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DEVELOPMENTS OF STATE POLICY OF GEORGIA ON ENVIRONMENTAL IMPACT IN AGRICULTURE

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Abstract
The article describes agro-technological difficulties and environmental changes in Georgian agriculture that have an economic and social impact on agrarian relations. Additionally, the potential possibilities of agricultural development to neutralize negative changes in the environment are presented. It is noted that to develop the agricultural sector and mitigate the effects of climate change and reduce emissions, activities should be conducted in three directions: technological, economic-institutional, and social. A description of each of them is provided, and the emphasis is made on agro-technological innovations, rational management, and security measures, as well as on green financing opportunities and defining social progress.
Keywords: Georgia, Agriculture, climate, technological, economic-institutional, social strategy.

Georgia has a geographical location characterized by multiple reliefs, diverse land, and a specific climate that covers almost all climatic zones, and causes many negative consequences of environmental change. Environmental attributes affect the productivity of agricultural labor and its yield, as well as cause changes in climatic conditions.[1]

According to the Strategy of Agriculture and Rural Development of Georgia (2021-2027), the characteristics of Georgia are processes such as the increase of the dry area of regions; the activation of soil salinization processes; rapid mineralization and degradation of soil organic matter; increase in intensity and frequency of frosts associated with lowering humidity; the creation of favorable conditions for the spread of pests and diseases due to the increase in temperature in winter; the activation of erosion processes in some humid regions due to the growth of sediments (Agriculture and Rural Development Strategy of Georgia 2021 – 2027).

In Eastern Georgia, most crops are sensitive to climate change, such as wheat, sunflower, vegetables, and corn; in South Georgia - potatoes. The crops in Western Georgia - tea, citrus, vines, and corn - are less sensitive to climate change. Despite such a difference in the climatic conditions of both sides of the country, requirements for agricultural development contain adaptation to environmental conditions and neutralization and mitigation of the negative consequences of interaction with it. It is an actual topic, the interest of which is growing more and more.

Climate change causes soil erosion, destruction of windbreaks, washing away, and acidification. Drought has increased in the bar, and rainfall in the mountains, the growing season has changed, the vegetation period has shortened, the adaptability of crops has changed according to zones, pests and diseases have multiplied, their reproduction periods have been extended, new kinds of viruses and rodents have appeared.

Agriculture's impact on climate change is exacerbated by the use of synthetic fertilizers, ether fermentation of domestic animals, manure management, etc.

Agriculture accounts for 25.5% of greenhouse gas emissions in Georgia, and carbon dioxide and methane emissions related to animal husbandry account for 14.5% of human-caused emissions, that is more than in the transportation sector. As a whole, 30% of harmful emission caused by human activity is created in agriculture. 35% of agricultural land is degraded (Shatberashvili E, 2014).

In addition to agro-technological difficulties, environmental changes also have social impacts related to food security and safety, the continued physical and economic access of all people to sufficient, safe, and varied food necessary for their active and healthy lives, as well as price increases further exacerbate poverty in rural and urban areas and affects the public health status of the country; the cultural and traditional attitude of the population to the land and its management gives rise to such social processes as two-way migration from the city to the countryside in the summer and from the countryside to the city in the winter.

From the point of view of food security, farms with a land area of less than 0.5 ha and residents of mountainous regions are among particularly high-risk groups. In Georgia, 98% is family farming. The consumption of home-cooked food is very high in villages - 53%, in small towns - 25%, in the mountains on average - 51%, and in bars - 31%. (Shatberashvili E, 2014). The segmentation of lands and small land ownership creates social causes in the development of poverty and food security.

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[1] In the article, we present climate and environmental impact in one context, although the latter is a broader concept. (Regarding this, see: Overview of Environmental Risk Analysis by Financial Institutions, Network for Greening the Financial System (NGFS), September, 202, p. 4.), https://www.ngfs.net/sites/default/files/medias/documents/overview_of_environmental_risk_analysis_by_financial_institutions.pdf

According to the 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), climate adaptation in developing countries tends to be autonomous and focused on water-related management, while in developed countries, in contrast, it is focused more on urban-oriented policies (IPCC, 2022, 556).

Agriculture has the potential to reduce carbon dioxide emissions by improving cropland and pasture management, rehabilitating degraded soils, and better bioenergy and water management, in livestock - through rotational grazing systems, introducing organic manure management, methane capture (by the development of biogas production), improving feed and feed additives, and other.

Therefore, reforming agricultural policy and clarifying the direction in order to fight against environmental changes becomes a subject of discussion worldwide.

EU policy in the field of agriculture and climate change (CAP) consists of three directions - market promotion, income promotion, and rural development. With this aim, funds are allocated for direct subsidies of market-related expenses and for rural development. It also advocates "green subsidies" for the implementation of environmental/climate standards, subsidies for the development of young farming businesses, and grants (investment assistance, subsidies) for the development of degraded/contaminated regions.

In order to develop the agricultural sector in Georgia and mitigate the effects of climate change and reduce emissions, activities will be conducted in three directions: technological, economic-institutional, and social.

Rapid response to droughts, floods, and other extreme events in agriculture from a technological point of view requires the preparation and implementation of plans, the introduction of innovative methods of irrigation management and water use, as well as the reduction of the use of nitrogen-containing fertilizers, the prevention of the burning of agricultural waste; prevention of erosion, etc.

From an economic point of view, emphasis is placed on subsidies, insurance, and green financing through the introduction of various programs.

The importance and volume of green loans in the global world are increasing more and more (Green Credit Guarantee Schemes for MSMEs, 2022: Farah Imran Hussain, 2020). Its use in Georgia is only in an embryonic state, however, the focus in the future should be on the promotion of "green financing" policy, where the degree of state involvement (participation in loans, subsidies, insurance, and allocation of grants, etc.) will significantly increase the environmental impact policies. In this direction, the National Bank of Georgia has developed the concept of loan repayment in accordance with changes in climatic conditions (environment), as well as with social and governance issues, (ESG), the implementation of which began in 2022.

In the direction of agro-insurance, the main goal is to develop the insurance market in the agro-sector, promote agricultural activities, and increase the competitiveness of persons employed in the agricultural sector.

On the initiative of the Ministry of Environmental Protection and Agriculture of Georgia and with the financing of the Danish International Development Agency (DANIDA), the program for supporting young entrepreneurs in rural areas - "Young Entrepreneur" - was launched in 2018. The main task of the program is to promote economic growth and reduce poverty in the regions by providing financial and technical assistance to young people, and the main goal is to develop the private sector in the regions, promote the involvement of young people in business and make investments in the production/sale chain of agricultural products.

Institutional measures, in our view, will have a positive impact on the non-productive use of resources including the introduction of certification systems and the imposition of fees for ecological/environmental protection or climate services.

From the social point of view, the impact on the environment should be determined by the progress that the regions achieve with using of multi-factorial social indicators revealing food security, health status growth, education expansion in environmental issues, social awareness raising, and other.

All these measures are not exhaustive, the field is wide and there are many practical examples in the world to influence the environment, but their effectiveness is only fragmentary. Accordingly, there is a need for the generalization of complex, best practices, which should be preceded by the formation of a unified system of country assessments that will combine economic, management, and security rational activities.

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BIOLOGICAL SCIENCES

OIL CONTENT IN SOYBEAN SEEDS BY NMR RELAXATION METHOD

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Abstract

Some of the data on the soybean seeds oil content were obtained by nondestructive NMR relaxation method for conditions of rainfed soybean fields. After harvest 2021 the minimal oil content was in the seeds of soybean variety Pentata (14,6±0,2% for the seeds with dry weight 100-150 mg and 14,9±0,4% for the seeds with dry weight 200-250 mg) and the maximal oil content was in seeds of soybean variety Ladutsa (19,3±0,3% for the seeds with dry weight 100-150 mg and 19,7±0,5% for the seeds with dry weight 150-200 mg). The oil content in seeds increases upon insufficient water provision of rainfed soybean field (Pentata, 2020 and 2022): 18-19% for the seeds with dry weight 100-250 mg.

Keywords: soybean seeds, oil content, RMN relaxation, rainfed field.

Seed oil content is important in the study of the genetic diversity of soybean. Cultivated soybean seeds have an oil content of approximately 18–22%, whereas wild soybean seeds contain about 8–10% oil [Patil G. et al., 2018]. Severe drought may change soybean seed oil content [D. L. Dornbos Jr. & R. E. Mullen,1992]. The variations in oil contents of seed were attributed largely to the differential rainfall during the seed filling stage [Vollmann J. et al., 2000]. In the conditions of Mississippi State University (USA, 33º28' N, 88º47' W) the oil content of soybean seeds was 20,2-22,5% in the pot experiments with 10 soybean varieties [Poudel S. et al., 2023]. In the conditions of Brasil for various soybean varieties the oil content of soybean seeds was 12-20% in the pot and field experiments [Filho M.M. et al, 2001]

The aim of our work was to evaluate the oil content in soybean seeds of some varieties in 2020, 2021 and 2022 (different rainfall conditions).

The studies were carried out in 2020 -2022 at the fields of the Institute of Genetics, Physiology and Plant Protection (IGFPP), in soybean cenoses with traditional cultivation technology ($400*10^3$ plants/ha, row spacing 45 cm) with the different maturity group (MG) varieties: Pentata (MG III) and Ladutsa (MG II). To assess meteorological conditions was used the relative precipitation index *(RPI)* - the ratio of precipitation sum for the given period *P* and the long term average for the same period $\underline{P}$ expressed in percent, $RPI = P/\underline{P}*100\%$;

for long period (from quarter to year) are such criteria of *RPI* value: 0-49,9% (extremely dry), 50,0-74,9% (very dry), 75,0-89,9% (dry) and 90,0-110,0% (average) [Kaczorowska Z., 1962; Bąk B., Łabędski L., 2002].

After the discovery in 1946 of the phenomenon of nuclear magnetic resonance (NMR), this method has also been used to determine the oil content in seeds. The use for biochemical purpose of the physical method, nuclear magnetic resonance and its improvement allow to do numerous rapid determinations of seed oil content during short period and significantly improve performance of analysis. Determination of oil content in seeds by NMR relaxation method is a clear, nondestructivel, fast and accurate alternative to traditional liquid chemistry methods. The oil content determined by NMR relaxation method strictly corresponds to the amount of oil extracted from the seeds by organic solvents [Беликов И.Ф., Сазоненко М.К., 1966] and that is why the NMR relaxation method for determination of seed oil content is one of the international standards [ISO 5511:1992 (en), ISO 10565:1998]. The technique is applicable for sufficiently dry seeds, for soybeans - no more than 14% water.

Table 1 shows the data on water content in seeds for oil content determination by NMR relaxation method.

Table 1

Water content in seeds for oil content determination by NMR relaxation method

Variety	Harvest year	Water content, *% dry weight*
Pentata	2020	**10,0±0,4**
Pentata	2021	**11,2±0,3**
Pentata	2022	**13,3±0,3**
Ladutsa	2021	**9,0±0,0**

Due to longer storage the water content in more aged seeds of Pentata variety (harvest 2020 and 2021) was less than those of harvest 2022.

The NMR measurements were performed on individual seeds. The oil content of seeds was determined by comparing echo-signal amplitudes from seeds with echo-signal amplitudes of calibration standards with different oil contents in glass chips.

Figure 1 shows the calibration standards for oil content determination by NMR relaxation.
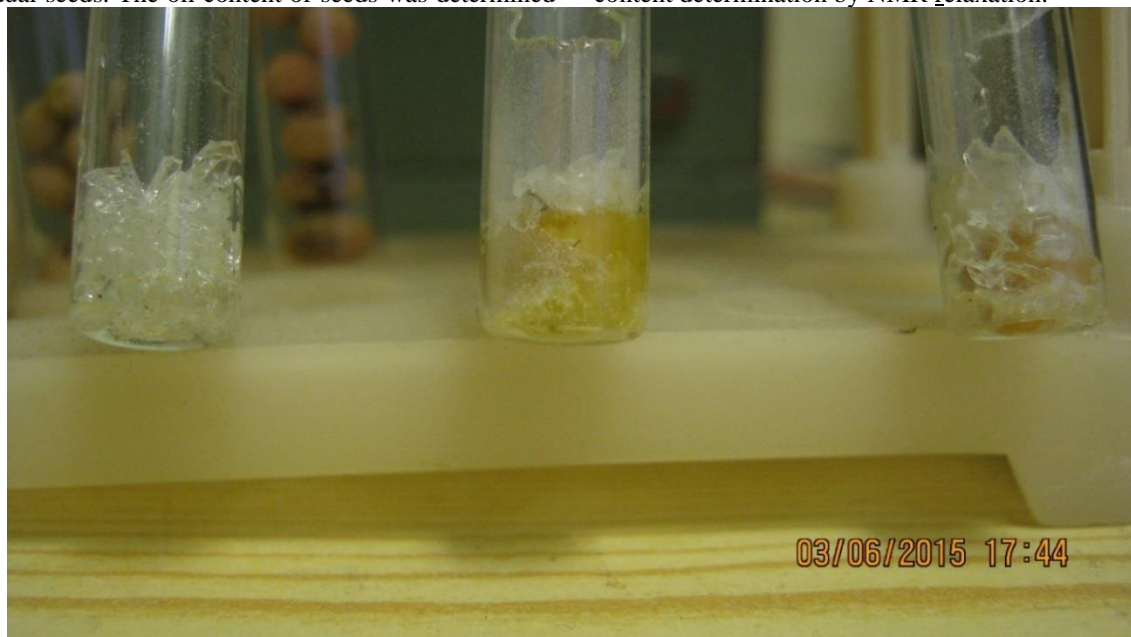
Figure 1. Some of the standards with different oil content in glass chips. For calibration was used soybean oil, obtained from soybean seeds soybean Bucuria, harvested in 2011. The oil from the seeds was obtained from soybean meal after two extractions by toluene.

The data on oil content in seeds of soybean varieties Ladutsa and Pentata (harvest 2021) are shown in Figure 2.
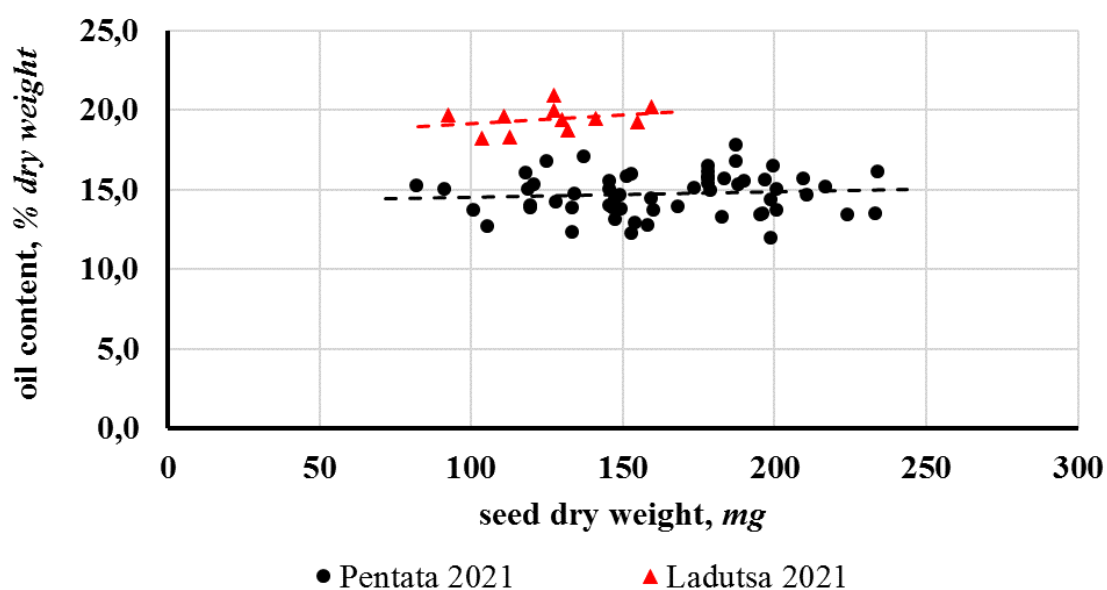
Figure 2. The oil content in soybean seeds of Pentata and Ladutsa varieties (harvest 2021). Each dot corresponds to a separate individual seed.

Table 2 shows the data on oil content determination by NMR relaxation method for different groups according the seed weight.

Table 2

Oil content in seeds of different weight for soybean varieties Pentata and Ladutsa (harvest 2021)

Variety	Individual seed weight, *mg*		Oil content, *% dry weight*
	range	average	
Pentata	100-150	128±4	**14,6**±0,2
	150-200	177±2	**14,8**±0,2
	200-250	214±5	**14,9**±0,4
	250-300	269±16	**15,0**±0,3
Ladutsa	100-150	123±4	**19,3**±0,3
	150-200	157±2	**19,7**±0,5

Based on the relationship between precipitation and potential evapotranspiration for Chisinau [Potop V., Boroneant C., 2014] with a view to biological particularities of soybean ontogenesis, have been analyzed the meteorological conditions of the soybean growing year for 8-months (from 1/09 last year to 30/04 of the harvest year) and 10-months (from 1/09 last year to 30/06 of the harvest year) periods. According to long-term average data for these periods, 326 and 444 mm of precipitation falls in Chisinau. For 2021 soybean seeds 8-months value (September 2020/April 2021) was 309 mm and 10-months value (September 2020/June 2021) was 450 mm. In meteorological terms [Kaczorowska Z., 1962; Bąk B., Łabędski L., 2002] the indicated periods of moisture accumulation for the seeds of the 2021 harvest were characterized by an *RPI* value of 95 and 101% (average).

Based on the meteorological data of 2021, from the data of Table 2 it follows that under normal conditions of water supply, soybean seeds of the Pentata variety are characterized by a lower oil content compared to the Ladutsa variety: 15 and 19%, respectively (by dry weight of seeds).

Data on the oil content in the seeds of soybean variety Pentata (harvest 2020, 2021 and 2022) are presented in Figure 3.
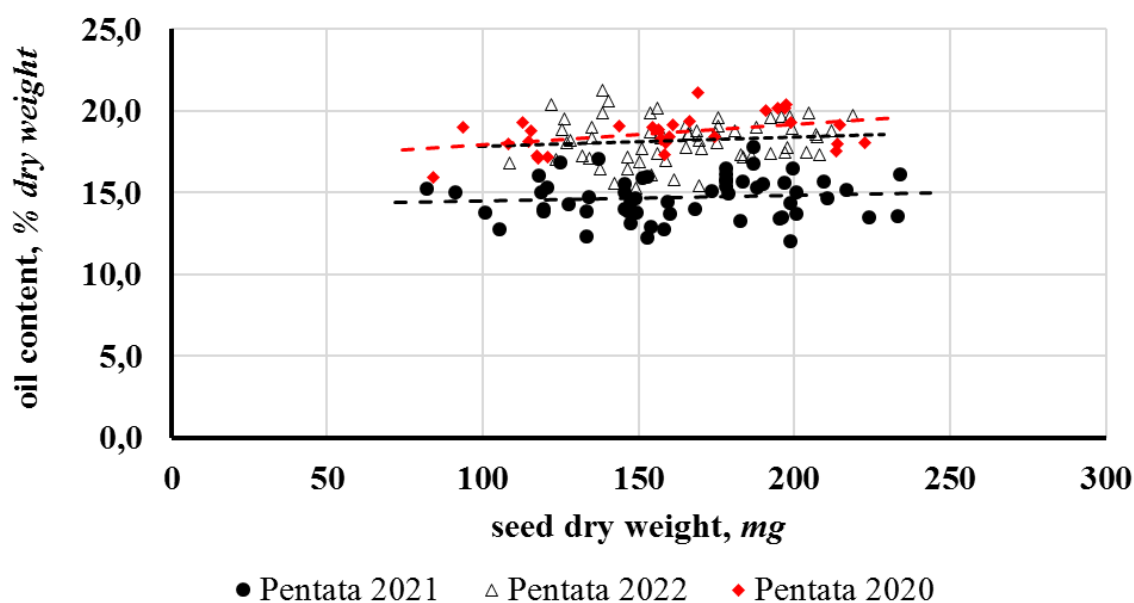

Figure 3. The oil content in soybean seeds of Pentata variety, harvest 2020, 2021 and 2022. Each dot corresponds to a separate individual seed.

Table 3 shows the data on oil content in seeds Pentata variety (harvest 2020, 2021 and 2022) for different groups according the seed weight.

Table 3

Oil content in seeds of different weight for soybean variety Pentata (harvest 2020, 2021 and 2022)

Harvest year	Individual seed weight, *mg*		Oil content, *% dry weight*
	range	average	
2020	100-150	119±4	**18,2**±0,3
	150-200	173±5	**19,2**±0,3
	200-250	216±2	**18,2**±0,3
2021	100-150	128±4	**14,6**±0,2
	150-200	177±2	**14,8**±0,2
	200-250	214±5	**14,9**±0,4
	250-300	269±16	**15,0**±0,3
2022	100-150	136±4	**18,0**±0,3
	150-200	174±3	**18,2**±0,2
	200-250	209±2	**18,6**±0,4

Based on the relationship between precipitation and potential evapotranspiration for Chisinau [Potop V., Boroneant C., 2014] with a view to biological particularities of soybean ontogenesis, have been analyzed the meteorological conditions of the soybean growing year for 8-months (from 1/09 last year to 30/04 of the harvest year) and 10-months (from 1/09 last year to 30/06 of the harvest year) periods. According to long-term average data for these periods, 326 and 444 mm of precipitation falls in Chisinau. For 2021 soybean seeds 10-months value (September 2020/June 2021) was 450 mm, and for 2020 and 2022 soybean seeds these values were 258 and 196 mm. In meteorological terms [Kaczorowska Z., 1962; Bąk B., Łabędski L., 2002] the indicated period of moisture accumulation for the seeds of the 2021 harvest was characterized by an *RPI* value of 101% (average), and for the seeds of the 2020 and 2022 harvest – by an *RPI* value of 58% (dry) and 44% (extremely dry).

For 2020 and 2022 soybean seeds 8-months meteorological values were 108 and 168 mm. In meteorological terms [Kaczorowska Z., 1962; Bąk B., Łabędski L., 2002] the indicated periods of moisture accumulation for the seeds of the 2021 harvest were characterized by an *RPI* value of 101% (average), and for the seeds of the 2020 and 2022 harvest – by an *RPI* value of 33% (extremely dry) and 52% (dry). Insufficient precipitation over 8 months of moisture accumulation (September 2021/April 2022) continued in May and June 2022 (21 and 7 mm, respectively) and resulted in severe meteorological drought for 10-months period (September 2021-June 2022) with an *RPI* of 44%.

Based on the meteorological data for 2020, 2021 and 2022, it follows from the data in Table 3 that soybean seeds of the Pentata variety under normal conditions of moisture supply (2021) are characterized by a reduced oil content compared to the conditions of extremely severe drought (2020 and 2022): respectively, 15 and 18- 19% on dry seed weight.

Conclusion

The minimal oil content in seeds was determined for soybean variety Pentata at harvest 2021 – 14,6-15,0% dry weight (14,6±0,2% for the seeds with dry weight 100-150 mg and 14,9±0,4% for the seeds with dry weight 200-250 mg). The maximal oil content in seeds was determined for soybean variety Ladutsa at harvest 2021 – 19,3-19,7% dry weight (19,3±0,3% for

the seeds with dry weight 100-150 mg and 19,7±0,5% for the seeds with dry weight 150-200 mg).

The oil content in seeds soybean variety Pentata increased upon insufficient water provision of rainfed soybean field. After harvest 2020 (*RPI* 33% for period from 01.09.2021 untill 30.04.2022 corresponds to extremely severe meteorological drought) oil content in seeds of this variety became higher (than after harvest 2021) - 18,2±0,3% for the seeds with dry weight 100-150 mg and 200-250 mg; and 19,2±0,3% for the seeds with dry weight 150-200 mg. After harvest 2022 (*RPI* 44% for period from 01.09.2021 untill 30.06.2022 corresponds to extremely severe meteorological drought) oil content in seeds of this variety became higher (than after harvest 2021) - 18,0-18,6% dry weight (18,0±0,3% for the seeds with dry weight 100-150 mg and 18,6±0,4% for the seeds with dry weight 200-250 mg).

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ECONOMIC SCIENCES

ПРЕДПРИНИМАТЕЛЬСТВО И ПРЕДПРИНИМАТЕЛЬСКАЯ ДЕЯТЕЛЬНОСТЬ: СУЩНОСТЬ И СОДЕРЖАТЕЛЬНЫЕ ХАРАКТЕРИСТИКИ

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ENTREPRENEURSHIP AND ENTREPRENEURIAL ACTIVITY: ESSENCE AND CONTENT CHARACTERISTICS

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Аннотация
В статье дается анализ сущности предпринимательства и малого и среднего бизнеса.
Abstract
The article provides an analysis of the essence of entrepreneurship and small and medium-sized businesses.
Ключевые слова: предпринимательство, предпринимательская деятельность, малое и среднее предпринимательство.
Keywords: entrepreneurship, entrepreneurial activity, small and medium business.

Деятельности малого и среднего бизнеса или как еще говорят малого и среднего предпринимательства (далее – МСП) уделяется большое внимание в современных условиях хозяйствования большинства стран мира. Формирование этого сегмента представляется важным, поскольку МСП является частью национальной экономической системы, вносит существенный вклад с социально-экономическое развитие государства. Реализуемые в этом направлении мероприятия носят характер национальных проектов, для реализации которых разрабатываются различные государственные программы финансовой и иной поддержки предпринимательства в различных формах, совершенствуется институциональная среда в целях создания условий, стимулирующих развитие МСП.

МСП развивается по определенным экономическим и социальным законам, имеет свои закономерности. Понятие МСП принято отождествлять с понятием предпринимательства и предпринимателя. Это обусловлено тем, что этим сегментом управляют, как правило, сами учредители, собственники. Они определяют миссию, стратегические цели и задачи своей деятельности, непосредственно участвуют в реализации этих целей, управляя производством, сбытом и иными направлениями работы созданного предприятия. Склонность к предпринимательству – это, безусловно, особое свойство отдельной части граждан. Это люди, способные генерировать идеи, рисковать собственным имуществом, а порой и здоровьем, зарабатывающие сами и предоставляющие возможность зарабатывать другим, несущие социальную ответственность посредством создания рабочих мест и уплаты налогов.

Состояние, размер доля МСП в формировании ВВП оказывает влияние на способность той или иной страны своевременно адаптироваться в условиях высокой изменяемости, волатильности различных внешних и внутренних факторов, оказывающих влияние на экономику.

Изучению деятельности МСП, иными словами, предпринимательства уделено большое внимание в экономической науке. Изучение феномена предпринимательства началось с развитием экономических (рыночных) отношений. В трудах ученых экономистов различных эпох рассматривались отличительные признаки предпринимательства, определяющие его идентификацию.

Классик экономической теории А.Смит к признакам предпринимательства относил владение капиталом, наличие коммерческой идеи, направленной на получение прибыли, с присутствием экономического риска. А.Смит сформулировал также эгоистичный подход предпринимателя к осуществлению экономической деятельности. [1].

На эгоистическую составляющую предпринимательской деятельности с одной стороны и социальную выгоду для общества и государства с другой стороны указывал К.Маркс, «….стремление каждого к своей собственной выгоде, своекорыстие, личный интерес. Но именно поэтому, что каждый заботится о только о себе, и никто не заботится о другом, все они в силу гармонии вещей и благодаря всехитростному проведению осуществляют лишь дело взаимной выгоды, общей пользы и общего интереса [2].

Оригинальные признаки предпринимательства были выделены немецким экономистом В.Зомбартом, который отметил в этом социальном явлении

две противоположных сущности. С одной стороны наличие экономической свободы, предпринимательского духа, способность к риску, генерирование идей, с другой – умеренность, рассудительность, расчетливость, примерность и прилежание, вообщем такие атрибуты традиционной немецкой составляющей.

Предприниматель по В. Зомбарту это завоеватель, организатор, торговец в одном лице, «...предприниматель является организатором, обладающим недюжинной изобретательностью; среди людей он мудро отбирает самых способных; среди товаров проницательно отыскивает наилучшие; быстро оценивает свои шансы на успех; проявляет напористость в своих отношениях с поставщиками; предприниматель видит так, как если бы имел тысячу глаз, слышит так, как если бы у него была тысяча ушей, и осязает так, как если бы располагал тысячью пальцами» [3].

Одним из первых фундаментальный анализ сущности предпринимательства сделал Й. Штумпетер. По его мнению предприниматель это субъект, который осуществляет новые комбинации факторов производства и сам выступает, как его активный элемент. Предпринимательский труд, как по своей природе, так и по выполняемой функции качественно отличается от любого другого, в том числе и труда по управлению, а тем более от умственного труда и от всего того, что делает предприниматель, помимо осуществления своей предпринимательской деятельности.

Развивая эту тему Й. Штумпетер определил, что ключевым элементом предпринимательства является именно наличие новизны в процессе осуществления деятельности, инноваций. После того, как учрежденное им дело начинает функционировать в рамках обычного кругооборота, предпринимательство прекращается и появляется капиталист, т.е. просто владелец бизнеса [4].

К последнему утверждению следует относится критически, поскольку хозяйственная деятельность МСП, которым управляет сам собственник достаточно гибка и требует в целях сохранения ее эффективности постоянно «держать руку на пульсе», принимая неординарные, а по сути новые решения в связи с чем очень проблематично провести эту грань где начинается обычный кругооборот. Таким образом МСП сам по себе инновационен по своей сущности.

В настоящее время определению предпринимательства также уделяется большое значение в трудах экономистов, философов, социологов. Сам феномен предпринимательства, его сущность стала предметом не только экономической науки.

Традиционно большую работу в этом направлении ведут зарубежные ученые, поскольку там предпринимательская деятельность существует уже на протяжении длительного времени, занятие предпринимательством передается из поколения в поколение.

Вместе с тем трансформация экономики и экономической мысли на постсоветском пространстве приводит к появлению исследований по проблеме предпринимательства странах СНГ. Российских ученые В.Г.Медынский, Л.Г. Скамай среди признаков предпринимательства выделяют творчество, поиск новых сфер вложения капитала, создание новых и совершенствование имеющихся продуктов, формирование собственных преимуществ, эффективное использование различных возможностей с конечной целью - получение прибыли [5]

Шевелев С. Ю., Шевелева Е.А., Кропотова Л.А. к особенностям осуществления предпринимательской деятельности относят интеллектуальность, динамизм, инициативу, смелость, воплощение реальность интересных идей [6].

По мнению Агеева А.И. «предпринимательство очевидным образом относится к классу новаторской экономической деятельности. Однако это новаторство особого рода — в комбинировании производственных факторов» [7,25]. Агеев А.И. также выделяет ключевым признаком предпринимательства такой элемент, как экономическая свобода, который заключается в наличии возможностей по самостоятельному принятию решений, направленных на выбор вида, формы и сферы хозяйственной активности, способов и методов ее осуществления, использованию продукта и дохода, приносимого данной деятельностью.

Легальное определение предпринимательства дается в Гражданском кодексе Республики Беларусь, где предпринимательская деятельность определяется как самостоятельная деятельность юридических и физических лиц, осуществляемая ими в гражданском обороте от своего имени, на свой риск и под свою имущественную ответственность и направленная на систематическое получение прибыли от пользования имуществом, продажи вещей, произведенных, переработанных или приобретенных указанными лицами для продажи, а также от выполнения работ или оказания услуг, если эти работы или услуги предназначаются для реализации другим лицам и не используются для собственного потребления.[8]

С течением времени осмысление понятия предпринимательства, его признаков изменялись. Это свидетельствует о том, что его не следует рассматривать, как какое-то постоянное явление. Поскольку этот феномен связан напрямую с развитием человека и общества, является динамичным, постоянно совершенствующимся под влиянием экономических и политических условий, вместе с развитием знаний и технологий.

Обобщая проведенные исследования сущности и содержательных характеристик предпринимательства можно сделать вывод о том, что существует большое количество его отличительных особенностей. Это обусловлено с тем, что учеными применяются различные основания, которые позволяют установить и описать специфические характеристики этого института.

Вместе с тем анализируя определения предпринимательства, предложенные учеными-экономистами можно выделить следующие отличительные черты:

– деятельность, основанная на самостоятельной инициативе, направленная на реализацию собственной идеи, за собственный риск;

– нацеленность на конкретный результат, самореализацию;

– способ участия индивида в системе рыночных отношений;

– форма реализации личного экономического или иного интереса, развитие личного потенциала;

– стремление к объединению различных ресурсов;

– человечность, т.е. стремление при осуществлении деятельности с иными субъектами сохранить естественный человеческий формат отношений;

Исходя из указанных особенностей, предпринимательство в настоящее время можно рассматривать в разных аспектах таких как:

экономическая категория;

модель экономического поведения и мышления;

образ жизни;

профессия;

система философских и нравственных ценностей и др.[9].

Деятельность МСП оказывает влияние на различные области экономики, что выражается в достижении тех или иных эффектов.

Эффекты деятельности МСП

Экономические	Социальные	Инновационные
увеличение ВВП развитие конкуренции совершенствование продуктов, услуг развитие факторов производства освоение новых рынков удовлетворение спроса	увеличение рабочих мест увеличение налоговых поступлений формирование среднего класса	развитие интеллектуального потенциала модернизация (цифровая трансформация) производства разработка новых продуктов формирование спроса.

МСП может осуществляться в различных сферах, основными из которых являются сфера торговли и оказания услуг, производство. В основе предпочтений МСП находятся те сферы, которые не требуют больших капиталовложений на начальной стадии с одной стороны и высокой оборачиваемостью вложений с другой. Богатство быстрее формируется в сфере обращения, а не производства.

На сегодняшний день в нашей стране пока еще не сложилась общепринятая экономическая теория отечественного предпринимательства, поэтому остро стоит проблематика теоретического осмысления сущности предпринимательства.

Одним из факторов, влияющих на развитие МСП в отдельно взятом регионе, является имеющаяся сформированная или формирующаяся культура предпринимательства.

Изучению обстоятельств, оказывающих влияние на культуру МСП, сегодня уделяется недостаточно внимание. В тоже время именно культура формирует систему ценностей, представление о вариантах должного поведения в соответствующей области, основы для взаимоотношений с другими субъектами. МСП, как составляющая часть общества также формирует свою культуру По мнению Дюмец Ж., Сизовой Ю.С. «под культурой предпринимательства понимается система совместно формируемых убеждений и представлений о ценностях и нормах поведения. При этом представления о ценностях позволяют дать ответ на вопрос, что важно для предпринимателя, а убеждения — понять, как предприниматель должен действовать» [10, 250].

Макеева В. полагает, что к культуре предпринимательства относятся также система социальных норм, развитее общественных институтов, оказывающих влияние на методы осуществления предпринимательской деятельности, которые обеспечивают передачу имеющегося опыта, что в конечном итоге оказывает прямое влияние на устойчивость и эффективность предпринимательства во времени. [11].

Культура предпринимательства формируется вместе с формированием самого МСП. Поэтому в странах, где МСП развивалось и становилось на протяжении нескольких веков, культура предпринимательства гораздо выше и прогрессивней. В нашей стране, как и в иных государствах, где МСП развивается небольшой промежуток времени, уровень культуры предпринимательства находится на этапе становления. Становление предпринимательства на постсоветском пространстве, в том числе в Республики Беларусь пришлось на начала 90-х годов, в период прекращения существования СССР в условиях непредсказуемости развития событий, дальнейшего экономического развития, отсутствия правовых основ осуществления предпринимательской деятельности, что приводило формированию МСП в нецивилизованных, искаженных, а часто и противозаконных формах, что в свою очередь обуславливало теневую направленность предпринимательства [12].

Поскольку в основе предпринимательской деятельности находятся решения и действия конкретного индивида, в целях осмысления понимания перспектив развития МСП следует обратить внимание на побудительные мотивы принятия решений об осуществлении предпринимательской деятельности.

Экономика страны — это система, координирующая деловую активность в обществе. Экономическая теория изучает экономику, как на уровне отдельных индивидуумов, так и на уровне общества в

целом. Микроэкономика, как составная часть экономической теории изучает основы взаимоотношений между людьми и определяет общие закономерности их хозяйственной деятельности. Непосредственным предметом микроэкономики является отношения, связанные с поведением людей, принятием ими решений и реализации соответствующих экономических действий, а также проблема выбора одного из альтернативных вариантов поведения. Таким образом, каждая составляющая часть экономики, ее проблема и основа заключается в индивидуальном выборе, который делают люди. Иными словами, это решения по выбору из различных альтернатив.

Предприниматели, как было указано ранее это составная часть экономической системы.

В этой связи важным с точки зрения изучения перспектив развития предпринимательства является определение побудительных мотивов человека к осуществлению предпринимательской деятельности.

Мотив согласно словарю С.И. Ожегова, это «побудительная причина, повод к какому то действию».

В психологии мотивация, как и многие другие термины, является многозначным. Наиболее общими словами под мотивацией в психологии понимают все формы внутренних побуждений человека, которые включают в себя потребности, импульсы, влечения, желания, хотения, интересы и прочие источники спонтанной активности. Отсюда формируется волевое поведение человека, которое заключается в реализации социальных и познавательных потребностях, таких как потребности в уважении, признании и любви, потребность занимать определенный статус в обществе, потребность узнавать новое. Эти потребности создают основу для сознательной формулировке цели, достижение которой может его удовлетворить.

Исходя их указанных определений можно выделить следующие мотивы для осуществления предпринимательской деятельности:

реализация собственных целей;
достижение относительной независимости;
получение статуса в обществе;
удовлетворение собственных потребностей.

Таким образом, представляется возможным дать авторское определение. Предпринимательство это деятельность конкретного субъекта, направленная на реализацию собственной идеи, основанная на личном представлении о методах и способах достижения цели, осуществляемая на свой страх и риск в целях получения материального или морального удовлетворения.

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ГОСУДАРСТВЕННОЕ РЕГУЛИРОВНИЕ В СФЕРЕ МАЛОГО И СРЕДНЕГО БИЗНЕСА

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Аннотация
В статье анализируются цели и формы государственного регулирования предпринимательской деятельности, деятельности малого и среднего бизнеса.
Abstract
The article analyzes the goals and forms of state regulation of entrepreneurial activity, the activities of small and medium-sized businesses.
Ключевые слова: государственное регулирование частного бизнеса, предпринимательство, предпринимательская деятельность, малое и среднее предпринимательство.
Keywords: state regulation of private business, entrepreneurship, entrepreneurial activity, small and medium business.

Основной функцией любого государства является обеспечение эффективного функционирования всех составляющих его элементов. Целью государства должно быть решение общих проблем и создание условий для обеспечения общего блага.

Экономические отношения являются одним ключевых элементов любой страны. Таким образом, экономика, экономические отношения существуют внутри государства.

Роль государства в экономическом развитии является предметом дискуссий и споров. Ранее мнения о роли государства в экономике были диаметрально различны, начиная с полного отрицания участия государства в регулировании экономических отношений, до рассмотрения методов регулирования, глубины вмешательства в экономические отношения.

А.Смит полагал, что лучший вариант для государства это не вмешиваться в функционирование экономической системы, рынок за счет конкуренции сам отрегулирует свое оптимальное состояние [1].

Однако история показала, что данная теория не подтвердилась практически, поскольку нельзя добиться идеальных условий в существовании экономики. Экономический кризис 1929 – 1933 годов стал триггером формирования иной теории взглядов, касающихся участия государства в регулировании экономики.

В результате этого Дж. Кейнс сделал вывод, что экономике не свойственна саморегуляция, таким образом она не имеет возможностей исключить периодические спады производства, а также инфляцию, безработицу, несправедливое распределения доходов [2].

В настоящее время полемика среди экономистов, политиков ведется не о наличии либо отсутствии государства в экономических отношениях, а о степени глубины влияния государства на экономику. Не может экономика, складывающиеся в экономике отношения существовать автономно, без участия государства. Ведь, например, о каком экономическом развитии может идти речь, если в государстве отсутствует общественный порядок и не обеспечена безопасность, а поддержание общественного порядка и безопасности это одна из функций и задач государства.

При осуществлении регулировании используются различные методы, в том числе директивного и административного управления. Государством осуществляется стимулирование действий субъектов экономики методами принятия социально - экономических доктрин и развития экономических и социальных институтов, формированием институциональной среды, идеологии экономического и социального устройства.

Создание благоприятной среды для развития экономики является необходимым условием для экономического развития. Все вышеперечисленное имеет прямое отношение к регулированию общественных отношений, связанных с функционированием малого и среднего предпринимательства (МСП).

Объектом государственного регулирования в области МСП являются общественные отношения, связанные с формированием условий, стимулирующих активную часть населения заниматься предпринимательской деятельностью. Главной целью регулирования МСП является повышение его роли в экономике, объеме в формировании ВВП, т.е. в конечном итоге его масштабировании.

Республика Беларусь не является исключением. Пройдя путь становления независимого государства и собственной экономики на настоящем этапе развития в Республике Беларусь принят ряд важнейших документов, направленных на создание институциональной среды развития и эффективного функционирования МСП. На уровне правительства утверждена Стратегии развития малого и среднего предпринимательства "Беларусь – страна успешного предпринимательства" на период до 2030 года». Целью данного документа является формирование динамично развивающегося сектора малого и среднего предпринимательства, способного существенно улучшить структуру белорусской экономики, повысить ее конкурентоспособность, обеспечить эффективную занятость и рост доходов населения.

В результате реализации Стратегии развития малого и среднего предпринимательства «Беларусь – страна успешного предпринимательства на период до 2030 года» при согласованных действиях органов государственной власти и бизнеса планируется к 2030 г. довести долю субъектов малого и среднего предпринимательства в общем объеме валовой добавленной стоимости до 50% [3].

Исходя из этих целей можно сформулировать основные функции государства в рамках регулирования МСП:

1. Регулятивная функция. В первую очередь основой развития любых отношений являются доктринальная, нормативная основа. Это система нормативных актов, формирующих задачи и цели регулирования отношений, связанных с МСП, критерии оценки эффективности выполнения этих задач, определение инструментов их реализации. Во вторую очередь это регулирования конкретных экономических отношений в рамках осуществления предпринимательской деятельности, главная цель которого заключается в создании единых правил поведения для всех субъектов хозяйствования.

2. Стимулирующая функция. Разработка и внедрение различных форм, методов материального и нематериального стимулирования и поддержки функционирования МСП. К этим формам относятся разработка специальных программ финансирования, имущественная, информационная поддержка, создание инфраструктуры для развития МСП, формирование понятных условий налогообложения, снижения издержек его администрирования. Существенным элементом условий эффективного развития МСП является соблюдение правил рыночной конкуренции, обеспечение равных прав субъектам хозяйствования независимо от форм собственности. Причем все эти инструменты поддержки МСП должны быть не самоцелью, а формироваться с учетом того положения, в котором находится МСП в конкретный промежуток времени, учитывать реальный спрос на те или иные формы. Это должна быть динамичная система, способная изменяться вместе с изменениями внешних и внутренних факторов.

3. Охранительная функция. Одна из важнейших функций государства – это обеспечение безопасности конкретного гражданина и всего общества в целом. Причем гарантирование как личной, так и экономической безопасности. Гарантия экономической безопасности заключается прежде всего в обеспечении реализации свободы добросовестного предпринимательства, охрану законных интересов бизнеса, его собственности. К числу указанной функции также относится реализации мер по недопущению недобросовестной конкуренции, борьбе с коррупцией.

Исследуя проблемы государственного регулирования предпринимательской деятельности, М. Эдаси, Е.О. Вдовенко полагают, что в государственном регулировании предпринимательской деятельности в нормативных правовых актах должны указываться только общие нормативы развития, а предприниматели вольны поступать в соответствии с принципом все что не запрещено – дозволено. При этом запреты устанавливаются на те цели, которые антигуманны и противоестественны [4]. Можно согласиться с этой точкой зрения. Но при этом следует понимать, что в этом случае предприниматели должны обладать высокой правовой культурой. В противном случае это может стимулировать криминализацию бизнеса. Важно также понимать, что государство с одной стороны предоставляя права и свободы, с другой предусматривает систему контроля за исполнением законов и ответственность за их нарушение. Говоря об ответственности за совершение экономических правонарушений, следует учитывать их характер, негативные последствия их совершения и другие факторы. Большую роль в недопущении совершения экономических правонарушений является стабильность законодательства, сформированная правоприменительная практика, профилактическая работа государственных органов.

В отношении взаимодействия государства и бизнеса интересен опыт Китая. Правительство играет роль скорее «ночного сторожа» а не «судьи» или «игрока», и с помощью макроэкономического регулирования корректирует «провалы рынка». Бизнес играет роль движущей экономической силы и придерживается сформулированного на государственном уровне правила: «Чтобы экономика росла не бизнес должен слушать правительство, а правительство бизнес» [5].

Государство и предприниматели должны взаимодействовать друг с другом, решая стоящие перед ними задачи. Предпринимательством занимается наиболее активная часть общества. При этом никто не может заставить кого-то быть предпринимателем. Исходя из этого государственное регулирование МСП, которое направлено на его устойчивое развитие и расширение должно стать побудительным мотивом для уже действующих предпринимателей и на потенциальных. Это может быть достигнуто только при системном подходе всех государственных органов от законодателей до правоприменителей, которые обеспечивают адек-

ватность, предсказуемость, определенную постоянность институциональной базы функционирования предпринимателей и ведения бизнеса.

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PEDAGOGICAL SCIENCES

TEACHERS' PERCEPTIONS OF FORMING LINGUOCULTURAL COMPETENCE OF SECONDARY SCHOOL STUDENTS USING MULTIMEDIA TECHNOLOGIES

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Abstract

The article is devoted to the actual problem of the formation of linguocultural competence in the context of informatization. The author analyzes the prerequisites for the demand for this competence in the light of the modern educational paradigm. However, the analysis of the scientific literature on this problem shows that it's necessary to implement different approaches (technologies) in order to develop this competence. Further, the author emphasizes that multimedia technologies can fulfill the needs of the individual in the process of forming linguocultural competence. Analysis of the secondary school teachers' perceptions show that the use of multimedia technologies contribute to the best assimilation of new material and the development of acquired skills. The author provides a list of useful multimedia resources that can improve the skills and increase the level of foreign language proficiency.

Keywords: teachers' perceptions, linguocultural competence, multimedia technologies, secondary school students.

Introduction

The modern system of teaching foreign languages to students is aimed at mastering language and speech skills in sociocultural space. In schools, there is a need for a linguoculturological approach to teaching the foreign language, which is based on the idea interconnected learning of language and culture. Co-study of language and culture, the development of not only linguistic, but also communicative and cultural competence of the individual becomes the main line of teaching the foreign language for secondary schools.

Linguocultural approach in the modern language education means that in the process of teaching, "the realities of society and culture (both spiritual and material) must be comprehended by a person through language as values of being" (Arkhipova 2004, p. 34).

In the textbook "Linguoculturology, value-semantic space of the language" N.F. Alefirenko notes: "An analysis of the methodological literature made it possible to determine the linguoculturological approach as one of the most effective, which is aimed at developing and improving intercultural communication skills through the study of language as a cultural phenomenon. Since linguoculturology is a theoretical justification for the formation of a secondary linguistic personality in a didactic interpretation, communication skills necessary for teaching carriers of various national images of the world and preventing intercultural interference, a linguocultural approach in teaching foreign language is one of the conditions for mastering vocabulary that mediates intercultural communication" [6 ,105].

However, there is a need in implementing possible means to master linguocultural competence. An effective means in teaching the linguo and cultural aspects are interactive programs created on the basis of multimedia technologies. These programs are effective both for accompanying classes and for independent work, since they can present the entire language and grammatical material of the lesson in a convenient and effective way to learn form. Multimedia technology allows to combine text into a single whole, sound, graphics, animation and video. Multimedia in many ways today overlaps the possibilities of other means [2, p. 56].

However, the previous studies have shown that the goal of multimedia technologies is to ensure equal access for all participants in the educational process to educational resources and technologies aimed at mass quality education. Multimedia tools make it possible to immerse students in an atmosphere close to that which occurs during real communication with native speakers. By playing audio tracks in a foreign language, students get the opportunity to hear free foreign speech. The teacher can use different types of tasks in lessons: situational, game, problem through the use of various activities, students experience positive emotions during the lesson, which increases their interest, and, therefore, they try to solve the task, using various methods, knowledge, skills and abilities[4,p.221]

Studies among secondary school teachers showed the trends with significant improvement on learning outcomes and formation of lingucultural competence towards English language teaching.Yet, empirical evidence on the aspects of language acquisition on the linguo and cultural aspects is still rare. The discussion on aspects of language attitudes linked to students' linguocultural competence could be generated to get a better understanding. It is hoped to reveal a new perspective in understanding the essence of linguocultural competence.Therefore, the present study aims to investigate teachers' attitudes towards formulating linguocultural competence using multimedia technologies.Specifically, this study addresses the following research questions:

1. How multimedia technologies can be important in forming linguocultural competence of secondary stage students?

2. What multimedia technologies are mostly used to develop the linguistic and cultural knowledge of students in English language teaching?

Literature review

Linguocultural competence

Linguocultural (cultural) competence - awareness of language as a form of expression of national culture, the relationship of the language and the history of the people, the national and cultural specifics of the language, knowledge of the norms of speech etiquette, culture interethnic communication.[4]

By linguoculturological competence, we mean a system of linguoculturological knowledge, skills and abilities that students master in English lessons. The formation of this competence is considered in the works of D.I. Bashurina, A.V. Getmanskaya, E.A. Ivanova, F.S. Kebekova, M.S. Kiseleva, E.E. Makarova, M.A. Mignenko, I.A. Orekhova, M.A. Pakhnotskaya, L.G. Sayakhova, N.A. Fomenko, F.B. Khubieva, E.A. Chubina, A.M. Shuraleva and others.Researchers V.I. Telia (2002, p. 309) and E.A. Dortman (2012,p. 26) define LCC as the ability to understand the cultural and national mentality of the carriers language, national specifics of the language picture of the world, national-cultural component of the meaning of linguistic units expressed in the cultural semantics of linguistic signs. At the same time, I.V. Kharchenkova and V.N. Taelia indicate that LCC includes the skill interpret linguistic signs and facts in terms of cultural code. Scientists V.V. Vorobyov (2007,p.56), L.A. Koneva, D.I. Bashurin (2005,p.63), I.V. Kharchenkova agree and believe that LCC is a system of knowledge about culture and cultural values embodied in the language. Therefore, linguocultural competence involves the formation of students of the necessary knowledge of educational culturological material, possession of a minimum of general literary vocabulary, knowledge of language means (phonetic, lexical, grammatical) allowing enter into the process of communication, the construction of their life in accordance with the spiritual and moral, moral and ethical, aesthetic and creative potential deployed in the linguistic consciousness conceptual sphere of national culture. In other words, it is focused on an "activity-based approach that allows to acquire the ability to use the knowledge gained in practice during intercultural communication and international communication" (Morozkina 2006, p. 324).

Multimedia technologies

Multimedia means are a set of hardware and software tools that allow a person to communicate with a computer using a variety of natural environments: sound, video, graphics, texts, animation.[9] The majority of technical tools that enable us to convey information in a very broad sense do so by utilizing the capacity for learning provided by human senses, turning information into knowledge, and stimulating learners' cognitive processes. For educational institutions to remain relevant in the twenty-first century, multimedia technologies are viewed as essential (Selwyn & Gordard, 2003). Educators have hailed the emergence of multimedia technologies as a catalyst for improvement in conventional teaching methods, encouraging innovation and advancement of established methods (Osin,2005).

Furthermore, promoting students' effective learning interest is one of multimedia language teaching's ultimate goals, and it can be a useful strategy for engaging students in language acquisition (Thamarana, 2015). Students now have more networking chances thanks to developments in information and communication technology, particularly the Internet and interactive multimedia. One option to connect students with subject-matter experts who can provide assistance, feedback, and advice is through technology-mediated mentoring (Kerka, 2008). The potential of multimedia in education extends beyond interaction and exploratory learning. A "Virtual Education Space" could be created by the participants in the education sector.

Research methods

This study used a qualitative research approach to uncover the views of the teachers regarding the development of linguocultural competence. Through the use of a survey questionnaire, the data were collected. The underlying essential elements that affect students' linguocultural competence were discovered through analysis of the technologies influencing students' acquisition of linguocultural competence through questionnaire items.

Participants

This study involved 15 secondary stage teachers who currently teach at secondary school as the research participants. All teachers teach in Almaty's state, private and language schools.All participants are aware of the methodology of FLE.

Table 1.

Participant Teachers' Profile (N=15)

Gender	Degree	Experience	School	Class
Female-10(66.7%)	Undergraduate-**7 (46.7%)**	1-5 y.-**13(86.7%)**	Private-**2(13.3%)**	5-6th -**6(40%)**
Male-3(20%)	Master's-**8(53.3%)**	5-10y.-**2(13.3%)**	State-**8(53.3%)**	7-6th -**9(60%)**
Prefer not to say-2(13.3%)	doctorate	10 or more	Lang.center-**5(33.3%)**	9th

Paricipant teachers' profiles show that most of the teachers' gender is female and most of them have master's degrees, which shows that they are aware of the methodology of FLT and its main conceptual basis. Most teachers' experiences vary from 1-5 years and they teach in state schools.

Instrument

The data were gathered by the researcher using an English-language questionnaire. Part 1 focused on revealing the effectiveness of applying multimedia technologies on creating this competence (5 items), and Part 2 indicated the types of technologies (multimedia) teachers utilize in their educational process. The total number of items was 10, and they were separated into two sections (5 items). First, a Likert scale with four response options—strongly agree (1), agree (2), disagree (3), and strongly disagree (4)—was used. The second section of the survey consisted of multiple choice questions that asked participants to suggest other kinds of effective multimedia technology.

Research Procedure

Before conducting the study, the researchers have reviewed the related literature, constructed the questionnaire, and tested the instrument's reliability. After meeting the requirements, the questionnaire was distributed to the target participants. The utmost confidentiality in all information given was also emphasized. More specifically, it was calculated to know the detailed differences in teachers' attitudes towards formation of linguocultural competence. Furthermore, exploration of key features that affected teachers' perception of English language teaching in linguocultural competence was discussed to give comprehensive pedagogical implementation.

Results

This article presents a test of the hypothesis about teachers' attitudes towards teaching English using multimedia technologies. The analysis of the responses gave the researcher an overview of teachers' understanding of multimedia technologies and, in particular, their attitude to the use of multimedia technologies in teaching English and the formation of linguocultural competence.

Research question 1

Analysis on four scales was done in order to interpret the average values of the teachers' responses to the question "How multimedia technologies can be important in forming linguocultural competence of secondary stage students?".Several questionnaire results showed teachers' attitudes by interpreting answers to the following questions:

Table 2

Participant Teachers' answers

Questions	Strongly agree	Agree	Disagree	Strongly disagree
1." Due to the integration of world cultures and languages in the modern world, linguocultural competence has become one of the most important competences that must be formed in a person"	6 (40%)	6 (40%)	3(20%)	-
2. Teachers should incorporate exercises for the formation of linguocultural competence in their lessons	7 (46.7%)	6(40%)	2(13.3%)	-
3. It is important to use multimedia tecnologies(presentations,audio/video materials, visuals) in English classes	12(80%)	2(13.3%)	1 (6.7%)	-

It's possible to formulate linguocultural competence using multimedia technologies

15 responses

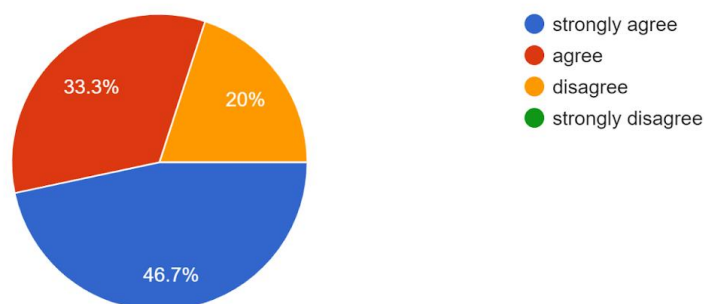- strongly agree
- agree
- disagree
- strongly disagree

Figure 1

Teachers' responses on the importance of formulating linguocultural competence using multimedia technologies.

Participants' answers' analysis in Table 2 showed mostly "strongly agree" and "agree" responses, that linguocultural competence should be developed in the educational process and this can be successful by using special educational technologies, in particular, multimedia. Figure 1 indicates that it is relevant to formulate linguocultural competence using multimedia technologies.

In general, instructors' attitudes toward the development of linguocultural competence in English classes were positive. Positive dynamics were particularly evident in the cognitive and behavioral aspects.

Research question 2

The purpose of the second questionnaire was to find out which multimedia technologies had the biggest impact on students' linguistic and cultural knowledge when teaching English.

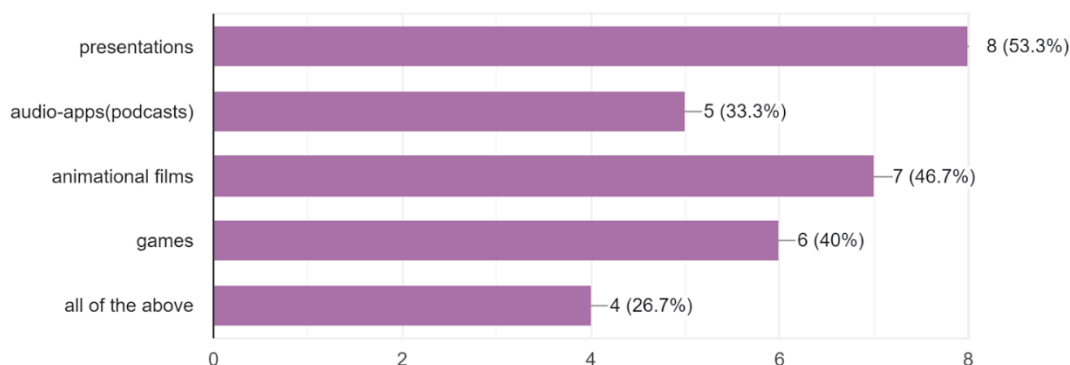Which of these multimedia tools do you use in your English classes
15 responses

Figure 2. Multimedia tools that mostly used in teachers' lessons

The results of the questionnaire indicated that 8 teachers use presentations(53.3%),7 teachers animational films(46.7%) and 6 teachers incorporate games(40%), others use audio apps (33.3%) in their English lessons. All of the above types of multimedia tools are used by 4 teachers(26.7%).

In order to specify what multimedia tools can be used to formulate linguocultural competence, teachers were asked the following question(Figure 3):
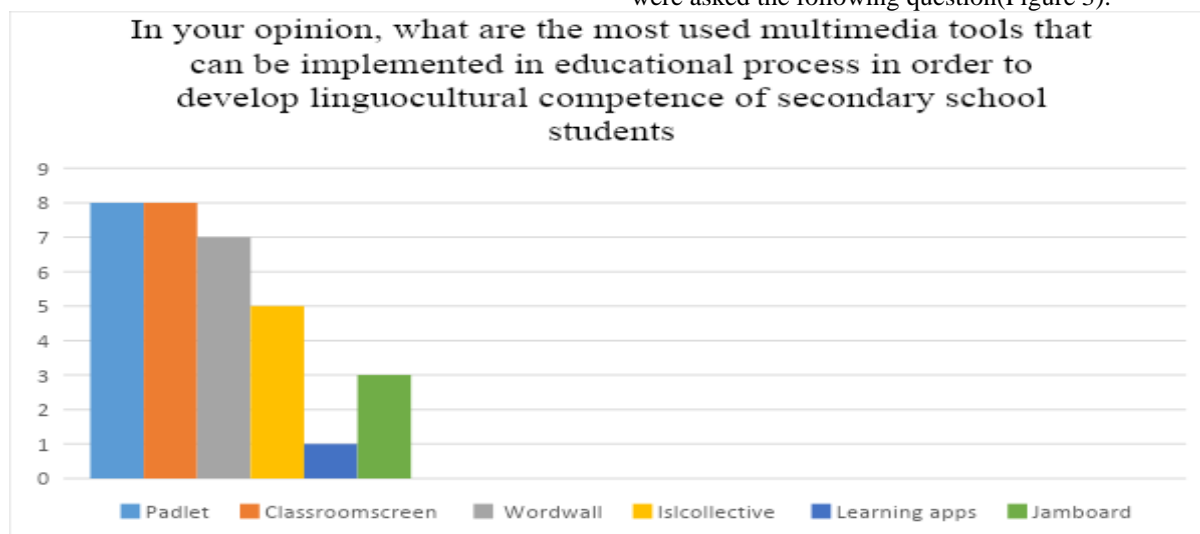

Figure 3. Teachers' responses on the most used multimedia tools, in order to develop linguocultural competence of secondary school students.

Figure 3 illustrates teachers' attitudes on the most used multimedia tools that can possibly formulate linguocultural competence of students. Thus, electronic boards like Padlet(8 teachers), classroomscreen(8 teachers), wordwall(7 teachers) had the best impact among other multimedia tools.

Discussion

The main purpose of this research is to study the perceptions of school teachers about the development of linguocultural competence using multimedia technology in English lessons. The formation of linguocultural competence, which contributes to the use of not only language, but also cultural norms, has become a serious problem due to the active globalization of society. Revealing the attitude of teachers to the formation of this competence, the author can offer an additional point of view. First, the study showed that teachers have a positive attitude towards the use of multimedia technologies that contribute to the development of certain competencies, including linguocultural one. This finding supported a prior study by Arkhipova (2010) and Telman (2010) that demonstrated the importance of the teacher in developing students' proficiency in foreign languages through the use of interactive technologies. According to Diachkova (2020), students demonstrated their language skills and a favorable attitude toward

language learning more frequently in activity classes that were participatory, immersive, and engaging.

Using questionnaire items to explore cognitive and behavioral factors can help English teachers better understand how to use multimedia technology to increase students' linguocultural competence. Teachers at secondary schools suggested a variety of multimedia technologies. According to an analysis of Simunova's (2020) work, multimedia tools are useful means of developing foreign language abilities.

Throughout the study, teachers demonstrated favorable views toward the development of linguocultural competency through the use of multimedia technology. Thus, it is suggested to use Padlet, ClassroomScreen, and WordWall as learning tools to develop their foreign language proficiency.

Conclusion

The findings demonstrate teachers' perspectives on the development of linguocultural competence through the use of multimedia technology. This study emphasizes how educators have an optimistic outlook on all given aspects of studies. This indicates that developing a proficiency in a foreign language is attainable with the use of multimedia technologies. As a result, these technologies will greatly improve linguocultural proficiency.

Although the study provides a variety of multimedia tools, it is confined to statistical analysis of practical applications. Future studies are therefore encouraged to employ more sophisticated data study. Additionally, the assessment of students' linguistic and cultural ability was not included in the research. It is suggested that future studies will make the analysis on use of experimental research to offer a fuller understanding for the development of this competence using multimedia-based technologies.

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SOME ISSUES OF THE USE OF MOBILE TECHNOLOGIES IN THE EDUCATIONAL PROCESS OF ACADEMIC LYCEUMS

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Abstract
In the article, the author revealed some issues of achieving the effectiveness of the use of mobile technologies in the educational process of academic lyceums.
Keywords: digital technologies, digital educational technologies, mobile technologies, media, efficiency, block construction, mobile application.

Modernization of the education system has become one of the most important tasks of the socio-economic policy of our country. Therefore, improving the quality of education at all levels remains an urgent problem in the country. In this regard, fundamental reforms were carried out during the years of independence and also various methods were used to enlarge the quality in each of its periods. As an example, in recent decades the widespread use of information and communication technologies in the education of secondary schools, academic lyceums and higher educational institutions has led to a qualitative change in the effectiveness of education. Accordingly, information and communication technologies have shown a positive impact on the effective organization, management and improvement of educational efficiency. Undoubtedly, these results were closely related to the development of computer and Internet technologies in society. In fact, such developments continue continuously, and their basis lies in the emergence and large-scale implementation of new technologies. Today, this update has become more modern, and now there is a device that is always with the student day and night as well as closer and faster than a computer, which are called smartphones. Although these mobile phones are small in size, they can easily replace personal computers due to their functional possibilities. The main advantage is that they are available to the majority of students and are always with them. Along with the rapid penetration of both mobile technology and new forms of digital technologies led toincreasethe effectivenessof education, reduced production costs as well as improved product quality. The use of digital technologies such as cloud technologies, big data, virtual reality systems and other similar types in education gives an opportunity to increase educational and managerial efficiency and even make managerial decisions.They can be divided into types according to their different characteristics.In addition, today there are many technologies that can be used in education.

According to N.P. Petrova, digital technologies are considered one of the main approaches can be used not only in education, but also in economic transformation.

This involves redistributing the place of technologies and processes in order to improve the information-educational environment [1].

Also, digitaltechnologies, social networks and instant messengers have changed social values and led to the network identification of a person. As a result, the foundation has been laid for the beginning of a new type in which students independently determine their educational direction. They are encouraged for personal development and self-determination, combining work with study.

Digital technologies are a modern form of activity in which a large set of digital data and the process of processing them serve as the main factor in production and management.

This requires the users to choose the one that is the most effective in achieving their goal.More precisely, we all know that different subjects require the use of various tools and technologies to enhance the effectiveness of learning, which in turn requires different approaches to improve the effectiveness of teaching each subject. That is, since the content of each topic is different, this requires to select the technologies which suitable for its optimal presentation. Additionally, agecharacteristics also play an important role. In other words, students of academic lyceums or higher educational institutions, of course, demand a different approach compared to schoolchildren. Students of academic lyceums widely use social networks and their various services for searching and storing information using their mobile phones.

Students of educational institutions actively use social network possibilities to communicate, search and store information for educational purposes. With the development of these services, in educational system appeared the subjects related to teaching the use of social networks. The use of mobile and network technologies in educational process actively developed and implemented due to their high practical significance. Therefore, the development of not only technical tools, but also software, especially pedagogical software, has become increasingly important. However, there are still many aspects that are not fully learn tin this field yet, which require expert scientists to improve it taking into account local conditions and opportunities.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) guidelines state: "In a world where communication and information dependency is growing, mobile devices are no longer a passing phenomenon. As the power and functionality of mobile devicesare continuing to grow, they can be extensively used as educational tools" [3;42].

A great example of this is the problems that the educational system has faced, especially during the pandemic.

In particular, almost all educational institutions conducted classes using the capabilities of the ZOOM platform, althougheducational content delivered through learningand content management systems, we faced restrictions in using various pedagogical software tools to organize self-study. This is due to the fact that a large number of distance learning students used mobile phones. More precisely, the problem was related to the fact that mobile phones did not support pedagogical software tools that had been developed for computersover many years.

There are many solutions to the problem, particularly, Joraev Vohid Tojimamatovich states [2], that the improvement of creating mobile applications for educational purposes is today's an urgent issue and suggested the MIT App Inventor environment as the best tool. *We have redesigned the following workflow, improving the workflow of creating pedagogical software tools in the MIT App Inventor block design environment:*

1. Create a new project in the MIT App Inventor environment. To do this, you will first be asked to name your newly created project when you first log in to the https://appinventor.mit.edu platform. If there is a need to create a new project, the **Start new project** command is given from the **Projects** menu. If you want to work on an old project, then the name of the necessary project is selected from the list of projects.

2. Create an application interface in the **"Designer"Mode**. In this case, the screen size is selected from the list depending on the device for which the project is intended. The list consists of 3 items:
▪ Phone size (505, 320) - creating an application for mobile phones;
▪ Tablet size (675 480) – make a tablet version;
▪ Monitor size (1024 768) - the size that allows you to create a model of monitors.

After the size is selected, it is filled with the necessary components. In the platform components are divided into several groups. For example, **User Interface** group elements are: Button, CheckBox, DatePicker, Image, Label, ListPicker, ListView, Notigier, Password Text Box, Slider, Spinner, Switch, TextBox, TimePicker, WebViewer; The Media group elements are: Camcorder, Camera, ImagePicker, Player, Sound, Sound Recorder, Speech Recognizer, TextToSpeech, Translator, Video Player. There are theinstructions that we need to know to install each component. You can view them by clicking the (?) symbol on each component.

3. To place the button, drag the **Button** instance from the user **Interface** palette to the center of the mobile device screen while holding down the left mouse button.

After the button is placed, its properties can be changed.For example, Back ground Color - change the color of the button, Font Bold - thicken the text, Font Italic - bend, Font Size - change the text size, Font Type face - change thefont, Height - the height of the button, Width - the size of the button width,Image - set the image as a background for the button, Text - the text for the button name.

4. To create a new screen Click the **"Add Screen"** button in the menu.

5. Switch to **Blocks mode** and select Button 1 inside the screen 1 (1st screen) on the **Blocks** window

6. Take **Open another screen** block from the list of **Control Blocks** and place it inside the previous block.

7. Place in it a block named **Text string** from the **Text Block**.

8. To do this, open **Screen1** in the menu list and select the 2nd screen (Screen2) from it.

9. In the 3rd screen (Screen 3), place the VideoPlayer component from the Media palette. If you choose VideoPlayer, you are required to do the followings:

A media component capable of playing video. When the application starts, the VideoPlayer screen is displayed as a rectangle. If the user clicks on the rectangle, there will be controls to play/pause, fast forward and rewind the video.

An application can also control actions by using the Start, Pause, and Seek methods. Video files can be in 3GPP (.3gp) or MPEG-4 (.mp4) formats. For more information about allowed formats, see Media Formats Supported by Android. App Inventor for Android supports video files only smaller than 1MB and limits the total app size to 5MB. If your media files are very large, you may experience errors while preparing or installing your application, so you should reduce the number of media files or their sizes.Many videoediting software, such as Windows Movie Maker and Apple iMovie, help reduce the size of videos by trimming or re-encoding the video to a more compact format. You can also set the media source to a URL that points to the streamingvideo, but the URL must point to the video file itself, not the program that plays the video.

10. In the 4thScreen (Screen 4), set the **Image** component from the **User Interface**palette.It is therequired component for placing images, the specified image, and other aspects of the appearance of the image can be specified in the **Designer** mode or in the **BlocksEditor**. Asthe video, the uploaded image has many editable features. For example, AlternateText, Clickable, Height, Width, Picture, RotationAngle, ScalePictureToFeatures are among them.

11. From the Build section of the main menu of the platform, we give the AndroidApp command (allows you to save it to your computer in .apk format).

12. This file can be used after it is copied and installed on a mobile device.

In this way, the creation of educational mobile applications covers a large audience of schoolchildren, students and students of various educational institutions. Providing students with the necessary knowledge and instructions will have a good impact on the effective organization of their self-study.

Because, mobile devices are always with the student, regardless of where he is (at home, in transport, on the street, in waiting areas and other places) and represent educational content in text, image, audio and video formats, and also provides interactivity that offers functional opportunities to communicate with students. The main thing is that the studenthas interest and desire to study.

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TECHNICAL SCIENCES

PRIMARY CRACKS IN ATOMICALLY SMOOTH CRYSTALS ALKALINE EARTH ELEMENTS

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Abstract
An alkaline earth metal crystal consists of a surface layer of size R(I), which we will call the σ_1 phase, and a base material, which we will call the σ_2 phase. Since the surface energy of the layer R(I) with σ_1 is 3 times less than the surface energy of the bulk phase, the destruction of the metal starts from the surface layer. For crystals with identical atoms, the share of space occupied by them in one cube is 68-74% for alkaline earth metal. The rest (26-32%) is occupied by empty space. After relaxation, we will call this space the maximum field of primary cracks. For us, the most important thing is the fact that the length of this crack L is equal to the thickness of the surface layer of the alkaline earth metal R(I). This crack length reflects the peculiarity that it is associated not only with the geometry of crystal lattices, but also with the physical properties of crystals. We have proposed a model for calculating the length of primary cracks that appear in metals due to the presence of a surface layer R(I). Griffiths considered the change in the energy of a body with a crack under loading and obtained an energy criterion for failure. Our calculation of the crack length L for an alkaline earth metal gave L = 2.52 10^{-9} m, which is very acceptable for our model.

Keywords: surface layer, crack, alkali metal, energy, model, surface, crystal, destruction.

Introduction

Alkaline earth metals (AEM) are chemical elements of the 2nd group of the periodic table: beryllium (Be), magnesium (Mg), calcium (Ca), strontium (Sr), barium (Ba), radium (Ra) [1]. Only calcium, strontium, barium and radium are often referred to as alkaline earth metals. With rare exceptions, beryllium and magnesium. But according to the nomenclature of work [2], all elements of the 2nd group are referred to the AEM. Beryllium and magnesium are closer to aluminum in their chemical properties. We will consider all AEMs, the physical properties that we will use in the calculations are presented in Table 1.

Table 1.

Physical properties of alkaline earth metals.

Element/property	Be	Mg	Ca	Sr	Ba	Ra
M (g/mol) - mass	9.0122	24.304	40.078	87.621	137.327	226.025
ρ (g/cm^3) - density	1.848	1.738	1.55	2.54	3.50	5.50
Structure	P6/mmm	P6/mmm	Fm3m	Fm3m	Im3m	Im3m
Lattice parameters (nm)	a = 0.2286 c = 0.3584	a = 0.3203 c = 0.5200	0.5580	0.6080	0.5020	0.5148
T_m (K) - melting point	1551	923	1112	1042	1002	1233
E (GPa) - Young's modulus	287	45	20	15.7	13	-
G (GPa) - shear modulus	132	17	7.4	6.03	4.9	-
K - bulk modulus of elasticity (GPa)	130	35	17	-	9.6	-

AEM crystals and their structure are shown in Figure 1.

Be **Mg** **Ca**

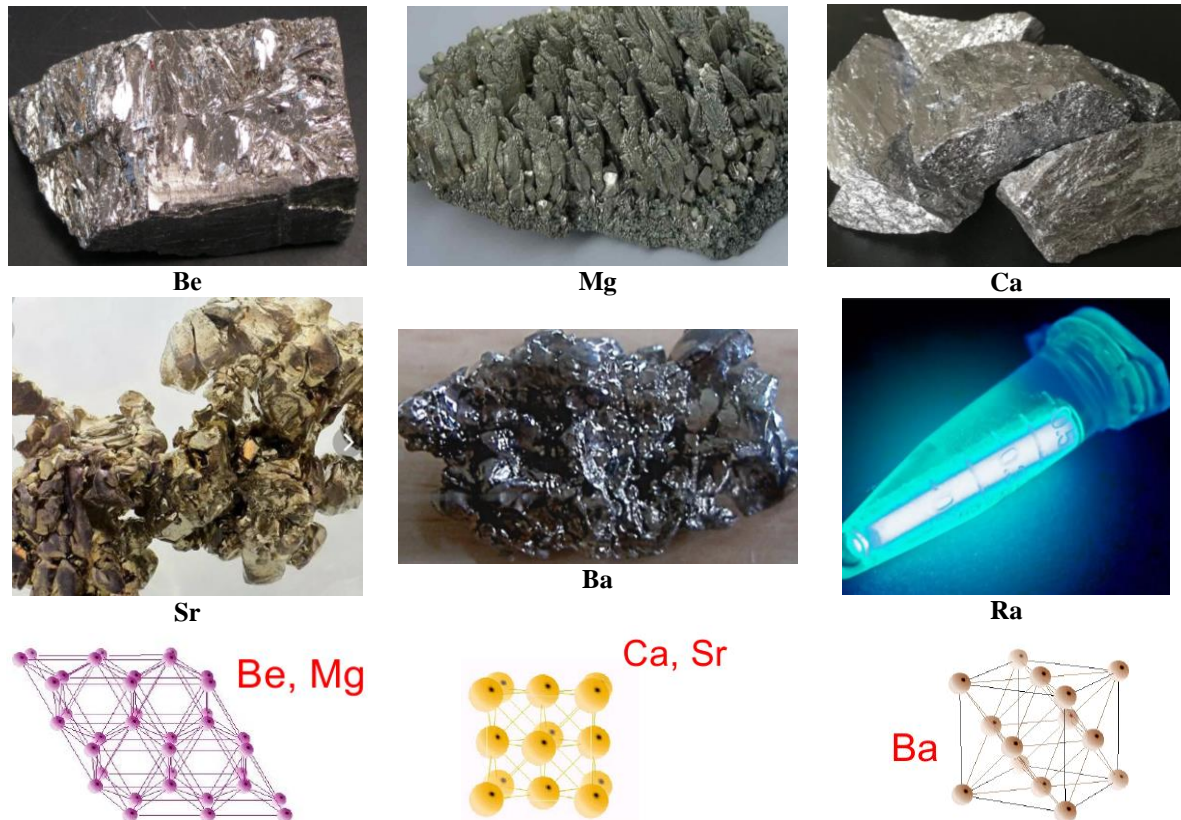
Sr **Ra**

Ba

Be, Mg Ca, Sr Ba

Figure 1. - AEM crystals and their structure.

In [3, 4], we proposed a model for determining the thickness of the surface layer of atomically smooth crystals of many elements. She looks like this:

$$R(I) = 0,17 \cdot 10^{-9} \upsilon \ . \text{(m)} \quad (1)$$

Equation (1) shows that the thickness of the surface layer R(I) is determined by one fundamental parameter, the molar (atomic) volume of the element ($\upsilon = M/\rho$, M is the molar mass, ρ is the density). The experimental determination of R(I) for atomically smooth crystals is described in [5, 6] (for example, for silicon, this layer depth is R(I) = 3.2 nm, and for gold, R(I) = 1.2 nm). From where it can be seen that the R(I) layer for most chemical elements is a nanostructure. Since AEM crystals have the structure of hexagonal close packing (hcp) in the case of Be and Mg, face-centered cubic (fcc) in the case of Ca and Sr, body-centered cubic (bcc) in the case of Ba and Ra (Fig. 1), equation (1)) is transformed to the form [7]:

$$R(I) = 0,17 \cdot 10^{-9} \cdot M/\rho, (m)$$
$$R(I)_{x=a} = 0,54 \cdot 10^{-11} \cdot x(a)^3, (m)$$
$$R(I)_{y=b} = 0,54 \cdot 10^{-11} \cdot y(b)^3, (m) \quad (2)$$
$$R(I)_{z=c} = 0,54 \cdot 10^{-11} \cdot z(c)^3, (m)$$

The values of the R(I) layer for AEM are given in Table 2, while using the following relations [8]:

$$Pm3m, Z = 1, l_{100} = 2R(I) \ l_{110} = R(I)\sqrt{2}, l_{111} = 2R(I)/\sqrt{3}$$
$$\text{Im}3m, Z = 2, l_{100} = R(I), l_{110} = R(I)\sqrt{2}, l_{111} = R(I)/\sqrt{3} \quad (3)$$
$$Fm3m, Z = 4, l_{100} = R(I), l_{110} = R(I)/\sqrt{2}, l_{111} = 2R(I)/\sqrt{3}$$
$$Fd3m, Z = 8, l_{100} = R(I)/2, l_{110} = R(I)/\sqrt{2}, l_{111} = 2R(I)/\sqrt{3}$$

To calculate the free energy of the bulk sample $\sigma(hkl)$ and the layer R(I), the following formulas should be used [7, 9]:

$$\sigma(hkl) = 0,7 \cdot 10^{-3} \cdot T_m, J/m^2$$
$$\sigma_a = 10^{-3} \cdot T_m \cdot R_a(I)/R(I), J/m^2$$
$$\sigma_b = 10^{-3} \cdot T_m \cdot R_b(I)/R(I), J/m^2 \quad (4)$$
$$\sigma_c = 10^{-3} \cdot T_m \cdot R_c(I)/R(I), J/m^2$$

To calculate σ_1 using formula (4) for the R(I) layer, it is necessary to take into account the size dependence of the melting temperature using the [7]:

$$T_m(h) = T_m(K) \cdot \left(1 - \frac{R(I)}{h}\right), \quad h \gg R(I) \tag{5}$$

$$T_m(h) = T_m(K) \cdot \left(1 - \frac{R(I)}{R(I) + h}\right), \quad 0 \le h \le R(I).$$

where T_m (K) is the melting temperature of the bulk sample, h is the layer coordinate.

In this article, the concept of atomically smooth crystals is presented and the length of primary cracks in AEM is presented for the first time.

Using methods for preparing atomically smooth surfaces (Fig. 2a), crystals can be obtained (Fig. 1). When single crystals are cleaved in vacuum along the cleavage plane, three types of surfaces can form: singular (atomically smooth), vicinal (stepped), and nonsingular (diffuse) surfaces (Fig. 2b) [5, 6].

Atomically smooth surfaces of AEM
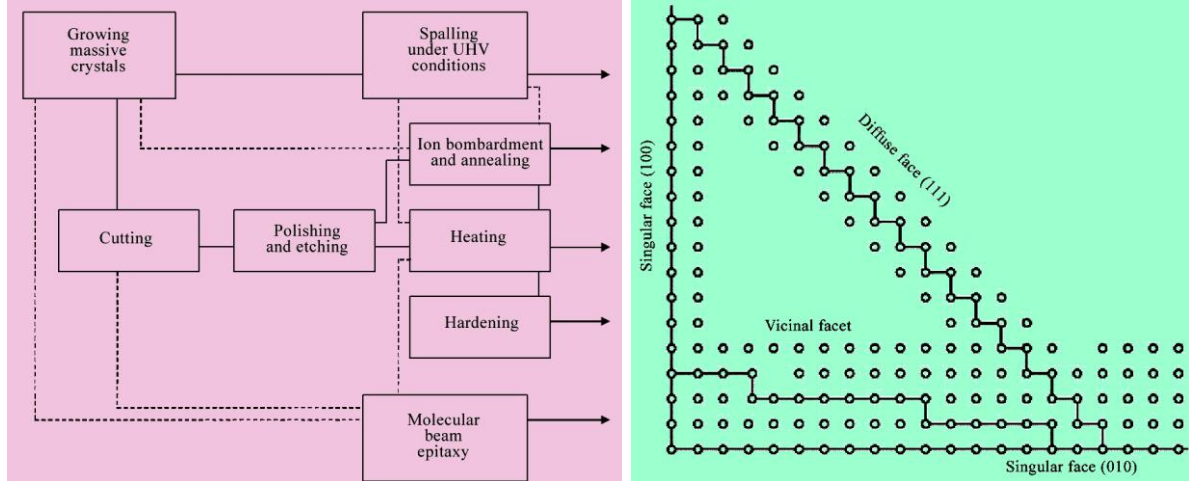
Figure 2. - Methods for preparing atomically smooth surfaces (a); types of faces of cubic crystals according to Frank and Cabrera (b) [5, 6].

If the surface plane is electrically neutral, then surface relaxation is observed (Fig. 3a). If the surface plane of atoms has complete order (the polar plane), then the reconstruction of the surface in the transverse direction is observed, the reason for which is the desire to neutralize the excess surface charge (Fig. 3b). Most metals are characterized by relaxation.

Both of these processes lead to the formation of an anisotropic layer R(I), which we will call the σ_1 phase, and a ground substance, which we will call the σ_2 phase (Fig. 4a). The layer thickness R(I) is calculated using formulas (1) and (2), and the work of separating the phases σ_1 and σ_2, called the work of adhesion, is given by the Dupré expression [10] (Fig. 4b):

$$W_a = \sigma_1 + \sigma_2 - \sigma_{12} \approx \sigma_1 + \sigma_2, (J/m2) \tag{6}$$

The adhesion energy is of interest to the calculation of the internal stresses of AEM, which arise due to the presence of uncompensated atoms on the surface and in the volume and the formation of a surface layer of size R(I). Internal stresses ε is between phases σ_1 and σ_2 can be calculated using the formula [10]:

$$\varepsilon_{is} = \sqrt{[W_a / R(I)] \cdot E}. \text{ (Pa)} \tag{7}$$

where σ_{12} is the surface energy at the phase boundary, which is negligible due to the second order phase transition.

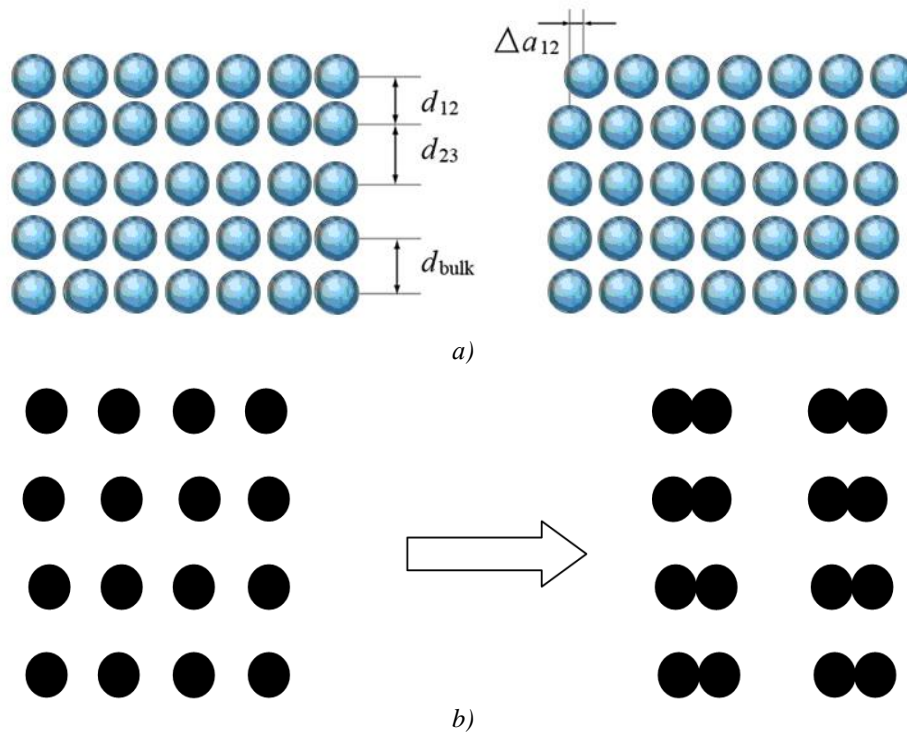*Figure 3. - Schematic illustration of normal (left) and lateral (right) relaxations of the upper atomic layer (a); surface reconstruction (1×1) → (2×1) (b).*
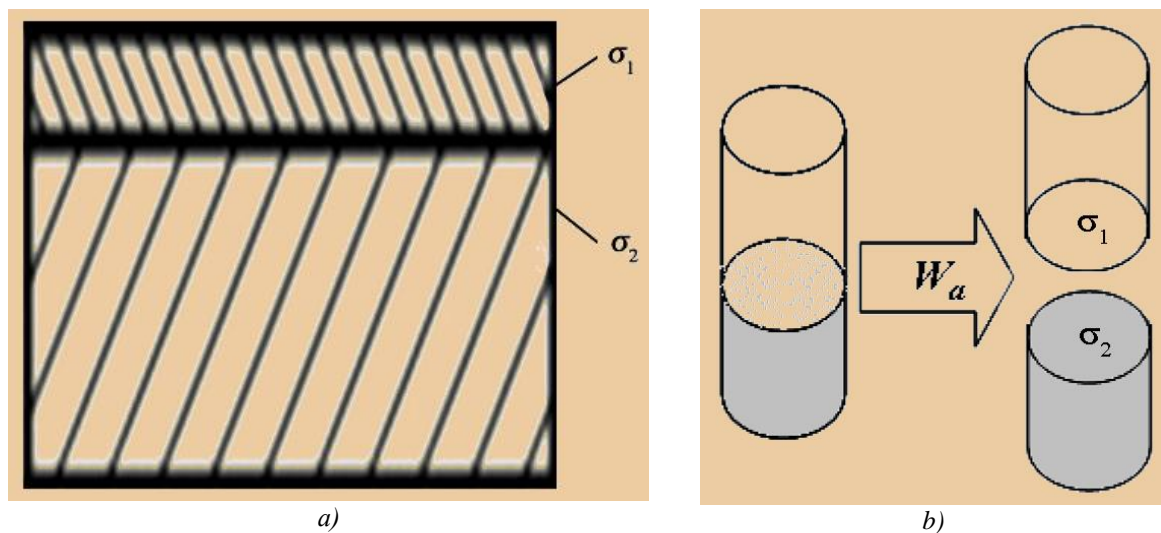

Figure 4. - Phases of AEM crystals (a) and work of adhesion (b).

The adhesion force for AEM is equal to:

$$F_1 = \sigma_1 \cdot R(I). \tag{8}$$

Calculation data according to formulas (1) - (8) are given in Table. 2. Here, in brackets, the values n = R(I)/a (a is the lattice constant) of monolayers of AEM crystals are given. Data on the work of adhesion are shown in table. 3.

Table 2.

Surface layer thickness R(I), adhesion force F_1, values of internal stresses ε_{is}.

Metal	(hkl)	R(I), nm	F_1, nN	ε_{is}, MPa
Be	a = b	0.66 (3)	0.25	25500
	c	2.52 (7)	3.69	25500
Mg	a = b	1.77 (6)	0.36	4740
	c	7.59 (15)	6.65	4740
Ca	(100)	2.38 (4)	0.55	2915
	(110)	1.70 (3)	0.28	2915
	(111)	2.80 (5)	0.77	2915
Sr	(100)	5.86 (9)	1.23	1594
	(110)	4.19 (7)	0.65	1594
	(111)	6.89 (11)	1.77	1594
Ba	(100)	6.67 (11)	1.40	1334
	(110)	9.34 (18)	2.60	1334
	(111)	3.92 (7)	0.49	1334
Ra	(100)	6.99 (13)	1.81	-
	(110)	9.78 (19)	3.49	-
	(111)	4.11 (8)	0.62	-

Table 3.

Adhesion energy W_a of AEM.

Metal	(hkl)	σ_1, J/m^2	σ_2, J/m^2	W_a, J/m^2
Be	a = b	0.384	1.280	1.664
	c	1.466	4.886	6.352
Mg	a = b	0.204	0.681	0.885
	c	0.876	2.919	3.795
Ca	(100)	0.233	0.778	1.011
	(110)	0.167	0.556	0.723
	(111)	0.275	0.915	1.190
Sr	(100)	0.219	0.729	0.948
	(110)	0.156	0.521	0.677
	(111)	0.257	0.858	1.115
Ba	(100)	0.210	0.701	0.911
	(110)	0.278	0.982	1.206
	(111)	0.124	0.412	0.536
Ra	(100)	0.259	0.863	1.122
	(110)	0.362	1.208	1.570
	(111)	0.152	0.508	0.660

From Table 2 shows the anisotropy of the layer thickness R(I) for hcp, fcc, and bcc crystals (Fig. 1). For hcp beryllium and magnesium R(I) in the a = b plane, the R(I) layer increases from 0.66 to 1.77 nm, and the number of monolayers increases from 3 to 6. This occurs with an increase in the atomic number from 4 for Be to 12 for Mg. In the c plane, the R(I) layer increases from 2.52 to 7.59 nm, and the number of monolayers increases from 7 to 15. For fcc calcium and strontium, the R(I) layer increases from 2.38 to 5.86 nm in the (100) plane, from 1.70 to 4.19 nm in the (110) plane and from 2.80 to 6.89 nm in the (111) plane, and the number of monolayers from 4 to 9 in the (100) plane. The maximum dimensions of the R(I) layer are observed in the (111) plane. For bcc barium and radium, the R(I) layer increases from 6.67 to 6.99 nm in the (100) plane, from 9.34 to 9.78 nm in the (110) plane, and from 3.92 to 4.11 nm in the (111) plane. The maximum dimensions of the R(I) layer are observed in the (110) plane. Tab. 2 shows that the layer thickness R(I) is an anisotropic nanostructure for hcp, fcc, and bcc

crystals. The value of internal stresses εis, on the contrary, does not exhibit anisotropy for all planes of these crystals. This is due to the fact that when calculating the value of εis using formula (7), we did not take into account the anisotropy of the Young's modulus E, taken from Table. 1. The value of internal stresses εis decreases from 25500 MPa for Be to 1334 MPa for Ba, i.e. almost 20 times.

The adhesion force F_1 (the force of intermolecular interaction) for Be is 0.25 10^{-9} N in the a = b plane and 3.69 10^{-9} N; for Ca, 0.55 10-9 N in the (100) plane, 0.28 10^{-9} N in the (110) plane, and 0.77 10^{-9} N in the (111) plane. For comparison: the force of attraction between an electron and a proton in a hydrogen atom is F = 0.2 10^{-9} N; sound pressure strength in the human ear at the threshold of hearing - F = 2 10^{-9} N; locomotive traction force F = 6 10^5 N; force of attraction between the Earth and the Moon F = 2 10^{20} N.

Model of primary cracks in AEM crystals

For crystals with identical atoms, the share of space occupied by them in one cube is 74 % for Be, Mg, Ca and Sr metals, and 68 % for Ba and Ra metals. The

rest (26 and 32 %) is occupied by empty space. After reconstruction and relaxation, we will call this space the maximum field of primary cracks. For us, the most important thing is the fact that the length of this crack L is equal to the thickness of the surface layer R(I) of AEM. This crack length reflects the peculiarity that it is associated not only with the geometry of crystal lattices, but also with the physical properties of crystals, namely:

with the type of chemical bond (ionic, covalent, metallic, etc.); porosity, anisotropy and other properties.

It was shown above that the crack length L is equal to the thickness of the AEM surface layer R(I), the value of which is determined in [6]:

$$L = 0,17 \cdot 10^{-9} \upsilon \cdot \text{(m)} \quad (9)$$

Table 4.

Crack length, pore size, specific surface area of AEM

Metal	(hkl)	L, nm	r, nm	S_{sp}, m^2/g
Be	a = b	0.66	0.10	4.92
	c	2.52	0.39	1.29
Mg	a = b	1.77	0.27	1.95
	c	7.59	1.17	0.45
Ca	(100)	2.38	0.37	1.63
	(110)	1.70	0.26	2.28
	(111)	2.80	0.43	1.38
Sr	(100)	5.86	0.90	0.40
	(110)	4.19	0.64	0.56
	(111)	6.89	1.06	0.34
Ba	(100)	6.67	1.03	0.26
	(110)	9.34	1.44	0.18
	(111)	3.92	0.60	0.44
Ra	(100)	6.99	1.08	0.156
	(110)	9.78	1.51	0.112
	(111)	4.11	0.63	0.265

Theoretically, in a layer consisting of one-dimensional spherical particles, the average pore size will be equal to the size of the empty space formed with a single-layer staggered arrangement of three spheres. The pore radius, in this case, is equal to:

$$r = 0.154 \cdot L. \text{ (m)} \quad (10)$$

When the particles are in the form of spheres of the same diameter L, the specific surface area S_{sp} is given by:

$$S_{sp} = 6 / \rho \cdot L. \text{ (m}^2\text{/g)} \quad (11)$$

Parameters (9) - (11) will be presented in Table 4.

According to the IUPAC definition, porous bodies are divided into microporous (pore diameter less than 2 nm), mesoporous (from 2 to 50 nm), and macroporous (more than 50 nm) [11]. In our case (Table 4), we have microporous AEMs. In materials subjected to deformation, it is customary to distinguish the following mechanisms of pore formation [12]:

- due to the merging of dislocation cracks, which are formed during the deceleration of slip planes;
- due to the formation of steps on the grain boundaries at the exit point of the sliding planes with subsequent sliding along the boundary;
- due to coagulation of vacancies;
- due to the annihilation of dislocations in opposite planes of the cluster, spaced from each other by 5-7 Burgers vectors.

A common mechanism for the formation of pores is through the formation of local accumulations of vacancies with their subsequent condensation into pores. Therefore, the pore can be considered as a complex of vacancies. The length of a microcrack (Table 4) is formed due to the formation of dislocations. The mechanism of dislocation formation is one of the least studied issues in the theory of crystal lattice imperfections [12]. After reconstruction and relaxation of AEM, edge and screw dislocations can appear (Fig. 5).
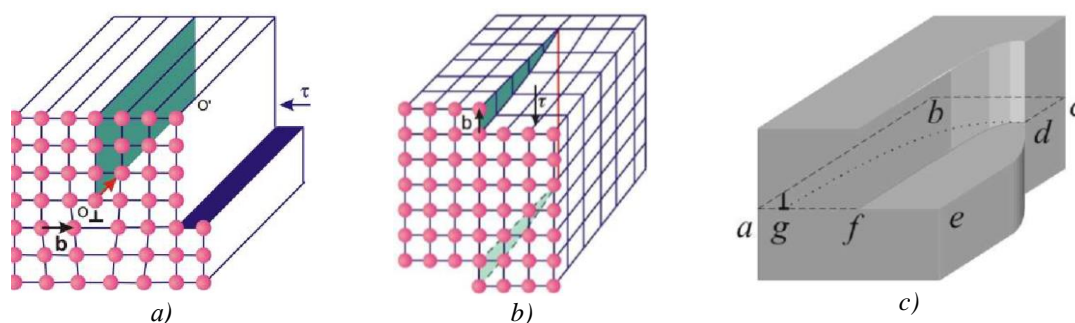

Figure 5. - Edge (a), screw (b) and mixed (c) dislocations [12].

Griffiths [13] considered the change in the energy of a body with a crack under loading and obtained an energy fracture criterion, according to which a crack acquires the ability to spontaneously propagate only when the rate of release of elastic energy during growth becomes equal to or exceeds the energy of the newly formed surface:

$$\Delta W = \frac{\sigma_{\hat{e}\hat{o}}^2 \pi L^2}{2E} + 2\sigma L \qquad (12)$$

- total energy change for the case of a plane stress state, where σ - specific surface energy, E - Young's modulus, σ_{cr} - applied stress, L - crack size, ν - Poisson's ratio.

The value of critical stresses at which a crack is capable of unstable growth can be found from the conditions:

$$\frac{\partial W}{\partial L} = 0, \quad \frac{\sigma_{\hat{e}\hat{o}}^2 \pi L}{E} = 2\sigma. \qquad (13)$$

Let us calculate the crack length L for hcp beryllium Be from formula (13) using the data in Table 1. 1 - 4, with $\sigma = \sigma_1 + \sigma_2$ and $\sigma_{cr} = \varepsilon_{is}$. We have: $L(a = b) = 955 \cdot 10^9 / 2041 \cdot 10^{18} = 0.47 \cdot 10^{-9}$ m; $L(s) = 1.79 \cdot 10^{-9}$ m. From the table. 4 we have: $L(a = b) = 0.66 \cdot 10^{-9}$ m and $L(c) = 2.52 \cdot 10^{-9}$ m, which is very acceptable for our model. For fcc calcium Ca we have: $L(100) = 1.57 \cdot 10^{-9}$, $L(110) = 1.14 \cdot 10^{-9}$, $L(111) = 1.87 \cdot 10^{-9}$. From Table. 4 we have: $L(100) = 2.38 \cdot 10^{-9}$, $L(110) = 1.70 \cdot 10^{-9}$, $L(111) = 2.80 \cdot 10^{-9}$, which is also very close to our model within experimental errors. For bcc barium Ba we have: $L(100) = 4.24 \cdot 10^{-9}$, $L(110) = 5.61 \cdot 10^{-9}$, $L(111) = 2.49 \cdot 10^{-9}$. From Table. 4 we have: $L(100) = 6.67 \cdot 10^{-9}$, $L(110) = 9.34 \cdot 10^{-9}$, $L(111) = 3.92 \cdot 10^{-9}$, which is also very close to our model within experimental errors. This implies the conclusion that the Griffith theory [13] should be subject to errors related to the length of the microcrack L (formulas 1-9). A number of microcrack formation models noted in [12-14]: the Zener-Straw-Petch model, the Cottrell model, the Ballaf-Gilman model, the Orvan-Straw model, the Koble model, the Nabarro-Herring model, complicate the Griffiths model, but do not determine the length microcracks, as it is done in our work presented.

Conclusion

At present, three micromechanisms of destruction of metals are distinguished [14]: ductile fracture, transcrystalline and intergranular cleavage. In addition, there are failure micromechanisms associated with fatigue, creep, and dynamic loading. However, the primary reason for the formation of microcracks, even for atomically smooth crystals, is the stresses associated with the formation of a surface nanostructured layer of metals due to the processes of relaxation or surface reconstruction. The calculation of the length of microcracks presented in this paper speaks unambiguously about the applicability of the Griffith theory for describing the fracture of metals.

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