increased. It means, that, *seteris paribus,* an improvement in the investment climate (which can be considered as the expected positive effect of complementary policies) within this group of countries can give a much greater impetus to macroeconomic dynamics than the policies towards global integration.

Conclusions. Thus, a quantitative analysis of the impact of the degree of a country's involvement in the world economy, as measured by the globalization index, and the complementary policy component in the form of a country risk premium on economic growth rates of Asian and African countries yielded contradictory results and partially confirmed the hypothesis. Analysis of the impact of globalization on the economic growth of Asian and African countries also showed the negative nature of the relationship. But the degree of sensitivity of the variable to the indicator of the level of globalization relatively decreased over the period from 2001 to 2019. The country risk premium was statistically insignificant for Asia and Africa in 2001; in 2013 it is significant, but only at the 10% p-level. A low coefficient of determination for all considered models was expected, since economic growth

is determined by a larger number of parameters and factors than those included in the analysis. Thus, under the undifferentiated approach to the target group of countries a statistically significant negative relationship was revealed between the level of globalization and economic growth, and the degree of sensitivity of the dependent variable to changes in the globalization index increased over the period from 2001 to 2019. A negative dependence of economic growth on the level of the country premium for investment risk was also revealed, but this relationship was statistically significant only in 4 modifications of the model.

Research limitations and perspectives. This study is based on a simplified quantitative analysis of the most general parameters reflecting the processes of globalization and economic growth. This means that the results obtained should be interpreted as preliminary ones. Although both the globalization index and the country risk indicator, to a certain extent, reflect the qualitative essence of these processes, the qualitative characteristics as independent variables were not considered. An in-depth study of the effects of complementary policy could significantly compensate for this drawback, clarify and correct the preliminary results obtained. However, it seems impossible to touch upon these issues within the framework of an undifferentiated country approach.

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https://doi.org/10.29013/ESR-21-5.6-90-91

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COVID-19 AND TRANSFORMATION IN TECHNOLOGY STRATEGIES

Abstract. Global economy underwent a historic acceleration of digitalization during Covid-19 pandemic. The role of technology and innovation has been transformed forever. Funding for digitalization has increased more than for any other area and become a strategic component of any business. Many temporary changes, planned during the crises, are becoming a permanent new reality.

Keywords: Covid-19, pandemic, technologies, innovation, global business.

Covid-19 had an unprecedented impact on the world economy. Before the pandemic struck technology budgets used to increase steadily. Covid-19 crisis accelerated this process on average by 7 years.

Distinction between tech and non-tech companies has almost become extinct. Now almost every business uses some kind of technology strategy. It can be used for logistics, supply chain, automation, development of new products, finance management, and remote work. The supportive services innovations were one of the most successful (Ramelli & Wagner, [4]).

Businesses with cutting-edge technologies, strategic partnerships and an agile approach have better abilities to change their technology priorities and adjust to economic challenges. Successful companies invest more on growing the business than securing it.

Artificial intelligence (AI) was one of the most used technologies for COVID-19 management (Vaishya et al., [7]). New business values are measured by its intellectual capital using AI and big data, similar to how individual IQ is evaluated. Deloitte expects 30% growth in cloud revenues from 2021 to 2025. Digital payments had a change from mere financial conveniences into public health safety priorities.

In 2021 the largest technological investments are made in healthcare and their effect is expected to keep increasing. The high impact of IT in healthcare is discussed by Singh, Javaid, Haleem, and Suman 2020. During COVID-19 medical professionals and patients were one of the biggest users of technologies (Keesara et al. [3]).

Nearly 70% of businesses reported plans to launch new digital projects or invest in a new area of technology. Digitalization provides any company with a potential to enter international markets.

Digitalization requires smart decisions and careful research of types of technology products for their portfolios. Businesses need to adapt and refocus on how to make digital transformation a priority. Successful strategies in technologies lead to fund reallocations and reprioritization of investments.

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https://doi.org/10.29013/ESR-21-5.6-92-94

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SECRET INVENTIONS AND ASPECTS OF ADMINISTRATIVE AND LEGAL-ECONOMIC RESTRICTIONS FOR THE STATE DEFENSE ORDER EXECUTING ENTERPRISES IN GEORGIA

Abstract. There is a strong connection between the secret invention, the fundamental principles of state secrecy and information security. In Georgia, the scope of administrative, legal and economic rights of an intellectual enterprise can be significantly limited, if the results obtained are patented, classified as secret and the enterprise is fulfilling the state defense order.

Keywords: Innovations, military economics, management of intellectual activity results, secrecy of inventions, information security.

Innovative processes are of special importance for the success of the country and the development of the military economy. The role of intangible assets is particularly significant in this regard. It should be noted that during the creation and modernization of weapons, military and dual-use products, great importance is attached to the issues of securing and protecting rights to the results of intellectual activity, which are directly related to state defense and security [1].

An application for an invention and for a utility model containing information on a new type of military weapon, combat equipment and defense technology, is subject to confidentiality based on the duly approved list, according to which this application may be considered as containing a secret content by the decision of the relevant authority. Proceeding from the "Rule for attribution of information to the category of state secrecy and its protection, the decision about considering the application submitted to Georgia's Patenting Agency "Sakpatenti", as belonging to the State Secret category, is taken and implemented by the Ministry of Defense or another executive body, as well as an enterprise, institution or organization that has submitted application for an invention or an utility model [2].

There is a practice in the field of defense that the state client follows the policy when during the fulfillment of the state defense order, the Client requires from the contractor the complete transfer of rights on practically all the results of the intellectual property, both on the acquired (newly created) and those results that were used in the conducted scientific research and design works. The main argument is that the results of this intellectual activity, in accordance with the Law of Georgia on Defense and other relevant normative acts, are extremely important and valuable for ensuring the defense and security of the country [3].

Depending on the country's defense capacity, the relevant authority may make a decision and keep the invention secret. These issues are regulated by Article 7 of the Patent Law of Georgia. In particular, the National Center for Intellectual Property – "Sakpatenti" issues a patent for an invention, which was classified as Secret Invention by the relevant body, only in the certain cases and in accordance with the established rules, based on the decision on the declassification, made by the above authorized body. In addition, the

secrecy of the invention is allowed for a period not more than 2 years, which may be extended several times during the term of the patent, for the period specified in this paragraph. In case of secrecy classification of the invention, the inventor shall be given appropriate compensation, the amount and the allocation procedure of which shall be determined and issued by a normative act adopted by the relevant authorized body [4].

In accordance with the Regulation on the Protection and Use of Secret Inventions and Utility Models, a special regime on the use and disposal of inventions and utility models considered to be state secrets, as well as restrictions on the rights of applicants for classified inventions and utility models are to be defined on the basis of the agreement to be formed with State Inspectorate for the Protection of State Secrets. However, it should be noted, that the amount of compensation defined for restricting the applicant's rights is only approximate. It is determined by a commission set up under the State Inspectorate for the Protection of State Secrets, which, unfortunately, does not include the applicant, and this, in my opinion, is a shortcoming. I should note that patent information is an informational asset of the relevant authority, a confidential intelligence whose breach of confidentiality, integrity or accessibility is likely to result in significant harm to the functions of the subject of the critical information system. Article 9 of the Law of Georgia on State Secrets defines the degree of secrecy of the information containing state secrets and the class of secrecy. In particular, information considered to be a state secret is classified by assigning it a relevant secret. The classification of secrecy is a necessary requisite of information containing state secrets. It must certify the degree of confidentiality of this information, indicate the period of confidentiality of the information and the authorized person who marked this category of secrecy. Considering the quality of secrecy, the following secrecy ranks have been established in Georgia: A) "of special importance" (equal to TOP SECRET); B) "top secret" (equated with SECRET); C) "secret" (equated with it CONFIDENTIAL); D) "for limited use" (equals to RESTRICTED). Pursuant to Article 10 of the said law, the period of secrecy of the information containing state secrets depends on the degree of its secrecy. The period of secrecy on a secret invention may be different, namely, for information with "special significance" secrecy class it is 20 years, for information having "completely secret" secret classification – 10 years, for information with "secret" secrecy class – 5 years, and for information with "limited" confidentiality – 3 years. It should be noted that the period of secrecy of state secrets, which are recognized in accordance with the international treaties and agreements of Georgia, is extended, the classification of secrecy is changed or declassified, in accordance with the requirements of these international treaties and agreements and the period of secrecy of state secret containing information is counted from the date of its classification as secret [5].

As can be seen from the above discussion, there is a strong correlation between the invention secrecy and the fundamental principles of state secrecy and information security. It can be argued that the scope of administrative, legal and economic rights of an enterprise engaged in intellectual activity may be significantly limited in Georgia, if the results obtained are patented and classified by a competent state body, and the enterprise fulfills the order of state defense. These enterprises are practically limited by the results of their own inventions and intellectual activities.

These enterprises are practically restricted in their right to invent, manage and use the results of intellectual activity in other areas, in the private sector. This can significantly slow down their innovative development and as a result, deprive them of the right to make potential profit in the future. It should also be noted that such enterprises engaged in execution of state defense orders, to some extent, lose the motivation to create new innovative designs, as they are limited in their ability to engage in civic turnover. After the secrecy classification of the invention by the relevant authorized body and until

its declassification of secrecy and the issuance of a patent, the rights of the executor of the state defense order, which are established by Article 48 of the Patent Law of Georgia, are restricted. Thus, for example, during the term of the state contract, the enterprise may not dispose of the result of its intellectual property at its own discretion. It has no right to sell it or alienate it in any other way, or issue a private license on usinge it in accordance with the established procedure and / or to pledge it, etc.

In conclusion, it can be said that the above issues require regulation, balancing between public and private interests in order for intellectual property and innovation processes to become important elements for the military-economic development of the country.

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https://doi.org/10.29013/ESR-21-5.6-95-98

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AGRICULTURAL INSURANCE AND PROSPECTS FOR ITS DEVELOPMENT IN GEORGIA

Abstract. Georgia is an agricultural country with rich traditions, the natural and climatic conditions of which make it possible to produce ecologically clean agricultural products for both the domestic and foreign markets. However, there are frequent cases of damage/destruction of crops and plants as a result of natural disasters and complete bankruptcy of farmers. To solve this problem, the Georgian government developed and launched the "Agricultural Insurance Program" in 2014, on the basis of which risks were reduced and incomes increased for a certain part of Georgian farmers. The income of insurance companies participating in the program also increased. Despite this, the state agricultural insurance program has certain drawbacks.

Keywords: Agricultural Insurance, State Agricultural Insurance Program, Natural Risks, Farmer, Franchise, Insurance Premium, Insurance Cases.

The agricultural sector refers to the sphere of the economy where the economic processes of reproduction are closely related to natural and climatic processes. It is important to note that Georgia is an agricultural country with great traditions, where there is a rich experience in growing vines and wheat.

After the collapse of the Soviet Union, the replacement of the existing insurance system with a completely different new insurance system had changed the mechanisms for providing the local market with agricultural products and, as a result, the structure of management and financing of the agricultural sector. Even in Soviet times, under the conditions of consolidated and specialized agriculture, Georgia was the main supplier of tea, wine, citrus, and various fruits and vegetables to the closed Soviet market.

Uncertainty that arose after Georgia's independence has seriously hampered the agricultural sector, especially the problem of selling agricultural products. The villagers could grow fruits, vegetables, and citrus, but they were unable sell them. State-owned processing factories went bankrupt and the private owners

were unable to maintain their fixed and working capital acquired through privatization. Also, Georgian farmers were forced to cultivate the land, buy seeds or seedlings, buy mineral fertilizers, etc with bank loans. Finally, the consequences of frequent hail, storms, and floods can lead a Georgian farmer to financial bankruptcy. Bankruptcy is facilitated by bank interests, late payment of insurance compensations and the problem of selling their products, low prices (for example, the price of 1 kg of grapes ranges from 70 tetri to 1 lari).

On September 1, 2014, a pilot agricultural insurance program for farmers was launched in Georgia, which was implemented by the Agricultural Projects Management Agency at the initiative of the Ministry of Agriculture. To stimulate agricultural insurance under the program, the state financed the largest portion of the insurance premiums (from 70% to 90%), and the farmer had to sign an insurance policy with a particular company, indicating the location of the land plot and the expected yield of harvest. Immediately after the launch of the program, a memorandum of cooperation was signed between the Agricultural Project Management Agency and 5 insurance companies operating in Georgia, the number of which later increased to 8. These companies are: JSC Aldagi, JSC GPI Holding, JSC Euroins Georgia, JSC Ardi Group, JSC Alfa, JSC TBC Insurance, JSC Georgia Insurance Group, JSC Global Benefits Georgia.

It was a pilot program with government subsidies under certain conditions. The state subsidy for the pilot program in the amount of GEL 5,000,000 was fully used during the first year of the program.

Based on the priorities of the country's strategic development plan and the experience of successful functioning of agriculture, the **"Agricultural Insurance Program"** was launched by the Resolution No. 188 of the Government of Georgia of April 11, 2019. With the development of the insurance market in the agricultural sector, the program aims to reduce the expected risks in the agricultural sector, increase competitiveness and maintain the income for farmers. This program regulates relations arising in connection with insurance of agricultural crops in Georgia (against hail, floods, storms and autumn frosts) between the insurer, the insurance holder/beneficiary and NNLE – Agricultural and Rural Development Agency [2].

It is important to note that according to the change made in the agricultural insurance program, the case of perennial crop insurance, farmers have the opportunity to insure their harvest for three calendar years. Under the agricultural insurance program for all crops except vines, the state co-payment was still set at 70% of the cost of the policy, and for vine – 50%, which, in our opinion, is not in favor of Georgian viticulturists; Georgian viticulturists are not financially stable, they have no other income, etc., which does not allow them to purchase an insurance policy (for an example see Table 1). In 2020, the budget allocated for agricultural insurance under the program amounted to GEL 9 million, which were used in full, as the number of farmers who own the policy was systematically increasing. This is evidenced by the fact that as of July 31, 2020, more than 16 thousand policies were issued under the state agricultural insurance program. More than 17 thousand hectares of land are insured, which is 34% more than in the same period of the previous year.

Table 1. – Insurance rates of the Insurance Company JSC "TBC Insurance"

Crops	**Rates**	**State Financing**	**Farmer's (the insured) co-payment**
1	***2***	***3***	***4***
Grains	6.5%	70%	30%
Legumes	6.5%	70%	30%
Vegetable	8.5%	70%	30%
Cucurbits crop	10%-10.5%	70%	30%

1	*2*	*3*	*4*
Vines	8.5%	50%	50%
Fruit	8%	70%	30%
Berry	11%	70%	30%
Nuts	6%-9.25%	70%	30%
Subtropical	10.7%	70%	30%
Citrus	15%	70%	30%

Source: https://tbcinsurance.ge/ka/page/agrodazRveva

The peculiarities of the **insurance premium** payment provided for in the agricultural insurance project are noteworthy, in particular – the insured has to pay its share of the premium in case of one-year crop insurance in full and at the time of issuance of the insurance policy. While when insuring perennial crops, the insured has the right to pay the amount of the insurance premiums stipulated by the insurance policy for the harvest period of the next calendar year after the end of the harvesting period/ the period of technical ripeness of a particular crop. In addition, the subsidized portion of the premium will be paid by the Agency in accordance with the program. In the case of an agricultural cooperative, the amount of the premium payable by the Agency to one insured/beneficiary shall not exceed GEL 50,000 (fifty thousand) in each calendar year.

In the case of an insured event, the insured/ beneficiary is obliged to inform the insurer by phone within 24 hours. At the same time, within 5 working days, the insured has to verify the following information by phone or electronically with the insurer: the insured's personal number/identification code, the insurance policy number, the insured's contact phone number, location of the insured damaged plot, its area and risk taken. Within 15 working days after the identification of the insured/beneficiary, the insured submits a written application to the insurer. From the identification of the insured/beneficiary, the insurer shall issue a report on the inspection of the damaged insured area (land plot) within 15 calendar days in case of annual crops, within 21 calendar days in the case of perennial crops, within 30 calendar days in the case of citrus crops.

However, in case of damage to 51% or more of land plots of the insurer's volumetric portfolio per concentrated geographical unit (municipality) as a result of one insured risk event, it is possible that the deadline for drawing up a report on the inspection of the damaged insured area (land plot) is extended to no more than 30 calendar days. If the insurer does not draw up the inspection report of the insured area (land plot) within this period, it shall pay 50 (fifty) GEL to the Agency for each overdue day. In case the amount of the fine exceeds 500 (five hundred) GEL, the insurer is obligated to sign the report on the inspection of the damaged area (land plot) immediately. Payment of the fine does not release the insurer from drawing up the report on the inspection of the damaged area (land plot). However, the insurer shall be fully released from the obligation to pay damages if the insured does not apply to the insurer within 15 (fifteen) working days after the identification of the insurer.

Based on the above deadlines, the deadlines for the payment of damage compensation also exceed at least one month period, which has a negative impact on the financial situation of the farmer. It should also be noted that 90–95% of farmers use agro-credits.

The amount of the insurance compensation to be paid by the insurer for the damage caused by the insured event (before considering the franchise) **is calculated as follows:**

A) By multiplying the receivable harvest by the damage percentage and the smallest value between the standard price and the market price;

B) If the receivable harvest from the insured area is less than the standard yield – by multiplying the receivable harvest by the damage percentage and the

smallest value between the standard price and the market price;

C) If the receivable crop from the insured area exceeds the insurance limit, then the amount of the insurance premium = actual damage multiplied by the insurance limit/cost of the receivable harvest.

Actual Damage = receivable harvest multiplied by the smallest value between the standard price and the market price of the crop (GEL/kg) multiplied by the percentage of damage.

The study revealed that the value of the insured harvest in 2014–2020 was GEL 827.9 million, while the amount of the damage compensation payments was GEL 45.3 million [5, 26] (see Table 2).

Table 2. – State-funded agricultural insurance measures for 2014–2020

Number of policies issued	The value of the insured harvest	Share of premium paid by the Agency	Insured crop area	The amount of compensation paid
115.8 thousand pieces	GEL 827.9 million	GEL 48.1 million	103.4 thousand hectares	GEL 45.3 million

Conclusion: Since 2014 to the present, insurance companies and farmers have gained more or less successful experience in using agricultural insurance services, as evidenced by the increase in the number of insurance companies and farmers participating in an agricultural insurance project over time, which has raised the level of farmers' awareness of the benefits of agricultural insurance.

Despite this, the agricultural insurance program has a number of drawbacks, namely:

I. 50% financing of the vine insurance premium;

II. Duration of damage compensation timeframes.

In our opinion, on the one hand, additional financial support from the state is required, especially in relation to vine insurance, as study has shown that farmers find it difficult to pay 50% of the insurance premium. On the other hand, the time frame set for the payment of compensation of damages should be shortened so that the farmer could receive financial assistance to recover the damages as soon as possible. By following these recommendations, farmers will be able to use the proceeds from the sale of the crop to insure risks for the coming year. This will further increase farmers' incomes and make the insurance market even more efficient.

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Section 11. Science of law

https://doi.org/10.29013/ESR-21-5.6-99-104

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HOSPITAL WASTE MANAGEMENT IN ALBANIA

Abstract. Hospital waste poses a serious risk and an important problem for the environment and the health of citizens. Hospital waste is produced by many medical subjects. Training of these waste in the respect of the environment is a professional and ethical duty of all the operators of the field of medicine. This treatment should eliminate the pathogen potential that these residues contain in order to reduce environmental contamination, chemical and radioactive toxicity and uncontrolled environmental pollution. About 20% of hospital waste is categorized as hazardous waste and at the moment that these residues are in contact with other objects, these objects are considered equally. Despite the fact that there are some companies licensed by the National Environmental Agency, which are contracted by state and private hospitals to attract and treat waste at incinerators, the reality is quite chaotic. Hospital wastes are easily evidenced in waste bins located in any road or in places where it is strictly forbidden. Often, hospital waste mixes with urban ones are becoming a source of the spread of a variety diseases in the population. For the first time, the issue of hospital waste management is raised to the attention of the public and decision-makers of environmental civil society. This paper aims to provide a general overview of hospital waste in the Albanian state and the measures that need to be taken to treat them efficiently.

Keywords: hospital waste, incinerator, licensed subjects, infectious waste etc.

1. An overview of hospital waste

Medical waste can be defined as waste generated as a result of diagnosis, treatment, and immunization of humans or animals. This is useful to categorize the total waste flow into four categories [2, fq. 10]:

1. Solid wastes include recyclable material or compound.

2. Infectious waste is generally defined as waste that is able to produce infectious diseases. Infectious waste should be treated and decontaminated before landfill disposal (Directive 99/31/EC).

3. Hazardous waste is defined as waste that may contribute to mortality or serious illness or pose a significant risk to human health and the

environment, whether managed or disposed of improperly.

4. Low level radioactive waste.

In 2000, the World Health Organization estimated that injections of contaminated syringes caused 21 million people infected with the hepatitis B virus (HBV), 2 million people infected with the hepatitis C virus, and 260,000 people infected with HIV worldwide. Many of these infections were shmangshmen if needles would be disposed safely [1, fq.10]. Infectious and anatomical remains represent the majority of hazardous waste, up to 15% of total waste from health care activities. Syringes and agates represent about 1% of total waste, but they are a major source of disease transmission if not managed properly.Chemical and pharmaceutical substances make up about 3% of waste from health care activities and 1% are radioactive substances of total health care waste [1, fq. 10].

Concerns over the issue at the European level have prompted HOSPEEM, the European Association of Healthcare Employers, and the public sector union's umbrella organization to negotiate a health and safety agreement, which was later transformed into 2010/32/EU Directive on Prevention of Injuries in the Hospital and Health Care Sector. This Directive was introduced into national legislation by EU member states and entered into force in May 2013 [3]. Health and safety regulations require employers to perform risk assessment, take appropriate control measures in the country, consult with employees, and provide information. For their part, employees must participate in training in accordance with workplace procedures. The new rules impose additional duties on both the employer and employee categories, including substitution-security devices ("Safe Sharps"), where their use is necessary and risk assessment indicates that it would be convenient and "quite practical" [3].

Four basic processes are used in the alternative treatment of medical waste: thermal, chemical, radiation and biological [4, fq. 3]. Thermal processes rely on heat to destroy pathogens. Low heating processes use moist heat (usually steam) or dry heating. Chemical processes use disinfectants to destroy pathogens or chemicals to act on waste. Radiation involves ionizing radiation to destroy microorganisms, while biological processes use enzymes to decompose organic matter. Mechanical processes, such as shredding, mixing of tools, or compactors have been added, such as supplements to make waste unknown, improve heat or mass transfer, or reduce the volume of waste treated [4, fq. 3].

Healthcare waste contains potentially harmful microorganisms that can infect hospital patients, healthcare workers and the general public. Other potential infectious risks may include the spread of environmentally resistant chemicals from their combustion; pollution poisoning emitted by pharmaceutical products, in particular antibiotics and special drugs; poisoning and pollution through sewage; poisoning and contamination by toxic elements or compounds, such as mercury or dioxins released into the air during the process of their treatment or disposal. In developing countries, additional risks also arise from the feeding of livestock with waste at landfills, as well as from the manual classification of hazardous waste by health care centers [1, fq. 11]. Of the total amount of waste generated by healthcare activities, about 80% is general waste, while 20% is considered hazardous material that can be infectious, toxic or radioactive [1, fq. 11].

2. Legal framework for hospital waste management in the Albanian state

As part of the important administrative and legal reforms that our country has undertaken to approximate the legislation with the legislation of the EU member states, the legal package related to the management of hospital waste, otherwise known as health care waste, has been developed. This legal basis has been established mainly on the European Waste Framework Directive (2008/98/EC) and continues to be supplemented, including the relevant bylaws.

Law no. 9323, dated 25.11.2004 "On drugs and pharmaceutical service". This law aims to determine

the rules for fabrication, import, export, trade, description, use, quality control and inspection of activities related to medicines used for people in the Republic of Albania [5]. This law is implemented by all entities, legal and natural persons, state and private, local and foreign, that exercise activities provided in the provisions of this law [1, fq. 12].

Law no. 9537, dated 18.05.2006 "On the administration of hazardous waste". The law aims to set norms that regulate the safe administration of hazardous waste, collection, transport, temporary storage, processing, treatment, disposal, import and export [6]. According to this law, the management of hazardous waste is carried out without endangering human health or the environment and without using processes that can harm the environment, in particular: they do not pose a risk to air, water, soil, plants and animals; do not cause annoyance, through noise or odors; do not adversely affect the rural, urban or other areas of special interest. Hazardous waste are not allowed to be mixed with other waste, except when the mixture is useful for improving safety during transport, recovery or disposal.

Law no. 10, dated 11.05.2009 "On public health". The purpose of this law is to protect the health and promote the healthy life of the population in the Republic of Albania, through organized actions, the impact of which is equally distributed in all population groups. This law defines the activities and services of public health, their implementation, the role of the state in providing public health services and the division of responsibilities between the responsible institutions [7].

Law no. 10431, dated 09.06.2011 "On environmental protection". This law aims to protect the environment at a high level, its preservation and improvement, prevention and reduction of risks to human life and health, ensuring and improving the quality of life, for the benefit of present and future generations, as well as providing conditions for the sustainable development of the country. This law stipulates that the non-treatment of hospital waste affects the pollution of land, water, air and consequently this pollution affects human health [8].

Decision of the Council of Ministers no. 99, dated 18.02.2005 "On the approval of the Albanian catalog for waste classification". This decision was approved by the Council of Ministers, in support of Article 100 of the Constitution and point 3 of Article 3 of Law no. 9010, dated 13.2.2003 "On the environmental administration of solid waste", on the proposal of the Minister of Environment. In this decision are classified the waste produced in our country and are listed according to their nature. According to this catalog, waste is divided into hazardous and non-hazardous waste [9]. The main chapter related to hospital waste is Chapter 18, where all hospital waste is listed with the appropriate identification number.

Decision of the Council of Ministers no. 798, dated 29.09.2010 "On the approval of the regulation for the administration of hospital waste". This decision was approved by the Council of Ministers, in support of Article 100 of the Constitution, points 3 and 4 of Article 42 of Law no. 10138, dated 11.5.2009 "On public health", of article 3 of law no. 9010, dated 13.2.2003 "On the environmental administration of solid waste" and articles 26 and 27 of law no. 9537, dated 18.5.2006 "On the administration of hazardous waste", on the proposal of the Minister of Environment, Water Administration and the Minister of Health.This regulation sets out the procedures, rules and technical standards for the administration of hospital waste in order to protect public health and the environment. The chapters of this regulation clearly list the obligations of hospital waste producers; hospital waste treatment; monitoring and administration of hospital waste, as well as control and sanctions [10]. In 2000, a national strategy for hospital waste management was developed.

3. Institutional framework for hospital waste management

Important institutions operating in the hospital waste sector are:

Council of Ministers – Approves regulations and laws on hospital waste management.

Ministry of Health – Approves the hospital waste monitoring program, mandatory for implementation by the producers of these wastes.

Ministry of Environment – Drafts hospital waste policies. Approves the hospital waste monitoring program, mandatory for implementation by the producers of these wastes.

ISSH – Carries out the hygienic-sanitary inspection and issues the hygienic-sanitary act for the exercise of the activity.

National Agency for Drugs and Medical Devices – Specialized institution for registration, inspection of medical devices and reporting of unwanted events.

State Environmental Inspectorate – Verifies the completion by the operator of the permit conditions after its issuance by the NBC and performs inspections in installations of type A and B.

National Environmental Agency – Defines the conditions for the relevant environmental permits, creates and manages the environmental information system, provides information to the public on the decision-making process on environmental issues, ensures the implementation of the environmental responsibility principle, manages the National Environmental Monitoring Network, verifies and evaluates any report submitted by the activity operator, verifies and evaluates the monitoring of compliance performed by the activity operator, examines the requirements for environmental impact assessment, consults and cooperates with the State Environmental Inspectorate and other inspectorates pursuant to environmental legislation, including situations of incidents, accidents and environmental emergencies.

The Regional Environmental Agency – Releases the environmental permit of type C, conducts inspections in installations of type C, maintains, administers and updates the Register of Environmental Permits of type C for installations operating in the region for which it is responsible.

Local Government Unit – Through the Municipal Inspectorate exercises control over the activity of hospital waste owners, gives permission for disposal of hospital waste treated in the landfill treated in the case when the latter is managed by the municipality, as in the case of Sharra.

4. Hospital waste management and licensed entities in their treatment

According to an update in the list of licenses issued by the Ministry of Environment, there are 10 entities, which are categorized as hospital waste treatment entities, such as: Univers Alb, "American Hospital", Hygeia, "Treatment of hospital waste", University Hospital "Shefqet Ndroqi", "Treatment of hazardous hospital waste with hydroklava capacity 38 kg waste/hour, Univers-albcorporation grinding", Euroteam(limited liability company), "Hospital waste treatment plants", Korca Hospital Service Directorate, "Hydroklava and hospital waste sterilization", Obsterik-Gynecological University Hospital, "Treatment of hazardous hospital waste with hydroklava, capacity 35–45 kg of waste/cycle", IRIDIANI & KADELI and Ecoteam.

From these entities licensed for the treatment of hospital waste in the country are five state hospitals, one attached to the private hospital and is an investment of the latter and four are private companies. In the case of hospitals, regardless of whether it is a private or public hospital, they only deal with a part of the hospital waste categories, so they must have a contracted service with one of the private companies. Pharmaceutical waste in the country is not treated by any of the licensed waste treatment companies. Consequently, this category in the country is not treated at all, or is treated by entities working outside the legal conditions.

The contracting of the service for the treatment of hospital waste started in 2004 and most of the contracts were concluded in 2011 and 2014. Medi-Tel (limited liability company) is the company that covers most of the country with the service of treatment of hospital waste, however for various reasons manufacturing entities over the years change these contractors. The manufacturing entities, which have

contracted the hospital waste treatment service, are equipped with special bins, which meet the standards of the World Health Organization for the collection of this waste. The rest buy the baskets themselves, or use only one basket for all hospital waste or and for all waste, which does not meet the standards.

In creating chaos in hospital waste management all manufacturers play their role, but private entities have excessive freedom and promote as much as possible the informalization of the administrative system. The costs of providing hospital waste treatment services vary depending on the amount of waste collected, although in the case of private entities, due to inaccuracies in payment, companies have also made compromises, regardless of the amount of waste generated, private entities will pay a fixed value. Regarding the ways of managing hospital waste, some entities manage them by contracting a third party such as private treatment companies for hospital waste, while most choose other ways outside the legal obligations for their administration such as dumping in bins public waste, incinerationor timely disposal of this waste.

5. Conclusions

In order to address the problems encountered in the hospital waste sector, an in-depth study by line institutions should be undertaken to assess the situation of hospital waste production and treatment throughout the country. This will provide a clear overview of the amount produced, the possible ways and places of treatment, the costs and fees associated with them, but will also help reduce informality in the sector. Public production entities work in conditions of lack of infrastructure and human capacity for proper management of hospital waste. The government should prioritize real budgeting of the sector's needs for long-term investments in hospital waste management.

Based on regional and european examples, a sustainable solution must be worked out specifically for the treatment of pharmaceutical waste in the country, both in providing the institutional framework for the management of this waste stream and in providing management and education alternatives for manufacturing entities. Inspectors should be trained to conduct inspections in waste production and treatment entities, as well as to conduct frequent inspections of all public and private entities. The philosophy of inspection should stimulate law enforcement and not the culture of penalization, despite the fact that this is one of the necessary links. An important element is the strengthening of inter-institutional cooperation, as well as the need to stimulate support among local institutions that control and monitor the situation of hospital waste.

Sector information, inspection, monitoring and self-monitoring reports should be transparent and accessible to the public. The information, educational and awareness campaigns with the production entities and the community are considered as a necessity in the conditions of a high lack of information on legal obligations and negative impacts on health and environment due to non-administration of hospital waste. Civil society organizations are a source of already established capacity, which can help the government in the steps it will follow to improve the sector. Strengthening cooperation and partnership between them complements the process in all its links, and strengthens democratic governance.

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