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AGRICULTURAL SECTOR THROUGH THE CREDIT GUARANTEE SYSTEM

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Abstract

A credit guarantee system is a program designed to provide investment guarantees based on specific terms, such as transaction nature, duration, amount, and business size/type. These programs are established to assist small-scale borrowers in obtaining credit and to generate financial and economic benefits. Their primary objective is to address situations where borrowers with similar default risks face unequal access to credit due to insufficient collateral.

While credit guarantee programs primarily focus on enhancing credit access for small businesses in developing and emerging economies, they can also aim to improve loan conditions for medium-sized businesses that already have formal credit access. Furthermore, these programs often have social objectives, such as mitigating social impacts, empowering marginalized groups, and supporting post-war or reconstruction efforts.

Although credit guarantee programs are typically viewed as market correctors in industrialized countries, they are also utilized as development tools in emerging economies. The sustainability of this sector largely depends on the performance of the loan portfolio and maintaining low overall administrative costs.

Therefore, this study aims to identify challenges and factors that contribute to the growth of the credit guarantee sector. By conducting a qualitative analysis, the study intends to serve as a valuable reference for further research and decision-making in this field.

Keywords: Credit guarantee system, agriculture, credit access, sustainable development, developing and emerging economies, Albania agriculture finance

Introduction

Albania's banking system has experienced rapid growth over the past decade, outpacing other sectors of the country's financial system. With a bank-centric structure, Albania's non-bank sectors remain shallow, and its capital market is relatively small. In fact, banks account for approximately 90 percent of the financial sector's assets, a significantly higher proportion compared to the Euro area where they represent only 45 percent.

Micro, Small, and Medium Enterprises (MSMEs) in Albania, despite their vital role in the economy, face challenges in accessing financial resources, impeding their growth. A significant percentage of small businesses (16%)[1] and medium-sized enterprises (34%) in Albania cite limited access to finance as a major obstacle. The estimated MSME financing gap in Albania amounts to approximately 9% of the country's GDP. Although the banking sector plays a crucial role in financial intermediation, further development is necessary. The dominant banking sector in Albania exhibits high liquidity levels, risk aversion stemming from the financial crisis, conservative policies, and a lack of incentives or capacity to explore innovative financing approaches. According to the World Economic Forum's 2019 Global Competitiveness Report, Albania's financial sector ranked 102nd out of 141 countries. Credit provided to the domestic private sector accounts for only 33% of GDP, significantly lower than regional peers, indicating inadequate levels of financial intermediation in Albania.

The agriculture sector holds significant importance for Albania, as it plays a crucial role in the country's economy. Contributing 18.9% to the gross domestic product (GDP), it serves as a major

[1] World Bank Enterprise Surveys (2019)

economic driver. Moreover, the sector serves as a substantial source of employment, engaging a significant portion of both the formal and informal workforce. Approximately 36.4%[2] of the population is employed in the agriculture sector, highlighting its significant contribution to employment opportunities in Albania.

Agriculture serves as the primary source of income for the majority of rural residents, acting as a safety net for employment. Despite comprising 50% of the total population, approximately 60% of the workforce in Albania is engaged in agriculture and related sectors.

The growth of agricultural loan portfolios faces significant challenges, particularly due to the limited and weak-quality demand for lending, especially among small farmers and agricultural MSMEs. These potential borrowers exhibit hesitancy in seeking loans due to uncertainties in production and market conditions, coupled with their limited financial knowledge and understanding of financial services.

Adapting guarantee schemes to local conditions is crucial, necessitating a reflection on past experiences and the identification of best practices to inform future schemes. When designing a credit guarantee scheme, careful consideration should be given to organizational factors, including whether it should be established as a government institution or a separate entity, the source and type of funds, the qualifications and number of staff and management, the level of centralization, and whether it should operate with a profit motive.

To ensure efficient functioning, a guarantee scheme must have clear objectives, including the establishment of processes for providing guarantees, eligibility criteria for borrowers, and the targeted type of financing. The success of the scheme relies on effective marketing efforts, risk-sharing mechanisms, additional services offered, cost savings in screening and monitoring, reasonable fees, the guarantor's credibility in handling claims, and the relationship between the guarantor and the lender. These details should be specified in contracts between the involved parties.

Financial institutions often perceive lending to MSMEs as risky due to several primary limitations:

a) Lack of collateral: Borrowers in this sector may lack sufficient assets or property to serve as collateral, making it risky for lenders to provide loans without any guarantee.

b) High levels of informality: Many businesses in this sector operate informally or lack proper documentation, financial records, or legal structures, making it challenging for lenders to assess their creditworthiness and repayment capacity.

c) Asymmetric information: Borrowers possess more information about their own financial situation and business prospects compared to lenders, making it difficult for lenders to accurately evaluate their creditworthiness and potential risks.

d) Lack of loan experience: Borrowers in this sector may lack a well-established borrowing and repayment track record, making it difficult for lenders to assess their ability to manage debt and meet repayment obligations.

These factors collectively create perceived risks and uncertainties for financial institutions, leading to limitations or restrictions on lending to this sector.

Regarding bank characteristics, larger banks tend to impose fewer barriers on customers, potentially due to their ability to leverage economies of scale and scope. The inclusion of risk-sharing elements with profit-oriented intermediary banks establishes an independent creditworthiness hurdle for borrowers and promotes transparency by leveraging the intermediaries' loan-loss experience.

Guarantee system

A credit guarantee system encompasses programs that provide guarantees for investments based on specific conditions, including the transaction's duration, amount, nature, and the enterprise's type or size.

There are four primary types of guarantees within credit guarantee schemes:

(a) Individual guarantees, which cover the loan principal amount and involve both the borrower and lender.

[2] WORLD BANK - ALBANIA AGRICULTURE FINANCE POLICY NOTE

(b) Investment facility guarantees, utilized in economies with established capital markets to generate medium to long-term investment funds.

(c) Portfolio guarantees, supporting lending to specific priority development sectors by providing partial guarantees from a single lender to multiple borrowers.

(d) Portable guarantees, where a specific borrower gains access to a guarantee and can compare terms and guarantee offers from various lenders.

Staff plays a crucial role in credit guarantee schemes, performing tasks such as reviewing, assessing, and approving applications for credit guarantees, examining reports on the guaranteed loan portfolio's status, processing claims for guarantee payments, monitoring defaulted loans and seeking repayments, providing periodic reports on the scheme's effectiveness and forecasting guarantee progress, and offering advice or assistance to borrowers facing difficulties within certain schemes (Levitsky, 1997).

Credit guarantees serve three main purposes. Firstly, they bridge the information gap between borrowers and lenders, as trusted guarantors possess better knowledge of the borrower's creditworthiness. Secondly, they facilitate risk spreading and diversification, particularly when lenders have concentrated portfolios, but guarantors have diversified ones. Lastly, credit guarantees can be employed for regulatory arbitrage, where an unregulated entity provides a guarantee to help lenders comply with regulations or align loans with industry practices (Honohan, 2010).

The success of a credit guarantee scheme also relies on effective marketing efforts, risk distribution mechanisms, additional services provided, cost savings achieved through screening and monitoring, reasonable fees charged, the guarantor's credibility in handling claims, and the relationship established between the guarantor and the lender. All these important details should be clearly specified in contracts between the parties involved.

Sustainability development

To ensure the long-term viability and success of credit guarantee schemes, careful design is essential. Many schemes have faltered in the past due to a lack of participation from skeptical lenders, resulting in insufficient credit volume and eventual failure. Sustainability challenges primarily stem from poor management practices, including inadequate marketing efforts, insufficient risk assessment, slow claims handling, and improper fund investment.

Most guarantee schemes cannot sustain themselves without subsidies, as the fees collected are often insufficient to cover the high costs involved. Unlike insurance companies, which maintain profitability by pooling risks and serving both high-risk and low-risk groups, guarantee schemes tend to focus on specific groups with common characteristics, often perceived as high-risk, such as micro, small, and medium enterprises. Therefore, it is crucial that government funds provided to guarantee schemes are utilized for initial capitalization rather than ongoing subsidies. In most cases, income generated from investments can cover the costs not offset by fees, offering better protection against changes in government priorities.

Guarantee schemes should consistently strive for self-sufficiency and financial independence over time (Meyer and Nagarajan, 1997). However, it is important not to mistake self-sufficiency for stability. Even if a scheme has achieved full self-sufficiency, it should not be automatically considered stable. Fluctuations in costs from year to year can pose risks, underscoring the need to build reserves to ensure stability and mitigate potential threats.

Main credit guarantee systems design and implementation elements

Honohan (2010) highlights several valuable lessons for the successful design and implementation of credit guarantee systems, providing useful insights:

a) Start with simple guarantee systems: Beginning with straightforward guarantee systems ensures a smoother implementation process.

b) Know your client: Both guarantors and financial institutions need to understand their clients, starting with guarantors when dealing with financial institutions and then financial institutions when working with farmers or agro-enterprises.

c) Increase access to agribusiness finance: Supporting agricultural financial institutions through loans and backing guarantees helps enhance access to finance for agribusinesses.

d) Tailor products to the context: Understanding the local context is crucial, allowing for product adaptation that better meets the needs of farmers and agro-enterprises.

e) Establish disaster management systems: Developing effective systems to manage financial and market shocks resulting from disasters is essential.

f) Understand market and weather-related risks: Recognizing the connection between credit guarantees and risks associated with market dynamics and weather conditions is important.

g) Provide sufficient funding for growth: Ensuring that a credit scheme receives adequate funding is vital to meet its growth requirements.

h) Efficiently manage claims: Implementing efficient claim management processes minimizes delays and complications.

j) Conduct proper research on value chains: Financial institutions should conduct comprehensive research on the involved value chains to effectively manage risks.

k) Establish a governance structure: Having a governance structure in place reduces the risk of political influence in operations. Outsourcing loan origination and servicing to a for-profit intermediary can enhance operational efficiency.

Outsourcing the origination and servicing of loans to a for-profit intermediary has the potential to improve operational efficiency (Honohan, 2010).

Agricultural finance in Albania and Credit Guarantee inclusion

Albania encompasses a total land area of 28,750 square kilometers, with agriculture covering 24%, forests accounting for 36%, and pasture or other types of land occupying 15%.

While agriculture no longer dominates the Albanian economy, it still made a significant contribution of around 21% to the national GDP in 2019. In terms of trade, agricultural product imports amounted to slightly over $1 billion in 2020, similar to the previous year. On the other hand, agricultural exports have been on the rise, reaching approximately $365 million in 2022, indicating a 10% increase from 2019.

Micro, small, and medium enterprises (MSMEs) play a vital role in Albania's economy. In 2018, according to the Albanian Institute of Statistics (INSTAT), MSMEs accounted for 99.8% of active enterprises, employing 79.8% of the workforce and contributing around 69% of the value added. However, the MSME sector is often characterized by high informality, particularly in agriculture, limited collateral availability, and low levels of financial capability.

The government of Albania aims to boost agricultural production by providing financial support to farmers and encouraging private investment in the agro-processing sector. In recent years, significant funds have been allocated to the development of fruit and olive orchards, vineyards, greenhouses, and crop storage facilities. The government has also backed projects in the agro-processing industry, investing approximately $55 million in 2020 alone for drainage and irrigation infrastructure, direct support for agricultural and livestock production expansion, as well as food safety and consumer protection initiatives.

This drive for formalization aligns with the requirements for European Union accession. However, it also means that some farmers and agro-businesses may need to expand in order to make investments in upgrades cost-effective, particularly to comply with EU regulations. Future expansion and access to finance will depend on meeting greater formalization and compliance requirements.

According to the latest Enterprise Survey of Albania in 2019, access to loans has increased, and collateral requirements have decreased. However, finance is still reported as a significant obstacle, and internal financing remains the predominant method for investments. The percentage of firms with a bank loan or line of credit increased from 29.4% in 2013 to 37.8% in 2019. The value of collateral required for loans also declined from 267% in 2013 to 177% in 2019, approaching pre-crisis levels.

Barriers to banking services can arise from rational business decisions made by banks based on their business models, market position, competition level, and the macroeconomic, contractual, and regulatory environment (Back et al., 2008). Some barriers may be considered "optimal" within a second-best scenario, where contractual, informational, and macroeconomic frameworks play a role.

High interest rates pose a major constraint for farmers and agro-businesses, making it challenging to generate sufficient cash flow for loan repayment. Factors such as the cost of funds, operational expenses, and risk premium, including the cost of enforcing bad loans due to sub-optimal legal environments faced by banks, influence interest rates. The credit guarantee system can impact interest rates and risk premiums in agribusiness financing by reducing lender exposure to risk, thereby lowering the perceived level of risk associated with lending to the agricultural sector.

Risk-sharing mechanisms in development finance redirect excess liquidity towards agribusiness by reducing lenders' risk exposure and providing sector-specific knowledge, facilitating profitable investments. The credit guarantee system can effectively facilitate this process as well.

Conclusions

In conclusion, a credit guarantee system can be a valuable tool in facilitating access to finance for farmers and agro-businesses by addressing constraints such as high interest rates and collateral requirements. By reducing lenders' risk exposure, the system has the potential to lower interest rates and risk premiums, making borrowing more affordable. Additionally, the credit guarantee scheme spreads and diversifies risk, improves loan conditions, and provides financial and economic benefits. It also supports sustainable development, empowers marginalized groups, and contributes to post-war or reconstruction efforts.

Successful implementation of a credit guarantee scheme requires clear objectives, efficient management, tailored products, effective disaster management systems, and an understanding of market and weather-related risks. Additionally, credit guarantee schemes should aim for self-sufficiency and financial independence over time. The design and implementation of these schemes should consider organizational factors and draw from good practices to maximize their effectiveness.

It is important to note that the specific constraints and benefits of a credit guarantee scheme can vary depending on its design, implementation, and the local context of the program. In the case of Albania, where agriculture plays a significant role in the economy, the credit guarantee system can contribute to agricultural finance inclusion and support the growth of the sector.

Constraints for lenders in a credit guarantee scheme include limited risk exposure, potential administrative burden, and perceived reduction in profitability. On the other hand, the benefits for lenders include reduced risk exposure, increased lending capacity, and enhanced credit assessment.

For borrowers, constraints of a credit guarantee scheme may involve meeting eligibility criteria, incurring additional costs, and limitations on coverage. However, the benefits for borrowers include improved access to finance, lower collateral requirements, and reduced borrowing costs.

It is crucial to evaluate the specific constraints and benefits within the context of each credit guarantee scheme to effectively support borrowers and lenders and promote inclusive and sustainable agricultural finance.

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PEST CONTROL MEASURES AND INFESTATION OF SPRING BARLEY CROPS

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МЕРЫ БОРЬБЫ ВРЕДИТЕЛЯМИ И ЗАСОРЕННОСТЬ ПОСЕВОВ ЯРОВОГО ЯЧМЕНЯ

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Abstract

Increased infestation of fields sharply reduces the yield of agricultural species. Crops with low competitiveness are particularly affected. In addition, weeds absorb large amounts of nutrients and water, which reduces the quality of the resulting product. The right combination of preventive and exterminatory operations with biological methods and chemicals will allow you to get an excellent harvest at minimal cost. To obtain high yields of agricultural crops, a well-established integrated system of protection against a complex of harmful organisms is necessary. In all species, including spring barley, it should include both organizational, economic and agrotechnical measures. In order to study the joint effect of mineral fertilizers and various protection systems on the infestation of crops and the yield of spring barley. A minimum technique involving seed dressing and herbicide treatment. The preparation "Baytan Universal" was used as a disinfectant at a rate of 2 kg/t, and a mixture of products "Dialen Super" and "Lontrel-300" in volumes of 1.2 and 0.3 l/ha, respectively, acted as herbicides. When implementing an integrated system, all PPP treatments are carried out when pests, diseases and weeds reach the economic thresholds of harmfulness.

Аннотация

Повышенной засоренности полей резко снижается урожайность сельскохозяйственных видов. Особенно сильно страдают культуры, обладающие низкой конкурентоспособностью. Кроме того, сорные растения поглощают большое количество питательных веществ и воды, из-за чего снижается качество получаемой продукции. Правильное сочетание предупредительных и истребительных операций с биологическими методами и химическими препаратами позволит получить отличный урожай с минимальными затратами. Для получения высоких урожаев сельскохозяйственных культур необходима хорошо налаженная интегрированная система защиты от комплекса вредных организмов. На всех видах, в том числе на яровом ячмене, она должна включать как организационно-хозяйственные, так и агротехнические мероприятия. С целью изучения совместного влияния минеральных удобрений и различных систем защиты на засоренность посевов и урожайность ярового ячменя. Минимальная методика, предусматривающая протравливание семян и обработку гербицидами. В качестве протравителя использовался препарат «Байтан Универсал» в норме 2 кг/т, а в роли гербицидов выступала смесь продуктов «Диален Супер» и «Лонтрел-300» в объемах 1,2 и 0,3 л/га соответственно. При реализации интегрированной системы все обработки СЗР проводятся по достижению вредителями, болезнями и сорняками экономических порогов вредоносности.

Keywords: minimum cost, preventive operations, extermination operations, competitiveness, infestation.

Ключевые слова: минимальными затратами, предупредительных операций, истребительных операций, конкурентоспособность, засоренность.

Введение. Цель проведения обработки почвы - это создание оптимальных условий для прорастания семян и развития корневой системы растения на протяжении вегетации, что обеспечит формирование максимального урожая с высокими качественными показателями. Традиционная система - предусматривает проведение вспашки с оборотом пласта, создает чистую поверхность пашни, растительные остатки перемещаются на глубину 20-30 см.

Минимализация обработки почвы носит зональный характер. Основные направления ее включают: сокращение числа и глубины основных, предпосевных и междурядных обработок почвы в севообороте в сочетании с применением гербицидов для борьбы с сорняками; замену глубоких обработок поверхностными и мелкими с использованием широкозахватных орудий, обеспечивающих высококачественную обработку за один проход агрегата; совмещение нескольких технологических операций и приемов в одном рабочем процессе путем применения комбинированных почвообрабатывающих и посевных агрегатов; уменьшение обрабатываемой поверхности поля путем внедрения полосной (колейной) предпосевной обработки почвы при возделывании широкорядных культур в сочетании с применением гербицидов. Систе́ма нулево́й обрабо́тки по́чвы, также известная как No-Till (англ. не вспахивать), — современная система земледелия, при которой почва не обрабатывается, а её поверхность укрывается специально измельчёнными остатками растений — мульчей. Поскольку верхний слой почвы не рыхлится, такая система земледелия предотвращает водную и ветровую эрозию почвы, а также значительно лучше сохраняет воду. Нулевую обработку почвы целесообразно применять в засушливых местностях, а также на полях, расположенных на склонах, в условиях влажного климата, а также в местностях, где традиционный способ земледелия с нарушением поверхностного слоя невозможен или запрещён.[1].

Предпосевная обработка почвы для борьбы с сорняками осуществляется в большей степени орудиями, оснащенными стрельчатыми рабочими органами. Однако, учитывая расположение корней сорняков в почве, необходимой глубиной обработки почвы должна быть обработка на глубину 3– 5 см, в то время как орудия со стрельчатыми рабочими органами работают на глубину 8–10 см [2]. Впрочем, стрельчатые рабочие органы хорошо справляются с задачей создания выровненного, уплотненного дна борозды. Их лезвия лежат в одной плоскости, и поступательное движение обеспечивает получение ровного дна борозды. Тем не менее, в перспективе остаются вопросы, связанные с повышением качества существующих агротехнических приемов. Предпосевная обработка почвы один из главных и наиболее эффективных агротехнических приемов в борьбе с сорной растительностью. Из вышесказанного для результативной борьбы с сорняками (на глубину 3–5 см) необходимо проводить предпосевную обработку на заданную глубину, в то время как орудия со стрельчатыми рабочими органами способны устойчиво работать лишь на глубине не менее 8–10 см в виду отсутствия противодавления. К тому же стрельчатые рабочие органы лишь подрезают сорняки, оставляя корни в слое почвы, при всем этом приживаемость сорняков составляет порядка 10 – 12% [3]. Также целью предпосевной обработки почвы является создание плотного ложа семян, которое необходимо для их благоприятного произрастания. В условиях нормальной влажности при работе стрельчатых рабочих органов как упоминалось ранее, отсутствует противодавление со стороны почвы, необходимое для резания и скольжения корней сорняков по лезвию рабочего органа. Чтобы создать необходимое противодавление рабочие органы заглубляют на глубину 8–10 см [4]. Это сопровождается излишним испарением продуктивной почвенной влаги, ростом тягового сопротивления, а также снижением производительности агрегата и как следствие всего – резкое увеличение затрат. В этом случае стрельчатые рабочие органы работают стабильно. Безусловно, увеличение глубины предпосевной обработки приводит не только к потерям продуктивной влаги, но и к необходимости сеять в рыхлую почву. В условиях повышенной влажности почвы, стрельчатые рабочие органы подвержены к залипанию почвой, а также обво-

лакиванию растительными остатками, росту тягового сопротивления. Вследствие этого тракторы работают с большим буксованием, так как почва в весенний период находится во влажном состоянии и имеет плохие сцепные качества. Тяговый КПД трактора находится в пределах 0,5–0,6. Из–за этого почти половина топлива выбрасывается в атмосферу, не выполняя полезную работу. Происходит сгруживание почвы и образуется гребнистая поверхность поля, приводящая к интенсивному испарению продуктивной влаги и как следствие снижению урожая [5].

Результаты и обсуждение. Важной составляющей частью технологии возделы-вания зерновых культур, позволяющих получить урожай с высоким качеством, является защита растений от вредителей, болезней и сорной растительности. Резкое падение культуры земледелия в регионе Западного Казахстана привело к увеличению засорённости и поражаемости болезнями и вредителями, как следствие, к существенному снижению урожайности зерновых культур. Недобор зерна по этой причине составляет как минимум 10-20%. В сложившейся ситуации приходится искать нетрадиционные пути решения, например, внедрение новых технологий, точнее минерализацию обработка почвы. Учет засоренности посевов, проведенный в фазу полных всходов ярового ячменя показал, что число малолетних сорняков по предшественникам составило от 1,9 до 9,6 шт./м^2, где доминировали сорняки из семейства-Amaranthaceae.

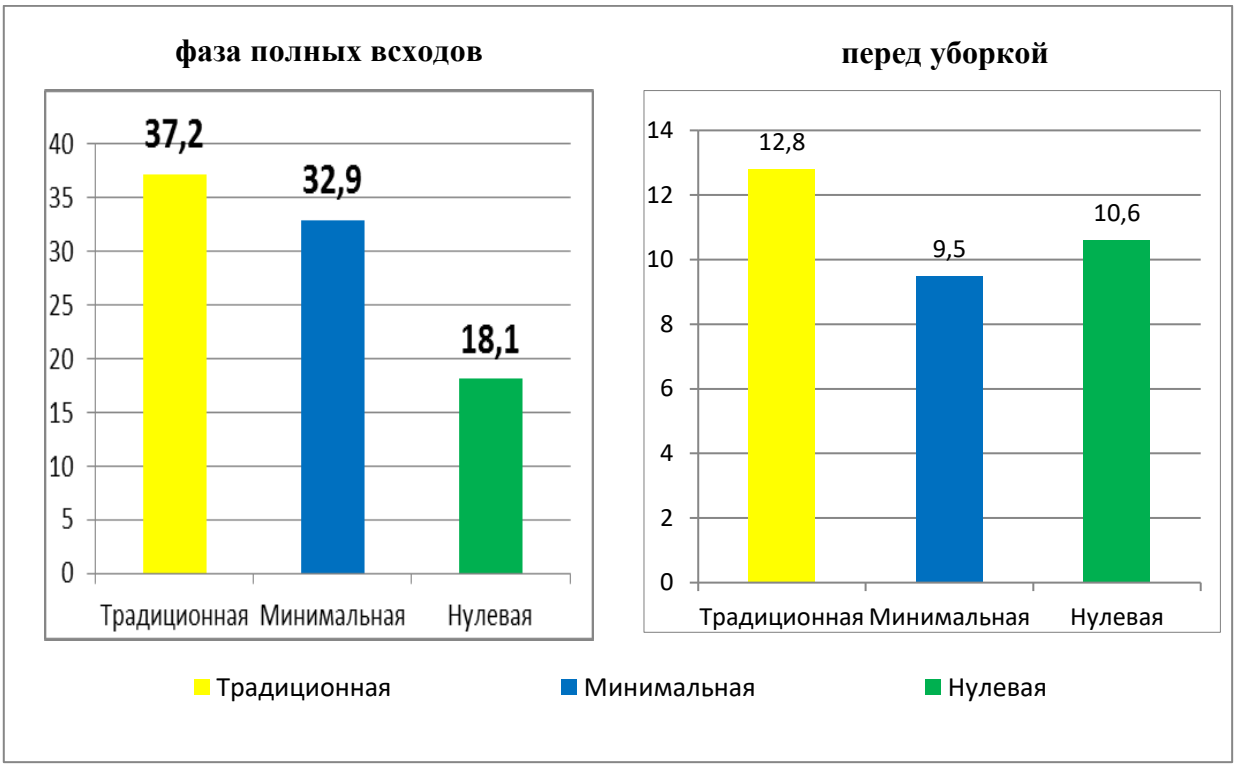

Рис. Засоренность посевов ярового ячменя, шт./м^2 (среднее за 2021-2022 гг.)

При этом следует отметить, что по всем предшественникам наибольшее их количество было на варианте традиционной и нулевой технологии, то есть где в предпосевной период обработка почвы проводилась сеялкой Джондир 1835. На вариантах минимальной технологии, где в предпосевной период применялся глифосато содержащий гербицид сплошного действия Ураган-Форте в дозе 1,8-2,2 л/га, засоренность в фазу полных всходов по всем предшественникам была минимальной. Блошки и цикадки: инсектицидная обработка Вантекс 75 мл/га в фазу всходов до середины кущения. С фазы 2-3 листьев можно совмещать с гербицидной обработкой. Скрыто стебельные вредители: обработка Вантекс 75 мл/га в фазу всходов до середины кущения. С середины кущения возможна обработка баковой смесью Вантекс 50 мл/га + Данадим Эксперт 0,6 л/га. Применение инсектицидов можно совмещать с гербицидной обработкой. Наиболее опасный вредитель при применении минимальной технологии обработки почвы ярового ячменя является Пшеничный трипс (Haplothripstritici) и Серая зерновая совка (Apameaanceps). Имаго и личинки трипса: инсектицидная обработка

баковой смесью применяется Вантекс 50 мл/га + Данадим Эксперт 0,6 л/га. Также вышеуказанная баковая смесь эффективна против серой зерновой совки. Видовой и количественный учет сорной растительности, проведенный в период уборки, показал, что наибольшее распространение имели следующие виды сорняков: из однолетних двудольных – щирица запрокинутая Amaranthusretroflexus L, из однолетних злаковых – щетинник зеленый Setariaviridis (L) и ежовник обыкновенный Echinochloacrusgalli (L) Beauv, из многолетних корнеотпрысковых – вьюнок полевой Convolvulusarvensis.

В основном сильное изменение видового и количественного состава сорной растительности наблюдалось, где доминирующим видом сорняков были поздние яровые однолетники из семейства мятликовых (щетинник зеленый Setariaviridis (L), ежовник обыкновенный, просо куриное (Echinochloacrusgalli (L) Beauv), которые, отличаясь высокой семенной продуктивностью, по литературным данным она составляет от 2500 до 13800 зерновок с одного растения, и, имея растянутый период прорастания, засоряли, восновном, посевы ярового ячменя. Если на вариантах нулевой и минимальной технологии проведением гербицидной обработки баковой смесью (Топик 0,3 л/га + Диален Супер 0,5 л/га) удалось снизить засоренность посевов, то на вариантах традиционной технологии количество малолетних сорняков в период уборки в гербицидном пару составляло 37,2 шт./м^2 Наблюдения за развитием сорной растительностью в посевах ярового ячменя в период их вегетации показали, что проведение до посевных химических обработок обеспечивает очищение посевов в начальные этапы развития культуры и сдвигает появление следующей волны сорняков на более поздние сроки. В связи с этим возникает необходимость проведения химической прополки с использованием селективных и сплошных гербицидов. Химическая прополка в период вегетации проводилась против двудольных и злаковых сорных растений по следующим типам засорения:

Тип засорения 1. Гербицидная обработка против двудольных, включая многолетние корнеотпрысковые: Гранстар 15 г/га + 2М-4Х 0,4 л/га, Респект 15 г/га+2М-4Х- 0,4 л/га Аккурат 7 г/га + 2М-4Х -0,4 л/га. Против полыни: Гранстар -15 г/га (Респект 15 г/га) + Эстет -0,3 л/га или Аккурат-7 г/га + Эстет -0,3 л/га.

Тип засорения 2. Гербицидная обработка против двудольных, включая многолетние корнеотпрысковые и однолетние злаковые: Гранстар-15 г/га (Респект 15 г/га) + 2М-4Х -0,4 л/га + Фокстрот Экстра-0,45 л/га; Аккурат -7 г/га+ 2М-4Х- 0,4 л/га + Фокстрот Экстра - 0,45 л/га;

Тип засорения 3: Гербицидная обработка против злаковых сорняков, включая просо сорнополевое и овсюг при позднем появлении Фокстрот Экстра – 0,45 л/га, Пума Супер 100 - 0,3 л/га + Эверест 25 г/га, Кугар форте - 0,25 л/га +Эверест 25 г/га и Пума Супер 100 - 0,75 л/га.

Таким образом, высокая культура земледелия с использованием современных гербицидов позволяет очистить посевы от сорняков.

Заключение. Использованием современных гербицидов позволяет очистить посевы от сорняков. Минимализация обработки почвы, вплоть до полного отказа от её проведения в этих условиях не ведет к росту засоренности посевов. За время вегетации растений на вариантах нулевой и минимальной технологии была проведена гербицидная обработка посевов ярового ячменя баковой смесью Топик 0,3 л/га + Диален Супер 0,5 л/га, которая позволила удержать численность сорняков по всем предшественникам ниже допустимого порога вредоносности, т.е. меньше 15 шт./м^2.

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PROGRESSIVE TECHNOLOGY OF CULTIVATION OF GRAIN CROPS IN CROP ROTATION

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ПРОГРЕССИВНАЯ ТЕХНОЛОГИЯ ВОЗДЕЛЫВАНИЯ ЗЕРНОВЫХ КУЛЬТУР В СЕВООБОРОТЕ

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Abstract

In world grain production, wheat occupies about 30% and provides almost 20% of all food calories for the world's population. Wheat is the main product in 53 countries, including our country. Cereal bread, first of all, is the food fund of mankind. Bread is the staple food of the world's population. In addition, grain breads are raw materials for the processing industry (brewing, alcohol, starch-treacle and others). Wheat occupies the first place among grain crops in world agriculture. The increase in grain production is a key problem for the development of the entire agro-industrial complex, not only in our republic, but also in the world. Satisfying the needs of the population in food products depends on this. In the Republic of Kazakhstan, special attention is paid to the production of strong and durum wheat grains. Saving farming is farming that is not ordinary cleansing farming. The first farmers to cultivate the soil using new methods and other reduced tillage systems faced a range of problems, from planters that should not penetrate the soil to ineffective herbicides. As agricultural equipment manufacturers and chemical companies responded to the introduction of new technologies, their benefits became apparent to more and more farmers. Crop rotation as one of the most important and necessary methods in agricultural production, which improves soil fertility, reduces the impact of water and wind erosion, and also reduces the number of plant diseases and pests, which, accordingly, makes it possible to obtain sufficiently high yields of agricultural crops. To date, promising schemes of 4-5-field grain-fallow (wheat-fallow) crop rotations with saturation of grain and grain-forage crops for the production of seed and marketable grain have been developed and mastered.

Аннотация

В мировом производстве зерна пшеница занимает около 30% и дает почти 20% всех пищевых калорий для населения земного шара. Пшеница является основным продуктом в 53 странах, в том числе в нашей стране. Зерновые хлеба, прежде всего, являются пищевым фондом человечества. Хлеб-основной продукт питания населения земного шара. Кроме того, зерновые хлеба-сырьё для перерабатывающей промышленности (пивоваренной, спиртовой, крахмала-паточной и других). В мировом земледелии первом место среди зерновых культур занимает пшеница. Увеличение производства зерна – ключевая проблема развития всего агропромышленного комплекса не только в нашей республике, но и в мире. От этого зависит удовлетворение потребностей населения в продуктах питания. В Республике Казахстан обращается особое внимание на производство зерна сильных и твёрдых сортов пшеницы. Сберегающее земледелие – это такое земледелие, которое не является обычным очистительным земледелием. Первые фермеры, которые стали возделывать почву, используя новые методы и другие сокращённые системы возделывания почвы, соприкоснулись с целым

рядом проблем, начиная с сеялок, которые не должны проникать в почву, и заканчивая неэффективными гербицидами. Как только производители техники для сельского хозяйства и кампании, производящие химикаты, откликнулись на внедрение новых технологий, то преимущество их стало очевидным всё большему и большему числу фермеров. Севообороте как одного из важнейших и необходимых приемов в ведении сельскохозяйственного производства, которое улучшает почвенное плодородие, сокращает воздействие водной и ветровой эрозии, а также уменьшает число болезней и вредителей растений, что соответственно позволяет получать достаточно высокие урожаи с/х культур. На сегодняшний день разработаны и освоены перспективные схемы 4-5-ти польных зернопаровых (пшенично-паровых) севооборотов с насыщением зерновых и зернофуражных культур для производства семенного и товарного зерна.

Keywords: high-quality wheat, preliminary, primary, optimal, grain quality, processing, potential, biological model.

Ключевые слова: высококачественной пшеницы, предварительный, первичный, оптимальный, качества зерна, обработка, потенциал, биологическую модель.

Введение. Послеуборочная обработка зерна проводится в потоке с уборкой урожая. Машины для предварительной и первичной очистки зерна на токах должны обеспечивать максимальное выделение сорной и зерновой примеси. В зонах с повышенным увлажнением зерна в уборочный период применяются зерноочистительно-сушительные комплексы и зерноочистительные агрегаты. Для размещения зерна необходимо иметь асфальтированные площадки, крытые навесы, а также погрузочные средства. Формирование товарных партий сильной, ценной и твёрдой пшеницы проводится по результатам предварительной оценки качества зерна, которая предотвращает обезличивание высококачественной пшеницы и обеспечивает реализацию её по высоким ценам.[1,2].

Предварительно оценку качества зерна следует начинать в предуборочный период и продолжать на токах хозяйства. Отбор стеблей пшеницы проводят по диагоналям полей за 2-3 дня до прямого комбинирования или обмолота валков. Выделенные из обмолоченных стеблей пробы зерна анализируются на содержание и качество сырой клейковины, стекловидность, натуру и другие показатели. По результатам оценки в период уборки урожая на токах формируются партии по классам качества зерна. От сформированной партии на току отбираются пробы и определяются все показатели качества зерна согласно ГОСТа.[3]. Одним из решающих факторов, обеспечивающих получение в засушливых условиях высоких урожаев, является правильное определение оптимальных сроков посева. Для окончательного определения календарной даты сева на каждом поле необходимо учитывать природные условия, особенности сорта, технологию подготовки пара, способы осенней обработки почвы, засоренность полей овсюгом и другими злостными сорняками, фон минерального питания, рельеф территории.[4]. Требования к подготовке полей к посеву должны быть исключительно жёсткими. Поверхность поля должна быть выровнена. Высота неровностей не должна превышать 3-4 см, глубина предпосевной обработки должна быть близкой к глубине посева. Солома на поле должна быть измельчена и распределена по полю. Если эти требования будут соблюдены, рабочие органы сеялок и пространство между ними не будут забиваться почвой и растительными остатками. Из посевной техники для минимальных энерго и ресурсосберегающих технологий следует выделить пневматические дисковые сеялки " John-Deere 1840", "Morris-Xpress" и "Morris-Noer Pin" шириной захвата соответственно 13,4, 9.1 и 12,2 м, а также механическую дисковую сеялку СС-6 "Baster" и универсальную рядковую сеялку "Amazone-Airstar Primera" с долотовидными индивидуально-копирующими сошниками.[5].

Дисковые сеялки прямого посева имеют повышенный потенциал технологической надежности и работоспособности на ранних сроках посева с более влажной почвой и на химических стерневых парах, отличающихся большим содержанием на поверхности омертвелых

растительных остатков. Они более пригодны для посева мелкосемянных культур, обладают большой удельной производительностью и устойчивостью по глубине заделки семян, а также менее энергозатратны в сравнении с сеялками-культиваторами.

При достаточном обеспечении верхнего слоя почвы влагой можно использовать сеялки СДС-18 с двухдисковыми двухстрочными сошниками. Эти машины имеют узкие междурядья (10-12 см) и малое тяговое сопротивление. Расход горючего по сравнению с сеялками-культиваторами снижается на 30-35%, а производительность на посеве увеличивается в 1,5 раза. [6].

Ранние посевы яровой пшеницы страдают от злостного сорняка овсюга и других сорняков, подвергаются отрицательному воздействию раннелетней засухи, плохо используют осадки второй половины лета, и в результате урожайность таких посевов снижается. При посеве в оптимальные сроки (15-25 мая) предпосевной обработкой уничтожаются всходы сорняков, в том числе и овсюга; семена пшеницы заделываются в прогретую почву и её всходы появляются дружно; критический период роста и развития яровой пшеницы по отношению к влаге «выход в трубку – колошение» совпадает с летним максимумом осадков, что положительно отражается на урожайности. При более поздних сроках посева затруднено получение дружных всходов из-за пересыхания верхнего слоя даже на паровых полях и зерно может подвергаться ранне осенним заморозкам, что вызывает резкое снижение качества зерна. [7].

Урожайность есть средний урожай с единицы площади посева. Урожайность зерновых культур в поле на корню определяется следующими основными показателями (элементы структуры урожая): числом растений на единице площади**,** их продуктивной кустистостью, числом колосков в колосе, средним числом зёрен в колоске, массой 1000 зёрен.

Элементы структуры посевов можно рассчитать, используя биологическую модель будущего урожая, по структурной формуле М.С. Савицкого:

$$У=Р*К*З*А/10000$$

где У – биологический урожая зерна, ц/га;

Р – число растений на 1м^2 перед уборкой, шт.;

К – продуктивная кустистость;

З – число зёрен в соцветии;

А – масса 1000 зёрен, г.;

10000 – коэффициент для перевода урожая в ц/га.

Для получения запланированного урожая следует к уборке иметь следующую структуру урожая, представленную в таблице 1.

Таблица 1

Планируемые элементы структуры урожая зерновых культур в севообороте

Севооборот	Количество растений, шт/м2	Продуктивная кустистость	Количество зёрен в колосе, шт	Масса 1000 зёрен, г	Планируемавя урожайность ц/га.
Пар	-	-	-	-	-
1КПП (пшеница)	226	1,3	18	35	18,5
2КПП (пшеница)	225	1,3	16	35	16,4
3КПП (пшеница)	220	1,2	16	35	14,7
4КПП(ячмень)	228	1,2	16	40	17,5
4КПП(овёс)	210	1,3	23	25	15,7

Исходя из произведенных расчетов элементов структуры урожая можно произвести корректировку нормы высева для посева по планируемой технологии На основании полученных в опытах и рекомендованных средних показателей для зоны, области, района нормы высева в млн. шт. всхожих семян на 1га. (коэффициент нормы высева). расчёт нормы высева (физическая масса) осуществляется по формуле:

$$Н_в=М*А*100/ПГ$$

где $Н_в$ – норма высева семян, кг/га;

М – рекомендованная норма высева в млн. шт. семян на 1га. (коэффициент высева);

А – масса 1000 семян, г.;

ПГ – посевная годность семян, %.

Согласно таблице 1 и произведенным расчетам планируемый коэффициент высев и весовая норма представлен в таблице 2.

При фактической норме высева идет большой перерасход семеного материала и как следствие ведет к большим убыткам. Рекомендованная норма высева расчитана на оптимальное количесто семян (млн. шт.) необходимого для посева определенной культуры.

Таблица 2

Расчёт нормы высева

Севооборот	Рекомендованная норма высева, млн всх.семян/га	Масса 1000 семян, г	Посевная годность, %	Норма высева планируемая, кг/га	Норма высева фактическая, кг/га
Пар	-	-	-	-	-
1КПП (пшеница)	2,9	35	94	108	120
2КПП (пшеница)	2,8	35	90	108	125
3КПП (пшеница)	2,7	35	90	105	120
4КПП (ячмень)	2,7	40	94	115	130
5КПП (овёс)	3,0	30	94	96	105

В проектной части увеличена площадь паров для того, чтобы проводились фитосанитарные мероприятия по очищению от сорных растений, происходил процесс разложения гумуса, накопления влаги. В результате на более большей площади будет эффективнее вестись борьба с сорняками и накопление питательных веществ. Выделенная площадь в 10000 гектар для посева элитных семян позволит получать урожай для планируемой реализации на семена по более высокой цене. На этой площади разместятся два севооборота с разными сортами пшеницы, и так как севообороты трёхпольные и семена дойдут до второй репродукции, необходимо будет проводить сортосмену или сортообновление. В условиях нашего региона с засушливыми весной и летом необходимо максимально сохранять влагу почвы, для того чтобы получать высокие урожай. Рекомендовано под первую культуру после пара весной не проводить предпосевных культиваций, а сразу вести посев чизельными сошниками. После первой культуры осенью обязательное оставление стерни и разбрасывание соломы при уборке. Осенняя обработка почвы не проводится.

Под вторую культуру после пара необходимо провести предпосевную обработку (химическую), осенью также оставление растительных остатков и рыхление почвы на глубину 12-14 см.

Весной под третью культуру после пара не проводить предпосевной обработки, посев производить чизельными сошниками по стерне. Во время уборки разбрасывать солому и оставлять высокую стерню для снегозадержания. Осенью провести рыхление почвы на глубину 12-14 см.

Под четвёртую культуру после пара планируется проведение предпосевной обработки, посев по стерне сеялками марки СЗС-2,1 с чизельными сошниками. Для повышения качества производимого семенного материала рекомендуется в хозяйстве выделение двух семеноводческих севооборотов, для товарных посевов четырёх польный зернопаровой севооборот.

Выводы. Исследованиями научных учреждений установлена высокая эффектив-ность в местных условиях севооборотов с короткой ротацией и полем чистого пара. Удельный вес чистого пара в структуре полевых севооборотов должен занимать 20-25%, зерновые 75-80%, что соответствует 4-5 – польным зернопаровым севооборотам. Такие севообороты являются наиболее продуктивными как по общему выходу зерна с гектара севооборотной площади, так и по выходу пшеницы в частности.

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Chemical sciences

PHOTOPHYSICAL, PHOTOCHEMICAL PROPERTIES OF DIPYRRINS AND SPECTRAL ANALYSIS

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DIPIRRINLƏRİN FOTOFİZİKİ, FOTOKİMYƏVİ XASSƏLƏRİ VƏ SPEKTRAL ANALİZİ

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Abstract

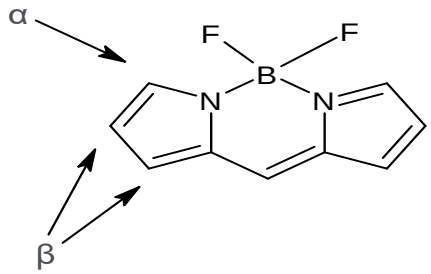
Dipyrrins are the simpest representatives of chromophore compounds. p-, d- and f – elements with stable covalent complexes with cations have intense chromophoric properties in the visible region of the spectrum/ one of the representatives of this family is difluoroborate complexes (BODIPY). BODIPY is thecommon name for a chemical compound with the formula $C_9H_7BN_2F_2$ Red crystalline solid, stable at ambient temperature, soluble in methanol. BODIPY derivatives are highly colored substances, and the maximum emission of BODIPY derivatives can be extended from 510 to 800 nm by functionalizing the BODIPY skeleton at the meso, α, β-pyrrolic, or 4 positions. BODIPY derivatives have high absorption coefficient (ε>50,000), high fluorescence quantum efficiency (φ>70%), sharp emission peak, good photostability and chemical stability. The SM2203 spectrometer is designed to analyze absorption and emission in the ultraviolet and visible regions of the spectrum. A UFPGS-4 device was used to create a gas mixture flow by supplying oxygen and argon to the test solution.

Keywords: Dipyrrin, chromophore, cation, complex, fluorescence, spektral

Dipirrinlər - açıq zəncirli oliqopirrol strukturuna malik xromofor birləşmələrin ən sadə nümayəndələrdir. Qeyd edək ki, dipirrinlər və əlaqəli birləşmələrin öyrənilməsi müasir kimyanın ən inkişaf edən sahələrindən biridir. Onların kationlarla sabit kovalent kompleksləri p-, d- və f-elementlər spektrin görünən bölgəsində intensiv xromoforik xüsusiyyətlərə malikdir. Bu ailənin ən perspektivli nümayəndələri difluoroborat kompleksləridir (BODIPY).

Qeyd edək ki, onlar keçən əsrin sonlarında sintez edilmişdir. Bu nümayəndələr hal hazırda uğurla öyrənilir, həmiçinin yüksək texnologiyalarda da istifadə olunur. Son illərdə dipirrinlərin, xüsusilə də onların aza törəmələrinin fotofizikı və fotokimya sahəsində intensiv tədqiqatlar aparılmışdır. Lazer daşıyıcıları, flüoresan markerlər və zondlar, optik sensorlar, OLED-lər, günəş batareyaları və s. kimi ən son texnologiyalarda istifadə edilən mürəkkəb üzvi birləşmələr əsasında optik cihazların yaradılmasına yönəldilmişdir. Optimal strukturların məqsədyönlü seçimi üçün bəzi məqamlar nəzərə alınır. Məsələn: spektroskopik xassələrin komplekslərin quruluşu ilə əlaqəsi və liqandda, kompleks əmələgətiricidə, həlledicidə əvəzedicilərin təsiri qeyd olunmalıdır.

1968-ci ildə BF_2 əsaslı flüoroforlar - dipirrin kompleksləri (BODIPY) haqqında ilk məlumatlar meydana çıxdı.



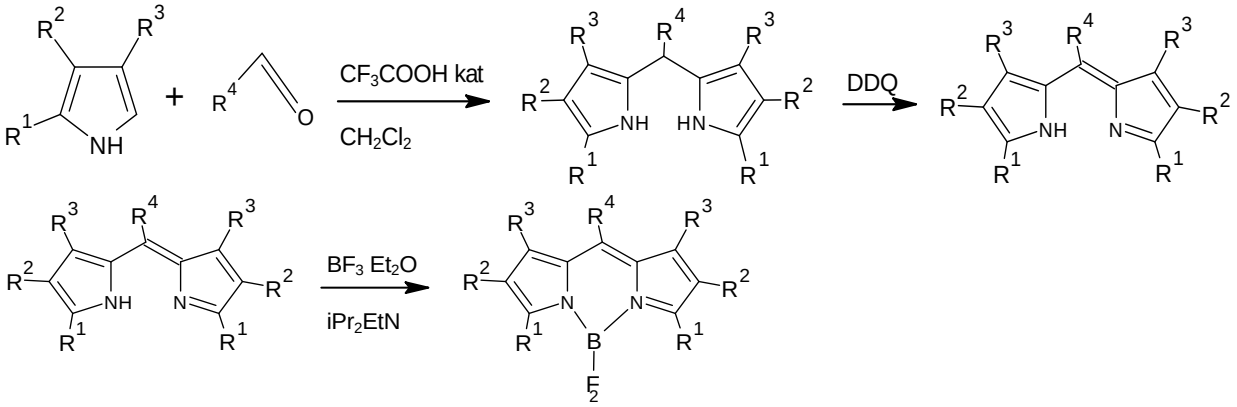
Şəkil 1. BF_2-dipirrin kompleksinin struktur quruluşu (BODIPY).

BODIPY, molekulu $C_9H_7N_2$ dipirrometen qrupuna birləşdirilmiş BF_2 bor difluorid qrupundan ibarət olan $C_9H_7BN_2F_2$ düsturlu kimyəvi birləşmənin texniki ümumi adıdır; xüsusilə, Beynəlxalq nomenklaturasındakı 4,4-difluoro-4-bora-3a,4a-diaza-s-indasen birləşməsidir. Qırmızı kristal bərk maddədir, ətraf temperaturda sabitdir, metanolda həll olunur. Kristal bərk formada olan BODIPY demək olar ki, tamamilə deyil, planar və simmetrikdir; perpendikulyar ikiyə bölünən müstəvidə yerləşən 2 flüor atomu istisna olmaqla. BODIPY (4,4-difluoro-4-bora-3a,4a-diaza-s-indacene) boyaları ən parlaq yaşıl işığı yayan flüoroforlar sırasındadır. BODIPY birləşmələri hüceyrələrə daxil ola bilən, lipid molekullarına bağlana bilən və xüsusi dalğa uzunluqlarında həyəcanlandıqda flüoresanlaşa bilən strukturlardır. Bu neytral birləşmələr yüksək lipofilliyə malikdir. Yəni hüceyrə divarından və membranından asanlıqla keçirlər. Bütün BODIPY birləşmələri bir dəqiqədən çox müddətdə parlaqlığını itirmədən flüoresan mikroskopiya ilə araşdırıla bilinir.

Aşağıda qeyd olunan əsas mərhələləri nəzərdən keçirək:

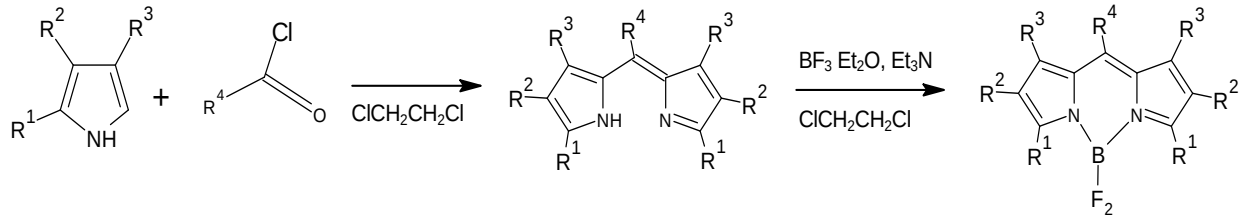
1) aldehidin iki pirrol molekulu ilə kondensasiyası;
2) oksidləşmə;
3) bor trifluorid ilə kompleksləşmə.

Reaksiyaları aşağıda göstərilmiş formada yazırıq:



Şəkil 2. Pirrolun aldehidlə kondensasiyası əsasında BODIPY-nin sintezi.

Burada, DDQ - dicyanodixlorobenzoquinondur.



Şəkil 3. Pirrolun turşu xloridlə kondensasiyası əsasında BODIPY-nin sintezi.

Deməli, aldehidi turşu xlorid ilə əvəz etməklə başqa bir sintez üsulu da mümkündür. Qeyd edək ki, bu üsul arzuolunmaz yan məhsulların əmələ gəlməsi ehtimalını aradan qaldıracaq. Bu metod uzun müddət qızdırma tələb edir. Amma buna baxmayaraq reaksiyanın ümumi məhsuldarlığı daha yüksəkdir.

Bundan başqa Trofimov reaksiyası mütləq qeyd olunmalıdır. Reaksiya super əsaslı mühitdə oksimlərin asetilenlə kondensasiyasına əsaslanır. Burada pirrolları daha həcmli əvəzedicilərlə sintez etmək mümkündür.

Son illərdə BODIPY-nin daha həcmli əvəzedicilərlə sintezinin yeni variantları hazırlanır. Bu tədqiqatların əsas məqsədi, proqnozlaşdırıla bilən xüsusiyyətlərə malik flüorofor nanoansambllarının səmərəli istehsalı üçün sadə düstur tapmaqdır. Bu yanaşmanın ideyası törəmə oliqopirrollara interpirrol spayser qruplarının strukturunu dəyişdirərək onların quruluşuna nəzarət əsasında müəyyən xassələr verməkdir. Beləliklə, bir neçə il bundan əvvəl ilk dəfə bis(dipirrinlər) sintez edilmişdir ki, burada dipirrol fraqmentləri asetilen, etilen və etan ayırıcılarından istifadə etməklə birləşdirilir.

BODIPY törəmələri yüksək rəngli maddələrdir və BODIPY törəmələrinin maksimum emissiyası BODIPY skeletini mezo, α, β-pirrolik və ya 4 mövqedən funksionallaşdırmaqla 510-800 nm arasında uzadıla bilər. BODIPY törəmələri yüksək udma əmsalı (ε>50,000), yüksək flüoresan kvant səmərəliliyi (φ>70%), kəskin emissiya pik, yaxşı fotosabitlik və kimyəvi sabitliyə malikdir.

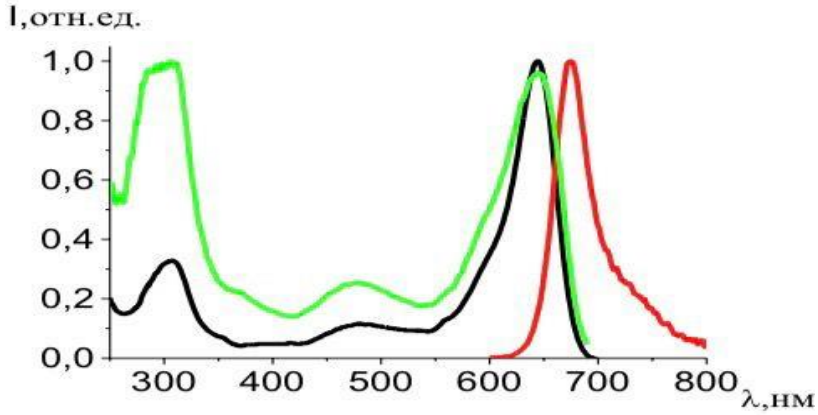
Bizə məlumdur ki, bu törəmələrin, bir qayda olaraq, yüksək texnologiyalarda tətbiqi üçün optimal olan spektral xüsusiyyətlərə malikdir. Misal olaraq: yüksək udma qabiliyyəti, yüksək flüoresan kvant məhsuldarlığı, şüalanma və qızdırma zamanı sabitlik və s. göstərə bilir.

BODIPY törəmələri optik xüsusiyyətlərinə görə böyük maraq doğurur. Çünki, yaxşı istilik və fotokimyəvi sabitliyə, güclü udma qabiliyyətinə və yüksək flüoresan kvant məhsuldarlığına malikdirlər. Bu xüsusiyyətlər dipirrinlərin difluoroborat törəmələrinin lazer aktiv mühiti, bioloji sistemlərdə markerlər, günəş batareyalarında enerji saxlama cihazları, üzvi işıq yayan cihazlar, qeyri-xətti optika və optik sensorlar kimi istifadəsini çox cəlbedici edir.

Lakin ənənəvi BF_2-komplekslər dipirrin adətən yalnız 480-540 nm diapazonunda udulmasını göstərir. Absorbsiya bölgəsini dəyişdirmək üçün, aza-BODIPY boyasını yaratmaq üçün mezopozisiyadakı karbon atomunu azot atomu ilə əvəz etmək üsulu qəbul edilmişdir. Bu üsuldan istifadə bir qayda olaraq, aza-BODIPY boyaları öz xarakterik xüsusiyyətlərini itirmədən udma qabiliyyətini açıq şəkildə uzun dalğa uzunluğu bölgəsinə keçirir.

Aromatik fraqmentləri mezo-mövqedə yerləşdirilmiş BODIPY fəal şəkildə öyrənilir. Qeyd edək ki, güclü mezo-mövqedə π-donor və π-akseptor udma və emissiya zolaqlarının böyük uzun dalğalı yerdəyişməsinə gətirib çıxarır. Eyni zamanda, doymamış karbohidrogen ayırıcıları vasitəsilə bağlanmış fenil fraqmentlərinin tətbiqi də güclü uzun dalğa uzunluğunun dəyişməsini təmin edir, kontur uzunluğunda əhəmiyyətli artım belə molekullarda π-elektron konyuqasiyası qütbləşmənin artmasına və nəticədə udma və flüoresans maksimumlarının uzun dalğa uzunluğunda yerdəyişməsinə səbəb olur. Tədqiqat obyektləri tetrafenil-aza-dipirrinin halogenləşdirilmiş diftorborat kompleksləri və diyodlaşdırılmış tetrametil-aza-dipirrin diftorborat kompleksidir.

Absorbsiya spektrlərinin, flüoresan, flüoressensiya həyəcanlandırma spektrlərinin və şüalanmanın kvant məhsuldarlığının ölçülməsi, ölçmə prosedurlarına uyğun olaraq otaq temperaturunda SM2203 (SOLAR) spektrometrində aparılıb. SM2203 spektrometri spektrin ultrabənövşəyi və görünən bölgələrində udma və şüalanmanı təhlil etmək üçün nəzərdə tutulmuşdur. Sınaq məhluluna oksigen və arqon verməklə qaz qarışığı axını yaratmaq üçün UFPGS-4 cihazından istifadə etməklə həyata keçirilib. Bu cihazın iş prinsipi verilmiş həcmli axın sürəti ilə mənbə qaz axınlarını yaratmaq və qaz qarışığı axını tərkibində homogen olana qədər qarışdırmaqdan ibarətdir. Qeyd etdiyimiz cihaz, axının idarə edilməsinin böyük dinamik diapazonuna və axın dəyəri üçün qısa yerləşdirmə müddətinə malik olan qaz axını tənzimləyicilərindən istifadə edir. Cihaz fərdi komputerin nəzarəti altında işləyir.



Şəkil 4. Dipirrinlərin aza-əvəz edilmiş bor ftorid komplekslərinin spektral xarakteristikası.

Bu birləşmələr 290-670 nm dispazonunda 3 udma maksimumuna malikdir. Deməli, Flüoresan həyəcanlandırma spektri udma spektri ilə uyğundur. Bu o deməkdir ki, tədqiq olunan məhlulda udma spektrinə uyğun olan birləşməyə malik struktur flüoresanlaşır və orada heç bir çirklənmə yoxdur. Absorbsiya və flüoresan zolaqlarının maksimumlarının mövqeləri həlledicinin təbiətindən çox az asılıdır və praktiki olaraq əvəzedicidən asılı deyildir. Qeyd edək ki, 2 boya üçün, müvafiq olaraq etanolda $Cl_2Ph_4NBODIPY$ və etil asetatda $Br_2Ph_4NBODIPY$ üçün 0,9 və 0,08 ns flüoresan ömürləri məlumdur. Etanoldakı $Br_2Ph_4NBODIPY$ birləşməsi qeyri-sabitdir və məhlul hazırlandıqdan sonra udma intensivliyi gün ərzində demək olar ki, 2 dəfə azalır. Digər aprotik həlledicilər olan asetonitril, aseton, toluol üçün bu təsir mövcud deyil. Buna görə də bromlu törəmənin etanoldakı məhlulları əlavə tədqiq edilməmişdir, Cl_2 və I_2-BODIPY etanolda tədqiq edilmişdir, çünki bu törəmələrin hər ikisi etanolda Br_2 törəməsindən fərqli olaraq sabitdir. Mümkündür ki, bu cür xüsusiyyətlər, proton-donor həlledici ilə qarşılıqlı təsir nəticəsində kompleksləşdirici agentin (BF_2) kompleksdən ayrılması ilə bağlıdır.

Absorbsiya və flüoresans spektrlərində maksimallarla yanaşı, müxtəlif zolaqlarda həyəcanlanma zamanı flüoresansın kvant məhsuldarlığı müəyyən edilmişdir. Yuxarıdakı cədvəldən belə bir nəticə çıxır ki, $So-S_3$ (310-320 nm) zolağında həyəcanlanma zamanı kvant məhsuldarlığı 5 dəfə azalır. Bu o deməkdir ki, müxtəlif orbital təbiətli və müxtəlif çoxluqlu vəziyyətlərin qarşılıqlı təsiri ilə bağlı qeyri-radiativ proseslər yüksək həyəcanlı vəziyyətlərdə artır və buradakı nəticələrə uyğundur. Belə qarşılıqlı təsir flüoressensiyanın azalmasına gətirib çıxarır və qısa dalğalı həyəcanlandırma altında sistemlərarası çevrilmə sabitlərini artırır. Bu da üçlülərin populyasiyasını artırır və təkli oksigen yaratmaq üçün istifadə olunur.

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Economic sciences

POPULATION COOPERATION AS A TOOL FOR THE IMPACT OF OVERRATED PRICES ON PRODUCTS AND GOODS

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Abstract

Today, the issue of high inflation is on the agenda of the Government of the Republic of Kazakhstan. Over the past 2 years, the rise in prices for food and goods show their historical highs. Thus, the price index for goods and services in annual terms (December to December of the previous year) in 2022 amounted to 20.3%, while in 2021 it was 8.4%, in 2020 - 7.5%, in 2019 - 5 ,4%. In addition, this figure is the highest since 2000, even in the crisis year of 2007, the figure was 18.8%. The reasons for the rise in prices are a number of factors, including factors related to higher production costs, monetary policy, as well as the presence of inefficient intermediaries between producers and consumers. The state takes various measures to prevent price increases: it provides financial assistance to retailers, enters into forward contracts with manufacturers, sets marginal prices for socially important food products, holds fairs, and so on. However, these mechanisms are not sufficient to reduce prices. The article discusses a potential tool for reducing consumer prices based on the cooperation of the population, which will be beneficial for both the population and the state.

Keywords: Population cooperation, prices, trade, food and goods

Over the past 2 years, the rise in prices for food and goods in the Republic of Kazakhstan shows quite high values. For example, the price index for goods and services in annual terms (December to December of the previous year) in 2022 amounted to 20.3%, while in 2021 it was 8.4%, in 2020 - 7.5%, in 2019 - 5.4%. In addition, this figure is the highest since 2000, even in the crisis year of 2007, the figure was 18.8%.

According to the data of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (hereinafter referred to as BNS RK), inflation growth in Kazakhstan in January 2023 in annual terms increased to 20.7%. In December 2022, there was an increase to 20.3%. Over the year, food prices increased by 25.7%, non-food products rose by 20.2%, and the cost of paid services increased by 14.2%.

It is worth noting that the situation improved in 2023. Thus, according to the BNS RK, inflation in the Republic of Kazakhstan in June 2023 for the year amounted to 14.6% and slowed down by 1.3% (in May 2023 - 15.9%). Prices for food products over the year increased by 14.6% (in May 2023 - 16.5%), for non-food products - by 15.8% (in May 2023 - 17.2%), for paid services - by 13.3% (in May 2023 - 13.5%).

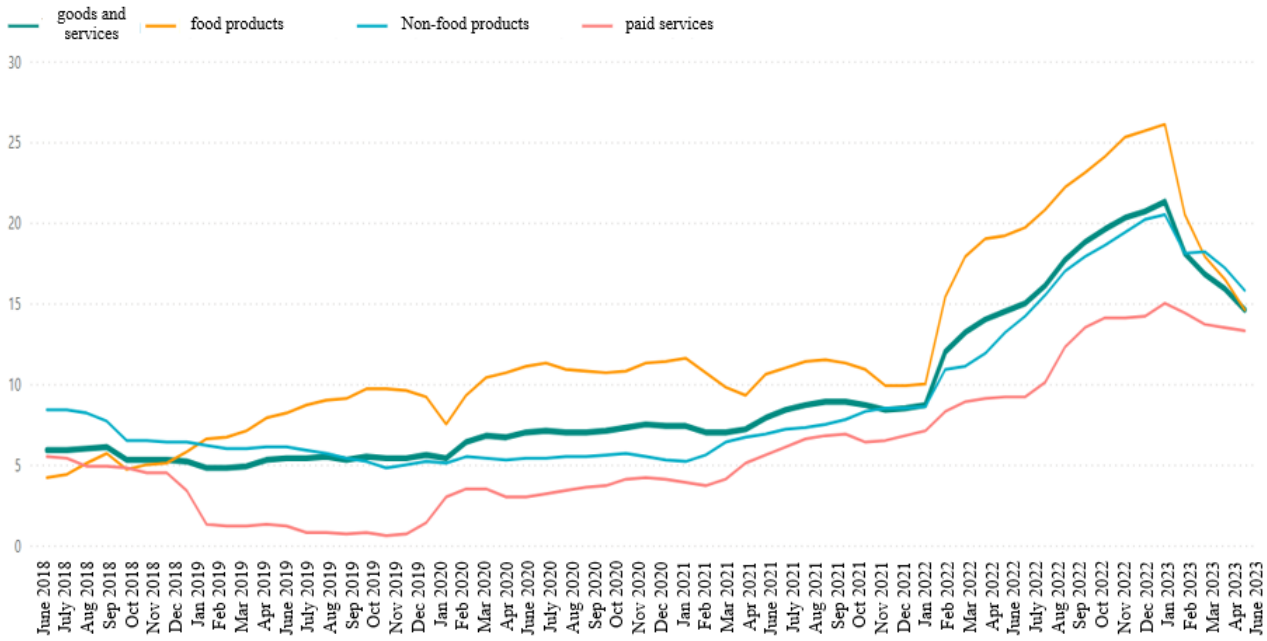

Figure 1. Annual inflation, in percent

Source: BNS RK

Compared to June last year, an increase in prices was noted for rice by 47.6%, cucumbers - by 33.4%, refined sugar - by 32.2%, mineral water - by 29.1%, oatmeal - by 24, 3%, pasta - by 24.1%, bakery and flour products - by 24%, eggs - by 23.1%, sour cream - by 23%, kefir 2.5% fat - by 22.6%, semolina - by 22.5%, pasteurized milk - by 21.6%, onion - by 18.7%, butter - by 16.6%, rye-wheat bread - by 15.6%. A decrease in prices was observed for cabbage by 13.8%, granulated sugar - by 11.5%, carrots - by 9.5%, potatoes - by 9.1%.

The reasons for the rise in prices in the Republic of Kazakhstan, according to international and local experts, analytical organizations and the state, are the rise in prices for raw materials and transportation (including foreign ones), general inflation, monetary policy, seasonality, high demand from abroad, the winding up of intermediaries [3], [4]etc. .

To combat the rise in prices for products and goods, the state controls and regulates prices for socially significant food products (hereinafter - SSFP). In terms of control, on a weekly basis, prices for NWFP are monitored at points of sale in the cities of the Republic of Kazakhstan.

Socially significant food products consist of 19 types of products: flour, bread, horns, eggs, buckwheat, rice, sugar, salt, sunflower and butter, some types of meat and vegetables (carrots, potatoes, onions, cabbage), the list of which is as of for 2022 approved by the Decree of the Government of the Republic of Kazakhstan dated March 1, 2010 No. 145.

Moreover, it should be noted that this resolution clearly defines the category of food, for example:

- wheat flour of the first grade;
- wheat bread from flour of the first grade (shaped);
- chicken egg (category I);
- pasteurized milk 2.5% fat in soft packaging;
- kefir 2.5% fat in soft packaging;
- butter (unsalted, not less than 72.5% fat, without fillers and vegetable fats).

And, for example, horns, buckwheat, rice - only by weight, packaged directly in the store. The consumer must understand that the same products packaged in individual packaging at the factory are not included in the list of SSFP.

[3] Dila ASFUROĞLU, "Determinants of Inflation in Developing Countries" - 2021

[4] Carlos Capistr´an , Christian Constandse , Manuel Ramos-Francia, "Using Seasonal Models to Forecast Short-Run Inflation in Mexico" - 2009

As part of the regulation and containment of price increases by the state, the following measures are applied:

- introduction of threshold values for retail prices for SSFP, the size of maximum allowable retail prices for NWPT;
- introduction of the size of the marginal trade markup for SSFP: the seller's margin should not exceed 15% of the manufacturer's selling price or the wholesale supplier's purchase price;
- concessional lending to retail facilities through a "revolving scheme" - the allocation of borrowed funds by local executive bodies for participants in the trading system at a preferential percentage;
- holding fairs;
- other.

It should be noted that many of the above measures have been implemented over the past 5 years, while these measures do not give a significant effect, which is primarily due to external factors of price growth and monetary policy. It should be noted that the regulation of food prices is an integral part of the price policy of the state. This policy is aimed not only at the implementation of price regulation, but also at monitoring their compliance [5].

At the same time, price regulation can only aggravate the state of commodity markets, provoking a shortage of relevant goods.[6]

As previously described, one of the reasons for high prices in Kazakhstan is the presence of many intermediaries between producers and consumers. In this study, a model will be proposed to reduce the effect of the presence of an intermediary.

According to the statistics of the BNS RK, the difference between consumer prices and producer prices is significant. For example, the difference in average prices for the period from June 2022 to May 2023 for some items exceeds 50%. Thus, the price of onion producers was 93.5 tenge per kilogram, while the consumer price was 160.9 tenge, that is, the difference is 72%. For carrots, the difference is 70%, for potatoes 42%, and for eggs - 28%.

It should be noted that the situation will look similar for other goods. As soon as the goods are sold from the manufacturer, they go to wholesalers (link 1), who then sell the goods to other smaller wholesalers (link 2) in the region or other regions (link 3). Next comes the distribution by points of sale (4th link) - markets, supermarkets, convenience stores. In some cases, goods are still delivered from markets and supermarkets to convenience stores (link 5). Thus, for each of the products and goods, a chain of 3 to 5 links is formed between the producer and the consumer. Each link to the point of sale winds up its margin from 3 to 10 percent, and convenience stores from 20 to 40 percent. As a result, the difference between producer and consumer prices is formed in the region from 40 to 80 percent on average [7].

As we can see from the current situation, the efforts of the state are not sufficient to curb the rise in prices, in particular when the rise is unreasonable. In this regard, it is proposed to introduce a system of cooperative population. Residents of residential complexes (one or more) can cooperate to open a store in which products and goods will be sold, for example, at 0 margin only for residents of these complexes, and for other store visitors, 20%. To implement this idea, you need a store with equipment, a store manager who will monitor the filling of the shelves and negotiate with wholesale suppliers or even manufacturers, an accountant, cashiers and a technician.

For example, consider the cooperation of 2 residential complexes that are located at a walking distance from each other within a 2-minute walk. Suppose that 4,000 families live in these complexes. Even if a third of the residents agree to work in cooperation, which consists in providing a monthly fee for maintaining the store at 3,100 tenge per month, then the monthly budget of such a store will

[5] Kaygorodtsev A. "State regulation of the agro-industrial complex as a factor in ensuring food security // Transit economy". –2006

[6] Mr Antonio CAPOBIANCO, “Competition and Inflation – Note by Kazakhstan” - 2022

[7] Zadvorneva E.P. Industrial and logistics infrastructure of the regional agro-food market. Materials of the international scient.- pract . conf . "Potential for the development of the agro-food complex: social capital, innovation, production, international integration" - 2017

be about 4,000,000 tenge. This will be enough to maintain a store with good conditions. The rent for a store with all relevant equipment, for example, will be 1,500,000 tenge per month. Staff maintenance per month (including 13 salaries during vacation): 1 manager - 700,000 tenge (salary), 1 accountant - 400,000 tenge, 2 cashiers - 400,000 tenge, 1 technician - 300,000. This staff will provide quality service for the customers of the store, so the wages of the staff are higher than the market ones.

The store will serve residents of residential complexes who pay a monthly subscription fee (let's call them contributors) at 0 margin. Depositors can be identified using digital tools (QR code) or special cards.

At the same time, the store should be as customer-oriented as possible for its depositors. It is necessary to create an application in which each contributor will select the necessary product, which should be on the store shelf. Further, the application, based on the majority of votes, must itself select the final list of products by manufacturers, volumes and other criteria. In addition, depositors should receive a report on the purchase of store goods through the application so that each depositor can be sure of 0 margin. Reporting will form the manager and accountant.

Note that the calculations were made in the case when only a third of the residents agree to participate in cooperation, if the number of depositors increases in the future, then the monthly subscription fee will decrease accordingly.

A survey was conducted of 150 families in the city of Astana on the subject of how much they spend on average when purchasing goods in convenience stores. On average, 1 family spends about 30,000 tenge. If we take into account that the margin of convenience stores is at least 20%, then their savings at 0 margin will be about 6,000 tenge per month. However, there are monthly purchases of goods in large supermarkets and markets. In addition, the opening of cooperation stores can partially cover the need for purchases in supermarkets and markets, which will save money and time for residents to purchase goods. Thus, the opening of cooperation stores will simplify the life of the population and reduce their financial costs.

To implement this idea, the state can help in the following:

1. Fund the development of applications for cooperation stores;
2. Provide training for store managers;
3. Provide financial support for the start of the shops within 3 months, until the required number of depositors is reached.
4. Provide a legal and legislative framework for the implementation of the idea;
5. Pilot launch the model in several regions of the country.

The creation and further scaling of cooperation stores will allow the state to reduce consumer prices for products and goods, provide jobs with high wages, monitor and analyze retail trade through the created applications.

Conclusion

Today, the issue of high inflation is problematic for Kazakhstan. Over the past 2 years, the rise in prices for food and goods show their historical highs. The reasons for the rise in prices are a number of factors, including factors related to higher production costs, monetary policy, as well as the presence of inefficient intermediaries between producers and consumers. The state takes various measures to prevent price increases: it provides financial assistance to retailers, enters into forward contracts with manufacturers, sets marginal prices for socially important food products, holds fairs, and so on. However, these mechanisms are not sufficient to reduce prices. At the same time, the regulation of food prices is an integral part of the price policy of the state. This policy is aimed not only at the implementation of price regulation, but also at monitoring their compliance. In this regard, the state needs to take other measures to reduce prices. One of the measures is the cooperation of the population to open their own stores in order to avoid the mark-up of intermediaries and the stores themselves. To implement the proposed idea, the state needs to provide support in terms of technological and legal solutions, as well as provide the necessary training and funding to start the initiative.

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GENDER EQUALITY AND THE EMPOWERMENT OF WOMEN AND GIRLS ON THE EXAMPLE OF CANADA

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Abstract

Gender equality and the empowerment of women and girls are fundamental to the effective recognition of human rights, and they are essential to the eradication of poverty and the achievement of sustainable development and peace. Women and girls can be powerful agents of change. There is a greater need to promote an environment that allows them to participate equally in decision-making in their homes and in society, to control their lives and bodies, to contribute to and benefit from development and prosperity on an equal basis.

No country has eliminated gender inequalities: a large and disproportionate number of women and girls face violence, discrimination and socio-economic marginalization. In addition, there are often other forms of discrimination based on such things as racial or ethnic identity, place of birth or residence, skin colour, religion, language, sexual orientation, gender identity, age or ability. There is growing evidence that high levels of inequality and gender-based violence in a society are associated with civil and international conflicts. The discrimination, marginalization and vulnerability faced by women and girls is heightened in such contexts, as well as in natural disasters and humanitarian or migration crises.

Keywords: gender policy, equality, Canada, public policy, rights of women and girls.

The 2030 Agenda for Sustainable Development challenges the global community to put an end to generalized gender inequalities once and for all, by making it an objective in itself and considering it as a prerequisite for achieving all the Sustainable Development Goals (SDGs). In response, Canada has adopted a feminist approach to international aid, which has six fields of action. For each of these fields of action, Canada recognizes the importance of gender equality and the role that autonomous women and girls play in shaping a better future for themselves, for their community, for their country and for the whole world. This field of action makes it possible to deploy the targeted and coordinated efforts that are necessary to put in place the foundations for strengthening the power of women and girls and to fight against gender inequalities. It is on this aspect that the progress that can be made in all the other fields of action depends.

To remedy poverty and gender inequality, the following issues must be addressed.

Gender inequality is deeply rooted and hinders social, political and economic development. Systemic discrimination, unequal power relations and harmful socio-cultural norms and practices, which are often reproduced or even accentuated online, are deeply rooted and hinder the promotion of women's and girls' rights and the strengthening of their power in all spheres. To overcome gender inequality, we need a movement of profound transformation that can only come from within societies, with the active participation of all, including men and boys.

Sexual and gender-based violence is undermining progress in all sectors. Sexual and gender-based violence constitutes a serious and widespread violation and abuse of human rights, a contributing factor to insecurity and an insidious obstacle to achieving gender equality. Sexual and gender-

based violence is perpetrated mainly by men and especially against girls and women, at all stages of their lives. It has immediate and permanent devastating effects, as it prevents victims from realizing their full potential and perpetuates gender inequality.

Women's organizations lack the funding and support needed to influence change. Organizations and movements dedicated to the promotion of women's and girls' rights, especially at the local level, play a crucial role in advocating for a change in laws, attitudes, behaviors, as well as socio-cultural norms and practices. However, their influence and viability are hampered by the lack of funds and support available to them to develop their capacities as well as the lack of political space.

The lack of gender-sensitive statistics and analysis makes it difficult to close the gender gaps. The lack of robust comparative analyses and data disaggregated by sex, age and other intersecting identity factors hinders the understanding of gender inequalities, as well as the identification and implementation of effective solutions. Age-disaggregated data are particularly important for tailoring strategies to the specific priorities and needs of girls and young women.

The weak gender equality capacity of the public sector undermines its role in ensuring equal rights and opportunities for women and girls. Public sector institutions have limited capacities to use the results of gender-based analysis that takes into account cross-identity factors, to ensure that the objectives of gender equality as well as the perspectives of women and girls are taken into account in a meaningful way in the development of policies, the allocation of resources and the implementation of programs.

This field of action aims to advance gender equality and the empowerment of women and girls as an objective in itself, by addressing fundamental and multidimensional challenges. To increase their overall impact, Canada's initiatives aim to form synergies between fields of action with regard to key issues such as economic empowerment, quality education, political participation and sexual and reproductive health and rights. Canada focuses its assistance on initiatives that foster an enabling environment for gender equality and the empowerment of women and girls, and that accelerate progress in all fields of action.

Canada is focusing its efforts on three courses of action:

1. Contribute to the fight against sexual and gender-based violence, including child marriage, early or forced marriage, as well as female genital mutilation or circumcision.

Canada's goal with regard to this course of action is to eliminate sexual and gender-based violence (SGBV), especially that which affects women and girls. To achieve this goal, it is necessary to strengthen the capacity of state and non-state actors to improve and effectively implement prevention and intervention strategies. It also requires addressing cultural, social, legal and judicial barriers, in order to put an end to SGBV through evidence on the factors and root causes of violence as well as strategies to prevent it, and involving women, men, girls and boys in promoting positive behaviors and changing social norms in favor of gender equality.

Sexual and gender-based violence includes any act that causes or is likely to cause physical, sexual or psychological harm to a person and is based on biological sex, gender identity or social norms of masculinity and femininity. Such acts can occur everywhere: in public or in private, at home, in urban or rural areas (for example, on the way to get wood or water, or when going to the toilet), at school, at work, online and in crisis or conflict situations. VSFG includes harmful practices such as child marriages, early and forced marriages as well as female genital mutilation or circumcision.

2. Support and strengthen women's organizations and movements that play an important role in defending gender rights and equality and strengthening the power of women and girls.

Canada's objective with regard to this course of action is to increase the effectiveness and influence of women's organizations and movements in order to bring about institutional changes and changes in social norms, and in order to hold governments accountable for the commitments they have made to protect the rights of women and girls. To this end, Canada must offer them assistance in carrying out their programs and activities, strengthen the capacities and viability of their institutions, facilitate the establishment of networks and alliances, as well as advocate for their role, participation and leadership in political dialogue at all levels and as partners in the design and implementation of various initiatives, in all sectors.

Women's organizations are civil society organizations founded and led by women and girls. These organizations are active at the local, regional, national and international levels and have as their raison d'être to bring about transformative changes in favor of gender equality and the empowerment of women and girls. Their activities include advocacy, policy and budget dialogue, awareness raising, service delivery, research as well as the creation of alliances and networks.

It is widely proven and the Canadian experience confirms it women's organizations play a crucial role in bringing about changes in policies, laws, services, as well as social norms and practices. These organizations mobilize families and communities, involve men and boys, call on influential people and decision-makers from the public and private sectors and those from civil society to address the obstacles that hinder gender equality and the empowerment of women and girls, including social expectations regarding the social and family roles of men and boys. As they are aware of the difficulties and the dynamics of their communities, these organizations are well placed to design effective strategies and to innovate. They provide many women and girls with platforms and networks that allow them to participate in decision-making processes, which supports their leadership in society. Moreover, they are vigorously resisting regressive forces that are trying to reverse the gains made in terms of gender equality, a phenomenon that is often a precursor of fragility or violent conflicts. These organizations must be at the forefront of community building, conflict prevention and resolution, and post-conflict state reconstruction.

3. Support evidence-based policy development and implementation of gender equality programs.

Canada's objective with respect to this course of action is to ensure that national and subnational state and non-state entities make progress in the development of policies and the implementation of responsible, effective and evidence-based programs, in order to advance gender equality. This may include strengthening the capacities and systems of these entities in order to advance gender equality through policies, laws, budgets, programs and services, and in order to produce, use and communicate evidence on gender issues. This can also include facilitating partnerships and networks of multiple stakeholders that can promote dialogue and accountability in the field of gender equality.

Public institutions at the national and subnational levels, including central agencies and ministries (e.g. finance, planning and public security), sectoral ministries (e.g. health, education and agriculture) and legislative assemblies have respective and complementary mandates to advance gender equality and to promote and protect the rights of women and girls, but most are experiencing difficulties in fulfilling their mandate. The ministries and agencies primarily responsible for gender equality (i.e. the national mechanisms for the promotion of women) have an important role to play as a catalyst and support to other government entities in their responsibilities, but they often lack resources, technical expertise and influence.

Moreover, statistics, including on demography and civil registration, are insufficient to adequately reflect the roles, realities, priorities and experiences of the various groups of women and men, girls and boys. In short, gender statistics are lacking as well as a solid gender-comparative analysis, both quantitative and qualitative, which is essential to guide policy development and program delivery as well as to find effective solutions to achieve gender equality and achieve the Sustainable Development Goals. Better and more accessible gender data can also be used to strengthen the demands and capacities of women's organizations.

These three courses of action are interdependent and mutually reinforcing. They encompass enabling issues that require specific and innovative investments in order to lay the foundations for achieving full gender equality.

Canada recognizes the multiplicity of identities, roles, challenges, perspectives and interests of women and girls, men and boys, as well as non-binary people. Canada's approach explicitly takes into account the importance of addressing gender equality from an early age, when gender norms are learned, and focusing efforts on promoting the rights and strengthening the power of girls, including adolescents, who face a double burden of discrimination based on both their sex and their age.

One element intersects with these three priorities: it is the mobilization of men and boys, as important actors and allies to guarantee gender equality and support the strengthening of the power

of women and girls. Harmful forms of masculinity lead to gender-based discrimination and violence. Social norms and gender-based stereotypes also confine men and boys to specific roles and prevent them from reaching their full potential.

Canada is aware of the risks involved in promoting gender equality and strengthening the power of women and girls in certain contexts, since it involves questioning power dynamics. In its efforts, Canada ensures that partners are not exposed to dangers, especially in situations of fragility and conflict. Canada's priorities in this field of action are aligned with Canada's National Action Plan on women, peace and security.

In addition, Canada encourages innovation by considering new partnerships, perspectives, policies, approaches, behavioral knowledge and technologies, in order to better understand what harms gender equality and to achieve more results than conventional approaches would have allowed, including by supporting the innovation capacities of women and girls at the local level.

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TRANSFORMATION OF THE PUBLIC ADMINISTRATION TO THE DIGITAL AND DOCUMENT MANAGEMENT

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Abstract

The document management plays a central role in the functioning of public administrations. Whether for reasons of internal operation, to the provision of services or further exercise of democracy through access to documents, data and documentation are crucial elements in direct support to this operation. Extensively documented, the contribution has been challenged by the development of media technology and sophisticated and very powerful in terms of capacity, connectivity and abstract. The development of the office, and today supports so-called smart grids makes the documentation more difficult and less predictable even if the expectations and needs are often the same. This is the aspect of the scarcity of this documentation that is clearly one of the biggest problems which had been resolved, at least in large part, by the practice of documentaries before the technological revolution. With the new technologies and the creation of an environment of digital work, several issues emerged. It is the quality or authenticity of the information, sharing it, or of its accessibility, its protection, its destruction or archiving sustainable; new approaches and solutions are required to ensure that the documentation continues to serve the public organizations and the citizens who depend on them.

Keywords: document management, informatization, public service, information technology, cybersecurity

The reflection on the transformation of the State towards the digital can make the economy look full and inclusive on the question of the means, of the essential ingredients and actors in its implementation. This means that it cannot be built only on the basis of technological, organizational, expert, or business, without which it would only be partial and incomplete, and possibly little functional or poorly performing. The digital organization is the result of an ecosystem in which the above-mentioned and many others are all a part. All participate in the culmination of the transformation desired. As well and in addition to its dimensions, human, technological or organizational, the challenge of the transformation also includes many facets, including aspects of information. Moreover, the question of the governance information has surfaced a few years ago, and continues to raise many questions as to how it should be formulated and deploy in the organization. This renewed interest is born of the massive arrival of information technologies and communications. "Information Governance Initiative" defines the governance of information in a very concrete and practical it is to say "(...) Information governance is the activities and technologies that organizations employ to maximize the value of their information while minimizing associated risks and costs (...) " (Information Governance Initiative, 2020). Even if it is still incomplete, this definition is interesting for at least two reasons. One hand, it recognizes the dimension deliberate manner in which the resource information is used in the organization. It recognizes that choices are made. On the other hand, this definition also reflects the importance of activities that lead the organization and technology at its disposal. The governance of information becomes a dynamic element of the organization to make choices intentional. This joins the concerns raised in other research that remind us of the importance of the involvement of senior management to ensure the integration of all the contributions (technological, expert and functional)

and the research of a coherent whole (Caron, Bhérer and Bernardi, 2020). The information governance has nothing mechanical or perfectly predictable. It is adaptive.

It's the same for the management of the daily information in all its forms, including those that represent the data. There is not so long, the question of the management of the data was not because the documentation practices, or use of, the data were quite standard and well-controlled organizations. That is to say that the organizations had found ways to maximize the value of these information with the available means.

Recently, several authorities are interested in back to the question of the use and exploitation of the data and the documentation of a more general, that is to say, outside of the way in which it is managed. In fact, interest has focused on its uses as well as the needs of transparency, accountability, design of public policies or making decisions informed by data, evidence. This concern is joined to The works of le Coadic, which recalls that one of the the main changes in paradigm brought by the information technology and communication is that we are witnessing today "(...) the progressive shift of emphasis in the documentary an emphasis informational, guidance system - a guidance user (...) " (Coadic, 2004). This reduces also the issue of more fundamental issues, and the oldest as the role of information in the efficiency and effectiveness at the organizational level (Galbraith, 1974). For example, the appetite organizational for obtaining data is now unlimited. This use of data has become of great interest due to the amount of data untapped potential that exists, and the multitude of analyses that can make the administrations and governments by the use of the abstract (e.g., machine learning, chain blocks and intelligence artificial). The data are from a rescue invaluable contributions to the construction and validation of the problems to solve and their operationalization by the public administrations. This new interest in the data is due in large part to the technologies of information and communication. Furthermore, and even if it is less studied or even considered by the government, the documentation and document management play a role as fundamental in the functioning of the State. First, because it contains the evidence and guarantees its existence, its traceability, and the fact that it can be easily identified. Secondly because this documentation may be operated as the data, because today it is decomposable. The documentation is therefore not only essential to the organization as it has always been, but, to the extent where it can be better exploited, its utility would be even greater.

This is what underlies a number of major projects and major initiatives of the transformation of public administrations in favor of an increased use of information technologies and communications. Since the end of the last century, the projects have seen the light of day across the world in order, especially, in a goal to take advantage of the benefits of the new technologies of information and communications. For illustrative purposes, one can think of the strategies of data, or the strategies of digital transformation. These great sites are often perceived and presented as challenges to the working of the authorities, and this, especially in their delivery of services to citizens. It is argued that they would do a sort of under-the use of the modern technologies available. However, without calling into question such an assumption, the implementation of these initiatives, in fact, reveal a greater complexity. For example, we find a multiplicity of needs of transformation or adaptation, which are needed to find new balances, and particularly in the ways to combine and arrange the resources and create, to transport and to use the information and data in the institutions to better serve their organizational missions. In addition, the forms traditionally hierarchical organization of the work are also disputed. These issues go far beyond the technological dimension, but above all, they show that the work to be done requires the assembly of several items, and multiple conditions favourable. On this point, one can think of the cloud strikes the imagination. But there are several others, including the chain of blocks, the robots talking, or the transactions online. All these innovations have an impact on the raw material of the organization or the information and how to regulate it and this upsets the systems internal.

The question that arises now is how the documentation and its management is heard first as a lever and then as expertise can contribute to the transformation of the public administration to the digital and contribute to the running of this administration once transformed. But first, it is interesting to make a brief overview of the state of Quebec as the three elements that form an important part of

the framework that supports the management of the documentation is the institutional responsibilities for, the expertise and coaching.

Until recently, the information work of the organizations was largely done by experts and through mechanisms bureaucratic in agreement with the functioning of government based on the possibility of contributions offset. In a first time, there is the work of the creators and users of information and data. In a second time, and as an intermediary, there is the contribution of information experts who take care of classify and organize information to be able to find it. This work is still there, but is called to move, because the self that provides the technology to designers and users is reflected in their work practices and in their needs. This will make some to say that the information is no longer created to be ranked, but to be used (Coadic, 2004). It will be noted that the definitions identified by Svärd (2017) show unequivocally that the management documentary has not crossed the barrier and is essentially rooted in the management of an object, today physical or virtual.

The move to a digital world has helped to drastically change the mode of organization where it was possible, even desirable, to break the task in order to ensure the effectiveness of the work to be done. In the past decades, the place of information in society and the economy of developed countries has continued to grow. The rapid development of office automation technology and digital has led to an explosion of data collection, processing and storage of information and data. The producers of information have also increased the pace of the increase of the connectivity of the individuals/users and objects, and the deployment of desktop tools. The integration of these technologies in the practice of the authorities, however, are complex. Because of the different technologies require different operating modes, their simple overlay does not and could lead to various forms of incompatibility organizational and technical. For example, the transition of administrations to digital is not equivalent to a simple scanning of documents. The organizations transform deeply under the influence of new structures of informational fluxes. These flows of information are transmitted more hierarchically from top to bottom in the administration, but come from multiple places and the cross by various channels, individual and organizational. These flows of information are the reflection of new methods of work from this technological environment. Of many questions emerge to the light of these changes. As an example, the work environment, digital is much more decentralized, the documentary value of administrative documents is more difficult to establish: for example, under what conditions, an email is an official document? All the interventions of an official on the Cloud should they be stored? These questions show the whole issue of digital documentation and its management in the administrations.

In what follows, we will first offer a definition of the digital world, and then we identify some features of the digital document, in particular which distinguishes it from the document traditional paper. We will see then what are the implications for the administrations of a point of view of documentation and its management.

The studies agree that the document management and, more broadly, information governance organizations must be adapted to comply with the requirements and operation of the digital environment. Thus, the principles and practices of document management need to be rethought and out of a "mentality paper" (Klarel and Gidlund, 2016). As the note Franks (2018), the practices of the modern office cannot be simply transposed into the digital world. The coordination between the management of paper documents and the 24electronic documents must be improved to avoid office employees to waste time having to search for documents in multiple locations. More broadly, policies and protocols in the field of information governance need to be modified to comply with the requirements of the digital in relation to the production, circulation and processing of the information. Even today, it is not unusual to find that the instrumentation informational still in place from a time pre digital (Caron and Bernardi, 2019). In addition, the use of different types of data (open data, mégadonnées, or Big Data, search data, etc) calls for the development of new skills (Da Sylva, 2017). In effect, the required skills are more disciplinary, but cross-sectional (Zwarich and Maurel, 2020). Questions on the content of training programs in information management in Quebec are required (Zwarich and Maurel, 2020). This transversality is essential to the achievement of an information governance optimal.

The definition of information governance is not unanimous in the literature. By information governance, some hear " the range of activities designed to establish a legislative basis to facilitate

and stimulate the interactions that produce meaning within an organization and between the actors that compose it or interact with it. More specifically, the governance of information caters to the classification of information according to the needs of the organisation and the control of the quality of this information (Smallwood, 2020). It is generally understood that it includes a number of features such as data management, big data, management of administrative documents and archives, knowledge management, on the eve of the strategic, business intelligence, information security, risk management information, access to information, the protection of personal information, intellectual property, library management, technology management information and meet compliance requirements," (Maurel, Dufour and Zwarich, 2017). Thus, the information governance must now also oversee the collection 25and the analysis of a considerable mass of data coming from any (Big Data) and the sharing of this data between the government and the rest of society (Open Data) (Clarke and Margetts, 2014).

In past years, many debates have taken place to try to limit the fields to include in the governance of information or even to define it as a field of expertise. It was also question of the set in relation to the management literature. These debates reflect a good portion of the divisions between disciplines and the distribution of roles between the different professionals of the information. The pre-eminence to one or the other between information governance and document management means to designate the discipline and the functions that will have the legitimacy to scientific and professional to take the decisions in the field of information within organizations. In the debate, some insist on the fact that the practices and principles of the document management have not evolved sufficiently to be able to manage new sources of information. Other rather put a spotlight on the need for complementarity between the different roles and functions that are required by the information governance (Saffady, 2015).

The multiplication of the responsibilities caused by new sources of information has also aggravated the functioning in silos. According to Ardern (2016), this is the main problem faced by the information governance: information should be managed, taking into account the whole of the organization and not only the prospects of the teams in charge of each of its parts. A study conducted with professionals of Library and Archives Canada notes the existence of these silos, as much due to the separation of functions (information technology on one side, document management on the other) that in the absence of common rules of management, documentary, or standards in terms of data (Jordan and Stricker 2013). In this context, the governance, the information should intervene in order to better define the roles and responsibilities of each, but this must be done in order to promote the greater the flow of information between the different departments in developing standards and common practices. For a detailed discussion on the issue of the information governance and its challenges in the digital world, one can refer to the research report entitled" governance of information within the public administration (Caron, Bherer, and Bernardi, 2020).

In conclusion, it is important to remember that the issue of the documentation and its management such as information governance is at the heart of the success of a multitude of government projects. For example, the digital identity is linked to the ability of governments to recognize, engage, and assemble wisely the various elements of the information ecosystem, including any documentation, data, work processes and technologies that will structure the new organization of work. For the documentation to be used in an efficient and effective manner, and that it contributes to the performance of the organizations public who wish to be at the service of the citizen, it will be necessary to explore the way of introduction of this element of dynamism in its governance, that is to say in the choices that are made by the organization to exploit it rather than manage it, that is to say, the time to contribute.

In Canada, it was announced the redesign of information systems Ministry of Health and social Services (Lachance 2021). This raised a central question in regards to document management, the ability to find information easily to that need in a timely manner. This question, central to the concerns of the MSSS, shows how the documentation is still problematic, and its management is not resolved. Even if the article in question was an issue that affected mostly to technology spending, the issue is also fundamental to the management of documents and information flow.

From the outset, it is worth remembering that the information governance in a digital environment should be aligned to the specific organizational, institutional and political functions of social and public administration. From there, the documentation and its management can play their role, which is to support processes, and the organization's operational (Cunningham, 2011).Also he notes that one of the central issues of information governance in public administration " is to reconcile aspects of the new environment information with the vast legacy of laws, policies, institutions, and practices in the field of information ". This echoes the situation presented above, and to the need to revise some of its elements. The two authors point out a certain number of these aspects:

1) to develop better tools to enhance the value of the information to the internal;

2) to assess the public value of information, an essential step in the context of Big Data and the sharing of information networks;

3) clarify the legal issues of accountability and ownership of information and data relative to the Cloud and data centers; and

4) oversee the relationship with the private sector, which can sometimes be the manager and the owner of the information, and government data.

Dootson, et al, (2020), meanwhile, offer six recommendations that could facilitate the transition to a governance informational digital:

1) redefine the notion of public document;

2) rethinking the objectives of the legislation on public documents to make them more in tune with the flow of the information and data in the digital environment;

3) reduce the latency of the legislation, particularly in the based on the principles broad, inclusive, and not on the characteristics of the technology;

4) expand the role of the agencies of information to enable them to oversee document management in different organizations in both the public and provide assistance as needed;

5) expanding the role of archivists to create a single repository of digital documents and data;

6) to develop the digital skills of professionals for the document management.

Secondly, the practice of open data has implications for the governance and management documentaries. It is increasingly common to share a part of government data so that they can be valued by the stakeholders in the economy and benefit the whole society. The open government brings in more transparency and accountability, helping to re-establish the bond of trust between the government and the citizens. However, its implementation requires some reforms of the public administration, at the level of the social, political, technological and administrative. Several studies have also shown that these objectives could be achieved without a document management functional is established within the government. Léveillé and Tims (2015, p. 181) note as well that" a part of document management supporting accountability as the creation, retention and control of documents complete, accurate, and reliable " is a must for any initiative open government. Similarly, Shepherd et al (2018) have shown, by studying the various local governments in England, that existed between these differences important in the distribution of roles and in the standards relating to the management of the data, suggesting that the absence of a shared framework of document management and common guidelines at the level of governance of the information was damaging the interoperability of the initiatives developed by the localities.

Thirdly, an issue of recent, but very complex is the use of cloud computing. It is "the delivery of computing resources on demand (ranging from applications to data centers) via the Internet, at a cost for each consultation" (Government of Canada, 2020). This type of service allows economies of scale and an adjustment easier on the supply and demand of services. However, research has identified several risks related to its use: unauthorized access to information and documents; undermine the protection of life private; loss of access to documents and their management; lack of transparency on the service and account management; location of the server, and destruction of data; difficulties to recover the data. Also, in the cloud, a document or file can be distributed to several locations, which may pose problems for the authentication of an original document. Therefore, steps must be taken to always being able to identify and trace back to the original document.

The fact that a part or all of the data or the information is not stored on-site creates new problems for the document management in public administration. Cloud computing, sometimes implies a dependence on more large-the private sector, which requires the public administration to define new rules for its collaboration with the private sector. The relationship between cloud service providers and the State may become unbalanced to the extent where the second depends largely on the infrastructure provided by the first for her operation. In some cases, the use of cloud-based services external can affect the sovereignty of the State, since the information may pass through servers located in foreign countries and be subject to their laws. More and more countries, particularly in Europe, are mulling measures that ensure a form of sovereignty, for example, by ensuring that the data are stored in servers on the national territory. If it is the responsibility of the State to take into account these elements in the contract of service, it is important all the same, in an economic perspective, more comprehensive, maintain a form of competition in order to avoid that a handful of companies capture most of the market.

Fourth, the question of the contribution of models of management of the information remains central. She has at least two ramifications. The first is related to the content of the proposed solutions and the second to how to include this contribution in the functioning of organizations. On the one hand, the progress made so far at the level of the solutions are still too often and disciplinary focus on the subject of documentary without consideration for the transformation is not so much in its essence as in the way of being created in the organization, in the way in which it manifests itself: in the flow. On the other hand, the contribution of information professionals should it be directed more towards a support for the development of algorithms with information architects? We believe that this would make the spaces and the tools to work more self-supporting, or even self-sufficient in terms of management of the documentation. By introducing standards and documentation requirements in the tools and spaces (such as Teams), the creator and the user would be encouraged to adopt behaviors' and practices documentaries transparent.

Without going into the details of the form that might take these items, some of them are identifiable as essential to the construction of a theory of change for the documentation and management participates in the transformation of the public administration to the digital. We think of the reform of laws and policies and the review of the professional competencies as well as the way in which information professionals contribute to the management literature.

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PRACTICAL APPLICATIONS OF DIGITALIZATION OF PRODUCTION ON THE EXAMPLE OF AN ENTERPRISE

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Abstract

The analysis of practices of modernization and digitalization of production on the example of JSC "ArcelorMittal Temirtau", for the implementation of control over the movement of coiled hot-rolled products through the application of conventional signs, letters, numbers, graphic signs or inscriptions on coiled products, for further identification (recognition), indicating its properties and characteristics. Robotic technology provides quick automatic marking of steel coils moving along the plant line conveyor.The procedure of marking implementation is described. A procedure for conformity assessment by observation accompanied by appropriate measurements, tests is described. In addition to further improving defect detection and productivity, a new layer is added which is designed to merge and filter defect data in such a way that the accuracy of the data is maximised and the amount of defect data is kept to a minimum, corresponding exclusively to the relevant data.

Keywords: digital design, modernisation, automated system, control.

Introduction. The essence of the Fourth Industrial Revolution is that the physical world connects with the virtual world, resulting in new cyber-physical complexes integrated into a single digital ecosystem.

Industry 4.0 means more and more automation and intellectualisation of all industrial production processes: from digital product design, digital replication, real-time predictive maintenance, automated component supply systems to personalised customer service.

Methods. Theories of information, networked, virtual digital society are applied. Robotic technology of manufacturing modernisation. The concept of modern industrial revolutions that rely on digital technology.

Results and discussion. In the sheet rolling mill it was necessary to install a bale marking robot. The main reason for installing the marking robot was to control the movement of coiled hot-rolled products through the application of conventional signs, letters, numbers, graphic signs or inscriptions on coiled products, in order to further identification (recognition), indicating its properties and characteristics[1].

The purpose of the assignment was to design and manufacture the following equipment: a fully automated machine system for labelling hot-rolled coiled products during line transport, complete with inking system and controls, as well as a PLC motion control system and microprocessor.

The coil marking station is a motorised hot-rolled coil marking robot. The robotic technology provides fast, automatic marking of steel coils moving on the factory's linear conveyor. The paint is applied directly to the surface of the steel coil [2].

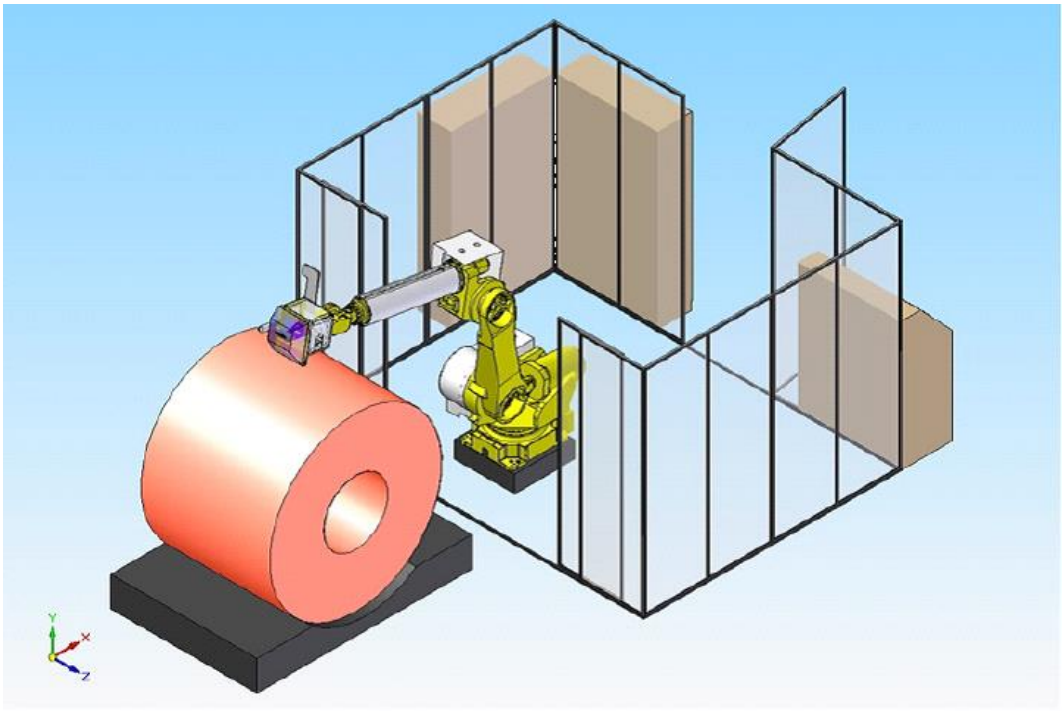

Figure 1 - Marking 1station

A marking system is a set of equipment powered by solenoid valves and designed to mark metal surfaces with symbols produced by spraying paint or ink and defined by a dot matrix, or by marking symbols in a continuous line.

The marking system is designed for the alphanumeric and graphical marking of metallic materials and products either statically (by moving the marking head over the stationary product) or dynamically (on the fly when the product moves); it can be supplied in different configurations depending on the type of material, size - shape, temperature, marking cycle time, etc.

Figure 2 - Example of a robot marker

Marking requires parallel and relative movement between the product to be marked and the marking head, which can be achieved:- by moving the product and the stationary marking head (on-the-fly marking)- by moving the head over the stationary product.

The marking is achieved by opening and closing the spray gun (on control unit commands for the solenoid valve) in sync with the relative movement of the marking head relative to the item to be marked.

The standard configuration of the marking system includes:

- One or more marking heads, each consisting of a base manifold and 1 or 2 or 7, 12, 16 or 19 atomisers, actuated by high speed solenoid valves. The marking head includes an electro-valve that controls the opening/closing commands for the atomiser and a safety box with quick disconnect.
- The ink/ink tank contains an ink or ink reservoir and a pump that circulates fluid continuously in the circuit, thereby avoiding blockages and keeping the pressure constant.
- The pneumatic chamber contains the pneumatic devices required to adjust the compressed air supply for the ink/ink circuit and for rinsing.
- A fluid circuit connecting all the above components
- The control cabinet from which the marking process is controlled (see the electrical drawings for the control system in the documentation of the marking system where the system is installed).
- Local control panel that allows the operator to flush the sprayers and carry out functional checks.

The marking head consists of a base manifold and 1 or 2 or 7, 12, 16 or 19 pneumatic atomisers controlled by high-speed solenoid valves. The marking head includes an electro-valve that controls the command to open/close the atomiser and a safety box with a quick disconnect [3].

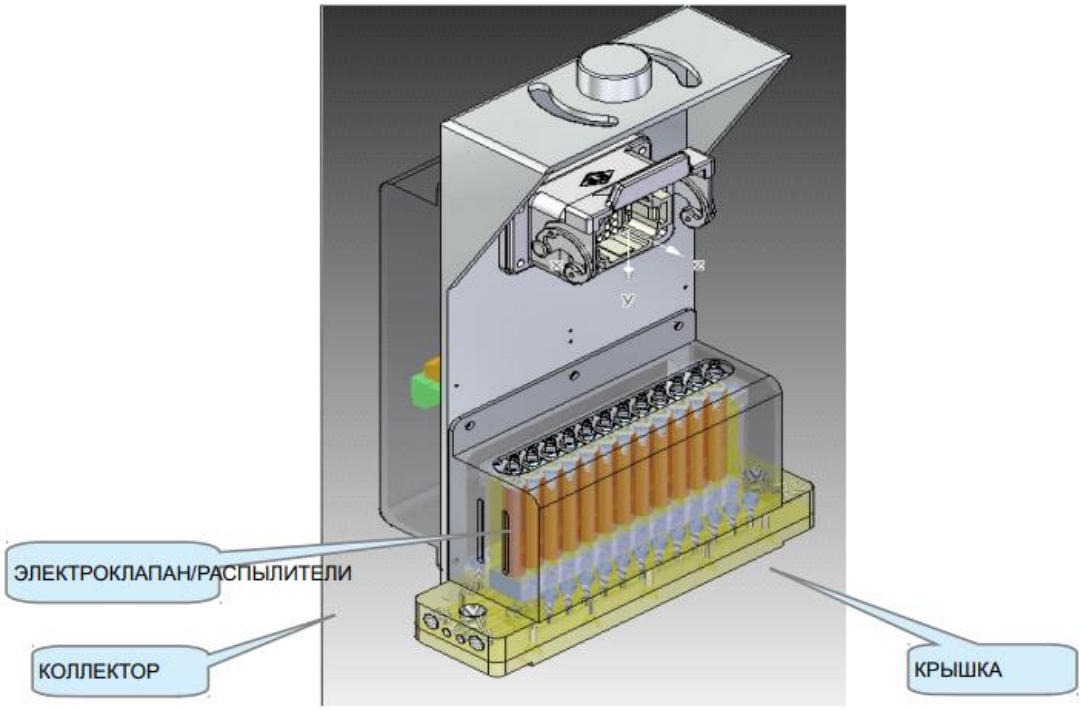

Figure - 3Marking head

The base manifold is an aluminium block with internal ducts that supply each atomiser (paint/solvent/air).

Channels (Figure 2): paint line A / paint line B (reversible) to obtain a continuous circulation of paint in the circuit; air intake pipe for atomising air (the air for the atomisers is mixed with the paint to form a dot); this channel also circulates the solvent for washing.

The base manifold can be designed for 1 or 2 or for 7, 12, 16, or 19 atomisers; the number of atomisers must be increased to obtain better resolution when in use.

The atomisers are fixed to the top of the base plate with two TCEI M4x10mm bolts; the joint between each atomiser and the base plate is sealed by an O-ring.

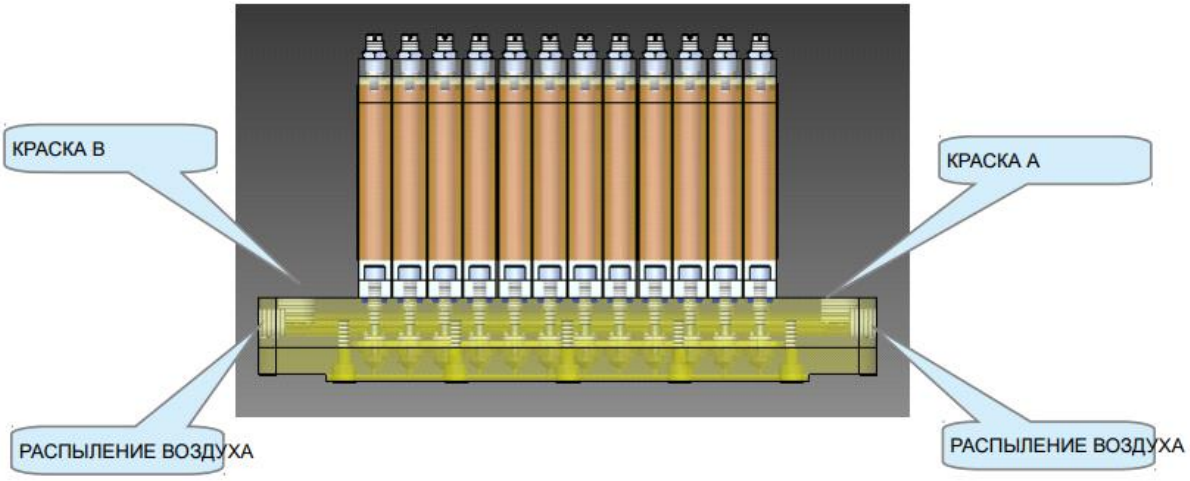

Figure - 4Inlet and outlet of marking head with 12 sprayers

The atomiser is the device that forms the paint dots. It is electrically powered and is attached to the base manifold with two bolts for quick disassembly. Each atomiser is tightened with a socket spanner (8 mm) at the bottom of the base manifold without using a seal (metal contact).

Under normal operating conditions, pressurised paint is fed into the marking device through a duct inside the base manifold; the paint fills the chamber between the atomiser and the finger; when the electrical system is activated the finger lifts and the atomiser opens; opening the atomiser causes a drop of paint to form at the outlet which, when mixed with the air jet, forms a cone-shaped spray of paint from under the cover.

When the solenoid valve cancels the command, a static magnetic field moves the finger back to close the atomiser; each opening/closing of the atomiser creates an air-mixed paint jet which forms a dot on the surface to be marked.

The atomiser opening/closing cycle for the formation of small dots is very fast (approx. 1ms) with a marking speed of over 2-2.5m/s for a 20mm high symbol; higher speeds may be possible for higher symbols.

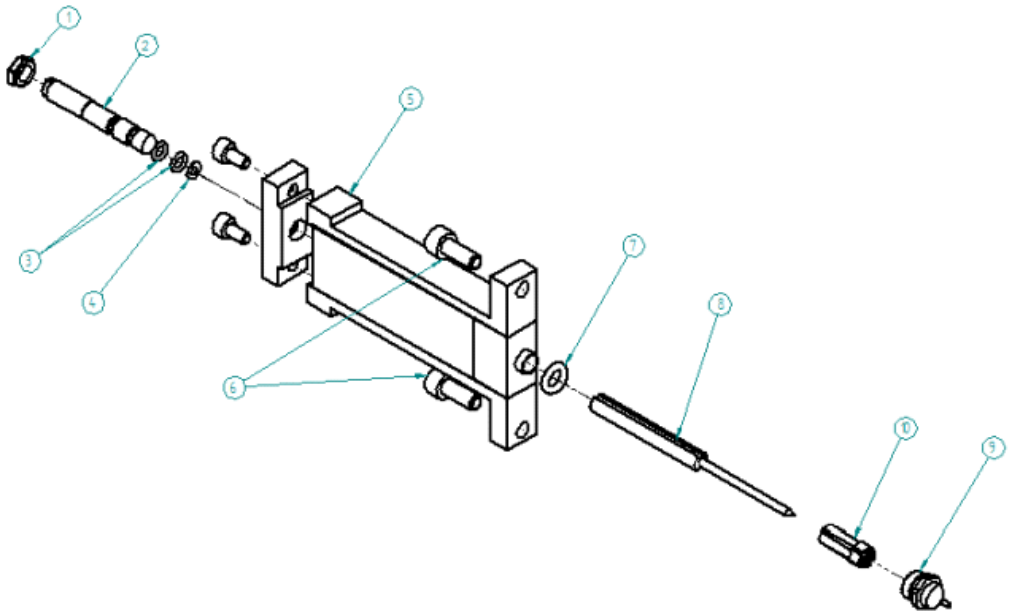

Figure 5 -Sprayer

The ink/ink preparation chamber is a system for supplying ink/ink and rinsing solvent to the marking heads. The chamber is a steel casing with doors and air openings for internal air recirculation in the standard size, namely H = 1800 mm, W = 1200 mm, D = 600 mm. The chamber can be made to individual dimensions and customer requirements on a case-by-case basis.

The automatic cleaning system, combined with the low tendency of the ink to clog, avoids frequent operator intervention in terms of internal cleaning of the atomisers. The only thing operators are required to do is to clean the outside of the atomisers using a solvent-soaked cloth when they detect a large amount of dry ink on the outside of the cover during their daily inspection.

At Plate Mill 1, the need arose for automated surface quality monitoring of hot-rolled strip. As a result, a specification was prepared for the design, production and commissioning of a fully automated system for detecting surface defects at the top and bottom of hot-rolled strip during transport along the diverting roller conveyor to the coiler, complete with control elements[4].

The surface inspection system consists of the main components comprising a sensor, a junction box, an inspection server and at least one inspection terminal.

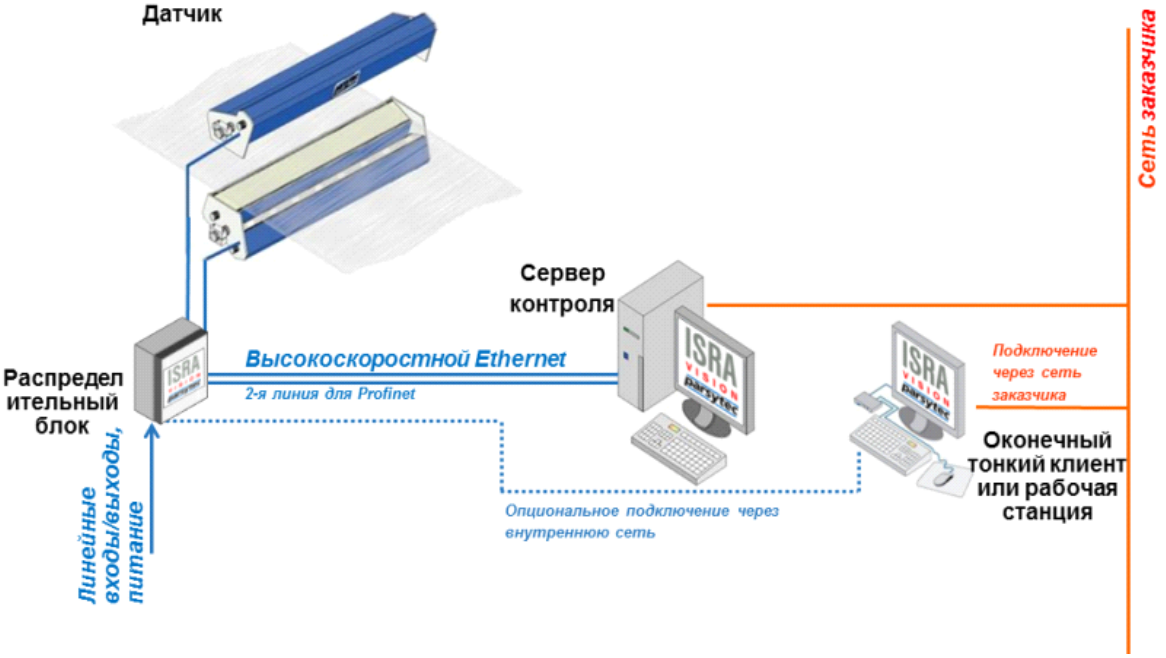

Figure 6 - Overview of the control system

The sensor itself consists of a camera console and lighting for inspection of the top side, bottom side or both sides. The junction box is the central electrical unit of the system. The power supply (e.g. fuses and filters), the signal interface (e.g. belt speed control, roll changes, etc.) to the image processing modules, and the internal sensor and inspection server connections are all located in the junction box.

The inspection results are stored on the inspection server. This server is the sole point of installation and maintenance of the software and back-up, as all image processing modules in the junction box (as well as inspection terminals such as ThinClints) are not equipped with a hard disk and are managed by the inspection server. Only additional network components, such as the data server and additional terminals, may require a separate backup and maintenance system.

The inspection server consists of a main server computer. The inspection terminal is implemented either as a thin client (small rugged PC without a hard disk) or on a desktop PC. It displays the inspection results[5].

A top and bottom side zone scanning sensor is installed in the line.The top side sensor part can be physically separated from the bottom side sensor part and installed in different locations.

The sensor must be positioned in front of the manual inspection station. The calculation of defects after image capture takes some time, which can vary over a wide range. It depends on the number of defects, line speed and other factors. The large distance between the manual inspection station and the inspection bridge increases the likelihood of defects appearing on the operator's display before they have passed the manual inspection station.

Slopes of 0 (horizontal rolling axis) and 90 (vertical rolling axis) degrees of the rolling axis (angle between horizontal and rolling axis) are allowed. Slope with vertical or deviated from horizontal movement of the strip must be determined[6].

The ISRA Parsytec system has been considering and supporting these complex aspects in its products for many years, in particular in parsytec5i or the corresponding EXPERT systems. Surface Master opens a new chapter in quality decision support. In addition to further improving defect detection and classification performance, a new layer has been added which is designed to merge and filter defect data in such a way that the accuracy of the data is maximised and the amount of defect data is kept to a minimum, corresponding exclusively to the relevant data.

In addition, confusion over defect names and severity levels is eliminated by solid standardisation of names and conversion of the line to specialised dialects based on plant-specific rules. All this has made it possible for the first time to bring the level of inspection performance to nearly 100%, meaning that nearly 100% of quality decisions turn out to be correct.

An optional intelligent fusion and filtering process, based on high fidelity surface defect data from the high-performance and accurate Surface Master system, ensures maximum accuracy of defect data and reduces defect data to the most relevant data.

Merging and filtering are carried out in accordance with rules developed by the customer. The tools ensure that the process is highly efficient. Merging and filtering are performed in several stages. The first, optional, step is to reduce the array of raw defect data to a set, usually consisting of 1000 defects for each reel, primarily used to optimise the production step. The next step is to compile a set of coil grit defects, usually consisting of 100 defects per coil. The final stage filters out the most severe defects for upstream and downstream transmission (e.g. for stand protection) (typically 1 to 10 defects per reel)[7].

The defect detection function must work with all materials and even under critical environmental conditions, in particular in the presence of some water, steam, dirt, etc. Surface Master supports the following defectoscopy tasks: high quality inspection of surfaces with uneven texture, through automatic adaptation of the structure; through early recognition of non-defective objects and their removal; material saving by optimising trimming through precise detection of borders and measurement of boundary defects; detection of defects with low contrast, through specialised defect detection algorithms (e.g. stains and periodic pressings); accurate detection even with significant deviations

Correct classification of surface anomalies significantly influences the correctness of quality decisions, in particular decisions about tolerance or blocking of coils for specific applications. Classification work is highly dependent on surface properties (e.g. homogeneity, texture, contrast). Therefore, Surface Master performance classes use different classification techniques according to different requirements.

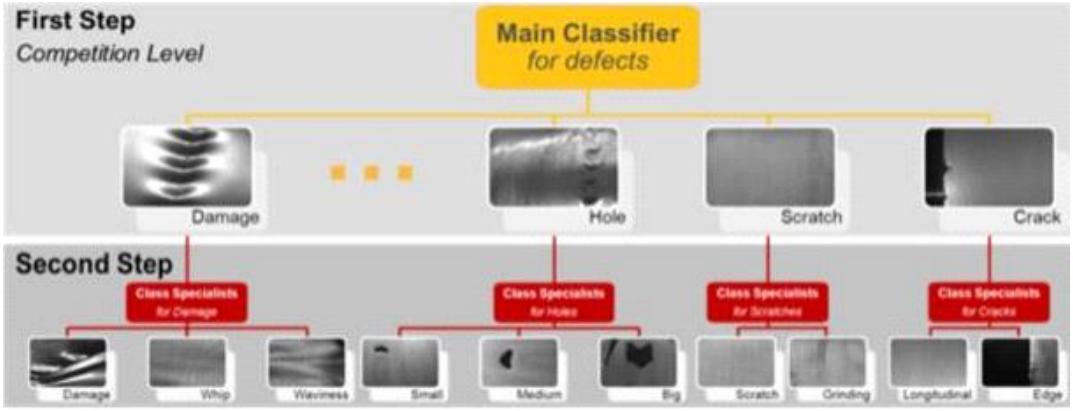

Figure 7 - Stages of the system

The Surface Master control system contains intelligent sensors featuring advanced cameras, illumination and integrated computer technology. ISRA Parsytec traditionally offers the widest range of line scan cameras and matrix cameras to create optimum control solutions for specific applications. Exceptionally bright LED illumination ensures excellent inspection results.

A small interface unit connects the surface sensors of a particular line to its signals and serves as the central connection point. A control system server for central data processing and system administration, a data quality assurance server and a set of additional terminals for system configuration,

control and real-time surface monitoring complete the list of Surface Master system essential components.

Figure 8 - Schematic diagram of the defect detection system

Bale report: A bale report is automatically generated and printed at the end of each bale. The report style can be adapted to the company's requirements. The ODIS software allows you to preview the report.

SURFACE MASTER provides access to any inspection results from anywhere using a standard internet browser. This speeds up access to surface quality information and allows ISRA Parsytec customers to make quicker decisions.

Inspectors and operators can easily access quality data using a standard web browser. Two web-based applications are available: Quality Report and Reel Report. The web-based Quality Reports give the user an overview of the quality of his products, expressed in particular by the reel name, reel ID, material, production time and reel length.

CoilRelease allows release decisions to be guided by precise and objective rules. Proposed decisions are generated in EXPERT5i CoilRelease based on rules that do not necessarily include surface defect data, but take into account all relevant process parameters available to the coil. The application automatically evaluates the coil and can make decisions with or without user feedback. All decisions are stored. EXPERT5i CoilRelease can work in automatic mode based on the last coil processed or in manual mode with selection of a coil from the list or by name. Release/blocking rules can be defined and edited. Different rule sets can be defined depending on material, size and end use. Rule sets can contain different thresholds for warnings and alarms.

CoilReassignment displays a list of blocked coils that are no longer part of a planned order or are unsuitable for end use. EXPERT5i CoilReassignment finds suitable orders or end-use areas matching the quality or quality segment of the blocked coil. These may include orders with reduced quality or size requirements. The results of a quality check or quality deviation towards more profitable orders are displayed. Planned repairs and results if trimming can improve the suitability of the material are displayed. CoilReassignment checks the suitability of the reel for an alternate order after the repair has been made, simulating trimming along the top, side or end of the reel. Consistent display of pre-repaired and post-repaired coils, showing the final quality of the coil and its consistency with the order, allows accurate decisions to be made to reduce scrap. The necessary key parameters are communicated to the operator who makes the final decision whether to release or repair and release. The results are saved, and a report can be generated indicating reassignment results and financial benefits. The reports are available on the local network.

CoilPreview shows the sequence of incoming coils and the position in which they will be processed. It is also possible to display coils in the processing sequence of a previous process. CoilPreview displays a map of the next one or more following coils coming onto the line as well as the position/location and picture of the next defect of the current coil in relation to the input position on the line. The alarm can be set to alert the operator of a catastrophic defect before it is introduced into the line. Rules can be set based on defect types and positions.

The current method of placing hot-rolled coils in storage and the way they are labelled, due to manual operations, allows for errors, duplications and confusion of coils by size, steel grade, batch number and melting.

The new bale transport method, once the horizontal bale transport axis project and the installation of the bale marking robot have been implemented, involves the automatic setting of unique digital marking codes on the body of the bale. This eliminates the accounting disadvantages listed above, but it also introduces difficulties in recognising bale positions in the shop floor and in quickly translating digital marking data to the appropriate code for the product.

The current technical equipment of the cranes in the storage areas of the workshop does not allow the bale markings to be recognised and the movement of the bales to be accounted for.

The actual location of coils by coordinates in warehouses is taken into account by the foreman's logbook, is not displayed automatically, and causes disruption when forming coil processing and plate cutting jobs, and when picking metal for shipment.

The terms of reference for the project included the following points[8]:
The warehouse organisation system must comply with ArcelorMittal's IT policies. IT security requirements are attached. According to equipment unification and corporate policies, equipment should be selected from the following brands: networking, telecommunication equipment - Cisco; personal computers, workstations, printers - Hewlett Packard; telecommunication, server and electrical equipment cabinets and racks - Rittal; controllers and automation components - Siemens; video cameras - Hikvision. Detailed discussion of specifications must be discussed with the customer. This obliges potential suppliers to comply with ArcelorMittal's policies.

The finished goods handling system is installed on cranes and is based on the PLC SIMATIC S7 and the operator panel SIMATIC PanelPC, which combines the functionality of a computer and a human-machine interface (HMI), the PLC is designed to collect and transfer data from various systems to the operator panel computer. The operator panel displays the warehouse layout with the storage locations, the position of the crane and the load-handling device, a list of the tasks assigned to the crane to move the products in the warehouse with the initial and final locations of the operation (the locations are highlighted on the warehouse layout). The position of the load-carrying equipment is determined by the dedicated positioning system and, together with the coil identifier, is used to determine whether one of the jobs issued by the WMS has been completed.

A video surveillance system is provided to monitor the process of receiving products for storage and shipping products to the customer without a recording function [9].

The coil identification system is based on the application of optical identification technology, which is a digit-letter or QR/ Bar code and includes: fixed optical readers installed at the crane grip and designed to read the identifiers of the lifted product unit.

Optionally, mobile optical readers for monitoring (confirming) the shipment of products to the customer and performing periodic warehouse audits (in the case of 1D/2D code marking of coils).

If the applied bale ID is not within the range of the stationary reader, the operation can be completed without identification, the system highlights the job corresponding to the starting position and destination position of the executed operation, the crane operator must manually confirm the execution of the operation. The job can be considered completed once it has been confirmed by the hand-held tool.

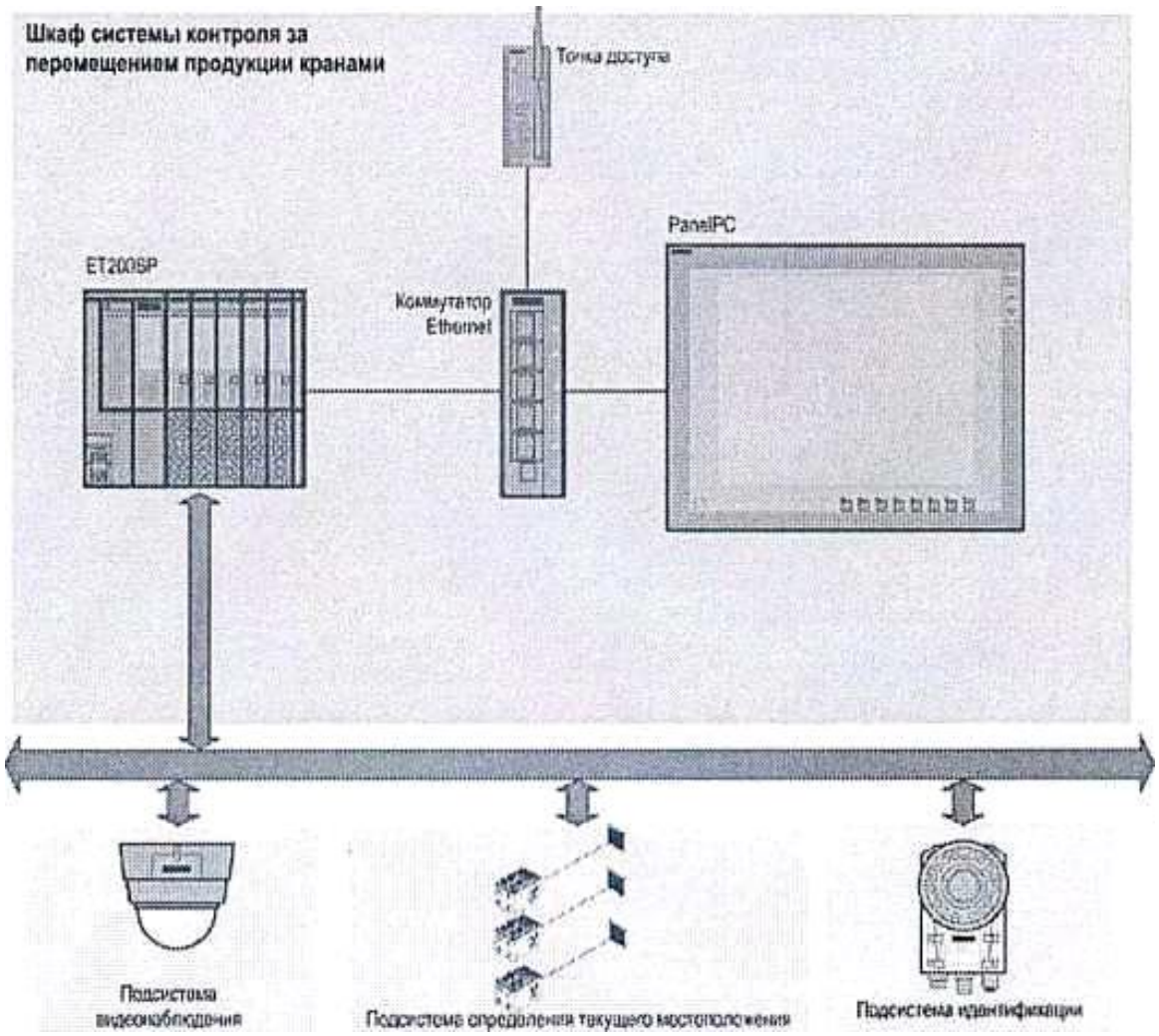

Figure 9 - Block diagram of the control system

The load-carrying equipment coordinate system serves the following purpose: to monitor the current position of cranes.

The positions of the crane mechanisms (crane travel, trolley travel, lifting) are determined by means of laser rangefinders whose beams are directed to the appropriate dead-ends. The rangefinders are installed in a special protective metal cover to prevent failure due to mechanical influences.

Figure 10 - Laser rangefinder

Transmission trolley position detection system. Transfer carts, designed to move bales between bays, are equipped with laser range finders to determine the current position on the tracks. The rangefinders are fitted in special protective metal covers to prevent failure due to mechanical impact. Communication with the rangefinders is via a Wi-Fi wireless network.

A system for identifying bales that are swept into neighbouring shops. Stationary optical readers and sensors are installed on the inter-workshop conveyor to move the bales for further processing.

Warehouse wireless communication system. In order to integrate the cranes into the company's existing information system, it is planned to cover the entire area of the finished product warehouse with a seamless Wi-Fi connection, which eliminates short-term interruptions in communication when the crane is moving. It is planned to install access points throughout the warehouse, united into a single network The system of identification of rolls moved to the neighboring workshops.

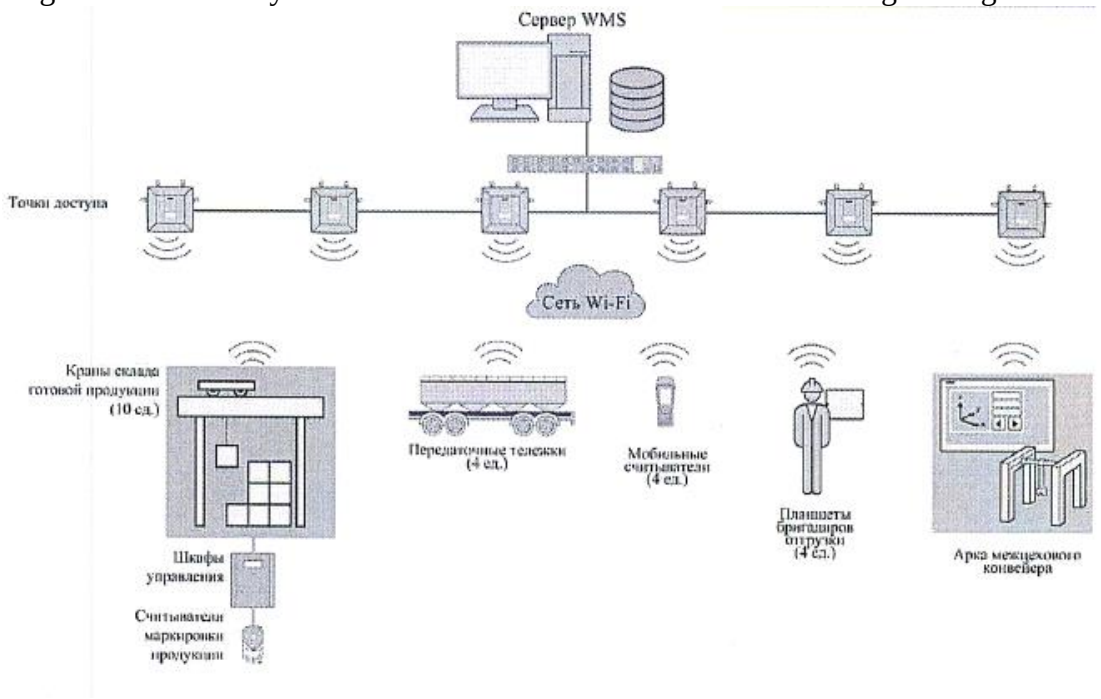

Figure 11 - Wi-Fi structural diagram

The installation of the hot-rolled coil warehouse management system will: reduce downtime for shipment of equipment; create a centralised management of the finished product warehouse, generate reports on product movements in the warehouse, identify the location of products, store information on completed jobs and operations; organise optimal product movements in accordance with tasks from the warehouse management system; prevent erroneous movements (shipment to a location not in accordance with the job or without a job); ensure

Conclusion. Digitalisation of production is a chance for domestic enterprises not only to increase their own profits, but also to reach a new technological level of development and find new market niches. In addition to short-term economic benefits, Industry 4.0 is an excellent opportunity to strengthen cooperation between business and applied science. Domestic developments of universities and research institutes can offer resource-saving, highly efficient, science-based technologies to production.

In addition, new high-tech IT service companies will be created around digitalisation projects, capable of competing internationally in the future. All this will also contribute to the development of highly skilled human capital.

The implemented projects have increased the shop's quality (yield of good, first grade), production, optimised production processes as well as the automation of dangerous and labour-intensive operations.

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Jurisprudence

INTERACTION OF OPERATIONAL UNITS WITH THE PUBLIC DURING THE DETECTION AND SOLVING OF MERCENARY AND VIOLENT CRIMES: DOMESTIC AND FOREIGN EXPERIENCE

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ВЗАЄМОДІЯ ОПЕРАТИВНИХ ПІДРОЗДІЛІВ З НАСЕЛЕННЯМ ПІД ЧАС ВИЯВЛЕННЯ ТА РОЗКРИТТЯ КОРИСЛИВО-НАСИЛЬНИЦЬКИХ ЗЛОЧИНІВ: ВІТЧИЗНЯНИЙ ТА ЗАРУБІЖНИЙ ДОСВІД

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У сучасних умовах, пріоритетним напрямом діяльності Національної поліції України є забезпечення та гарантування реалізації конституційних прав кожного громадянина нашої держави, запобігання злочинним посяганням, особливо з боку організованих угруповань і злочинних організацій, захист громадян від насильницьких дій, а також боротьба з особливо небезпечними злочинами, такими як розбої та грабежі, нанесення тяжких тілесних ушкоджень, економічні злочини [1]. Національна поліція України відзначається високим показником виявлення та розкриття загальнокримінальних злочинів. Тому особливо важливою є проблема взаємодії оперативних підрозділів, створених для боротьби зі злочинністю в рамках виконання своїх обов'язків, з населенням. Охорона громадської безпеки, забезпечення прав і свобод громадян, а також боротьба з корисливо-насильницькими злочинами не можуть бути ефективними без підтримки населення.

Закон України "Про Національну поліцію" встановлює конкретні вимоги щодо організації взаємодії поліції з населенням. Зокрема відповідно до п. 2 ст. 9 цього Закону поліція

зобов'язана забезпечувати постійне інформування органів державної влади, органів місцевого самоврядування та громадськості про свою діяльність у сфері охорони та захисту прав і свобод людини, протидії злочинності, забезпечення публічної безпеки і порядку. Крім того, пункт 6 тієї ж статті передбачає, що проекти нормативно-правових актів, що стосуються прав та свобод людини, обов'язково підлягають громадському обговоренню у порядку, визначеному Міністром внутрішніх справ України.

У свою чергу, ст. 11 Закону України "Про Національну поліцію" закріплено положення, згідно з яким "діяльність поліції здійснюється в тісній співпраці та взаємодії з населенням, територіальними громадами та громадськими об'єднаннями на засадах партнерства і спрямована на задоволення їхніх потреб". Також, пункт 2 статті 89 того ж Закону визначає співпрацю та взаємодію поліції з громадськістю як необхідну умову для ефективної роботи поліції, що спрямована на виявлення та усунення проблем, пов'язаних з здійсненням поліцейської діяльності, а також на сприяння застосуванню сучасних методів для підвищення результативності та ефективності такої діяльності [2].

Питання взаємодії населення з поліцією є актуальним і є предметом досліджень як практиками-правоохоронцями, так і науковцями з практичної та теоретичної сфер. Значний внесок у розвиток цієї проблематики зроблено такими вченими, як М.І. Ануфрієв, О.М. Бандурка, М.В. Голуб, В.І. Дяченко, А.П. Закалюк, А.П. Клюшніченко, Л.М. Колодкін, А.П. Коренєв, М.В. Костицький, Ю.Ф. Кравченко, С.Л. Курило, А.В. Майдиков, С.І. Субота, В.Д. Сущенко та ін.

Останні демократичні процеси в країні призвели до зростання активності громадських організацій з правоохоронними функціями. Це можна пояснити зростаючим інтересом громадськості України до вирішення складних проблем, пов'язаних з протидією злочинності та забезпеченням громадського порядку. У зв'язку з цим правоохоронні органи зобов'язані не лише здійснювати свої функції у сфері правопорядку, але й брати на себе більш широкі соціальні обов'язки перед населенням. Це вимагає розширення взаємодії Національної поліції (далі – НП) з соціальними групами, різними верствами населення та суспільством в цілому.

Завдяки взаємодії з громадськістю, поліція може підвищити рівень і ефективність своєї роботи у забезпеченні порядку в громадських місцях, боротьбі з хуліганством, запобіганні крадіжок державного та приватного майна, а також в профілактиці правопорушень і виявленні факторів, що спричиняють їх вчинення [3].

На сучасному етапі розвитку країни виникають певні складнощі у взаємодії поліції та громадськості. Це пояснюється деякими недоліками, зокрема: низький рівень інформованості громадян щодо злочинності та діяльності поліції у боротьбі з нею. Громадяни не мають достатньої свідомості про проблеми злочинності, а також про роль і успіхи поліції в цій сфері.Узагальнене ставлення до поліції, яке може бути вказівником ставлення суспільства до її діяльності. Це відображається у недовірі та негативному сприйнятті роботи поліції загалом.Громадяни не проявляють достатню готовність до співробітництва з правоохоронними органами взагалі. Відсутня бажання громадян активно співпрацювати з поліцією та надавати необхідну інформацію.Престиж професії поліцейського низький, що може впливати на привабливість цієї професії для молоді та потенційних працівників.Ці недоліки впливають на процес взаємодії між поліцією та громадськістю і потребують уваги та вдосконалення [4, с. 99-100].

У зв'язку з цим, основним пріоритетом для правоохоронних органів, зокрема оперативних підрозділів, є вжиття невідкладних та ефективних заходів для поліпшення оперативної обстановки. Серед таких заходів важливе значення мають дії правоохоронців щодо залучення громадськості до охорони публічного порядку, як через громадські формування, так і через окремих громадян, які мають відповідний досвід, інформацію та бажання приєднатися до поліції у проведенні відповідних заходів. Надзвичайно важливо, щоб поліція належним чином організовувала цю роботу, максимально ефективно використовувала потенціал населення для покращення ситуації з безпекою та залучала до співпраці якомога більше громадян.

Також необхідно повністю використовувати накопичений зарубіжний досвід щодо взаємодії поліції з населенням. У країнах, таких як США, Німеччина, Франція, Великобританія, Австрія, Бельгія, Італія, Японія та інші, вважається, що взаємодія поліції з населенням є необхідною умовою для ефективної роботи правоохоронних органів. Ці країни впроваджують різноманітні програми взаємодії, такі як "Сусідська допомога", "Зупини злочинця", "Громадський патруль", "Адміністративна допомога", "Команди нерозкритих справ", "Допомога жертвам правопорушень" та інші. Також проводиться створення оперативних груп для охорони громадського порядку і боротьби з правопорушеннями, а також утворення наукових та педагогічних організацій, які передають поліції результати своєї роботи та надають рекомендації з підвищення ефективності правоохоронних органів [4].

У Великобританії існує позитивний приклад взаємодії поліції з населенням, які називаються консультативними комітетами. Ці комітети організовані в кожному поліцейському окрузі. Метою засідань цих комітетів є обговорення питань забезпечення громадського порядку, запобігання злочинам, розкриття злочинів та вирішення проблем на відповідній території. На засіданнях цих консультативних комітетів розглядаються звіти та інформація від поліції. Рішення та побажання громадськості, які розглядаються на цих засіданнях, включаються до планів роботи відповідного поліцейського підрозділу. Використання такого досвіду інших країн, після його ретельного аналізу та впровадження в роботу правоохоронних органів України, на нашу думку, сприятиме активізації взаємодії поліції з громадськістю в питаннях забезпечення громадського порядку, запобігання та розкриття злочинів, включаючи корисливо-насильницькі злочини.

Враховуючи зазначене, можна зробити наступні висновки. 1)вдосконалення взаємодії поліції з населенням є необхідною умовою для побудови довіри громадян до правоохоронних та до влади загалом.2)аналіз та використання зарубіжного досвіду участі населення у правоохоронній діяльності є ефективним засобом покращення співробітництва між поліцією та громадськістю, що дозволяє підвищити ефективність роботи поліції. Впровадження моделі діяльності поліції зарубіжних країн, що базується на використанні консультативного механізму та співпраці з населенням у справі охорони громадського порядку, є актуальною потребою сьогодення.3)необхідно розробити та прийняти нормативні документи, що регламентують аспекти правоохоронної діяльності як на державному, так і на галузевому рівні, включаючи Закони України та накази Міністра внутрішніх справ.

Залучення населення до правоохоронної діяльності є однією з ключових складових для підвищення ефективності роботи поліції в забезпеченні громадського порядку, профілактиці та розкритті злочинів. Взаємодія правоохоронних органів з громадськістю, удосконалення громадських формувань по охороні громадського порядку та активна участь громади у вирішенні проблем на певній території - це сучасні вимоги. Враховуючи це, якісне реформування правоохоронної системи в нашій країні неможливе без уваги до цих аспектів та врахування вимог сьогодення.

Не менш важливою проблемою є реалізація здійснення соціально-правового захисту громадян, які сприяють оперативним підрозділам кримінальної поліції. Але більшість фахівців галузі ОРД визнають, що корінь всіх цих проблем криється у недосконалості або недоробленості чинних норм вітчизняного оперативно-розшукового законодавства. [5].

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Pedagogical sciences

PSYCHOLOGİCAL AND PEDAGOGİCAL SPECİALİZATİON OF TEACHİNG ELEMENTS OF MATHEMATİCAL MODELİNG İN V – VI GRADES

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ПСИХО — ПЕДАГОГИЧЕСКИЕ ОСОБЕННОСТИ ОБУЧЕНИЯ ЭЛЕМЕНТЫ МАТЕМАТИЧЕСКОГО МОДЕЛИРОВАНИЯ В V – VI КЛАССАХ

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Abstract
The article addressed the following questions:
- the role of mental thinking in problem solving;
- psychological and pedagogical features of the inclusion of elements of mathematical modeling ;
- explanation of psychological and pedagogical features by various scientists ;

Аннотация
В статье затронуты следующие вопросы:
- роль умственной деятельности в решении проблем;
- психо — педагогические объяснения, включение элементов математического моделирования;
- разъяснение разных ученых о психо — педагогических особенностях

Keywords: model, mathematical model, object, logical mentality, mental activities.
Ключевые слова: модель, математическая модель, объект, логическое мышление, образные действие.

Постановка проблемы. Важный принцип в процессе преподавания предметов - преподавать материал школьникам с минимальными затратами времени. Для этого используются различные методы и средства обучения. Существуют различные методы и инструменты для обучения математике. Важнейшим из них является метод математического моделирования. В содержание этого метода входят различные наглядно-иллюстративные средства, отвечающие требованиям принципа наглядности.

Обучение решению текстовых задач - самая ответственная работа на уроках математики. Школьникам часто сложно решать проблемы. В связи с этим применение моделирования как метода дает эффективные результаты.

Известно, что учебная деятельность школьника в процессе решения задач напрямую связана с умственной деятельностью. Процесс решения проблем состоит из двух частей: процесса внешнего воздействия и процесса умственной деятельности. Когда внешние воздействия направлены правильно, легче найти решение.

Школьники должны понимать содержание задачи и уметь моделировать ее на математическом языке. Для этого учитель должен познакомить учеников со всеми этапами решения задач и обозначить цель каждого.

Этап перехода от текста задачи к ее модельному языку активизирует абстрактное мышление школьника.

Решение проблемы обнаруживается путем визуального и графического описания зависимостей, данных и неизвестных, описанных в проблеме, а также путем описания текущей проблемной ситуации в более общем и устном виде. В конце процесса школьник должен уметь различать данные, условия и неизвестные, выражая проблему в целом. Школьник может решить задачу самостоятельно, только если он умеет выразить ее наглядным и математическим языком.

Психо — педагогические особенности. Включение элементов моделирования в школьную программу математики объясняется различными психо-педагогическими аспектами:

1. Как средство понимания и усвоения новых знаний.

Сторонниками этой идеи являются Л. М. Фридман, С. И. Архангельский, О.Б. Епистев, В. И. Крупич, Н. С. Казимов, Б. С. Джабраилов и другие. можно показать. Однако вопросы разработки и эффективного внедрения методики обучения элементам моделирования до сих пор полностью не решены.

2. Ученые - педагоги, акцентирующие внимание на идее формирования интеллектуальной активности школьников в условиях развивающего обучения, предпочитают формировать личность школьников (В.В. Давидов Сторонники обеих идей отдают предпочтение следующим принципам: модель облегчает восприятие любой ситуации, обеспечивает полноту восприятия, развивает компоненты абстрактного мышления (сравнение, анализ, обобщение, абстракция и т. Д.), улучшает логическое мышление, обучает учебному материалу и все это позволяет получить важные характеристики и свойства об изучаемом объекте. [93; 185].

Внесение элементов математического моделирования в V-VI классы школы оправдано также психологическими и педагогическими соображениями. Потому что психологическая подготовка учебного процесса занимает важное место в исследованиях П.Я.Гальперина и его коллег. Они видят процесс обучения как процесс усвоения системы умственной деятельности. Именно в этом процессе мыслительная деятельность возникает в результате соответствующего воздействия внешней практической деятельности. Таким образом, чтобы ученик мог изучить любую операцию, он должен сначала начать операцию на основе подходящего материала. Таким образом, ученик видит элементы, необходимые в общем случае, и постепенно входит в ситуацию. При этом не нужно учитывать лишние свойства. Итак, необходимо работать над моделью, заменяющей объект. На самом деле умственная деятельность осуществляется материальными средствами. Например, такие инструменты, как графическая диаграмма, рисунок геометрической фигуры, образная или знаковая модель., А.К. Артемов, М.Ягубов, Ш.Хамидова, И.С. Якиманская и др.). [118; 23].

Потому что моделирование ситуации позволяет более детально «увидеть» объект исследования. Есть возможность заранее определить необходимые операции. Применяемая модель позволяет расширить содержание исследования. Согласно принципу Гальперина-Тализиной поэтапного формирования мыслительной деятельности, очень важный этап происходит при работе школьников с моделями.

Математические модели играют важную роль в формировании у школьников представлений о том, как с помощью математики можно описать реальные события и процессы. Эти модели играют важную роль в психологическом, математическом и общем развитии учащихся. Таким образом, дидактические и общие модели развития, включая математические модели, являются важными инструментами, используемыми в процессе обучения. Если ученик умеет составлять диаграммы, таблицы, диаграммы, графики, резюме содержания задачи, числовые, математические выражения, уравнения в математике, то он обладает способностями и навыками математического моделирования, и каждый учитель

математики должен преподавать новые знания по этому вопросу основание. [118; 23]. Потому что предмет математики (по оценкам) как система понятий требует логического действия (действия), чтобы понять его, изучить, применить знания на практике. Математическое моделирование играет важную роль в достижении всего этого. Математическое моделирование - его самый необходимый и динамичный элемент в современном обучении математике. Математическое моделирование более интенсивно применяется в школьной практике, в основном при решении задач, теоремах, геометрических доказательствах и задачах построения. Способность учащихся решать задачи по математике зависит от ряда научно-педагогических составляющих:

- как ученик воспринимает содержание вопроса;
- как проанализировать проблему;
- умеет излагать краткий текст в различных формах в зависимости от содержания вопроса;
- может выбрать наиболее подходящие методы решения проблемы;
- умеет использовать взаимосвязь между количествами и свойствами действий;
- умеет составлять уравнения или неравенства для решения задачи и т. д.

В общем, если старшеклассник способен решить любую математическую задачу (в пределах уровня знаний), то у него развита способность моделировать математически. Самый важный обучающий инструмент, который мотивирует учеников к моделированию - это текстовые или систематические вопросы. Понятия «модель» и «моделирование» часто кажутся ученикам абстрактными. Фактически, работа, выполняемая в процессе решения проблем, напрямую связана с моделем и моделированием. [17; 45]. В настоящее время понятия «модель» и «моделирование» используются в учебниках математики I-VI классов школы. Однако эти концепции следует использовать при необходимости.

Школьникам необходимо развить идею о том, что моделирование - это как познавательный, так и исследовательский метод.

Понятия «модель» и «моделирование» следует интерпретировать относительно разумно и практично в курсе математики V-VI классов. Потому что именно в учениках этих классов происходят определенные психологические изменения. Именно на этом этапе необходимо серьезно отнестись к вопросу самостоятельного приобретения знаний. В то же время математические знания, полученные в этих классах, играют основную роль в следующих классах школы.

Применение моделирования в обучении математике развивает у учеников аналитическое и логическое мышление. Для этого нужно уделять больше места решению разного рода задач.

Моделирование - это особый вид деятельности, имеющий внешнее практическое содержание и внутреннюю психологическую природу. Таким образом, моделирование может быть частью психических процессов как составляющая умственной деятельности. Например, к этим процессам относятся восприятие, воображаемая память, мышление. Эти компоненты могут быть задействованы в моделировании. Потому что концепция модели и связанные с ней идеи являются продуктом сложной познавательной деятельности.

Модели являются одновременно продуктом познавательной деятельности и средством ее реализации [118].

Применение моделирования в обучении математике служит методическим инструментом развивающего обучения. Потому что моделирование отражает теоретическую сторону мышления и следовательно, формирует исследовательское мышление у школьников. Поэтому некоторые ученые-педагоги предлагают обучать моделированию в школах поэтапно[93]:

1) в начальных классах в неприметной форме или на практике;

2) В 5 классе его суть раскрывается наглядно и на конкретных примерах;

3) В 6 классе учащиеся используют элементы моделирования для решения задач полунезависимо и полностью самостоятельно.

Элементы лепки в V-VI классах носят пропедевтический характер.

Содержание элементов моделирования в начальной школе включает такие действия, как сравнение объектов, выявление сходств и различий, навыки обобщения и абстракции.

К проблеме моделирования в начальной школе есть исследования А.К. Артемвун, Л.П. Стойловой, Е.В. Кононова, Т.Н. Харламова.

О математическое модель и моделирование в V-VI классах есть методические работы Г.В. Дорофеева, Л.К. У Петра.

Ведущии учителя математики в азербайджанских школах работают с учеными-методистами А.С. Адыгозалов, С.С. Гамидов, М. Махмудов, М. Ягубов, Р. Шукуров, А. Мамедов и др. и они достигают высоких результатов обучения за счет модель и моделирование.

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RELATIONSHIP BETWEEN LANGUAGE AND CULTURE

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Abstract

This paragraph discusses the relationship between language and culture, as well as their basic concepts and approaches to analysis. The problem of the relationship between language, society, and culture has an important scientific aspect. The actuality of the research topic is that language and culture are interrelated, as language is the basis of human being and is reflected in culture. That is why many researchers (I. Grimm, R. Raek, V. Humboldt, A. A. Potebnya) study the problem of interrelation and interaction of language and culture, which is one of the important and serious in the theory of linguistics. For the first time, the researchers' aspiration to solve this problem is noted in the writings of V. Gumbolt. Its concepts and basic provisions are that material and spiritual culture is embodied in the language and that every culture is national, its nationality is expressed in the language through a special vision of the world. According to V. Humboldt, the language has a specific internal form for each people. The main ideas of V. Humboldt are reflected and interpreted in the work of A. A. Potebnya, as well as in the writings of such researchers as R. O. Jacobson, I. A. Baudouin de Courtenay, J. Vandriez, Sh. Bally and others. According to the scientists, the development of society and scientific thought, the need for detailed analysis and study of linguistic and sociocultural processes in their mutual interaction is highlighted. It is obvious that it is impossible to consider language phenomena without establishing the conditions and boundaries of the culture of society.

Keywords: language, culture, linguistic, functions, phenomena.

The concept of "language"

Language is the most important means of communication in a society, which is closely connected with thinking and consciousness. Therefore, there is a need to study this language, which is engaged in linguistics, one of the central sciences, investigating man and human society in general.

The concept of "language" is usually used in two meanings:

– Language in general as an abstract representation of a single human language-a certain class of iconic systems;

– A specific language as a real sign system used to communicate in a particular society in a particular space and at a certain time [55, p. 46].

In his book, F. De Soccer argues that the language is a certain system, the structure of which is still not fully studied, but which, despite this, is known to all members of this language group and is the product of its activities, i.e. has a social nature. The language system finds its realization in speech, i.e. the language is present in the US constantly [53, p. 69].

According to F. De Soccer, the language exists in the collective as a set of prints, available in each head, like a dictionary, copies of which is quite identical would be in the use of many persons. Thus, something is available to each people, at the same time a common one and being out of the will of those who possess it [53, p. 82].

"Language is one of the original etiological systems, which is the main and essential means of communication of the members of this human collective, for whom this system is also a means of development of thinking, transmission from generation to generation cultural and historical traditions, etc." [5, p. 39].

The linguistic picture of the world

In science the concept of the image of the world is one of the new categories, and its study still requires a lot of time. Linguistics has two different terms, such as the image of the language world and the national image of the world. To determine the national image and life is fully considered as: nature, phenomena, life, folklore, sense of poetry, space-time relationship, and all of this, first of all

through language. It is well-known that the methods of translation and comparison are used to understand the language of any ethnic group. The carriers of the same language from their own world in the form of a set of knowledge about the world, reflected in phraseology and grammar. At the same time, according to V.A. Maslov, the meaning of the image of the world is the substance of the word and judgment, the change in meaning, the emotional activity of the world, the personality and the nature of its use [6, p. 37].

According to G.A. Bravian, the linguistic picture of the world is information about the inner and outer world, accumulated through living languages. The national image of the universe is based on static images consisting of categories of knowledge characteristic of a given population. It is the mythical principle of the worldview of the nation. One of the most active and creative forces of this world is the space and time of communication. In visual arts, spatial time means a significant event and phenomenon.

Any name appears in the language, and it is passed from generation to generation. Every nation has a spirit of its own developed spirit, strength of spirit and the ability to keep it from generation to generation. It is closely connected with the human mind, culture and spiritual life. Against the background of Humboldt, language does not directly represent the world, but it reflects the human perception of the world. According to the scientist, the word is not an exact symbol of the subject, but rather an image of our imagination as a result of the linguistic creative process. When a language depicts any person, the speaker opens the world around the world and represents it.

The history of a particular language cannot be considered as a developer of the language, the user and its owner, regardless of the history of people. The connection between the history of the language and people is bilateral relations which are preserved by the ancient traditions of the people, ethnographic ideas about life, dictionaries of names and historical works.

Ethnographers, cultural scientists cannot deal with linguistic facts when studying the lifestyles, traditions and customs of people; language is one of the tools that have been preserved throughout the world for many generations. The assumption of some new ones related to science differently from the point of reference, since there are many reference books that link the national language and culture, as well as the influence of culture on language. However, the point of the subject of this science is that it is translated into the language of the national mentality and spiritual values.

In each language the perception of the world is cut through carious linguistic facts. The linguistic world is in many ways similar to the logical image of the human mind. The similarity between phenomena affects to taking of conceptual categories. If the names of these types of expressions are the basis of the language, then the world of phenomena can be traced to the peculiarities of the nation. Linguistic sciences have many opinions about the relationship of national culture and language.

Ethnolinguistic and scientist E. Zhanpeisov in the work “ethno-cultural vocabulary of the Kazakh language” researched the epic of M.Auezov which is called “the Way of Abay”. Here he noted that the study of ethnography in terms of linguistic and folk life is a huge contribution to the popularization of cultural language.

Consideration of the nature of any linguistic phenomenon, based not only on language models, but also on worldview, traditions and national identity. It is a general law of ethno-linguistics and linguistics. Professor K. Zhubanov stated: “It is well known that the oral tradition of the nation was preserved as a cultural and linguistic heritage for the generation of ethnic groups in each era, and a new branch of language and culture emerged.”

Because people have a different lifestyle, they have different names. A language is a long period of time, it does not change immediately, its change depends on the culture” [25, p 290, 92-93]. These studies by professor K.Zhubanov, who left behind an indelible heritage and scientific path of our language, show the first symbols of ethno-linguistic science and linguocultural disciplines of linguocultural subjects, which today have chosen a solid foundation.

The idea of academician A. Khaidar about “the rich treasure of language is the treasure of linguistic dynasties of national reality” lies at the heart of linguistic science. Linguistic is the result of nationality and knowledge of the language born with the goal of preserving, reviving, cognizing and presenting it to future generations, retained in historical memory and language for centuries, as a

spiritual and cultural heritage. Secondly, language in the broadest sense is aimed at explaining the conceptual system of culture which based on other cultures and explaining their position in the language. Scientists also have the task of identifying cognitive structures that are deeply rooted in symbols. Third, using cognitive methods they find out how cognitive mechanisms in the phraseology of a language are relative and comparable, reveal cultural expressions based on linguocultural analysis, analyze the image-oriented basis of emotional-semantic phraseological expressions, and determine the role of linguocultural competence in understanding the meaning of phraseology.

The problem of realities of the language

The problem of realities of the language is reflected to the language of culture, as well as the theoretical and practical problems of their translation into English.

To solve the above problems, the researcher focused on complex linguistic methods: linguistics, conceptual, etymological, cultural and linguistic reconstruction, experimental cognitive linguistics, and cognitive theory of metaphor.

As the same time, linguocultural competence of linguistics, cultural connotation, and other concepts related to materials in language are determined. However, scientists would like to emphasize that linguistic-cultural terminology or conceptual apparatus is not limited to the definitions that they have defined or presented today. The state of theoretical novelty, which deepens in the field of researcher in any field, is typical to linguistic culturology.

There are various attempts to highlight the functions of the language, but all the researchers, diverging in particulars, are united in the fact that there are two important functions that the language performs in human being-communicative and cognitive.

Language serves communication, it is the main, the most official and socially recognized of all kinds of communicative behavior. “Language is a communicative process in its purest form in every society known to us”[49, p. 211].

Main functions of language

Cognitive function of language (from Latin cognition – knowledge, cognition) is connected with the fact that in signs of language the consciousness of the person is carried out or fixed. Language is a tool of consciousness, reflects the results of human thinking.

In addition, the language distinguishes a number of private functions:

– Stating – for a simple “neutral message of fact”;

– Question – to request information;

– Appletini (lat. appello “appeal to someone”) – serves as a means of appeal, motivation to certain actions;

– Expressive – express a voice (intonation, selection of words) the attitude of the speaker, his moods and emotions;

– Contactor (actual) – to create and maintain contact between the interlocutors (the formula of greeting, and farewell, the exchange of replicas of the weather);

– Metalinguistic – for interpretation of language facts (explanations of terms, unfamiliar words);

– Indicator – for the designation of belonging to a certain group of people [39, p. 103].

The main function of the language is cumulative, as the language in this function acts as a link between generations, serves as a “repository” and a means of transmission of non-linguistic collective experience.

Relationship between language and culture

It is necessary to pay attention to the aspect of personality in the language paradigm. The relationship between the phenomenon of such a culture and language requires study. And this is a question of social change in a society where every nation lives. According to researchers, cultural linguists have comprehensively examined the relationship between language and culture. Language is phenomenon of culture, as a manifestation of national culture, has not yet been studied in science. Cultural communication is a pragmatic way of interacting with a complex of cultural and linguistic associations. Learning the language is used in the speech that visualizes with the respect to cultural values. In this regard, the scientific audience often mentions the concept of intercultural competence,

which focuses on collecting, synthesizing linguocultural communication. Each of these concepts is a complex and systematic problem.

Today culturology is the basis for the knowledge of the national language in some studies of G.S. Smagulova, A. Aldasheva, A.Salkynbay, A.Seisenova, G.Kajigalieva and etc.

G.S.Smagulova defined the interrelation of the national language culure that studied the concept of culture in the linguistic aspect from the point of semantic idioms. In this work it reflects the specificity of linguoculturology: "Linguoculturology is ethno-cultural and ethno-psychological factors and components of the national cultural significance of the language through the language studies in the direction of culturology, and shows modern appearance of the national language identity without any ideology. In this case, language is the subject of studying trilingual, lingvoculturological aspects [13, p 147].

The purpose of the subject of studying the linguistic culture in civilization along with the development of social sciences is expressed in the subject of the study. In this context, it is also worth noting that the linguistic information is related to the cultural life of our people. In A.Salkynbai's dictionary of the language: "The study of linguistic data is primarily to determine common humanitarian, cultural and civilizational aspects of languages". The world of consciousness and customs is reflected in the whole language, as well as in the name and the way of its expression in the linguistic and cultural aspects [14, p 41].

A. Seisenova emphasizes the unity of folk culture and national mentality, which compares etiquette with the forms of the linguocultural aspect and concludes that "linguoculturology is the interaction of culture with the language system and the connection of language factors with human factors" [15, p 19].

Linguoculturology in linguistics also provides cultural information from the life of other nations. It also seeks to compare a nation with its neighboring countries or its tradition. In this respect, the language and cultural theme was not neglected by those who were engaged in translation. In linguistic and cultural problems of translation, A.Aldasheva noted that linguistic culture is much broader than the latter, because it is the language in each language unit that is an element of a certain nation, its own language, which does not replace others, word, phrase, aphorism, prose; draws attention to the fact that the so-called word "person" can provide information about national, social, ethnic, political, moral and living standards and principles [16, p 121].

The theoretical foundations of linguistic and ethno-linguistics do not contradict the fact that the object and purpose of the study are radical. The relationship between the two can be seen as a link between the general and the code, the whole and the fragment. More specifically, the object of ethnolinguistic research is the "linguistic world", which is an aggregate of an ethnos. Depending on the nature and relevance of the components of this principle, the fact that researchers distinguish the entire range of the "linguistic world", known as "ethno-linguistics", for certain areas of an ethnic group, cannot determine the entire assessment. In this regard, "it was born between ethno-linguistics and social sciences" (B.Worf), "it is reflected in the language and traditions of the population" (F.de Sossyur), "ethnic recognizes the world through language, its tradition, ethnography, mythology and other symbolic events" (E.Sepir), and "the realities of ethno-linguistic anthropology" (USA), "ethnolinguistic scientists study only "old world" or "archaism researcher" science" (E.Janpeyisov), "ethnolinguistic is interdisciplinary science" (M.Kopilenko). Ethno-linguistic aspects Steak does not classify as science, but it is classified as areas of complexity, which define various aspects of its origin. In fact, they are combines into one channel. Academician A. Khaydar, who studies various aspects of ethno-symbolism associated with ethno-linguistics based on such linguistic data, divides:

1) Related to the ethnic groups in general (for example: ethnography, ethnology, history, folklore, mythology, astronomy, pedagogy, didactics and other sciences).

2) Directly associated with ethnic groups to determine the nature of the language (for example: etymology, dialectology, onomastic, phraseology, terminology, lexicography, sociolinguistics, psycholinguistics, ethno-linguistics) [17, p 12]. Thus, we see in the linguistic sources of the ethnos that links these two branches of science with ethno-linguistics. One of such continuities is the linguistic

culture associated with cultural studies, which is in the interests of the interests of the ethnos of culture.

Today, cultural recognition through linguistics is mentioned in the science of ethno-linguistics in front of linguistic cultural studies. Linguistic dictionary: "The direction of linguistics, which connects ethno-linguistics (Greek and French) with linguistic culture, language, ethno-cultural and psychological factors" [18, p 275].

Linguistic science is made up of American scientists F. Boas, E. Sepir, B.L. Lorf, Hirer and others. The source was in works of N.I.Tolstoy, who used the Russian language in the late 80s of the 19th century to study the language and culture of folklore with Russian scholars F.I.Busslayev, A.N.Afanasyev, A.A.Potemnya. Ethno-linguistic studies of such scholars as V. Ivanov, V.T.Toporov raised the nominal sphere to the highest scientific level. Russian scientists studied the history of a particular language in close connection with the culture, history and ethnography of this nation. In this context, the Russian journalist O.S.Akhmanova commented: "Ethno-linguistics is a part of macro-linguistics, interacting with the language and interrelation of linguistic and language factors of the functioning and development of languages" [19, p 539]. This definition in the dictionary indicates a direct connection between language and people, and the subject of the study is the subject of the other disciplines.

The concept of "culture"

Analyzing the concept of culture, it is necessary to note the fact that today there are no universally recognized and universal definitions. Researchers in the field of modern cultural study recognize that culture is complex and multidimensional. In their view, it was impossible to explain the concept of culture in an exhaustive way, using only one methodological approach. Therefore, it is important to know the basic approaches to the cultural definition:

1. The anthropological approach is considered to be one of the most common. According to this approach, culture is all that man has created. This understanding is based on the opposition "natural-artifact" and distinguishes between things and phenomena that have an exceptionally natural origin ("nature") and are associated with human activity and culture.
2. The axiological approach avoids the above-mentioned problem because it comes from the opposition "cultural-non-cultural" and divides the social and cultural aspects of human life.
3. Normative definitions of culture are quite close to the axiological approach and have been widely disseminated in the Western Cultural (social) anthropology, the bright representatives of which are considered B. Malinovsky, A. Radcliffe-Braun, M. Mead, etc. According to this approach, culture is the social norms that govern human behavior. In this context, culture is understood as the sum of different kinds of acquired behavior, which is based on social standards, models passed from generation to generation within a certain society.
4. The development of the activity approach in the national cultural study was conducted by E. S. Markarian, V. Davidovich, Yu. A. Zhdanov, etc. It is a completely different view of cultural understanding. According to this cultural study, the basis of human being is the activity, which is characterized by purposeful, gun and productive activity. If all being of man is an activity, then culture can be considered as a special way or technology of human activity.
5. According to the symbolic approach, culture is a world of meanings, or a special non-genetic "memory" of human society, which is encoded, stored and transmitted from generation to generation by means of signs. In this approach the sign is considered as materially perceived object (phenomenon, action) which replaces in consciousness of the person another object or represents some sense, attitude to something. As a sign can be a word, gesture or thing. Because the same word, gesture or thing can have a completely different meaning and connection with other signs because of the peculiarities of consciousness and perception of people who live in different societies. Hence, it is necessary to "decipher" their meanings and reconstruct these worlds of meanings, constituting the basis of different cultures [52, p. 218].

Summing up, Yu. Reznik notes that certain shortcomings and limitations of the analyzed approaches are partially or completely removed within the framework of "integralist", or the complex

approach uniting cognitive possibilities of these areas of knowledge on the basis of the methodology of complex cultural analysis [47, p.64-65].

According to E. Sepir, language is a "guide" to the understanding of culture, and the vocabulary of the language is a mirror reflecting the level of culture, spiritual wealth and originality of the intellect of the people [49, p. 162].

As it was noted earlier, the language is the basis of human being and is reflected in culture, so since the XIX century and to this day the problem of the interrelation of language and culture is one of the central in linguistics.

The problem of interaction between language and culture, besides I. Grimm, R. Raek, V. Humboldt, A. Potebnya, also studied the school of E. Sepir and B. Wolf, various schools of neo-humboldt, which are engaged in the development of the so called "hypothesis of linguistic of relativity". This hypothesis is based on the belief that people see the world in different ways – through the prism of their native language. According to the proponents of this approach, the real world exists insofar as it is reflected I the language. But if each language reflects the reality inherent in its only way, then languages differ in their "language paintings of the World". B. Worf argued that language is not a means of expression, not a "packaging of thoughts", but rather a form that defines the image of our thoughts".

According to this theory, a person's picture of the world is largely determined by the system of the language in which he speaks. As stated by B. L. Worf: "Grammatical and semantic categories of language serve not only as tools for conveying the thoughts of the speaker, they also form his ideas and govern his mental activity" [41, p. 105].

Thus, people who speak different languages will have different perceptions of the world, and if there are significant structural differences between their languages, they may have difficulty understanding when discussing certain topics. People who own more than one language may actually be guided by different structures of thought when speaking different languages.

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Physical sciences

PREPARATION OF ZN-SB SEMICONDUCTOR INTERMETALLIC COMPOUND AND SOME OF ITS ELECTROPHYSICAL PROPERTIES

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Abstract

The article proposes a method of preparing a Zn-Sb intermetallic compound with a stem-like polycrystalline structure using powder technology. The method of preparing the semiconducting Zn-Sb polycrystalline structure is carried out by pressing the Zn-Sb particles together, followed by thermal treatment in several steps. It was found that the stages and temperature of heat treatment have a significant effect on its electrophysical properties. The mobility of charge carriers (μ) decreases during heat treatment stages. In this case, the charge carriers stay in the crystal lattice $\tau \sim 1{,}52 \div 1{,}1 \cdot 10^{-12}$ sec. was found to change between. The results of the study were explained on the basis of the influence of intergranular boundary fields on charge transfer processes.

Keywords. ZnSb intermetallic compound, powder technology, charge transfer processes, polycrystalline structure, electrical conductivity, charge carrier concentration and mobility.

Introduction

It is known that Zn-Sb compound semiconductor is one of the important materials widely used in transistors, infrared detectors, thermal imaging devices and magnetoresistive devices [1]. Currently, the Zn-Sb semiconducting intermetallic compound is considered to be well-studied both theoretically and practically (see, for example, [2÷13] and references therein). Studies show that the electrophysical and thermoelectric properties of the compound depend on the physical processes that occur during the preparation of the Zn-Sb semiconductor intermetallic compound. In particular, the processes of preparation and pressing of ZnSb powders have been shown to significantly affect the formation and growth of grains, as well as their electrophysical and thermoelectric properties.

It should also be noted that in recent years there has been increasing interest in preparing granular semiconductors and obtaining thermoelectric materials based on them, studying their electrophysical properties [14÷21]. It is shown in the literature that an increase in temperature leads to an increase in the electrical conductivity (σ) and the Seebeck coefficient (α) and, conversely, a decrease in the thermal conductivity (λ) depending on the properties. heterogeneous environment.

However, today, charge transfer processes and thermoelectric phenomena during the preparation stages of granular Zn-Sb semiconductor intermetallic compounds are one of the issues that have not been fully studied. Solving such issues allows for the preparation of new types of energy converters based on the Zn-Sb semiconductor intermetallic compound. Taking this into account, this work discusses the results obtained in the study of charge transfer processes and some of its electrophysical properties during the preparation stages of granular Zn-Sb semiconductor intermetallic compounds.

Materials and Methods

The novelty of our research is that the granulated ZnSb intermetallic compound obtained by the powder method was chosen as the object of this study, and the method of Egor and Disselkhorsta [21, 22] was chosen to study charge transfer processes and thermoelectric processes. events. Electrophysical and thermoelectric properties of the sample were conducted at temperature T=300-700 K.

Figure 1 shows a simplified scheme of samples using the Egor and Disselhorsta method. ZnSb particles (1) are placed in a tubular dielectric (2). Two of the particles (A and V) are pressed through the copper contacts (M_A and M_B) as shown in Figure 1. Pressure force P~30÷50 kilograms [15, 19, 20]. In this case, the sample can be imagined in the form of a stem.

When the heat Q is applied, the charges generated in the field A are transferred to the field B and an electric current is generated due to the temperature difference between the contacts M_A and M_B. The temperature difference is controlled using thermocouples T_A and T_B. It should be noted that all studies were conducted in the process of increasing and decreasing the temperature and time of heat treatment. Between each heat treatment, the sample was cooled for 1 h, then retested.

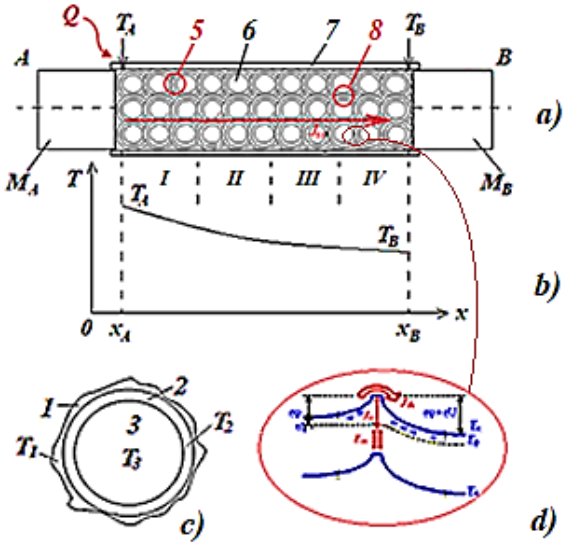

Figure 1. A simplified scheme of measuring samples based on the Egor and Disselkhorsta method (a), temperature difference (b), ZnSb particle structure (a), zone diagram (d). Here, 6 – granulated ZnSb particles, 7 – heat-resistant dielectric case, 5 and 8 – interparticle boundary area, ohmic contacts and thermocouples in areas A and V, respectively, M_A and M_B, T_A and T_B.

Results and Discussion

Figures 2÷4 show the dependence of electrical conductivity (σ), concentration of charge carriers (n) and mobility (μ) on temperature. It was observed that the thermal treatment steps and temperature have a significant effect on σ and n (Fig.3). For example, at the initial stage of heat treatment, as the temperature increases, σ and n suddenly decrease. On the contrary, such a process is not observed in the later stages of thermal treatment. In the initial stage of heat treatment, 1 – σ_o~0,06 $(Om \cdot sm)^{-1}$, n_o~1,42·10^{18} sm^{-3}, and in later stages σ_o~0,017 $(Om \cdot sm)^{-1}$, n_o~4,03·10^{17} sm^{-3}; 3 – σ_o~0,019 $(Om \cdot sm)^{-1}$, n_o~4,47·10^{17} sm^{-3}; 4 – σ_o~0,0187 $(Om \cdot sm)^{-1}$, n_o~1,38·10^{17} sm^{-3} will have values. At the initial stage of heat treatment, when the temperature is T≥375 K, the electrical conductivity suddenly changes to σ_o~0,017 $(Om \cdot sm)^{-1}$, and the concentration of charge carriers changes to n_o~2,85·10^{17} sm^{-3}. However, such processes were not observed in the dependence of the mobility of charge carriers on temperature (Fig.4). μ decreases with increasing temperature at all stages of heat treatment. This is due to a decrease in the residence time (τ) of charge carriers in the crystal lattice. In our case, in all cases τ~1,52÷1,1·10^{-12} sec. it was found to change between

A sudden change in electrical conductivity and charge carrier concentration can be attributed to the heterogeneous environment formed in the granular ZnSb intermetallic compound. It can be explained using the structure of the granulated ZnSb intermetallic compound obtained by the powder method and its simplified scheme shown in Fig. 2.

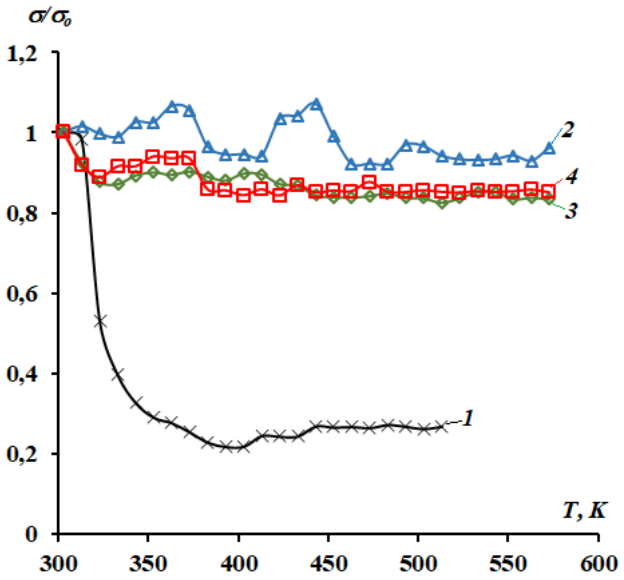

Figure 2. Dependence of electrical conductivity on temperature: 1 – σ_o~0,06 $(Om \cdot sm)^{-1}$, 2 – σ_o~0,017 $(Om \cdot sm)^{-1}$, 3 – σ_o~0,019 $(Om \cdot sm)^{-1}$, 4 – σ_o~0,0187 $(Om \cdot sm)^{-1}$.

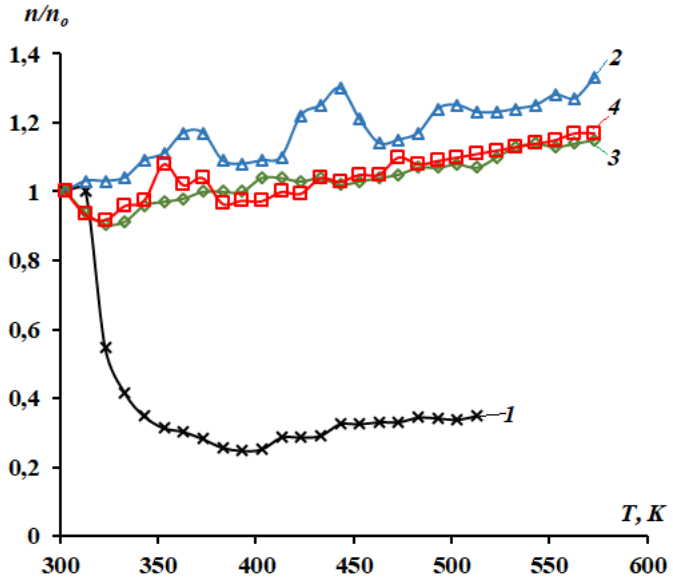

Figure 3. Dependence of charge carrier concentration on temperature: 1 – n~1,42·10^{18} sm^{-3}, 2 – n~4,03·10^{17} sm^{-3}, 3 – n~4,47·10^{17} sm^{-3}, 4 – n~1,38·10^{17} sm^{-3}.

It is known that the structure and morphology of granulated semiconductor particles depends on the technology of their production [14÷21]. For example, the structure of particles obtained on the basis of powder technology can be conditionally divided into 3 parts (Fig.1c). In [21], we used the same method to explain the physical processes in Mg_3Sb_2. Based on it, the powdering process is performed mechanically. In the mechanical method, the phenomenon of friction depends on the heating of the powders, as well as the atomic structure of the powder core and the surface of the powder. The amount of atomic crystallographic distortion increases from the powder core to the surface, which leads to phase changes in each domain. Also, the reactivity of the surface area increases from the powder core to the surface [16]. In our case, the granulated ZnSb intermetallic compound has a particle size of 10÷50 μm. Their arrangement on the heat-resistant ceramic substrate can be described as ZnSb particles arranged in series and parallel to each other, as shown in Fig.1a. Through the metal contacts M_A and M_B, ZnSb particles are pressed together with a specified force from both sides. The compressive strength was selected by measuring the sample resistance. It was observed that when pressed together with a force of 30-50 kG, the resistance was ~1 kOhm. It should be noted that ZnSb particles have a resistivity of ρ~0,221 $(Om \cdot sm)$ when measured on a PIUS-3 device.

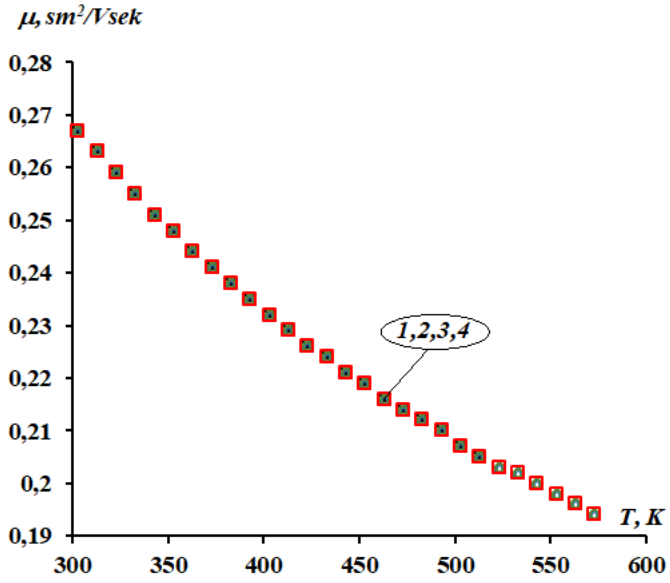

Figure 4. Dependence of the mobility of charge carriers on temperature.

Interparticle boundary regions rich in defects and crystallographic distortions are formed between series and parallel ZnSb particles (areas 3 and 4 in Fig.1a). They form Ein-level localized traps for charge carriers (Fig. 2d). Because the interparticle boundary regions create a barrier effect for charge carriers, the ZnSb particle structure pressed together causes the resistance to change from Ohm to kOhm. The process of charge transfer in series and parallel ZnSb particles can be divided into two parts. If the particles are located in series with each other, the process of charge transfer from the first particle to the second particle takes place through the interparticle boundary areas formed between them (area 3, Fig.1a). If the particles are located parallel to each other, the charge transfer process takes place mainly along the 4th region, which is parallel to each other.

In our opinion, at the initial stages of thermal treatment, with an increase in temperature, the amount of charges trapped in E_{in} energy level localized traps (Q_i), which appear successively in the interparticle boundary between ZnSb particles (areas 3 and 4, Fig.1a), leads to a decrease in σ and n will come In this case, ZnSb particles combine to form an intermetallic compound. It is known that the crystallization of ZnSb intermetallic compound corresponds to T~450÷600 K [2÷13]. In our case, T=300÷700 K is sufficient for the crystallization of the ZnSb intermetallic compound. In the 2nd, 3rd, 4th and 5th heat treatment steps, the ZnSb intermetallic compound is further strengthened. Research has shown that when the sample is taken from the substrate, it is found that the ZnSb intermetallic compound has formed a polycrystalline structure. Therefore, the decrease of σ and n with increasing temperature at the initial stage of thermal treatment belongs to ZnSb particles. The results of the next (2nd, 3rd, 4th, 5th and 5th) stages of heat treatment refer to the ZnSb intermetallic compound with a polycrystalline structure. Its electrophysical properties correspond to charge transfer processes in polycrystalline semiconductors.

Conclusions

Thus, the results obtained for ZnSb particles differ significantly from the results obtained for ZnSb material presented in the literature, for example, in works [2÷13]. By powder technology, it can be achieved by pressing Zn-Sb particles together, followed by heat treatment in several steps, to prepare a granular Zn-Sb intermetallic compound with a polycrystalline structure. For this, it is required that the temperature of the thermal treatment corresponds to the crystallization of the ZnSb intermetallic compound T~450÷600 K. The resulting ZnSb intermetallic compound has a polycrystalline structure, and its electrophysical properties depend on the characteristics of the heterogeneous medium consisting of intergranular boundary areas. The method of preparation of granulated Zn-Sb intermetallic compound with polycrystalline structure by powder technology can enable the preparation of new types of energy converters based on semiconducting Zn-Sb intermetallic compound.

The results of the research and the considerations given to explain it can be of great importance in obtaining granular materials and explaining the kinetic phenomena in them.

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STRUCTURAL MODELS AND CHARGE TRANSFER PROCESSES OF GRANULATED NANO SEMICONDUCTORS

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Abstract

It is known that the physical properties of granulated semiconductors that appear under certain conditions depend on their size or access state or defects on their surface, and their formation depends on the methods of obtaining granulated semiconductors. Structural models of granular semiconductors and charge transfer processes in them are explained in this work. The granulated semiconductor particles may consist of granulated semi-conductor particles arranged in series with each other and adjacent to each other. In the second case of arrangement of granular semiconductor particles, there are several rows of semiconductor particles arranged in series, which form a system of semiconductor particles located in parallel and in series with each other. In the first case, the charge transfer process is carried out from the first particle to the second particle through the interparticle boundaries formed between them. In this case, the J_{th} current appears. As the temperature increases, localized traps to successive E_{in} energy levels appear in the interparticle boundary regions. An increase in the amount of charges (Q_i) trapped in the localized traps in the interparticle boundary areas leads to an increase in the height of the potential barrier (φ), which, in turn, leads to a decrease in electrical conductivity. In the second case, semiconductor particles consist of a system of particles located in parallel and in series with each other, and the process of charge transfer is the same as in the first case, and simultaneously across adjacent interparticle boundary regions happens in. In this case, the conductivity of localized traps increases. Because the charge transfer process mainly occurs along interparticle boundary regions located next to each other. The results of the research and the considerations given to explain it can be of great importance in obtaining granular materials and explaining the kinetic phenomena in them.

Keywords: granular semiconductors, charge transfer processes, particles, interparticle boundaries between two adjacent particles, energy-level localized traps, trap conductivity.

Introduction

The physical properties of granulated nano-semiconductors under certain conditions depend on the access state or defects in the volume or surface of the semiconductor, and their formation depends on the methods of obtaining granulated semiconductors [1÷10]. From the analysis, it can be seen that in the process of obtaining semiconductor materials, a change in thermodynamic balance or foreign atoms or molecules entering from the external environment lead to the distortion of the crystal lattice. Such processes mainly occur strongly in micro-sized semiconductors and form boundary areas between two crystals characteristic of a polycrystalline structure. In nanoscale structures, it leads to size effects.

In this work, the theoretical and practical results of the study of the structure of two adjacent granules and the specific models and mechanisms of their explanation are proposed. The results of the research show that the surface of silicon particles consists of different unevenness and roughness of silicon dioxide. In our opinion, the processes of charge transfer in them depend on the size, structure and arrangement of the granules.

Granular silica particles can be arranged in two different ways, in a row or side by side (Figures 1 and 2). The charge transfer processes in them are completely different from each other. Below we will consider the location schemes and structure model of granulated silicon.

1. Structure model and charge transfer mechanism of granulated semiconductors with consecutively arranged particles

Fig. 1a shows the structural model of a granular semiconductor with its particles arranged in a row and the corresponding zone diagram. In order to explain the scheme of sequential arrangement of particles, it is appropriate to consider the size of the base occupied by the particles and the size of the particle. For this, a heat-resistant dielectric base, for example, a ceramic tube, can be used [4, 5].

When the particle size is equal to the diameter of the ceramic tube, a sequential arrangement of granular semiconductor particles is observed inside the substrate (Fig. 1a). The ohmic contacts M_A and M_B are pressed from the two ends of the dielectric case by an external force, resulting in the formation of contact areas between the silicon particles (Fig. 1a, area 5). When heat Q is given by A of the sample, an electric force appears due to the temperature difference between M_A and M_B contacts.

When the temperature is increased by one standard, electron-hole pairs are formed in area A. Charge carriers move to B side. In this case, the process of charge transfer takes place through the areas of the boundary between two adjacent silicon particles (area 5). In this case, the charge transfer processes can be explained as follows on the basis of the zone diagram of the interparticle boundary areas presented in Fig. 1b.

The process of transfer of charge from the first particle to the second particle is carried out through two contiguous interparticle boundary zones formed between them. In this case, J_{th} current will appear. As the temperature increases, localized traps with E_{in} energy level appear successively in the interparticle boundary regions. An increase in the amount of charges (Q_i) captured in localized traps leads to an increase in the height of the potential barrier (φ), which, in turn, leads to a decrease in electrical conductivity.

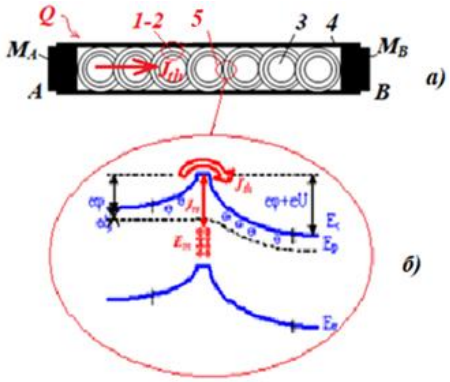

Figure 1. Arrangement scheme (a) and zone diagram (b) of granulated semiconductor particles arranged in series. 1-2 - rough surface area of the particle, 3 - particle core, 4 - dielectric body, 5 - interparticle boundary area.

2. Structural model and charge transfer mechanism of a granular semiconductor with adjacent particles

Figure 2 shows the structural model of a granular semiconductor with adjacent particles and the corresponding zone diagram. This type of particle arrangement can be observed in a heat-resistant ceramic tube like the one above. For this, the size of the particles should be several times smaller than the inner diameter of the ceramic tube. In this case, the location of the particles can be described as in Figure 2a. Inside the ceramic tube, the particles form a series of particles arranged parallel to each other, as shown in Figure 1a. Their number is equal to how many times the particle size is smaller than the pipe diameter. That is, inside the tube, it forms a set of parallel and side-by-side granulated particles as shown in Fig. 2a. In contrast to Fig. 1a, an interparticle boundary (6 areas) is formed in parallel between granulated particles located in a row. also, the process of charge transfer in such a structure is fundamentally different from the process of charge transfer in a structure located in a series with each other, discussed in the previous paragraph.

When Q heat is applied, electron-hole pairs are formed in the A region of the sample, and they move to the B region. The charge transfer process takes place simultaneously through the granules connected in series and across 6 areas formed between the granules connected in parallel. In this case, the charge transfer process can be explained as follows based on the zone diagram.

According to the thermoelectric emission model, the charge carriers formed as a result of heating of the field A are trapped in the localized traps (E_{in}) above the Fermi level E_f and the J_{ss} current appears as a result of their release. J_{ss} depends on the current and E_{in} on the full conductance of the level traps (Y_{ss}).

In [2, 12], the conductivity Yss of localized traps in two adjacent areas was determined and a model was proposed to explain the charge transfer mechanisms through them. According to it, successively different energy levels under the influence of temperature, for example, at T~70÷420 °C, successively E_{in1}~0,15 *eV*, E_{in2}~0,17 *eV*, E_{in3}~0,36 *eV*, E_{in4}~0,3 *eV* energy level traps can appear. The charge leaving the E_v valence zone is first trapped in E_{in1}, then E_{in2}, E_{in3}, E_{in4} energy level traps (Fig. 2b). This event continues until the traps are filled. The migration of charges across the levels leads to the generation of current J_{ss} and Y_{ss}.

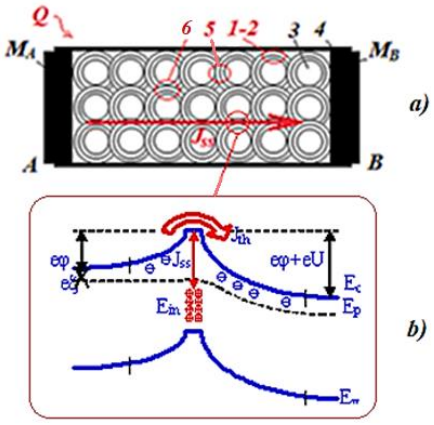

Figure 2. Arrangement scheme (a) and zone diagram (b) of granular semiconductor particles whose particles are adjacent to each other. 1-2 - rough surface area of the particle, 3 - particle core, 4 - dielectric body, 5 and 6 - interparticle boundary formed between consecutive and adjacent particles, respectively area, M_A and M_B are ohmic contacts in areas A and B, respectively, Q is the amount of heat supplied.

We believe that the same process can occur in granular semiconductors. That is, charge carriers are trapped in traps with energy levels E_{in1}, then E_{in2}, E_{in3}, E_{in4}, which appear successively in the interparticle boundary (5 areas, Fig. 2a) and move along the traps (Fig. 2b). This in turn can lead to J_{ss} current and localized trap conductance (Y_{ss}). In granulated semiconductors, the process of charge transfer takes place in two adjacent 6 interparticle boundary zones (Fig. 2a). It should also be noted that charge carriers caught in localized traps do not move towards the core of the granule. That is, the charge carriers caught in the localized traps that appeared in the 5 interparticle boundary areas move to the localized traps that appeared in the 6 areas that are energetically close to each other. This, in turn, leads to an increase in the current Jss and Y_{ss}.

3. Thermoelectronic emission model for granular semiconductors

Above, we considered the structural models of granular semiconductors. Let's consider the charging processes in granular conductors and their production processes using the proposed models and the thermoelectronic emission model. As discussed above, when Q heat is applied, the temperature difference is the difference between M_A and M_B contacts. In this case, compared to the charge carriers formed due to the heating of the A area, the carriers of the B area, which have a lower temperature, move and the concentration of the charges increases under the influence of temperature. temperature, transfer of charge carriers from area A with higher temperature to area B occurs. This process continues until a balance appears in both areas. Charge migration processes in such structures are similar to charge migration processes in polycrystalline semiconductors.

It is known from the physics of polycrystalline semiconductors that intergranular boundary areas act as localized traps for charge carriers [2, 12÷23]. The capture and release of charge carriers in localized traps leads to an increase in the potential barrier height (φ) in the intergranular boundary region, which in turn increases the resistivity (ρ) of semiconductors with a polycrystalline structure [16÷21]. Even in granular semiconductors, intergranular boundary regions act as localized traps for charge carriers. Accordingly, Figure 2b shows a zone diagram of two adjacent areas.

According to the thermoelectron emission model, a thermoelectron emission (J_{th}) current appears during the transfer of charges from left to right [13, 14]:

$$J_{th} = A^* \cdot T^2 \exp(-\beta(\zeta + \varphi))(1 - \exp(-\beta U)) \quad (1)$$

where, $\beta = e/kT$ - potential difference, A^* - Richardson's efficiency constant, U - given voltage, $e\varphi$ - height of the barrier on the left, $e\zeta$ - Fermi level depending on the doping concentration of the inputs in the grain.

It can be seen from the zone diagram that in addition to the J_{th} thermoelectron emission current, the second J_{ss} current is also present. This current occurs when charge carriers are captured and re-released in localized traps (E_{in}) in the intergranular boundary region above the Fermi level Ef when moving from left to right. J_{ss} current is the difference between the intensity of trapping and re-release of charge carriers in localized traps. This current depends on the total permeability of the traps (Y_{ss}), i.e., the complete permeability, which depends on the grain surfaces and energy distribution of the traps, and the potential barrier height ($\delta\varphi$).

$$J_{ss} = Y_{ss}\delta\varphi \quad (2)$$

J_{ss} and $\delta\varphi$ have an inverse dependence due to the capture and release of charge carriers in traps. Such vibrational dependence is determined by the properties of traps.

In [2, 17÷23], during temperature change from 300 K to 800 K, the capture of charge carriers in localized traps (E_i) increases the value of $\delta\varphi$ from 0.3 eV to 0.9 eV, on the contrary, during temperature decrease, $\delta\varphi$ it is determined that it leads to a decrease and that it consists of a feedback process. One of the more important properties for two connected fields is the dependence of not only Jss, but also the Jth current generated during the thermoelectronic emission process. A change in the height of the potential barrier ($\delta\varphi$) also causes a change in the current J_{th}. When the temperature changes, the trapping and re-release of charge carriers in the localized traps leads to a change in $\delta\varphi$ and J_{ss}, which leads to a change in the total current. In such cases, the total current can be expressed as:

$$J_{tot} = J_{th} + J_{ss} \quad (3)$$

It can be seen from expression (3) that the total current depends on the trapping and re-release of charge carriers. As the temperature increases, the generation of electron-hole pairs increases. Due to them, the total current will also increase. So, the process of charge transfer in polycrystalline semiconductors mainly depends on the complete conductivity of the J_{ss} current and Ei level traps (Y_{ss}) appearing in the two junctions, i.e., intergranular boundary areas. In [2, 12], an increase in total conductivity of E_i-level traps (Y_{ss}) was determined, which was explained on the basis of the appearance of thermo-voltaic effects with penetration in two junction areas. In our case, the processes taking place in the boundary between two adjacent granules may depend on the manifestation of voltaic effects with input heat.

4. Mechanisms of formation of localized traps in interparticle boundary areas

Defects formed in the intergranular boundary areas of polycrystalline semiconductors during crystallization or preserved crystalline states form deep or shallow localized traps for charge carriers [13÷15]. They can appear or disappear during temperature changes. For example, in the range of ~20÷400 °C of thermal treatment, in series The emergence of recombination centers at E_{in1}=0,15 *eV*; E_{in2}=0,17 *eV*; E_{in3}=0,36 *eV* and E_{in4}=0,3 *eV* levels has been found to cause a disproportionate change of electrophysical parameters of polycrystalline silicon with increasing temperature [2]. In granular semiconductors, localized traps appear in the areas of the boundary between two adjacent particles.

The interparticle boundary field appears between two particles during the process of pressing the particles together. As we have seen in the previous paragraphs, the atomic structure of this field consists of various defects or entry states. The appearance of localized traps in granular semiconductors at different energy levels and the mechanism of charge transfer in them can be explained as follows.

Figure 3 shows the zone diagram of a granular semiconductor and the mechanism of charge transfer in recombination centers [12]. Electrical contacts are placed in areas A and B of the sample. In order to explain the occurrence of localized traps at different energy levels and the process of charge transfer in them, we will conditionally divide it into sections I, II, III, IV, V and VI.

1. At the initial stages of temperature increase when Q heat is given, for example, when the temperature of section I is T_1<50 °C, the charge carriers that have passed from the valence zone to the conduction zone move from the area A with a higher temperature to the area B with a lower temperature. . In this case, the charge carriers move along sections II, III, IV, V and VI (Fig. 3a), resulting in a current in a closed circuit.

2. As the heat energy Q increases, the temperatures in the sections change. For example, the temperature of section I is 50°C<T_2>70 °C and the temperature of section II is increased to T_1<50 °C, let a recombination center with energy level E_{in1}~0,15 eV appear in section I. In this case, the migration of generated charge carriers depends on the concentration of recombination centers. If the recombination centers are greater than the concentration of charge carriers generated in the II section, the charge carriers are caught in localized traps with an energy level of E_{in1}~0,15 eV and move towards the I section (Fig. 3b). On the contrary, if the concentration of recombination centers is less than the concentration of charge carriers generated in section II, charge carriers move from A to area V.

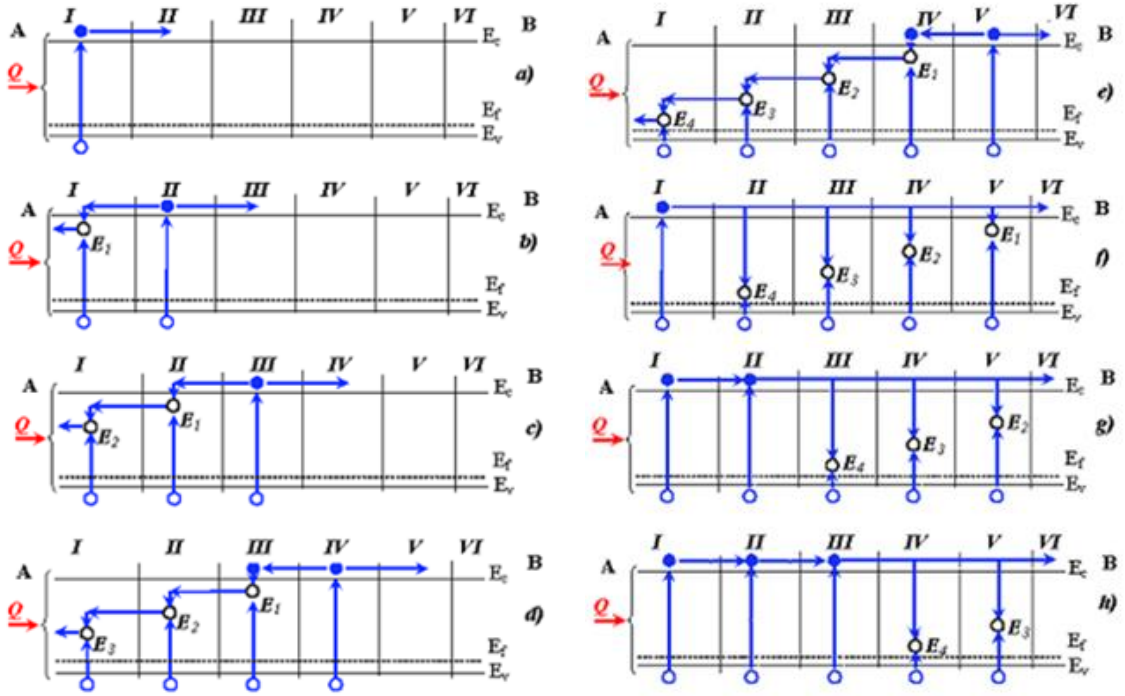

Figure 3. Zone diagram of granular semiconductor and mechanism of charge transfer in recombination centers.

3. If the temperature of section I is 70°C<T_3>100°C, that of section II is 50°C<T_2>70°C, the temperature of section III is T_1<50°C, as well as the energy level E_{in2}~0,17 eV in section I, Let a recombination center with an energy level of E_{in1}~0,15 eV appear in section II. The charge carriers generated in sections I and II are trapped in the recombination centers of levels E_{in2}~0,17 eV and E_{in1}~0,15 eV, respectively. Even in this case, charge migration depends on the concentration of recombination centers. That is, if the concentration of recombination centers is greater than the concentration of charge carriers generated in section III, charge carriers move towards sections I and II along the levels that appear in these sections (Fig. 3c). In this case, charge carriers move from area B to area A of the sample. Otherwise, charge carriers move from A to B.

4. If the temperature of areas I, II and III changes to 100°C<T_4>250°C, 70°C<T_3>100°C, 50°C<T_3>70°C, respectively, in these sections, E_{in3}~0,3 eV, E_{in2}~0,17 eV and E_{in1}~0,15 eV energy level recombination centers should appear, and the IV region temperature should increase to T_1<50°C.

In this case, as mentioned in point 3, the generation and migration of charge carriers is observed (Fig. 3e, 3f, 3g and 3h). In this case, charge carriers move from B to A area. This process continues until the process of manifestation of recombination centers stops or the levels disappear. With the loss of successive recombination centers in sections I, II, III, the direction of charge carriers changes from area A to area B.

At the next stages of temperature increase, such processes are observed that, due to the increase in the concentration of charge carriers generated in sections I, II and III, and the appearance of the above-mentioned recombination centers in sections IV, V and VI, correspondingly, charge carriers move from A to B area. it accelerates. The amount of current in the closed circuit increases. In addition, the generation of charge carriers in localized traps can be observed at later stages of temperature increase. This process also accelerates the transfer of charge carriers from A to B area. The considered considerations play an important role in the explanation of thermal voltaic effects in a granular semiconductor.

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Political sciences

THE UNITED STATES' AND NATO' STRATEGY OF DETERRENCE AND CONTAINMENT TOWARDS RUSSIA

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Abstract

The strategic stability and the international rules-based order are under increased pressure causing a significant deterioration of the international security environment. Russia's war against Ukraine severely affects the security architecture in Europe, as well the international stability and peace. Realist and neorealist perspectives, along with the associated concepts of balance of power, deterrence and containment, continue to prove their relevance as theoretical frameworks of analysis. Deterrence and defence and containment towards Russia are at the core of the United States' and NATO' strategy to address the challenges and threats to the international rules-based order and to the security in the Euro-Atlantic area posed by Russia.

While the war in Ukraine is Russia's most violent act of aggression in decades and its most brutal violation of international law, triggering global consequences, the Russian aggressive posture towards its neighbors and the West is not new, but a progressive process that began in 2008 and intensified starting with 2014.

In this context, we focus our analysis on the United States' and NATO' strategy towards Russia during the past decade, especially after the Russian military aggression against Ukraine, following the main avenues of approach – deterrence and containment.

Keywords: defensive realism, offensive realism, deterrence and defence, containment, US National Security Strategy, NATO Strategic Concept, Russia, war in Ukraine.

Introduction

Against the background of strategic competition's amplification, starting with 2016-2017, reflected by the increasingly contesting and aggressive behavior of major powers who oppose the post-Cold War international order, having the United States at its the center, we are witnessing the return to a prominent position of realist and neorealist approaches of international security and strategic stability.

Containment and deterrence are rooted and linked traditionally to the Cold War period, when the threat of the former Soviet Union's expanding influence at the global level put the United States' victory at risk and the balance of power between the two blocs' nuclear arsenal prevented direct aggression and the catastrophic consequences of a nuclear war. At present, after more than 30 years since the end of Cold War, we can notice that the principles of containment and deterrence remain valid and effective, even though they are adjusted to the current security environment, and remain essential for the United States' and NATO' strategy aimed at addressing Russia's challenges and threats to the rules-based international order and to the security of the Euro-Atlantic area.

The war in Ukraine is Russia's most violent act of aggression in decades and its most brutal violation of international law, including the purposes and principles of the Charter of the United Nations[8], breaking the sovereignty and the territorial integrity of an independent state, and triggering global consequences and overlapping crises. However, the Russian aggressive posture towards its neighbors and the West is not new, but a progressive process that began in 2008, intensified starting with 2014 and reached its peak in February 2022, when Russia invaded Ukraine.

A theoretical perspective on the US, NATO, and Russia and containment and deterrence

[8] United Nations, *Charter of the United Nations,* Chapter I – *Purposes and Principles,* p. 3, San Francisco, USA, 1945, accessed at https://treaties.un.org/doc/source/docs/charter-all-lang.pdf.

Transcending the realist condition according to which states are the main actors that matter and influence the dynamics in the anarchic international system, we can affirm that both the United States and the North Atlantic Treaty Organization are major representative actors from realist and neorealist perspectives. Due to the global relevance throughout modern history and its superpower status after the end of the Cold-War, the United States are at the core of realist and neorealist schools of thought, as well as of international security studies. Realists emphasize that it is precisely the realist approach and behavior of the US in the international system that enabled and secured its development into a superpower and the achievement and preservation of the dominant position globally during the past 30 years.

As for NATO, we can view and analyze the political and military Alliance from both realist and liberal perspectives. Taking into consideration its non-state status, the international organization is linked to the liberal institutionalism. However, for the purpose of this paper, we focus on the global relevance of NATO in terms of military power and its core task of deterrence and collective defence of the member states that entitle the classification of the North Atlantic Alliance as a major actor in the international system from realist and neorealist perspectives. At the same time, we take into consideration NATO' significance of the sum of its member states' power.

While there are numerous arguments that entitle the association of the United States and NATO to different realist and neorealist perspectives, *structural realism*, in general, and *defensive realism* school of thought, in particular, characterize to the highest degree the behavior of the two actors in the international system.

Kenneth Waltz, the most prominent representative of *defensive realism*, advocates that defensive behavior, focused on survival, and the natural tendency to maintain the balance of power are the main features that describe and influence the conduct of states within the anarchic international system, due to the reason that power-states are under threat permanently[9]. Waltz notes that, as individual actors, regardless of their degree of power, states must secure their own position in the face of revisionist powers, and the most appropriate means to do that is the balance of power. Therefore, defensive realists count on the predominant moderate behavior of actors confronted with the perspective of direct conflict, as they consider it the appropriate approach to ensure their own security, in contrast with the aggressive behavior, which affects the balance of power, and consequently, their own security.

Waltz is a strong supporter of the balance of power as a means to ensure security and stability, at the expense of hegemonic power, considering that any hegemonic power will be subject to contest and challenge by other powers sooner or later. Finally, yet importantly, he notes that the defensive posture offers far more opportunities to engage and achieve objectives, with limited costs, than the offensive posture, which requires significant investments in the military power and numerous types of resources, as well as assuming the risk of counter-rection and possible failure, with significant consequences on the aggressor's image and potential of power within the international system.

On the other hand, promoters of *offensive realism* advocate that states will always pursue the opportunities offered by the anarchic international system to increase their own power, with the final aim at achieving hegemony, a status which guarantees the uncontested dominance over all the other powers. The exponent of offensive realism John Mearsheimer based his theory on the instability and uncertainty in the anarchic international system that determine an anxious state of mind and behavior of the states focused on their own survival and security.[10] Against this background, in his view, states accumulate and develop their military power in order to increase the probability of success in the perspective of a direct confrontation with their adversaries.

Building on the same principles of structural realism as defensive realism, Mearsheimer emphasizes the relevance of states' uncertainty regarding the intentions of other states that fuels the perception of unsafety and insecurity, as well as the relevance of military power, which increases the risk of confrontation.

[9] Kenneth Waltz, *Theory of International Politics*, the McGraw-Hill Companies, USA, 1979.
[10] John Mearsheimer, *The Tragedy of Great Power Politics*, W.W. Norton & Company, New York, London, 2014.

Against this background, offensive realists consider that states will adopt one the following three types of behavior, based on their perception of threat and their aim: (1) fear; (2) self-help; and (3) power maximization. Offensive realism theorists argue that states with limited power mostly adopt the first two types of behavior, fear and self-help, while great powers pursue the maximization of power. Offensive realists advocate for building the capacity of states to ensure their own security and regard alliances as temporary and circumstantial solutions to achieve their own interests, while maximization of power remains the aim of great powers, which perceive the probability of aggression and conflict as inversely proportional to their level of power. Therefore, in the offensive realist view, the most appropriate and most effective way to ensure one state' security is to permanently improve and increase power aiming at hegemony.

On the other hand, Kenneth Waltz, the promoter of defensive realism, as well as Barry Buzan[11], the exponent of the Copenhagen School of security studies, consider that the entire international system is based on self-help, viewed as the sum of measures adopted by states and international organizations to ensure their survival and security.

In Mearsheimer's view, survival in terms of status quo is the main aim of great powers only, while the other powers will never accept the perpetual dominance of a hegemon and, therefore, they will pursue a revisionist agenda to change the status quo to their own advantage, including in terms of power distribution within the international system.

The military power has a central role in Mearsheimer's assessment. In his view, being a great power is conditioned by the capacity to cope with and resist a total conventional war against the most powerful state in the world, if needed, even though the perspective of success is limited[12]. In the same note, he argues that the mix of conventional and nuclear power is an effective means of deterrence towards other great powers, at the same time facilitating the achievement of balance of power and stability within the international system. Analyzing fear in relation with power and probability of conflict, Mearsheimer concludes that: "*The more profound the fear is, the more intense is the security competition and the more likely is war"*[13].

Closely related to structural realism is the *security dilemma* concept, which argues that states' uncertainty regarding the intentions of other states determines them to consolidate their power in military terms and by doing so, even thought for defensive reasons and purposes, they generate anxiety and the perception of threat to other states influencing them to do the same. Thus, the circle of uncertainty and mistrust is created and perpetuated fueling the risk of miscalculation and escalation. *Preventive war*, *proxy war*, *arms race*, *deterrence* and *containment* are among the concepts derived from or associated with the security dilemma.

For the purpose of our paper, we will focus on *deterrence* and *containment*. Both deterrence and containment are concepts, as well as methods and civil-military strategies, used especially during the Cold War, that aim at reducing the opponent party's possibility of an act of aggression and of power projection and extending influence.

Deterrence is a form of coercion involving the implicit or explicit use of threat or limited force to prevent the rival from taking any action, which could alter the status quo. The probability of deterrence strategy' success increases if the actor subject to deterrence considers that the costs of disregarding the threat and pursuing the violent course of action will be significantly higher than the possible advantages achieved by aggression. At the same time, in order to be effective in reaching its aim, deterrence must be credible and convincing, both in political and military terms.

Theorists indicate two types of deterrence, namely *general deterrence*, which is determining an actor to refrain from an action that might conduct, and *immediate deterrence*, when an actor is on the verge of taking an action, but abandons it. Paul K. Huth[14] differentiates deterrence based on its beneficiaries, and argues that *extended deterrence* serves the protection of allies, while *direct*

[11] Barry Buzan, Ole Wæver, Jaap de Wilde, *Security: A New Framework for Analysis*, London, 1998.
[12] John Mearsheimer, *The Tragedy of Great Power Politics*, W.W. Norton & Company, New York, London, 2014, p.5.
[13] Ibidem, p. 42.
[14] Paul K. Huth, *Deterrence and International Conflict: Empirical Findings and Theoretical Debate*, Annual Review of Political Science, 1999.

deterrence serves only the protection of the deterrent state. In the first case, deterrence might involve the threat of a great power towards a potential aggressor of a weaker state and in the second case, the security of the great power itself is at stake and deterrence is directed towards the rival and potential aggressor.

Bruce W. Jentleson and Christopher A. Whytock[15] examined three main features with great impact on deterrence, namely proportionality, reciprocity, and coercive credibility. They argue that the relation between the defending state's aim and its instruments available to pursue the aim may lead to a significant challenge as the demands of assistance from other states come with substantial costs in terms of compliance. Reciprocity involves the balance between the support for the defending state and the concessions for the aggressor state and, therefore, the prudence regarding when and what the deterring actor offers in relation to defender and aggressor to ensure the success of deterrence. Coercive credibility is an important condition for successful deterrence, therefore all instruments involved – threat, use of force, economic sanctions – must be effective in determining the aggressor to refrain from his course action as a result of cost-benefit calculations.

The deterrence theory originated in the '50s and developed, in its initial phase, up to the '70s, having at its core the nuclear power that involved the perspective of retaliation and mutually assured destruction. After the end of the Cold War, as the nuclear risk of confrontation reduced in the context of arms control, disarmament and nonproliferation international treaties and related commitments, deterrence theory was adjusted and applied also in the conventional domain. However, nuclear deterrence remained valid as nuclear powers continued to develop their nuclear arsenal, even though the visibility and preoccupation for the matter diminished significantly until recently, when Russia's conventional aggression against Ukraine was doubled by its increased threatening nuclear rhetoric.

Containment represents a strategy of foreign policy used by the United States during the Cold War. George F. Kennan promoted containment as a state policy covering a large spectrum of initiatives, measures, and actions aimed at reducing the expansionist tendencies of the former Soviet Union. Based on his in-depth knowledge of the Soviet history and the roots of its revisionist behavior, Kennan argued that the United States should remain vigilant regarding the former Soviet Union's actions and limit the expansion of its influence at the global level by any necessary means of prevention and countering, other than the offensive military ones, especially economic and diplomatic. He noticed that the former Soviet Union's misleading openness towards the United States was not genuine and urged Washington to be prudent regarding the dialogue and cooperation with Moscow, as the former Soviet Union would continue to be hostile towards the US, while pursuing its own agenda of power.

The administrations in Washington had different approaches towards Kennan's theory of containment, according to the different phases of the Cold War. For certain periods of time deterrence and military pressure were the main avenues of approach, while in other periods the United States focused on containing the former Soviet Union. However, the containment theory maintained its relevance along the Cold War, one of the main results being the limitation of the Soviet influence expansion beyond the Eastern Europe.

Based on this theoretical background, we can assess that while the United States and NATO are predominant exponents of defensive realism, Russia is a genuine representative of offensive realism and a subject of deterrence and containment, again, after more than 30 years since the end of the Cold War.

Russia's aggressive behavior during the past decade

The fall of the Berlin Wall in 1989 and the dissolution of the Union of Soviet Socialist Republics (USSR) two years after made the transit from the bipolar world to the unipolar world, which was built around the winner of the Cold War, the United States. The winning liberal democracies set the foundation of the new rules-based international order and promoted dialog and cooperation, multilateralism and enlargement globally. Thus, economic development replaced the security concerns at the top of the international agenda.

[15] Bruce W. Jentleson, Christopher A. Whytock, *Who Won Libya,* International Security, 30:3, 2005.

During the '90s, the newly established Russian Federation was weak and confused, but preserved its potential to develop in the new world order in the perspective of its re-emergence in the international system as a great power.

Against this background, the NATO-Russia Founding Act on Mutual Relations, Cooperation and Security was signed by all NATO members and Russia in 1997, and the NATO-Russia Council was established in 2002 as a forum of consultation and cooperation on security topics of common interest. At the same time, the US – Russia Summits took place at least annually during 1992-2001, and continued with a reduced frequency in 2005, 2010, 2018 and 2021. Even though there was no major common project of Russia and NATO or the US, the Cold War tensions diminished significantly in the late 1990s and the early 2000s and reciprocal dialog increased the probability of cooperation between the US and NATO, on one side, and Russia, on the other.

However, NATO leaders' decision to offer Ukraine and Georgia the prospect of joining the Alliance, at the NATO Summit in Bucharest in 2008, caused a radical shift in Russia's behavior towards its neighbors, the US and NATO. That year, shortly after the NATO Summit, Russia invaded Georgia and the five-day war of aggression represented the first indicator of Russia's attempt to return to the international arena reclaiming the status of great power.

Also, starting with 2010, in conjunction with China's economic fast-growing, Russia has consolidated its military presence and influence in the Middle East region in the context of the Arab Spring and US' diminishing engagement, assuming the role of the Syrian leader Bashar Al-Assad' protector. Moreover, Russia developed its bilateral cooperation with Iran and Egypt, two major regional actors in the Middle East, thus complicating the strategic balance of power in the region.

Still, the Black Sea region and its neighbors not affiliated to NATO remained Russia's main focus. The illegal and illegitimate annexation of the Crimean Peninsula and the conflict in Eastern Ukraine in 2014 emphasized Russia' superior level of aggressiveness, as well as Russia's determination to defend its vital interests regardless of the costs that the West might impose against it.

Indeed, the Western sanctions against Russia following the war in Georgia and the illegal annexation of Crimea had little impact on the aggressive behavior of Russia in the Black Sea and Baltic Sea region. Russia consolidated its military presence, especially in Crimea, accelerated the modernization of its military capabilities, including the nuclear triad, and intensified its ample military exercises, including short notice and snap ones, in the proximity of NATO Allies' borders. Moreover, Russia amplified its aggressive posture by repeated violations of NATO airspace and the deployment of double-use capabilities in Kaliningrad. In addition to the conventional and nuclear developments, Russia increased the use of cyber and hybrid instruments (cyber-attacks, propaganda, disinformation, economic and energetic pressure etc.) targeting its neighbors, especially Ukraine and the Republic of Moldova, but also NATO Allies.

On 24th of February 2022, Russia invaded Ukraine, following the failure to impose its conditions to the United States and NATO, which included: the cancellation of Ukraine's and Georgia's prospect to join NATO; ending US' and NATO' support for and cooperation with Ukraine; US' withdrawal of its military capabilities from the territory of NATO Allies in Central and Eastern Europe; reducing the level of NATO military exercises in the vicinity of Russia's borders; US' withdrawal of short and medium range missiles from Europe; and US' and NATO's restraint with regards to actions that Russia might perceive as a threat[16].

Deterrence and containment at the core of the US' and NATO' strategy to address Russia

The North-Atlantic Treaty[17], also referred to as the Washington Treaty, lays the foundation of NATO (the North Atlantic Treaty Organization) on the purposes and principles of the Charter of the United Nations. Thus, NATO member states adhere to the values of democracy, individual rights and freedoms, and the rule of law and state their determination to work together in solidarity to ensure their collective defence and to preserve international peace and security.

[16] Ben Aris, *Russia issues an eight-point list of demands*, 13th of December, 2021, accessed at https://www.intellinews.com/russia-issues-a-eight-point-list-of-demands-229829

[17] *The North Atlantic Treaty*, Washington D.C., April 1949.

Article 5 regarding collective defence is at the heart of NATO as it stipulates that an armed attack against one NATO member will be considered an attack against all members and every member will provide support for the state subject to aggression as it considers appropriate, including by using force[18]. Based on this commitment, NATO member states pledge to share both the benefits in terms of collective defence and the risks and responsibilities to ensure their own security within the Alliance and to sustain international security. While being an essential security guarantee for NATO member states, collective defence serves also as a strong deterrent to any potential aggressor of a NATO member state.

NATO was founded against the background of Cold War, but during its almost 75 years of existence the Alliance has adapted continually to the international security environment to address the broader security agenda post-Cold War, to counter international terrorism after 9/11, and more recently to manage new threats and challenges in the cyber, hybrid and space domains.

Nevertheless, NATO's first and foremost task has remained collective defence and its unparalleled role of deterrence, as the evolution of NATO' Strategic Concepts fully reflects. The first Strategic Concept of NATO (1950) validates the deterrence role of Article 5; the second Strategic Concept (1952) lays the foundation of NATO Command and Force structures; the third Strategic Concept (1957) consolidated the Alliance in military terms, based on the Massive Retaliation Doctrine; and the fourth Strategic Concept (1968) includes the nuclear dimension as the last option of deterrence.

Starting with 1970, NATO gradually emphasized the political dimension of the Alliance and opened to dialogue, including with Russia. In 1973, 35 states including the Union of Soviet Socialist Republics and the United States pledged to respect the individual fundamental rights at the Conference on Security and Cooperation in Europe and set up the basis of the Helsinki Funding Act. In addition, as the end of the Cold War was approaching, in 1987, the US and the USSR signed the Intermediate-Range Nuclear Forces Treaty. After the end of the Cold War, the first three NATO Strategic Concepts issued in 1991, 1999, and 2010, extended the security agenda and continued to enhance the Alliance politically.

The new Strategic Concept of NATO issued in 2022 indicates a major shift of approach compared with the previous one as it addresses with high priority the imperative to adapted and enhance NATO's deterrence and defence posture in order to effectively manage the major changes in the international security environment caused by the strategic competition, which amplifies new threats and challenges in the new technologies, hybrid threats and cyber security domains, as well as Russia's increasingly aggressive behavior towards the West. Against this background, NATO recognizes Russia as *"the most significant and direct threat to Allies' security and to peace and stability in the Euro-Atlantic area"*[19] and sets out the following three core tasks of the Alliance: (1) deterrence and defence; (2) crisis prevention and management; and (3) cooperative security, adapting the previous ones - collective defence; crisis management and cooperative security.

However, in political and practical terms, starting with 2014, after Russia's illegal annexation of Crimea, and in the context of increasingly aggressive posture of Russia towards its neighbors and the West, NATO initiated an ample adaptation process on the political, military and institutional levels. During the period of 2016 - 2023, NATO leaders gathered annually at NATO Summits and Allied high-level meetings, except for 2020 due to the Covid-19 pandemic, and adopted significant decisions in support of NATO's adaptation to the security environment. As a result of these decisions, NATO implemented a series of significant measures to consolidate its deterrence and defence posture.

On the political level, Allies increased their national defence budgets towards or beyond the target of 2% of GDP, according to the Defence Investment Pledge adopted at the NATO Summit in 2014 and burden sharing became increasingly important within NATO's overall effort.

Since 2014, NATO has suspended practical cooperation with Russia and followed a dual approach towards Moscow i.e., enhancement of NATO's deterrence and defence posture and availability to dialogue with Russia, especially to reduce the risk of incidents and escalation.

[18] *The North Atlantic Treaty*, Article 5, Washington D.C., April 1949.
[19] *NATO Strategic Concept 2022*, paragraph 8, p. 4.

At the same time, NATO remained committed to support both in political and practical terms its partners in the East – Ukraine, Georgia and, to a lesser degree, the Republic of Moldova.

NATO's *open-door* policy continued to deliver, and three new members joined the Alliance after 2014, namely Montenegro, North Macedonia and Finland. At present, Sweden's integration is probable, but still pending. Moreover, NATO enhanced its assistance and encouraged Ukraine, Georgia and Bosnia and Herzegovina to accelerate efforts to fulfill the conditions to join NATO.

Also, NATO – European Union cooperation increased and entered a new phase based on the NATO – EU common declarations issued in 2016, 2018 and 2023, that setup the agenda of the new domains of cooperation between the two international organizations, i.e.: resilience; hybrid threats and terrorism; cyber security; capabilities and military mobility; support for partners; strategic communication; critical infrastructure; new technologies; space; and climate change.

The most important developments occurred on the military level resulting in NATO's significantly enhanced posture of deterrence and defence. Thus, the setting up of the Very High Readiness Joint Task Force, in 2016, totaling 5.000 troops, strengthened NATO Response Force, which totals 40.000 troops, and the establishment of eight NATO Force Integration Units in Central and Eastern Europe[20] facilitated Allied forces' integration and interoperability.[21] The most visible involvement was strengthening the Eastern Allies by setting up, in 2016, NATO *enhanced Forward Presence* in Poland and the Baltic States, comprising of four battle groups led by the US in Poland, the Great Britain in Estonia, Canada in Latvia and Germany in Lithuania, and NATO *tailored Forward Presence* in Romania and the Black Sea region, comprising of a multinational brigade and a framework for combined joint training. At the same time, NATO developed new brigade, division and corps level multinational headquarters on the Eastern Flank and increased air and maritime presence in the Black Sea and Baltic Sea regions, as well as NATO exercises with a deterrence role.

NATO Ballistic Missile Defence became operational in 2016 due to the Allies contributions and cyber (2016) and space (2019) were recognized as operational domains and, consequently, became subject to training and missions the same as land, maritime and air operational domains. In addition, NATO set up dedicated support teams to assist the Allies in need in hybrid threats and cyber security domains.

On the institutional level, NATO moved to a new headquarters in Brussels and, in 2018, set up a new Joint Force Command for the Atlantic in the United States, and a Joint Support and Enabling Command in Germany.[22]

In February 2022, Allied measures adopted in the context of Russia's military aggression against Ukraine significantly improved NATO's deterrence and defence posture. For the first time in its history NATO activated the Allied defence plans in order to deploy additional forces on the territory of the Eastern Allies and put over 100 fight airplanes on alert, while more than 120 ships protected the security of the Alliance from the High North to the Mediterranean Sea.[23] In Romania, the Alliance deployed NATO Response Force troops, on the 1st of March, and soon after set up a NATO battle group under the command of France, similar to those in Poland and the Baltic states.

In addition, the United States deployed additional troops to Europe both as part of NATO effort and based on bilateral agreements with European Allies. According to the State Department, during the period of February – June 2022, the US deployed over 20.000 troops to Europe, raising the total of the American military in Europe to 100.000. Moreover, at the NATO Summit in Madrid, president Joe Biden announced the permanent deployment of a forward command post, a garrison command

[20] Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, and Slovakia.

[21] NATO, *Warsaw Summit Communiqué issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Warsaw, 8-9 July 2016.*

[22] NATO, *Brussels Summit Declaration Issued by the Heads of State and Government participating in the meeting of the North Atlantic Council in Brussels 11-12 July 2018*.

[23] NATO, *Press briefing by NATO Secretary General Jens Stoltenberg following an extraordinary meeting of the North Atlantic Council*, 24 February 2022.

and a support battalion to Poland, as well as the deployment of a brigade to Romania, and additional forces in the Baltic states, Great Britain and Italy.[24]

At the political level, at the Summit in Madrid in 2022[25], NATO leaders reaffirmed Russia's status of the most significant and direct threat to Allies' security as stated in the NATO Strategic Concept 2022 and reaffirmed the ironclad commitment to Article 5. Moreover, the Allies showed solidarity with Ukraine and endorsed once again NATO's *open-door* policy and the prospect of Ukraine and Georgia's integration in the future. At the same time, the Summit evoked the new political dimension of NATO aimed at intensifying cooperation with partners in the Indo-Pacific.

At the military lever, the NATO Summit in Madrid set up a new baseline to strengthen NATO's deterrence and defence posture in the long term by a comprehensive multi-domain approach to address all challenges and threats to the Euro-Atlantic security, placing the Allies in the Eastern Flank at the core. Thus, NATO commits to develop existing battles groups, including the newly established ones in Bulgaria, Hungary, Romania and Slovakia, to the brigade level, when necessary, and to provide them with appropriate reinforcements and prepositioned military equipment and capabilities.[26]

We can conclude that the entire deterrence and defence effort of NATO revolves around two main objectives, namely deterring any aggression against a NATO member state and ensuring the readiness to succeed in the event that any NATO member becomes subject to aggression.

The United States has a major role in deterring Russia both as an important member of NATO and individually by its continuous engagement in European security through bilateral agreements with European Allies. Estimates indicate that when the US and USSR nuclear tension reached the highest level during the Cold War, the US had approximately 2.500 nuclear missiles stationed in Europe and approximately 450.000 US troops were deployed in 1.200 military facilities in Europe[27]. After the end of the Cold War, the US significantly reduced its military presence in Europe but remained engaged in European security, and starting with 2014 re-increased gradually its presence and attendance to the multinational military exercises, especially by US Operation Atlantic Resolve and the European Deterrence Initiative.

Compared with the Cold War era, the present situation is significantly different, but there are certain similarities. Despite Russian rhetoric, the United States and Russia are not peer competitors in the strategic competition. Russia represents a genuine rival of the US, NATO and the West in general, who opposes the international rules-based order, and by doing so, it attempts to elevate its global relevance and power.

That is, most likely, the reason for the US' adjustment of the containment strategy towards Russia to the constraining strategy in the current context, influenced by Russia's large-scale war against Ukraine. Starting in February 2022, the United States assumed the leading role in providing and promoting international assistance to Ukraine on multiple dimensions: political, military, economic, humanitarian etc. At the same time, the US encouraged joint actions, together with its worldwide partners, especially the European Union and NATO Allies, in order to limit Russia' possibilities of aggressive actions, both in Ukraine and outside Ukraine.

The US' National Security Strategy issued in 2022 regards Russia as *"an immediate and persistent threat to international peace and stability"*[28] and emphasizes its destabilizing role by the brutal violation of the Un Charter' fundamental principles. Considering its increasingly aggressive behavior during the past decade, the United States sets up a constraining strategy towards Russia following four lines of action: (1) continuing support for Ukraine, including for its European

[24] US Department of Defense, *Fact Sheet - U.S. Defense Contributions to Europe*, June 2022, accessed at https://www.defense.gov/News/Releases/Release/Article/3078056/fact-sheet-us-defense-contributions-to-europe/

[25] NATO, *Madrid Summit Declaration Issued by NATO Heads of State and Government participating in the meeting of the North Atlantic Council in Madrid 29 June 2022*.

[26] Idem.

[27] Daniel Kochis, *2021 Index of US Military Strength, Global Operating Environment, Europe*, pp. 108, 128, The Heritage Foundation, accessed at https://www.heritage.org/sites/default/files/2020-

[28] The White House, *National Security Strategy*, 2022, accessed at https://www.whitehouse.gov/wp-content/uploads/2022/10/Biden-Harris-Administrations-National-Security-Strategy-10.2022.pdf

aspirations; (2) ironclad commitment to Article 5 of the NATO Treaty and enhancing cooperation with partners in Europe and worldwide to prevent other consequences of Russia's provocative acts; (3) deterring and responding, if necessary, to Russia if it threatens US interests; (4) not allowing Russia to use or threaten to use nuclear weapons in order to achieve its objectives.[29]

Conclusions

The ongoing strategic competition significantly affects the strategic stability and international security, and the war in Ukraine represents an integral part of this development, even though Russia is not a peer competitor to the United States. The international rules-based order and the balance of power post-Cold War are under increased pressure. Against this background, we witness the revival of realist and neorealist perspectives along with their associated concepts of deterrence and containment. From a theoretical perspective, NATO and the US are exponents of defensive realism, while Russia is a genuine representative of offensive realism.

Russia's aggressive behavior has intensified during the past decade simultaneously with the rise of China, in Moscow's attempt to restore Russia's power and global relevance. Russia has amplified its aggressive posture towards its neighbors after the NATO Summit in 2008 when Allied leaders offered Georgia and Ukraine the prospect to join NATO. The Six days war against Georgia was followed by Russia's illegal annexation of Crimea in 2014 and the large-scale invasion of Ukraine in 2022.

In response to the changing security environment, starting with 2014, NATO has reinforced its power and its deterrent role by implementing a series of political and military measures aimed at strengthening NATO's deterrence and defence posture, while remaining committed to Article 5 of the Washington Treaty and consolidating the transatlantic link. NATO presence has gradually increased in Central and Eastern Europe and reached its peak in the context of Russia's military aggression against Ukraine. In close coordination with NATO Allies, the United States renewed its engagement in European security, deployed additional troops in Europe, and assumed the leading role in international endeavors to assist Ukraine.

While NATO' deterrence and defence effort revolves around deterring any aggression against any Ally and ensuring the success of collective defence, the United States focuses on constraining Russia by pledging to deter and respond, if Russia threatens US interests. At the same time, the US is determined not to allow Moscow to use or threaten to use nuclear arsenal.

We can conclude that deterrence, both conventional and nuclear, and containment, adjusted to constraining, remain valid in US' approach towards Russia in the current security environment, despite significant differences between the strategic competition during the Cold War era and ongoing one.

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Technical sciences

ON SOME PHYSICAL EFFECTS, ARISING IN METAL-CARBON MATERIALS UNDER SHOCK-WAVE INFLUENCE

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О НЕКОТОРЫХ ФИЗИЧЕСКИХ ЭФФЕКТАХ, ВОЗНИКАЮЩИХ В МЕТАЛЛОУГЛЕРОДНЫХ МАТЕРИАЛАХ ПРИ УДАРНО-ВОЛНОВЫХ ВОЗДЕЙСТВИЯХ

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Abstract
The abstracts of the report present some experimental results obtained by the employees of the Dnipro Polytechnic Institute of fundamental research in the field of shock-wave processing of porous materials. The main scientific and practical results are briefly described, most of which were obtained for the first time in world practice.

Аннотация
В тезисах доклада представлены некоторые экспериментальные результаты, полученные при выполнении сотрудниками Днепровской политехники фундаментальных исследований в области ударно-волновой обработки пористых материалов. Кратко описаны основные научные и практические результаты, большинство из которых были получены впервые в мировой практике

Keywords: explosion, shock wave, synthesis, diamonds, extreme parameters
Ключевые слова: взрыв, ударная волна, синтез, алмазы, экстремальные параметры

Во второй половине 20-го столетия в мировом машиностроении и материаловедении сформировалось новое научно-техническое направление, связанное с ударно-волновой обработкой металлов, сплавов, различных веществ и материалов [1-6], применением физико-химических методов исследования материалов после воздействия экстремальных давлений и температур [7-12]. Практически все экспериментальные и теоретические результаты в мировой практике были получены впервые [13-17].

Некоторые из направлений по использованию энергии взрыва получили развитие в Днепропетровском горном институте (ныне Днепровская политехника). Некоторые из них: сварка и упрочнение металлов взрывом, штамповка, разработка ударно-волновой технологии синтеза поликристаллов алмаза, разработка технологии производства эмульсионных взрывчатых веществ и создание промышленного их производства, утилизация твердого ракетного топлива, синтез нового класса первичных светочувствительных взрывчатых композитов для средств взрывания лазерных систем. Исследовались физико-математические модели, например. таких явлений как зажигание взрывчатых веществ лазерным импульсным излучением, скачкообразная потеря вязкости металла при высокоскоростном ударе

микрочастицы. Прокомментируем некоторые новые результаты, полученные при выполнении исследований.

1. Ударно-волновой синтез алмаза. Исследованиями микроструктур различных металлических сплавов и чугунов были установлены новые физико-химические эффекты, в частности, включающие диффузионное взаимодействие чугуна со сталью при ковке, обработке взрывом и термоциклировании, образование биметаллических соединений между серым чугуном и сталью после ковки и ударно-волнового воздействия с последующим термоциклированием; установленаа степень влияния межфазных границ неметаллическое включение-матрица на изменение зеренной структуры армко-железа [18-30]. Как показали результаты физико-химического анализа ударно-волновой обработки металлоуглеродной смеси с последующим охдаждением со скоростью 10^8 К/с, надежно фиксируется новая углеродная сверхтвердая фаза – чаоит [31-36], синтезированный впервые в истории.

Физическую суть установленной закономерности зародышеобразования алмазной фазы [37-39] можно проиллюстрировать на следующем примере. При воздействии на чугун сильных ударных волн (более 80 Гпа) и высоких температур (более 2500 К) структура графита и контактирующих приповерхностных атомных слоев металлической матрицы в пределах границы фаз разрушаются в результате диссоциации химических связей. Вещество переходит в состояние единого активированного комплекса, характерного для высоких степеней сжатия. После прохождения ударной волны стабилизируется та форма вещества, которая будет устойчивой при данных физических условиях. Флуктуации энергии и плотности приводят к спонтанному возникновению множества новых наноразмерных кристаллов алмаза, имеющих размер до 150 Å, сцепленных в поликристаллические агрегаты, карбидов сложного состава и других соединений, возникших в результате бездиффузионных реакций [40].

Важным результатом исследований ударно-волновой обработки чугуна, микроструктура которого характеризуется избытком запасенной энергии (результат пластического деформирования), является синтез монокристаллов алмаза и других минералов [41-45]. Анализируя эти результаты были разработаны различные способы перевода микроструктуры металлов-катализаторов и металлов-охладителей в метастабильное состояние перед обработкой высокими давлениями [46-49]. Таким образом, было экспериментально обнаружено неизвестное ранее новое явление твердофазной автоэпитаксии метастабильных монокристаллов алмаза. Это явление авторы подтвердили в ряде последующих экспериментов с металлоуглеродными сплавами, используя метод термоциклирования [50, 51] и дополнительную обработку электромагнитным полем [52-54].

Используя результаты экспериментальных исследований ударно-волнового синтеза и с учетом открытия наноалмазных частиц в метеоритах [55] и квантовомеханических закономерностей, описывающих устойчивость химической связи в поле кулоновского центра [56], предложены механизмы образования алмазных зародышей [57, 58] и физико-химические условия твердофазной кристаллизации монокристаллов алмаза [59], в том числе в природе как один из возможных сценариев алмазообразования [60].

2. Особенности течения вещества за ударным фронтом. При воздействии ударных волн в смеси порошков меди с графитом экспериментально обнаружено ранее неизвестное новое явление, которое заключается в образовании спирально-вихревого течения вещества за головным фронтом ударной волны [61, 62]. Это гидродинамическое явление было использовано при разделении материалов на компоненты по их массам [63], и неоднократно повторялось в экспериментах [64, 65]. Экспериментально установленное явление спирально-вихревого течения вещества и его физические особенности представляют интерес для космогонии как наиболее вероятный механизм образования протозвездных и протопланетных газово-пылевых спиральных облаков и галактик. В работе [60] авторы представили гипотезу образования Земли , в том числе и ядра с учетом особенностей спирального вихря и закономерностей распределения в нем компонентов по массам. Предлагаемая концепция образования Земли и ядра планеты термоядерных реакций в ядре с теоретическими расчетами представляет собой принципиально новый взгляд на эволюцию звездных и планетных систем.

Особенностью условий образования спирально-вихревых гидродинамических течений является криволинейный фронт головной ударной волны, образованной в результате соударения у оси наклонных ударных волн (в устройствах с цилиндрической симметрией размещения элементов). Скорость фронта головной волны, движущейся вдоль оси, равна скорости детонации взрывчатого вещества, размещенного на боковой поверхности устройства. Таким образом, скорость головной волны в зависимости от типа взрывчатого вещества может быть равна 5-9 км/с, создавая давление в пористых материалах до нескольких миллионов атмосфер и температуру до нескольких десятков тысяч градусов, соответствующую температуре холодной плазмы. Скачкообразный переход вещества из области сверхвысоких температур и давлений к нормальным условиям является принципиально новым методом ударно-волновой обработки с последующей сверхскоростной закалкой вещества [66]. Этот метод был использован в процессах динамического синтеза сверхтвердых материалов, нанесения металлических покрытий с уникальными антикоррозионными и механическими свойствами, для получения аморфных сплавов и материалов.

Экспериментально установленное явление спирально-вихревого течения вещества и его физические особенности представляют интерес для космогонии как наиболее вероятный механизм образования протозвездных и протопланетных газово-пылевых спиральных облаков и галактик. В работе [60] авторы представили гипотезу образования Земли , в том числе и ядра с учетом особенностей спирального вихря и закономерностей распределения в нем компонентов по массам. Предлагаемая концепция образования Земли и ядра планеты термоядерных реакций в ядре с теоретическими расчетами представляет собой принципиально новый взгляд на эволюцию звездных и планетных систем.

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