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## New Ways of Developing Algorithms for Generating Numerical Series in High-Load Systems at the Compile Time Using the C++ Programming Language

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**Key words and phrases:** Sieve of Eratosthenes; constexpr; number series; compile-time.

**Abstract.** The study aims to demonstrate a new way of generating numerical series at the compile time in the C++ programming language. Additionally, the work seeks to study the practical usefulness of the demonstrated method. For demonstration, an increasing series of prime numbers is used as a number series, limited to the number specified at the compilation stage. The methods used are the C++ programming language standard 17, and the sieve of Eratosthenes. The novelty of the paper and the proposed method is the use of syntactic constructs from C++17, which significantly improves code support and speeds up the compilation stage in comparison with classical approaches. The results show that this is an efficient and effective way of generating a series of prime numbers at the compilation stage. Practical recommendations are given for using the presented method. The practical relevance of the method is its potential use in the basic libraries of large high-load systems to prevent typing errors or reduce the use of third-party utilities when generating numeric series. This method is also suitable for microcontrollers and high-load systems with limited resources.

### Introduction

Computing a series of primes at compile time in the C++11 or C++14 is a non-trivial task [1] that involves programming with templates in a functional style [2]. C++17 extends the functionality of compile-time tools and significantly simplifies implementation [3]. The study aims to demonstrate a new way of generating numerical series at the compile time in the C++ programming language, as well as to study the expediency of using the demonstrated method. A series of prime numbers is used as the numerical series for testing purposes.

The novelty of the paper is the use of new syntactic constructs from the C++ programming language, which were introduced in the 17th standard [3]. From a practical point of view, the

presented method can be used, if necessary, to place numerical series in the built software. In this case, the software will work with a previously known number series, saving time in comparison to creating such a series at runtime. Alternatively, software engineers can use third-party utilities to put number series into software. However, this approach entails the need for an additional compilation step and the need to implement a third-party utility that will also need to be supported. The presented method allows us not to add unnecessary compilation steps and to stay within the framework of the C++ programming language. For the demonstration, we will use the problem of generating an increasing series of primes, limited by a certain number (*limit*), which is established at the compilation stage.

### Solving the problem for the runtime

Solving the problem for the runtime is trivial (Appendix 1). But it is necessary to look at it to better understand the compile-time solution.

The solution begins with the implementation of the Sieve of Eratosthenes [4]. The implementation is located in the *get\_table* function, the result of which is a *not\_prime* vector of length *limit*. The element index is mapped to a number, and the flag is mapped to the prime number symbol. A query for the prime number *i* will look like *not\_prime[i]*; the result *false* means that the number is prime, while the result *true* means that the number is composite.

The following is an implementation of the *get\_primes* function, which iterates over the index and fills the output with primes in ascending order.

Next, an implementation of the *main* function is provided, which is necessary to check the correctness of the implementation.

### Solving the problem for the compile time

To transform the code, it is expedient to rewrite the *main* function at the beginning (Appendix 2). For the compiler to treat the *limit* constant as a compile-time constant, let us replace its *const* qualifier with a *constexpr* qualifier. For nested functions to be able to use the *limit* constant as a compile-time constant, we will pass it to the *get\_primes* function through a template parameter. In addition, we need to add the *constexpr* qualifier to the *primes* constant, since we expect the problem to be solved at compile time. Now, we can replace *assert* with *static\_assert*, since *prime* has become a compile-time constant. *static\_assert*, unlike *assert*, is capable of checking invariants at compile time.

Now, I rewrite the *get\_table* function (Appendix 3). The value of the *limit* constant will be accepted through the *Limit* template parameter; this is necessary so that we can instantiate the returned *std::array <bool, Limit>* array. For a function to be used at compile time, it must be designated as *constexpr*. It also uses *auto* as the return type, which will be equal to the type *not\_prime*, since it is returned from the function. The rest of the code is the same as the runtime code.

Next, the *get\_primes* function (Appendix 4) is implemented. The value of the *limit* constant will be accepted through the *Limit* template parameter; this is necessary so that we can send it to the *get\_table* function. The return type is also defined as *constexpr auto*. The first step in the implementation of this function is to define the compile-time constant *not\_prime*, which is obtained from the *get\_table* call. Next, we can define a compile-time constant *m*, which will be obtained using the *ranges::count* function. Further, since *m* is a compile-time constant, we can use it to declare the returned array *std::array<int, m>*. This array is then populated with regular runtime code. At the very end of the function, the result is returned, which also deduces the return type.



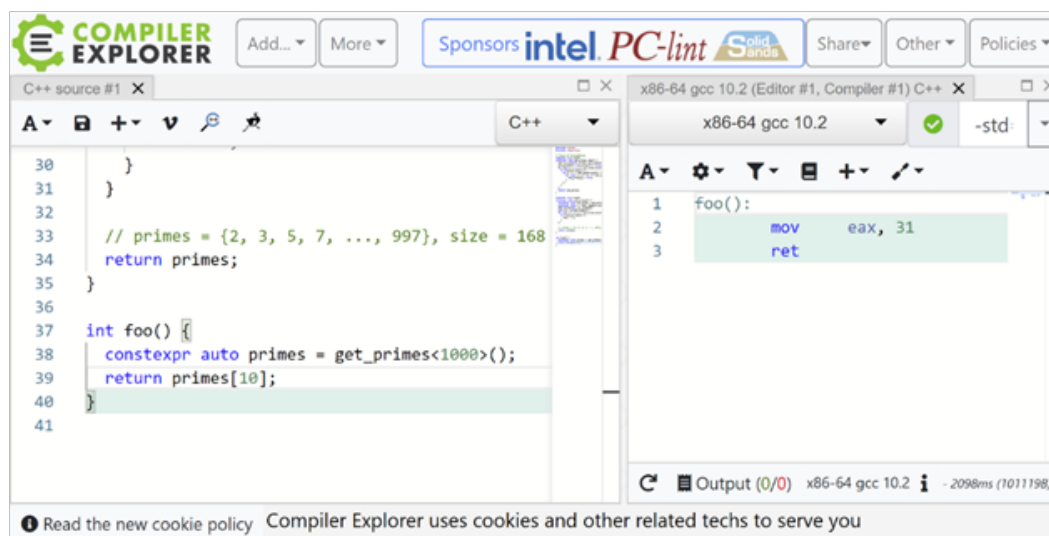


Fig. 1. Demonstration of generated machine codes

Table 1. Running times of the usual version of the algorithm

| Limit      | Running time (median, std < 5 %) |
|------------|----------------------------------|
| 10         | 272 ns                           |
| 100        | 984 ns                           |
| 1,000      | 7.058 $\mu$ s                    |
| 10,000     | 76.505 $\mu$ s                   |
| 100,000    | 439.028 $\mu$ s                  |
| 1,000,000  | 4.73507 ms                       |
| 10,000,000 | 51.6781 ms                       |

Note that the shown code is intended for C++20, since the code uses `std::ranges::count`. If it is necessary to port the code to C++17, we can define the `std::ranges::count` function ourselves (Appendix 5).

### Understanding how the compile-time algorithm works

The solution presented for the runtime will obviously generate machine code that will compute the prime table and sieve of Eratosthenes. However, the compile-time solution demonstrated will immediately embed the computation into the machine code. For example (Appendix 6), if in the compilation unit we declare the function `foo`, which will return the 10th prime number, then the compiler will inline one instruction: “return the number 31”, as in Fig. 1 below.

To demonstrate the function, the interactive resource `godbolt.org` and `gcc` version 10.2 with the compilation flags `“-std=c++20 -O3”` are used.

### Results

First, I examined the running time of the runtime algorithm. Further, the measurements will

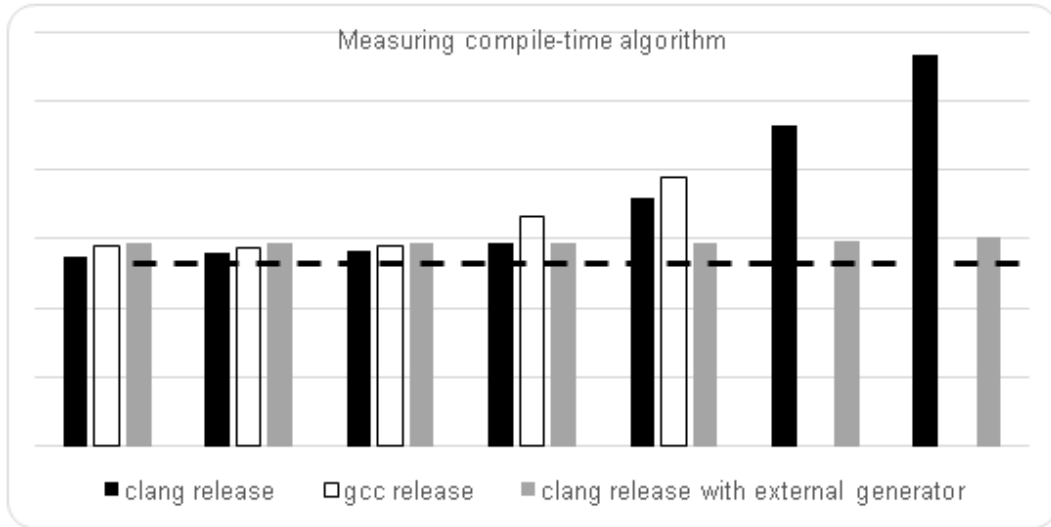


Fig. 2. Estimation of the running time of the compile-time algorithm

use an approach in which a series of 20 runs of the algorithm is performed, after which the median is taken, and the standard deviation is estimated. The table shows data with a standard deviation of less than 5 %.

From the table, it can be understood how much time the developed compilation algorithm will save, depending on the *limit* parameter. However, we need to estimate how much the compilation time increases.

Compilation time was obtained using a similar methodology, as presented above; however, due to the large standard deviation (~ 20 %), it was customary to present measurements in the form of a graph. This scatter of data can be explained by the involvement of many mechanisms during the compilation process: disk I/O operations, various data caching algorithms, etc.

Three configurations were involved in testing: clang release – compilation with the “-O3” flag using the clang version 12 compiler; gcc release – compilation with the “-O3” flag using the gcc version 10 compiler; clang release with external generator – solving a problem using an external utility that embeds the result into the code (the compilation time of the external utility is not taken into account).

The dotted line on the graph marks the approximate compilation time of one regular translation unit.

In addition, for successful measurements with *limit* = 100,000 and higher, special compilation flags are used: clang – *fconstexpr-depth*, *fconstexpr-steps*, gcc – *fconstexpr-depth*, *fconstexpr-loop-limit*, *fconstexpr-ops-limit*. These flags allow us to increase the *constexpr* computation limits.

The following conclusions can be drawn from the presented graph.

- The use of the developed method makes sense when *limit* is up to 10,000, since the compilation time deteriorates further beyond this. With *limit* = 1,000,000, clang takes 15 minutes to compile, although the runtime algorithm runs in 4.73507 ms.

- With *limit* less than 10,000, the clang compiler handles faster than the solution with an additional compilation step.

- The clang compiler handles compile-time algorithms better than gcc. In this case, gcc stops working at *limit* = 1,000,000 (due to heavy memory consumption).

Such a strong slowdown when *limit* is more than 10,000 is because the compiler executes



the code in the interpreted mode, performing all known diagnostics along the way, and checks for undefined behavior.

## Conclusions

A method of developing the generation of numerical series at the compile-time stage is demonstrated using the example of generating a series of primes in the C++ programming language. Conclusions are also made regarding the applicability of this method depending on the requested row length.

## Appendix 1

Listing of the code in the C++ programming language. Generation of a series of primes at runtime.

```
#include <vector>
#include <cassert>
// Sieve of Eratosthenes
std::vector<bool>get_table(int limit) {
std::vector<bool>not_prime(limit);
not_prime[0] = not_prime[1] = true;
for (inti = 2; i<not_prime.size(); ++i) {
if (!not_prime[i]) {
if (i * i<not_prime.size()) {
for (int j = i * i; j <not_prime.size(); j += i) {
not_prime[j] = true;
}
}
}
}
returnnot_prime;
}
std::vector<int>get_primes(int limit) {
std::vector<bool>not_prime = get_table(limit);

std::vector<int> primes;
auto it = primes.begin();
for (inti = 0; i<not_prime.size(); ++i) {
if (!not_prime[i]) {
primes.emplace_back(i);
}
}
// primes = {2, 3, 5, 7, ..., 997}, m = 168
return primes;
}
int main() {
constint limit = 1000;
```

```

auto primes = get_primes(limit);
    // in range [0, limit)
    // primes = {2, 3, 5, 7, ..., 997}
assert(primes[0] == 2);
assert(primes[1] == 3);
assert(primes[2] == 5);
assert(primes[3] == 7);
assert(primes.size() == 168);
return 0;
}

```

## Appendix 2

Listing of the code in the C++ programming language. Generating a series of primes at compile-time (1/3).

```

int main() {
constexpr limit = 1000;
constexpr auto primes = get_primes<limit>();
    // in range [0, limit)
    // primes = {2, 3, 5, 7, ..., 997}
static_assert(primes[0] == 2);
static_assert(primes[1] == 3);
static_assert(primes[2] == 5);
static_assert(primes[3] == 7);
static_assert(primes.size() == 168);
return 0;
}

```

## Appendix 3

Listing of the code in the C++ programming language. Generating a series of primes at compile-time (2/3).

```

// Sieve of Eratosthenes
template<size_t Limit>
constexpr auto get_table() {
std::array<bool, Limit>not_prime{};
not_prime[0] = not_prime[1] = true;
for (size_t i = 2; i<not_prime.size(); ++i) {
if (!not_prime[i]) {
if (i * i<not_prime.size()) {
for (size_t j = i*i; j <not_prime.size(); j += i) {
not_prime[j] = true;
}
}
}
}
}
}

```

```
returnnot_prime;
}
```

#### Appendix 4

Listing of the code in the C++ programming language. Generating a series of primes at compile-time (3/3).

```
template<size_t Limit>
constexpr auto get_primes() {
constexpr auto not_prime = get_table<Limit>();
constexpr auto size = std::ranges::count(not_prime, false);
std::array<size_t, size>primes{};
auto it = primes.begin();
for (size_t i = 0; i<not_prime.size(); ++i) {
if (!not_prime[i]) {
    *it++ = i;
}
}
// primes = {2, 3, 5, 7, ..., 997}
returnprimes;
}
```

#### Appendix 5

Listing of the code in the C++ programming language. Implementation of `std::ranges::count` for C++17.

```
template<typename Container>
constexprsize_t count(const Container& container, typename Container::value_type value) {
size_t result = 0;
for (auto& element : container) {
if (element == value) {
    ++result;
}
}
return result;
}
```

#### Appendix 6

Listing of the code in the C++ programming language. Query for the table of prime numbers. `intfoo() {`.

```
constexprint limit = 1000;
auto primes = get_primes<limit>();
return primes[10]; // Returns 31
}
```

### References

1. Weatherhead, N. Template Programming Compile Time Combinations & Sieves / N. Weatherhead [Electronic resource]. – Access mode : <https://members.accu.org/var/uploads/journals/Overload131.pdf#page=14>.
2. Meertens, L. Calculating the Sieve of Eratosthenes / L. Meertens // Journal of functional programming. – № 14(6). – P. 759–763.
3. C++ Standards Committee, 2017 // ISO International Standard ISO/IEC 14882: 2017, Programming Language C++ [Electronic resource]. – Access mode : <http://www.open-std.org/jtc1/sc22/wg21>.
4. Helfgott, H. An improved sieve of Eratosthenes / H. Helfgott // Mathematics of Computation. – 2020. – № 89(321). – P. 333–350.
5. Dolinskiy, M.S. Elementy teorii chisel: Resheto Eratosfena / M.S. Dolinskiy // Informatizatsiya obrazovaniya. – 2016. – № 1. – S. 11–20.

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### Новые способы разработки алгоритмов генерации числовых рядов на этапе времени компиляции на языке программирования C++ в высоконагруженных системах

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**Ключевые слова и фразы:** constexpr; решето Эратосфена; числовой ряд; этап времени компиляции.

**Аннотация.** Целью работы является демонстрация нового способа генерации числовых рядов на этапе времени компиляции на языке программирования C++, а также исследование вопроса целесообразности применения демонстрируемого способа. Для демонстрации в качестве числового ряда используется возрастающий ряд простых чисел, который ограничивается числом, заданным на этапе компиляции. Используемые методы: язык программирования C++ стандарта 17, решето Эратосфена. Новизна данной научной работы и предлагаемого способа заключается в использовании синтаксических конструкций из C++17, что значительно улучшает поддержку кода и ускоряет этап компиляции в сравнении с классическими подходами. Получен эффективный способ генерации ряда простых чисел на этапе времени компиляции. Даны практические рекомендации по использованию представленного способа. Представленный способ может использоваться в базовых библиотеках крупных высоконагруженных систем для предотвращения ошибок при наборе или сокращения использования сторонних утилит при генерации числовых рядов. Также представленный способ подойдет для микроконтроллеров и высоконагруженных систем с ограниченными ресурсами.

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## Identification of Effective Methods for Assessing the Risks of a Construction Company in Conditions of Uncertainty

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**Key words and phrases:** Monte Carlo method; black box method; risk; construction enterprise; construction production; Dempster-Schafer theory.

**Abstract.** The purpose of this article is to study a number of numerical group methods that can be used in the study of construction risks under conditions of uncertainty. In accordance with this goal, the following tasks were performed: the Monte Carlo, black box methods and the fundamentals of the Dempster-Schafer theory were considered. The research hypothesis is based on the assumption that using the methods discussed in the article it is possible to assess the risks of a construction enterprise, both at the planning stage and during the implementation of an investment – construction project. This allows to reduce the level of risks in an uncertain environment if has minimal knowledge about the investment and construction project and the destabilizing factors that affect it. The authors of the article used descriptive and generalizing methods, as well as the method of analysis. The results of the study showed that the methods considered contribute to an effective risk assessment in conditions of uncertainty at the initial stages of the implementation of an investment – construction project.

The problem of assessing the risks of construction production is relevant for every construction enterprise. Currently, there are a fairly large number of methods that allow for risk identification, analysis and comprehensive assessment. Some of them will be considered in this paper.

1. *The Monte Carlo Method* is a method that is used for quantitative risk analysis, including determining the level of risk of construction in progress. Also, Monte Carlo modeling is widely used to eliminate probabilistic uncertainty in the assessment of investment – construction projects [1–2].

This method uses mathematical modeling to determine the probability of changes in the main indicators of an investment – a construction project in case of possible occurrence of

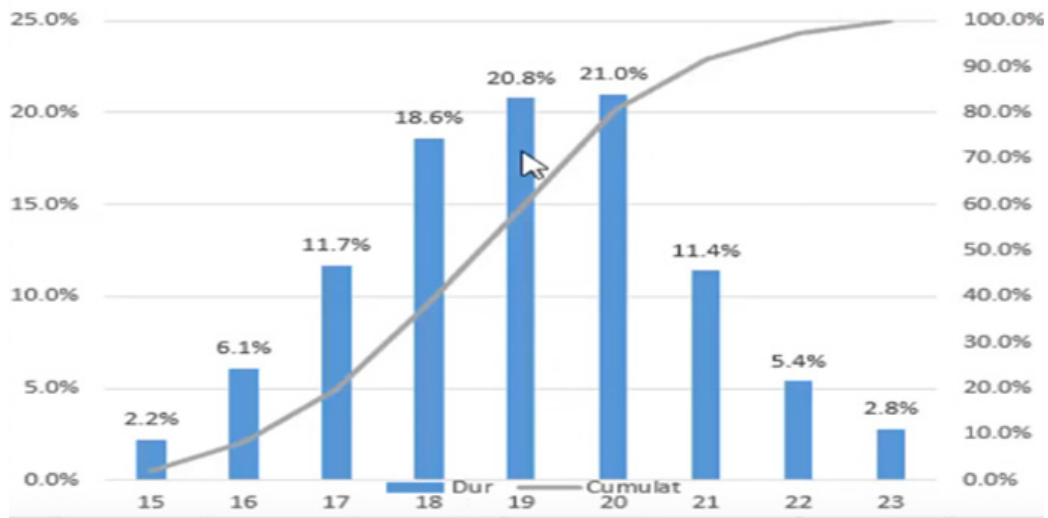


Fig. 1. Application of the Monte Carlo method in scheduling construction work

destabilizing factors. The main goal of the Monte Carlo method is a comprehensive risk assessment based on multiple modeling of scenarios for the implementation of a construction project with different sets of random values of estimated indicators. It should be noted that when modeling each new scenario, the values of all the estimated indicators change at once.

Thus, this method is based on a statistical analysis of the repeatability of the project implementation scenario using mathematical modeling in real time. The Monte Carlo simulation is performed using the appropriate software. This method allows us to analyze the stochastic parameters of the project and the level of impact of external and internal risks [3].

We consider the stages of applying the Monte Carlo method [4]:

- 1) creating a quantitative model of the form  $y = f(x_1, x_2, \dots, x_n)$ ;
- 2) selecting random variables  $x_{i1}, x_{i2}, \dots, x_{in}$ ;
- 3) evaluating the model and the output capacity of a  $y_i$ ;
- 4) repeating steps 2 and 3 as many times as necessary (for  $i = 1$  to  $k$ );
- 5) analyzing the results.

Fig. 1 shows the way Monte Carlo works by calculating the duration of each activity using a random number according to the inputs, and then calculating the critical path according to the number of activities in the project to give after that the probability of ending each activity, and this is one of the benefits of using Monte Carlo simulation to assess risk in practical scheduling with an increasingly complex and rapidly changing construction.

The advantages of the Monte Carlo method are as follows [5]:

- it allows assessing the risk of the project;
- it allows making a forecast regarding the occurrence of possible adverse situations, the appearance of losses;
  - risks are expressed in numerical terms, which makes it easier to assess their impact on the results of construction production activities;
  - it allows forming a realistic budget and determine the most optimal order of work;
  - it facilitates the process of risk management;
  - it allows making management decisions based on objective data;
  - it allows determining the probability of achieving the project goals.

Despite the fact that the Monte Carlo method increases the chances of successful

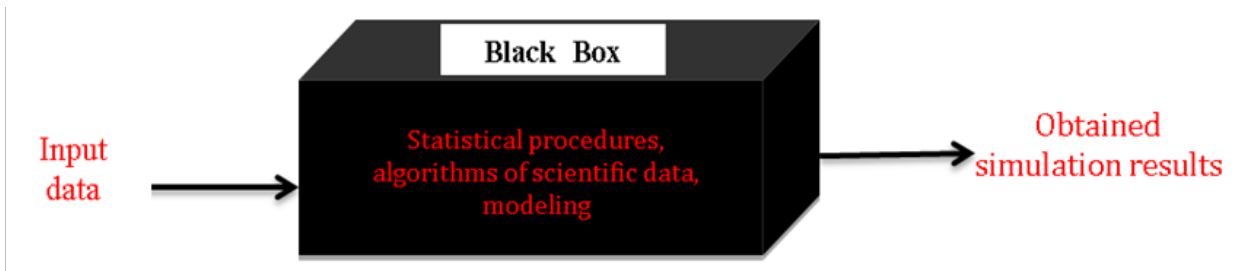


Fig. 2. Black box model

implementation of a construction project within the approved baseline indicators, it is rarely used in assessing the risks of small and medium-sized construction projects [5; 6].

The disadvantages of the method include:

- 1) the complexity of collecting the necessary amount of statistical data: the lack of necessary information leads to model errors [7];
- 2) problems with the choice of variable distribution functions that are used in calculations;
- 3) the complexity of creating mathematical models;
- 4) the problem of correlation of variables, which can lead to misleading conclusions;
- 5) accuracy of the solution depends on the number of iterations that can be performed;
- 6) the method could not adequately simulate the events with very high or very low probability of occurrence [8].

2. *Black box method* used when working with complex systems. With this analysis, it is not required to have information about the internal structure of the system, its elements and connections between them. Black box testing is performed by testers, while they examine the system, having only the input (impact on the environment of the system) and output (impact of the system on the environment) data about it. Therefore, the control point and the observation point are outside the internal structure of the system (Fig. 2).

A significant advantage of conducting research using the black box method is that it avoids bias in the assessment of random experts and influences the course of research by stakeholders. Independent experts separately develop solutions to the set scientific and technical hypotheses and transmit them to the analytical center, which draws up a conclusion based on the presented developments.

3. *Dempster-Schafer theory (DS)* of evidence considers a set of assumptions (hypotheses) and assigns to each of them a probability interval of uncertainty (likelihood), which belongs to the degree of confidence in each assumption.

The main probability assignment or mass function (confidence measure) is a function represented as  $2\Theta$  in the interval  $[0; 1]$ , so that  $m\{\Theta\} = 0$ , where  $\Theta$  is an empty set and

$$\sum m(A) = 1.$$

In the DS theory, Dempster's combination rule is symbolized by the operator  $\oplus$  and is used to combine two different sources of evidence. This operator can be used to combine two proofs like  $m_1$  and  $m_2$ :

$$m_{1,2}(A) = (m_1 \oplus m_2)(A) = \frac{\sum B \cap C \{m_1(B).m_2(C)\}}{1 - K},$$



where  $A \neq \emptyset$  and  $m(\emptyset) = 0$ ;  $K$  is the balancing factor.

It is also called a contradiction factor, because it indicates the degree of contradiction between two sources of evidence:

$$K = \sum_{B \cap C = \emptyset} \{m_1(B) \cdot m_2(C)\},$$

where  $\oplus$  – a combination of two mass functions;  $B$  – first value of mass;  $C$  – second value of mass.

The application of the Dempster-Schaefer theory is most appropriate in the case of heterogeneity of the available information and a priori uncertainty of the data [9–10].

It should be taken into account that based on the available a priori information during the application of the DS an inaccurate conclusion can be made. However, the use of preliminary information in the DS method is optional. This is one of the advantages of the method. In addition, the DS theory allows establishing the relationship of the available uncertain indicators with the final results. Unlike the Bayesian method, the application of the DS theory does not require the calculation of the previous probability. The theory has a flexible and understandable mass function [11; 12], which is easy to create. The computational complexity of this method is much less than that of other methods.

Another feature of the DS theory is that confidence and likelihood measures are a special case of interval probabilities. The confidence measure is the lower probability, and the likelihood measure is the upper probability defined on nested intervals. This allows constructing a distribution function of trust and interpret it [9–13], as well as make decisions based on expert assessments of alternatives by criteria.

The application of the methods studied in this article contributes to a comprehensive risk analysis with a combination of qualitative and quantitative approaches in conditions of uncertainty. There are many factors influencing the choice of one or another method for assessing construction risks, including the degree of complexity of the calculations, the quality and readability of the results obtained, the degree of adaptation to a specific problem. Herewith, in each individual case, it is necessary to consider the possibility of using several risk assessment methods simultaneously.

## References

1. Sadeghi, N. Fuzzy Monte Carlo simulation and risk assessment in construction / N. Sadeghi, A.R. Fayek, W. Pedrycz // *Computer-aided civil and infrastructure engineering*. – 2010. – Vol. 25. – No. 4. – P. 238–252.
2. Abramov, I.L. Predicting the sustainability of construction companies under uncertainty / I.L. Abramov, Z.A.K. Al-zaidi // *Components Scientific and Technological Progress*. – 2020. – No. 8(50). – P. 5–8.
3. Tregub, I.V. Dinamika potrebitelskogo povedeniya na rossiyskom rynke informatsionno-kommunikatsionnykh tekhnologiy / I.V. Tregub // *Upravlencheskie nauki v sovremennoy Rossii*. – 2014. – T. 2. – No. 2. – S. 42–46.
4. Zhaoni Kong. Risk assessment of plan schedule by Monte Carlo simulation / Zhaoni Kong, Jianping Zhang, Chao Li // *International Conference on information technology and management innovation*, 2015. – P. 509–513.
5. Fahimeh Allahi. A stochastic risk analysis through Monte Carlo simulation applied to the

construction phase of a 600 mw gas turbine plant / Fahimeh Allahi, Lucia Cassettari, Marco Mosca // Proceedings of the International Conference on modeling and applied simulation, 2017. – P. 136–143.

6. Abramov, I.L. Analiticheskiy instrumentariy dlya analiza ustoychivosti stroitelnykh predpriyatiy / I.L. Abramov // Stroitelnoe proizvodstvo. – 2019. – No. 2. – S. 9–12.

7. Strakhova, N.A. Kharakteristika naibolee ispolzuemykh metodov analiza riskov / N.A. Strakhova, S.A. Karmazin // Naukovedenie. – 2013. – No. 3. – S. 1–7.

8. GOST R ISO/MEK 31010-2011. Menedzhment riska. Metody otsenki riska. – M. : Standartinform, 2012. – S. 74.

9. Desmond Adair. Application of evidence theory to construction projects / Desmond Adair, Martin Jaeger // The International Journal of the Constructed Environment. – 2014. – Vol. 4. – P. 25–34.

10. Abramov, I.L. Formation of a Model to Assess Risk Factors Affecting Sustainable Functioning of Construction Enterprises / I.L. Abramov, A.K. Al-zaidi Zaid // Components Scientific and Technological Progress. – 2020. – No. 7(49). – P. 15–24.

11. Gantseva, E.A. Statisticheskiy podkhod razresheniya neopredelennosti ekspertnykh suzhdeniy na osnove teorii sluchaynykh mnozhestv / E.A. Gantseva, V.A. Kaladze // Vestnik VGU. Seriya: Sistemnyy analiz i informatsionnye tekhnologii. – 2015. – No. 2. – S. 82–88.

12. Hatefi, S.M. An evidential model for environmental risk assessment in projects using Dempster-Shafer theory of evidence / S.M. Hatefi, M.E. Basiri, J. Tamošaitienė // Sustainability. – 2019. – Vol. 11. – No. 22. – P. 6329. – DOI: 10.3390/su11226329.

13. Abramov, I.L. Identification and assessment of risk factors during planning the production activities of a construction enterprise / I.L. Abramov, A.K. Al-zaidi Zaid // Components Scientific and Technological Progress. – 2020. – No. 7(49). – P. 25–29.

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### **Исследование методов для оценки рисков в условиях неопределенности планирования строительным производством**

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**Ключевые слова и фразы:** метод Монте-Карло; метод черного ящика; риск; строительное предприятие; строительное производство; теория Демпстера-Шафера.

**Аннотация.** Цель настоящей статьи заключается в изучении ряда методов, которые могут быть использованы при исследовании строительных рисков в условиях неопределенности. В соответствии с поставленной целью были выполнены следующие задачи: рассмотрены методы Монте-Карло, черного ящика и основные положения теории Демпстера-Шафера. Гипотеза исследования заключается в предположении, что при помощи рассмотренных в статье методов можно проводить оценку рисков строительного производства как на этапе планирования, так и в процессе реализации инвестиционно-строительного проекта. Это позволяет при наличии минимальных знаний об инвестиционно-строительном проекте и оказывающих на него влияние дестабилизирующих факторах снизить уро-

вень рисков в условиях неопределенности. Авторы статьи использовали описательный и обобщающий методы, а также метод анализа. Результаты исследования показали, что рассмотренные методы способствуют эффективной оценке рисков в условиях неопределенности на различных этапах реализации инвестиционно-строительного проекта.

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UDK 334

## The Growing Role of the Information Component of Economic Security in the Context of the Formation of New Economy

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**Key words and phrases:** informatization; information technology; information threats; economic security.

**Abstract.** The purpose of the article is to identify trends in the influence of the information component on the economic security in the context of the formation of a new economy. The objectives are to determine the main elements of the influence of the information component, the presentation of the dual influence of information factors on economic security, the demonstration of data in dynamics, proving the strengthening of the negative factors of the information component of economic security, the description of protection measures against information threats. The research hypothesis is as follows: the degree of influence of the information component in terms of threats on economic security will increase with the development of information technologies.

The beginning of the twenty-first century was marked by a transition to a new direction of economic development. The growing role of knowledge, innovative technologies, intellectualization of labor, the spread of computer technologies and communication networks were catalysts for the transformation of the existing system. The changes that have occurred in this regard in socio-economic processes have led to the formation of a new economy.

Today, the economic potential of any state largely depends on the quality of the elements of the information structure. The economy is becoming more vulnerable to information threats. Therefore, the problem of ensuring economic security in the context of the formation of a new economy, which is directly interconnected with information security, is becoming increasingly acute.

The theoretical foundations of information security began to form relatively recently; therefore they do not have a coherent structure. In scientific sources, the tasks of information security and the implementation of information technologies are defined by both humanitarian and technical directions. If the technical approach is aimed at the software component and the technical side of information security, then the humanitarian approach studies information security in an interdisciplinary context.

The effectiveness of the information component of economic security is determined by the

procedure for the mutual exchange of information of the internal economic complex of the state, as well as with foreign agents.

The development of informatization determines the development potentials of the entire civilization. This transformation is causing revolutionary changes in technology, society, economics and political agendas around the world, with observable consequences within a generational time frame.

Over the past 40 years, there has been an explosion in digital goods and services: Google, Facebook, LinkedIn, Skype, Wikipedia, online courses, maps, messaging, music, and all other smartphone apps. Since many internet services are free, they are not counted in official economic activity indicators. Studies show that there has been a significant increase in welfare that is overlooked by traditional economic indicators such as GDP or labor productivity [1].

It can be concluded that information factors influence economic security both positively and negatively. There is no doubt that the process of continuous development of information technology leads to an increase in efficiency in the use of economic resources, and this leads to economic growth. In addition, thanks to the latest information technologies, a better management of processes in society is achieved, which makes it possible to improve the quality and standard of living, which leads to an improvement in macro- and microeconomic indicators. There is also a direct impact on a number of important indicators of economic security, the result is an increase in its level.

At the same time, information technologies themselves generate threats to economic development, which are different in composition, consequences, nature of influence, as well as reasons for their occurrence. These threats negatively affect economic security at all levels of economic agents: the state, the society, the enterprise, and the individual. More and more threats and problems associated with new technologies of informatization are being identified. Consequently, an important problem of ensuring economic security in the information sphere is on the agenda.

By controlling the flow of information, controlling its delivery, in the new economy, one can influence the course of economic processes. That is why today's technologies of economic struggle are moving from traditional zones to information-network or cyberspace, which is the reason for the emergence of the theory and practice of information wars.

In the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030 [2], telecommunications and information technologies are identified as important components of the national infrastructure. The goal of developing an information society is to build a knowledge society and create a digital economy in Russia.

The main indicator characterizing the level of the information component of the country's economic security is the volume of expenditures on scientific research as a percentage of GDP. In 2018, in our country, this indicator was 1.1 %, which is shown in Fig. 1, and in terms of the share of spending on science in GDP, Russia is significantly inferior to the leading countries of the world and is in 34th place [3].

According to the conclusions of the expert and analytical report of 2020 [4] to determine the main reasons hindering scientific development in the Russian Federation: "This area remains insufficiently productive, does not form its own scientific and technological basis for creating and implementing priorities, responding to "big challenges" facing society and the state does not act as a driver for socio-economic development".

Over the past decade, many regulatory documents and standards have been developed that include approaches and methodologies in risk management, interrelated with the increase in information threats.

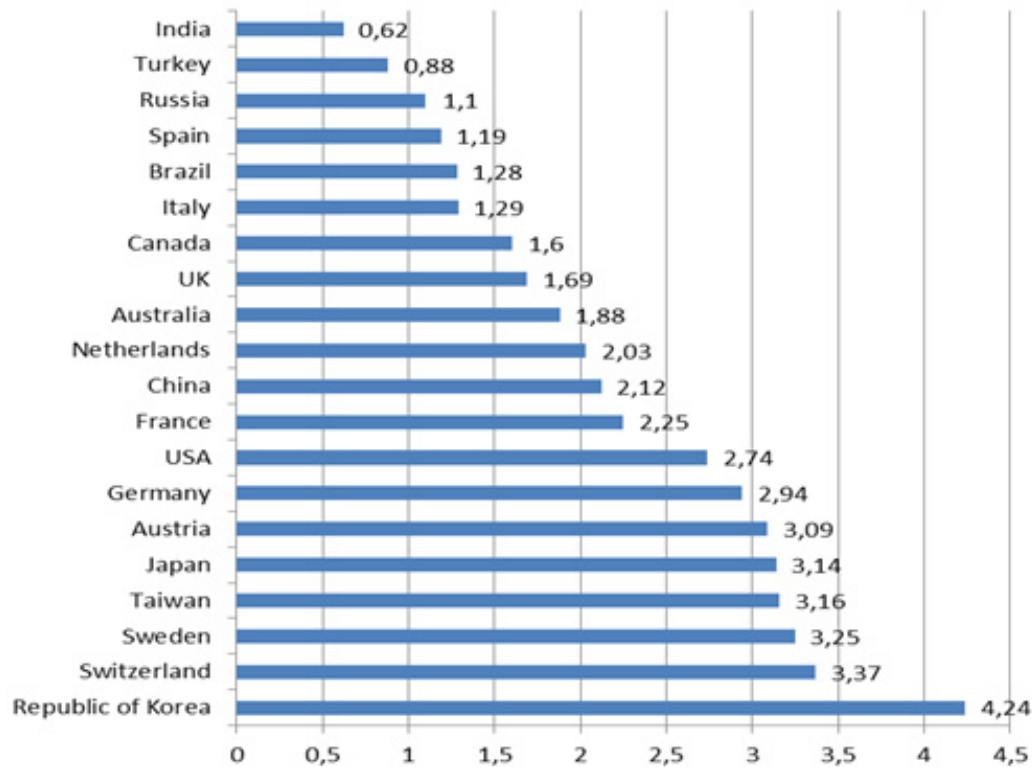


Fig. 1. The volume of spending on research in % of GDP for 2018 [3]

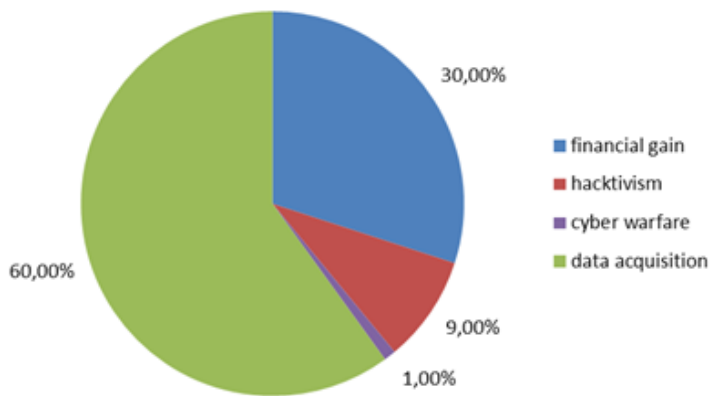
For example, global practices in information security risk management are declared in ISO / IEC 27005, NIST 800-30, ITIL, COBIT, OCTAVE, etc. There are many classifications of threats, however, most often as foreign (Harmonized Threat and Risk Assessment Methodology, CSE) and Russian standards (GOST R ISO / IEC 1335-1-2006) most often the threats are systematized according to the nature of their occurrence: environmental threats (natural) and threats associated with the human factor. The peculiarity of these types of threats is that they cannot be predicted.

Information security is an important priority of any business in the new economy, since many companies go bankrupt due to negative processes in this area. Today, the introduction of high information technologies in the activities of companies is a guarantee of significant competitive advantages, but at the same time there are threats of theft, leakage, distortion, blocking, forgery, copying, destruction of information, which means causing economic, social or other types of damage. Therefore, every year the issue of finding ways to reduce damage from information threats is becoming more acute on the agenda of business, society and the state.

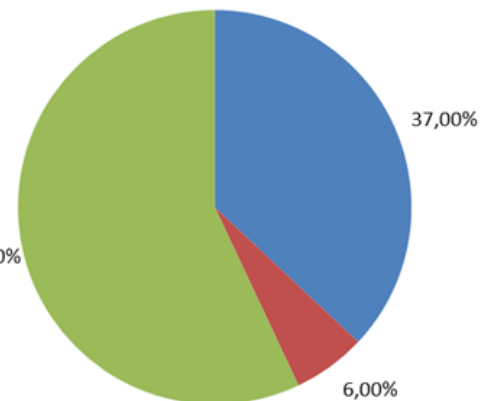
The purpose of information security is to identify possible threats to information security, determine the consequences and potential damage, as well as provide protection means and assess their effectiveness.

Information is not a material object, it is itself a property of matter, therefore its measurement parameters are different from material objects. Information differs from data in that it does not depend on the medium, but on the method of information processing and is always stored in an encoded form. The cost of an information resource is determined by its owner (International Standard for Information Security ISO 27001, ISO 17799), but in the Russian Federation the cost of information is not determined by any law. The cost of state information can also be





**Fig. 2.** Cyber-attacks by types of legal entities



**Fig. 3.** Cyber-attacks by type of individuals

determined indirectly, by the classification of secrecy for different levels of information.

Today information superiority is the source of economic dominance. The information warfare mechanism consists of a group of specialized methods and tools designed to control information resources and disable (temporary or irrevocable) information infrastructure or certain elements of it.

According to Positive Research's 2020 annual survey [5], the number of cyber-attacks in 2019 increased from quarter to quarter and by the end of 2019 exceeded the number of attacks in 2018 by 19 %. Most often, government agencies, industry, medicine, science and education, and the financial industry were subjected to cyber-attacks. These industries accounted for more than half of all cyber-attacks against legal entities (54 %). The share of attacks on industrial companies increased to 10 % against 4 % in 2018. Of greatest interest to the attackers were personal data, accounts and bank card data. The total number of malware infections in 2019 was 38 % higher than in 2018. In 2019, the share of attacks aimed at stealing information from legal entities was 60 %. Significant changes affected the motivation of attackers in attacks against individuals: 57 % of attacks were aimed at stealing data, while in 2018 the same indicator was only 30 %, Figs. 2 and 3 show data for 2019. In general, the main motive for cyber-attacks in 2019 aimed at organizations and individuals is information theft.

The growing negative trends in informatization have led to a response from all economic agents. To eliminate emerging threats at the international and state levels, active development is underway.

In conclusion, we can say that in the new economy today, it is not possible to achieve effective economic growth without the use of information technologies. The use of new information technologies in all sectors and spheres of the economy is an undoubted blessing.

However, the processes of development of the informatization of the economy present both new opportunities and new threats. Today it is impossible to stop or reverse the processes of informatization, they are integral elements of developing systems. Effective management of information technologies requires the efforts of the international community, state and society.

## References

1. Brynjolfsson, E. How Should We Measure the Digital Economy? / E. Brynjolfsson, A. Collis // Hutchins Center Working Paper # 57. – January 2020 [Electronic resource]. – Access



mode : [https://www.brookings.edu/wp-content/uploads/2020/01/WP57-Collis\\_Brynjolfsson\\_updated.pdf](https://www.brookings.edu/wp-content/uploads/2020/01/WP57-Collis_Brynjolfsson_updated.pdf).

2. Strategiya razvitiya informatsionnogo obshchestva v Rossiyskoy Federatsii // Sistema GARANT [Electronic resource]. – Access mode : <http://base.garant.ru/182535/#ixzz6dDYOWQDU>.

3. Gokhberg, L.M. Indikatory nauki-2019 : statisticheskiy sbornik / L.M. Gokhberg, K.A. Ditkovskiy, E.L. Dyachenko i dr.; Nats. issled. un-t Vysshaya shkola ekonomiki. – M. : NIU VSHE, 2019. – 328 s.

4. Izotova, G.S. Otchet o rezultatakh ekspertno-analiticheskogo meropriyatiya «Opredelenie osnovnykh prichin, sderzhivayushchikh nauchnoe razvitie v Rossiyskoy Federatsii: otsenka nauchnoy infrastruktury, dostatochnost motivatsionnykh mer, obespechenie privlekatelnosti raboty vedushchikh uchenykh» / G.S. Izotova [Electronic resource]. – Access mode : <https://ach.gov.ru/checks/9658>.

5. Sbornik issledovaniy po prakticheskoy informatsionnoy bezopasnosti Positive Research, 2020 [Electronic resource]. – Access mode : <https://www.ptsecurity.com/ru-ru/research/analytics/positive-research-2020>.

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### **Возрастание роли информационной составляющей экономической безопасности в условиях формирования новой экономики**

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**Ключевые слова и фразы:** информатизация; информационные технологии; информационные угрозы; экономическая безопасность.

**Аннотация.** Целью статьи является определение тенденций влияния информационной составляющей на экономическую безопасность в условиях формирования новой экономики. Задачами следует считать определение основных элементов влияния информационной составляющей, представление дуального влияния информационных факторов на экономическую безопасность, демонстрацию в динамике данных, доказывающих усиление негативных факторов информационной составляющей экономической безопасности, описание мер защиты от информационных угроз. Гипотеза исследования: степень влияния информационной составляющей в плане угроз на экономическую безопасность будет нарастать по мере развития информационных технологий. Для доказательства гипотезы использованы методы дедуктивного анализа и синтеза, сравнения и моделирования. В результате исследования гипотеза была подтверждена.

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## Organizational and Economic Mechanisms to Increase the Efficiency of Energy Integration among Countries

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**Key words and phrases:** energy system; integration; energy strategy; cross-border solutions; common electricity market.

**Abstract.** Cross-country integration of national energy systems aimed at increasing the efficiency of cross-border solutions is considered to be a particularly important area in terms of ensuring the safety of the functioning of energy spaces. However, the implementation of such projects in practice is accompanied by various problems and difficulties. The purpose of the article is to consider the organizational and economic mechanisms to increase the efficiency of energy integration between countries. In accordance with this goal, the following tasks were solved: a review of the world experience in the integration of energy systems was carried out, the main methodological aspects of the process of energy integration between countries were highlighted and an analysis of the results obtained was carried out as well. The hypothesis of the article is the assumption that a systematic approach is required in order to increase the efficiency of energy integration. Integration is a strategic vector, therefore, unlimited opportunities for interaction between countries will appear with common decision that making in one direction. To achieve this objective, research methods such as data collection and analysis, synthesis, observation, comparison and comparison were used. The result of the work is the identification of prerequisites for the further development of the process of cooperation in the energy sector using the example of the Eurasian space and increasing the efficiency of international energy integration, despite the complications caused by the impact of economic and social or political factors.

Over the past 2019 and unpredictable 2020 years, the situation has changed, the priorities of integration for Russian companies remain, but they have shifted to the East. This does not mean abandoning collaborative work with Western partners, that is why we are returning to the

topic of integration, especially in the context of the recession in Russia and the difficult situation in other countries. Now this industry and many others requires large investments. According to the European Commission analysis, only for the creation of a common energy market, namely the construction of high-voltage grids, by 2020 more than 140 billion euros are required.

Cross-country energy integration is mutually beneficial projects of the world's largest companies and countries, the organization of parallel, synchronous operation of energy systems, uniform rules and principles of technical regulation. One of the integration elements is the export of electricity. At the moment the export of electricity from Russia is 15 million kWh per year. These are mainly east and northwest directions.

Mechanisms within the framework of Russia's energy integration are as follows:

- working with the countries of the former USSR in the restored synchronous mode;
- strengthening the Eurasian Economic Union, which includes five countries (Russia, Belarus, Kazakhstan, Kyrgyzstan, Armenia);
- enhancing cooperation with the countries of the European Union;
- improving energy cooperation with East Asia; this integration is now in an active stage of implementation. A single energy ring with South Korea, Japan, Mongolia and China; new projects for the construction of direct current lines; construction of a 50 GW wind farm and others.

Actions such as integration and consolidation are highly reliable and cost effective for the network infrastructure. It is known that more than two hundred integration projects are being implemented in Europe. For example, the Bulgaria-Greece project is a serious energy ring, a good example of the reliable operation of two energy systems.

There is no doubt that the most important thing in integration is the trust of consumers, partners and business. Integration processes begin with this.

Long-term planning, tariff regulation and integration help to reduce the costs of implementing large projects: each national power system leaves 25–50 % of its own generation as a reserve. A decrease in the volume of these reserves will make it possible to direct funds for the modernization of generation and the grid complex. This architecture requires completely different approaches.

China is investing heavily in network infrastructure development. It should be noted that China is integrating in two main areas: high-voltage and ultra-high-voltage transmission systems and the creation of a unified energy network. By 2018, energy companies had invested \$ 73 billion in the construction of thirteen transmission lines, five of which will be ultra-high voltage with a total length of 70 thousand km. Then the energy system will be almost completely covered with ultra-high voltage lines. China shares the corresponding technologies with other countries [1].

Controversial issues always arise during the operation of an energy system that unites several countries. For example, some countries receive more funding, others less. How are such issues resolved in the European Union, what priorities exist in a particular country and what new projects contribute to integration? Funding and use of funds within the EU are determined by EU regulators. There are also regulators in each country that determine transit tariffs, which include the costs incurred by the country building the infrastructure.

Changes in the energy industry occur quite suddenly. Firstly, there is a transformation of society, people begin to produce energy locally. If it can be understood what benefit can be derived from it, it will lead to a positive effect. For example, digital networks can provide this functionality. Italy has a fully integrated digital network - 600 thousand small power plants, they take some capacity off the market, but at the same time give flexibility. The transformation

occurs both under the general influence of the economy, mentality, and under the influence of an external force - technological development. Today we are talking about broadband, optical fiber, and this is done as part of the network, because the networks serve the same customers and by working together, countries can reduce the costs. All these are elements of integration.

The reliability of the electricity supply, the financial availability of energy and the environmental friendliness are very important for the end user. Each country has its own rules and often do not contradict the rules of another country. Long-term investments require a stable legal environment. Many technologies are currently being developed, and in terms of international development, countries can benefit from this cooperation.

Electricity transmission systems at the level of ultra-high voltage technologies – breakthrough technologies. An example is the project that connects the power systems of Norway and Germany – NordLink. The latest technological advances are used there. The project operates according to the rules of the EU. Many companies work on it and this guarantees the energy security of both countries. At the same time, the project is being integrated into renewable energy sources, solar sources are involved here. This project shows that if there is a good legal basis, then the parties can effectively cooperate and provide integration that solves a huge variety of problems at the same time.

West-East-Russia is a good direction of cooperation and a reason for further strengthening the reliability and availability of energy resources, confidence of the consumer and economic benefits of all participants on a new basis. Currently there are various integration associations such as the European Union (EU), the Common Market of the Southern Cone Countries (MERCOSUR), the North American Free Trade Agreement (NAFTA) and others. There is a huge integration potential for the gas industry in the integration association (APEC), for natural gas in the EAEU [2].

Depending on the depth of the declared integration goals, there are the following mechanisms to increase the efficiency of energy integration between countries. This can be a set of measures to eliminate tariff and non-tariff barriers between countries, coordinate and harmonize regulatory, commercial and technical policies and standards. As a rule, this is the simplification of customs procedures in the mutual trade of energy resources, the granting of national business entities, on the basis of reciprocity, the priority right of access to energy resources, infrastructure, markets and consumers of integrating countries. In addition, the coordination of indicative balances of gas production and consumption, coordination of investment activities and subsidies policy, pricing principles and tariff methodology is carried out. It is necessary to carry out a lot of work to harmonize the rules for gas supply, technical requirements for the quality of services provided. Specialized regulatory bodies play a key role in these activities.

The countries of the Eurasian Union signed an agreement to create a common electricity market during this summer, expected timing the launch of which – 2024–2025. The Eurasian Economic Commission believes that the common market will have a positive effect on the pricing and energy security of the Union states, but many more issues need to be settled.

One of the basic and the most controversial areas of integration within the EAEU continues to be the formation of common markets for electricity, gas, oil and oil products, designed to ensure the even energy development of the Union member states. It can be argued that the future of the common Eurasian economic space depends on the successful energy integration of countries. Since if there are common principles and rules for the functioning of energy systems, models of national markets that are similar and easily adaptable to each other only then we can talk about long-term integration as a whole [3].

The thesis that in the context of growing energy intensity of national economies common

energy markets should become the engines of the integration process in the EAEU, is an integral part of the official rhetoric of all members of the Union. However, this does not prevent the bearers of the same rhetoric sometimes take an extremely skeptical position, while considering the formation of common markets.

Initially, the EAEU negotiated the formation of a single electricity market, but the epithet “single” was changed to “common” in 2016, that indicated the readiness of the member states to follow the path of integrating energy systems while maintaining the structural features of national markets.

The formation of a common electricity market assumes that members of the Union will be able to purchase electricity both under bilateral contracts and within the framework of centralized bidding. A special electricity stock market will be formed for this reason. At the same time, a general analysis of the national energy systems of the EAEU member states shows the presence of a very low demand for electricity imports. At the moment there is a certain deficit only in Belarus, that will soon be covered with the launch of two units of the BeINPP (2400 MW) in 2020 and 2021, which will allow Minsk to act as an exporter of electricity with a focus, in particular, on the Baltic markets.

The electricity industry is developing dynamically in Kazakhstan, and the country aims to reach the level of complete self-sufficiency in the coming years. At the same time, it is planned to provide up to 50 % of electricity generation from renewable sources by 2050. This direction will allow starting the development of export strategies towards Asian markets [5]. In Russia, generating capacities are also excessive and are many times higher than the rest of the EAEU members combined, that also indicates an export-oriented energy sector. Russia is one of the largest exporters of electricity, annually supplying up to 18 billion kWh of energy abroad.

The formation of a common market for oil and oil products, first of all, supposes the demonopolization of national markets [3].

In conclusion, there are various mechanisms to improve the efficiency of energy integration between countries. Taking into account the current difficult political and economic situation in the world, it can be concluded that strengthening cooperation in the energy sector in the Eurasian space is one of the main strategic interests of the countries. The main obstacle to the formation of a common energy market is the lack of a common vision of the liberalization of national markets among the member states – an important condition for the implementation of the integration project.

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## References

1. Zhang, N. A Novel Inter-Country Integrated Power Generation-Transmission Expansion Planning Model: Case Study on North-East Asia / N. Zhang; State Grid Energy Research Institute, October 2018.

2. Zemskova, K. The common energy market of the Eurasian economic union, Implications for the European Union and the role of the Energy Charter Treaty (ECT) / K. Zemskova; Energy Charter Secretariat, 2018.

3. Westphal, K. Eurasian Economic Union Integrates Energy Markets – EU Stands Aside / K. Westphal, M. Pastukova; German Institute for International and Security Affairs, 2018.

4. Perović, J. Russia's Turn to Eurasia / J. Perović. – Center for Security Studies

(CSS), 2018.

5. Eurasian Economic Commission [Electronic resource]. – Access mode : <http://www.eurasiancommission.org>.

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**Организационно-экономические механизмы  
повышения эффективности энергетической интеграции между странами**

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**Ключевые слова и фразы:** интеграция; объединенный электроэнергетический рынок; трансграничные решения; энергетическая система; энергетическая стратегия.

**Аннотация.** Межстрановая интеграция национальных энергосистем, направленная на повышение эффективности трансграничных решений, считается особенно важным направлением в отношении обеспечения безопасности функционирования энергетических пространств. Однако реализация таких проектов на практике сопровождается различными проблемами и сложностями. Целью статьи является рассмотрение организационно-экономических механизмов повышения эффективности энергетической интеграции между странами. В соответствии с поставленной целью были решены следующие задачи: проведен обзор мирового опыта интеграции энергетических систем, выделены основные методологические аспекты процесса энергетической интеграции между странами и проведен анализ полученных результатов. Гипотезой статьи является предположение о том, что для повышения эффективности энергетической интеграции необходим системный подход, интеграция – это стратегический вектор, следовательно, безграничные возможности взаимодействия стран появятся при совместном принятии решений в одном направлении. Для достижения поставленной задачи были использованы такие методы исследования, как сбор и анализ данных, синтез, наблюдение, сравнение и сопоставление. Результатом работы является выявление предпосылок для дальнейшего развития процесса сотрудничества в энергетике на примере евразийского пространства и повышения эффективности международной энергетической интеграции, несмотря на осложнения, вызванные воздействием экономических и социально-политических факторов.

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## Main Consumer Trends in Retail in the Context of Coronavirus

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**Key words and phrases:** retail trade; entrepreneurship in the context of pandemic; adaptation of trade to the conditions of pandemic; main trends in the development of retail trade.

**Abstract.** The article deals with the features of retail trade development in the context of a pandemic. The purpose of this study is to identify the main trends in the development of retail trade and the specifics of changes. The hypothesis of the study is that there will be a transformation of consumer behavior and retail will respond to this by using new technologies of sales and interaction with customers. The main research methods in the article are the comparative research method and the analysis of scientific literature. Based on the results of the study, the authors concluded that the majority of customers have changed their lifestyle and decreased consumption, as a result of which there was redistribution between trade formats, resulting in the customers' moving online, and leading to an increase in online trading.

Coronavirus is the main factor affecting consumer behavior today. Under the pressure of circumstances, they changed their consumption habits and criteria for choosing stores and sales channels. How will the buyer act in the near future? What should businesses prepare for?

The quarantine factor from March to September 2020 significantly affected consumer behavior – 32 % of buyers noted that they were affected by the coronavirus both in terms of health and finances. Our life is firmly established concern for safety – masks and sanitizers. And if masks are a forced measure, sanitizers are a more conscious purchase, and hand sanitizer can be found in every 10 shopping cart. And 29 % of customers say that they use antiseptic at the point of sale. HoReCa segments and the vending business were severely affected by the coronavirus. 37 % of consumers do not visit public catering establishments, and 44 % do not use coffee machines at gas stations. The main reason is that it is not safe, the buyer feels the risk of infection with a virus. A similar situation occurred in the vending segment – sales of snacks and beverages fell by 60–80 %, but the demand for bottled water and milk (+20 %), as well as personal protective equipment increased.

Customers were more likely to focus on the price: an increasing proportion of private label, discounters and promotional sales. Significant changes have taken place in the business climate



[1, p. 32].

There was a drop in the level of wages for almost all categories of citizens [2]. During the pandemic, the share of the chain's own brands has grown – 8 out of 10 customers buy STM because of the good price-quality ratio. Over the past year, analysts have noted a growing trend in the share of private labels.

In Europe, the share of discounters is growing, in Russia, players are also actively investing in this channel, and a significant number of buyers have appeared who position themselves as low-price stores and win customer loyalty. Fix Price network, “Da!” are ready to recommend 46 % of customers, discounter “Pobeda” – 43 %, “Mayak” – 42 %, “Svetofor” – 41 %.

The share of promo sales is growing: 46 % of consumers made purchases at a new point just for the sake of promotions and discounts. At the same time, the customers are looking for promos both offline (+34 %) and online (+32 %), which was not observed a year ago. For purchases, 62 % of customers use both sales channels, and 38 % continue to buy only in physical stores.

As a result, the share of online trading is growing. Before coronavirus, 59 % of key FMCG retailers developed their online stores and 21 % partnered with marketplaces. As of September, 76 % of retailers went online, and 48 % began selling their products through marketplaces and delivery services. The fact that the industry is actively investing in an online channel suggests that remote sales will continue to grow rapidly.

The motive for choosing a particular purchase channel has also changed. They go to a physical store out of habit (36 % of customers) to take a walk or leave the house (27 %). The online channel is chosen for a wide range of products (37 % of customers), saving time (35 %) and not wanting to stand in line (34 %).

And they also go online for the sake of purchasing for the future.[3] By the way, large purchases in the FMCG sector are not new to the market, but it is also developing in a new paradigm, there has been a noticeable redistribution between points – buyers are more often purchased in online stores, discounters and “at home” stores, and not in large formats, hypermarkets as it was before. The buyer also changed the location and place of purchase (went to the country, to the village during self-isolation). As a result, sales in modern trade in rural Russia are growing faster than in urban Russia – 22 % against 8.9 %.

The population's lifestyle has changed – cooking at home, remote work, online training and training, beauty treatments with their own hands, etc. Many of the things that someone used to help us do, now we do it ourselves, so the market has become dominated by the do-it-yourself model.

As a result, sales of such categories as baking ingredients, condiments, cooking utensils, ovens, fryers, grills, etc. increased. the alcohol group Began to grow as compensation for the reduction of the HoReCa segment. The increase was shown by the categories of beer (7.5 %), rum (9.3 %), whiskey (9.8 %), cognac (7.4 %). The home care category is growing – paper towels (12.7 %), floor cleaning products (7.4 %), bleach (2.4 %). People want to make their home, first of all, safe. However, sales of personal care products – hair styling products (–24.6 %), shampoos (–11.5 %), skin care products (–11.1 %), personal hygiene products (–10.5 %), toothpaste (–10.6 %), deodorants (–2.4 %) – declined. Sales of medical tests, sports and sleep products are growing [4].

Food products in general are growing faster than the market, for example, such categories as cottage cheese (5.6 %), milk (2.4 %), ground coffee and cereals (3.4 %), ready-made breakfasts (4.1 %). The customers want to please themselves, as admitted by 62 % of customers. The top 5 categories of treats that study participants purchased during their last visit included chocolate

(23 %), juices (23 %), cookies (19 %), alcohol (19 %), and sweet carbonated drinks (11 %) [4].

There is also a trend for healthy food – 18 % of customers have started to buy fresh food more often in the last 4 weeks. Overall, the category grew by 2 % compared to last year. The customers explain their choice with the phrase: “Fruit is Better than buns and cookies”. But the categories of long-term storage (cereals, broths, tea, butter, pasta) today buy less: consumers bought these products for future use in the spring.

The main factor that affects consumer behavior is the coronavirus. We have survived the quarantine, the summer, and are entering the second “wave” of the pandemic. Now is the time when we can draw conclusions and make forecasts for the next year – what the business is waiting for and what to prepare for. After 2014–2015, the market recovered to the 2013 revenue level for several years. Now there has been a pullback again, and real incomes are lower than in 2013 by about 10–15 %. This means that many of the trends shown are long-term and will affect the market development for at least 2–3 years.

Thus, lifestyle changes have changed the consumption pattern. As before, there is an increase in the share of online trade, but there has been a noticeable redistribution of preferences: customers are more likely to buy in online stores, discounters and stores “at home”, rather than in large hypermarkets as it was before. The trend for a healthy diet continues. The customers have also changed the location and place of their purchases.

### References

1. Panova, A.YU. Vliyaniye delovogo klimata na konkurentosposobnost rossiyskikh predpriyatiy / A.YU. Panova, R.I. Semenov // Globalnyy nauchnyy potentsial. – SPb. : TMBprint. – 2018. – No. 2(83). – S. 32–33.

2. Rynok truda, zanyatost i zarabotnaya plata // Federalnaya sluzhba gosudarstvennoy statistiki [Electronic resource]. – Access mode : [https://rosstat.gov.ru/labor\\_market\\_employment\\_salaries](https://rosstat.gov.ru/labor_market_employment_salaries).

3. Desfontaines, L. The role of social networks in the political life of society / L. Desfontaines, Yu. Semenova // Proceedings of the 33rd International Business Information Management Association Conference, IBIMA-2019: Education Excellence and Innovation Management through Vision 2020, 2019. – P. 4582–4585.

4. Potrebitel-2020 i novye privyichki, stavshie normoy [Electronic resource]. – Access mode : <https://www.retail.ru/articles/nielsen-potrebitel-2020-i-novye-privyichki-stavshie-normoy>.

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### Основные потребительские тренды в розничной торговле в условиях коронавируса

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**Ключевые слова и фразы:** адаптация торговли к условиям пандемии; основные тренды развития розничной торговли; предпринимательство в условиях пандемии; розничная торговля.

**Аннотация.** В статье рассматриваются особенности развития розничной торговли в

условиях пандемии. Цель данного исследования – выявить основные тренды развития розничной торговли и специфику изменений. Гипотеза исследования заключается в предположении о том, что будет происходить трансформация потребительского поведения и розничная торговля будет реагировать на это, используя новые технологии продаж и взаимодействия с покупателями. Основные методы исследования в статье – сравнительный метод исследования и анализ научной литературы. По итогам исследования авторами сделаны выводы о том, что у основной массы покупателей произошли изменения в стиле жизни и снизился уровень потребления, вследствие чего произошло перераспределение между форматами торговли, покупатель изменил локацию и место совершения покупки, по-прежнему наблюдается рост интернет-торговли.

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## Technological Unemployment as a Consequence of Digitalization of the Economy

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**Key words and phrases:** digitalization of the economy; labour market; social consequences of digitalization; technological unemployment.

**Abstract.** The article deals with the problems of growth of technological unemployment in modern conditions. The purpose of this study was to study the specific features of the employment structure in the context of digitalization and the introduction of artificial intelligence technologies in the economy. The hypothesis of the study is that the structure of supply and demand in the labor market will differ significantly from the current structure. The main research methods in the article are the analysis of scientific literature and statistical data. Based on the results of the study, the authors formulate the main trends of changes in the labor market and suggest possible ways to minimize the negative effect caused by the transition to a new technological order. The main challenges and possible solutions to these problems are identified.

McKinsey estimates that last year the share of the digital economy in Russia was 3.9 %, while in the US it was 10.9 %, in China it reached 10 % [5]. However, the national program assumes that this volume will triple by 2025. What will digitalization in the corporate and public sector mean for individuals? Business is clearly in favor of digitalization: transferring routine processes “to digital” allows companies to get rid of millions of blue-collar workers. Digitalization of processes that require a creative approach helps to get rid of part of the “white collar”: artificial intelligence, unlike a living person, does not require any bonuses, social insurance, or vacation pay. The driver of digitalization in the corporate sector is the desire of businesses to increase profits by getting rid of social obligations. The state also clearly supports digitalization, because it opens up unprecedented control opportunities for state institutions: each citizen can be numbered; by creating a digital profile, you can track financial transactions, correspondence, geographical movements, and social contacts.

Although theoretical forecasts are optimistic in the long run, the direct effects of technological substitution on the structure of social inequality require serious attention. According to a 2016 study by Artificial Intelligence, Automation, and The Economy conducted by the Executive office of the President of the United States, the median probability of full automation is 83 % for low-paid jobs, while for middle-income jobs it drops to 31 % [4]. Finally, the technological replacement

of highly paid types of work is only 4 %. Since the level of remuneration often depends on the level of education, such statistics mean that the beneficiaries of the spread of AI will be primarily highly educated people employed in well-paid jobs. Low-paid, low-skilled workers will lose their livelihoods. In addition, since the education system is also a major driver of income inequality, this inequality can worsen: if the ability to learn new skills correlates with the education received, but is not a direct consequence of it, simply increasing access to education will not fix the situation. Another effect of AI that can exacerbate inequality between people is the increasing share of capital in the economy. As Toma Piketty has shown, the excess of the level of return on capital over the level of economic growth leads to increased economic inequality. If AI is a new and highly efficient form of capital, its spread will only reinforce this trend.

An alternative scenario assumes that artificial intelligence technologies will lead to a new wave of de-training, which, as Collins predicts, will primarily affect high-paying jobs and middle-class professions. For example, in medicine, one of the most important tasks is diagnostics, which is essentially a kind of prediction. There will be a change in the business climate, which will affect the competitiveness of all Russian enterprises [3, p. 32]. Thus, the use of algorithmic diagnostics, by definition cheaper and possibly more reliable, will replace the work of qualified doctors. At the same time, the use of advanced technologies to replace the work of nurses, junior medical staff, etc. does not make economic sense. However, historical experience shows that more skilled workers are better adapted to technological substitution, so this scenario is still less likely.

Top managers fear that digital technologies will weaken their position in the corporate hierarchy. It is obvious that the professions that we grouped into the “white-collar” category will become a thing of the past. People whose work is related to the movement of documents, entering information and its primary processing will become unnecessary: accountants, HR specialists, lawyers specializing in claims and contractual issues.

At the same time, there will be a growing demand for programmers, database specialists, and system architects. Another growth sector is engineers who design automated devices, which are commonly referred to as robots. Robots in the physical sense are solutions used in industry and transport, including the management of unmanned aerial vehicles, cars, trams, trolleybuses, trains, and even river vessels.

The third direction is business design. This is not just about business analysts who have studied business systems, but also about specialists who can design, build, and reconfigure business systems as platforms. The concept of “lifelong learning” will gain popularity [2, p. 183]. Employers will be forced to initiate retraining programs to adapt them to the conditions of automated work.

Mobility will solve the problem of recruiting employees. By 2030, about 40 % of the European population will live in clusters, where the number of jobs will be significantly reduced. Job searches will increase internal migration and moving to megacities. Digital networks and new technologies will increase employee productivity and solve the problem of mobility [1, p. 33]. COVID-19 has demonstrated the ease with which millions of people can switch to remote work at the same time. Subsequent use of the home office format can increase the size of the local labor market by 25 % [5].

As practice shows, not only blue-collar workers can suffer, but also knowledge workers. Many tasks will soon be possible for robotic systems that will gradually replace people. Artificial intelligence itself is not identical to process automation, but the development of AI will lead to the fact that more and more tasks will be available to a computer program.

Artificial intelligence is being used more widely and has an impact on an increasing number of areas of human life, and this impact can be both positive and negative. This is typical of many significant inventions that have changed people's lives: nuclear energy can be used for both peaceful and destructive purposes; oil production solves energy problems and provides raw materials for the synthesis of new materials, but leads to environmental pollution; money circulation allows you to quickly exchange values, but leads to corruption, overconsumption, speculation, etc. Implementation of digital solutions is impossible without a program to adapt society to these solutions. In order to move to a digital society with care, without material losses and emotional stress, we need specialists who are on the one hand technology-oriented, on the other hand, focused on working with people and are ready to help them interact effectively with technology.

### References

1. Desfonteynes, L.G. TSifrovaya transformatsiya biznesa v period ekonomicheskoy turbulentnosti / L.G. Desfonteynes, YU.E. Semenova // Sbornik materialov 6-y Natsionalnoy nauchno-prakticheskoy konferentsii Integratsiya nauki i proizvodstva. – SPb. : RGGMU, 2019. – S. 33–37.
2. Kurochkina, A.A. Problemy ispolzovaniya tsifrovyykh tekhnologiy v obrazovanii / A.A. Kurochkina, YU.E. Semenova // Nauka i biznes: puti razvitiya. – M. : TMBprint. – 2019. – No. 11(101). – S. 182–186.
3. Panova, A.YU. Vliyanie delovogo klimata na konkurentosposobnost rossiyskikh predpriyatiy / A.YU. Panova, R.I. Semenov // Globalnyy nauchnyy potentsial. – SPb. : TMBprint. – 2018. – No. 2(83). – S. 32–33.
4. Artificial Intelligence, Automation and the Economy [Electronic resource]. – Access mode : <https://obamawhitehouse.archives.gov/sites/whitehouse.gov/files/documents/Artificial-Intelligence-Automation-Economy.PDF>.
5. The future of work in Europe [Electronic resource]. – Access mode : <https://www.mckinsey.com/~media/McKinsey/Featured%20Insights/Future%20of%20Organizations/The%20future%20of%20work%20in%20Europe/MGI-The-future-of-work-in-Europe-discussion-paper.pdf>.

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### Технологическая безработица как следствие цифровизации экономики

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**Ключевые слова и фразы:** рынок труда; социальные последствия цифровизации; технологическая безработица; цифровизация экономики.

**Аннотация.** В статье рассмотрены проблемы роста технологической безработицы в современных условиях. Целью данного исследования являлось изучение специфических особенностей структуры занятости в условиях цифровизации и внедрения технологий искусственного интеллекта в экономику. Гипотеза исследования заключается в предполо-

ложении о том, что структура спроса и предложения на рынке труда будет существенно отличаться от структуры в настоящее время. Основные методы исследования в статье – анализ научной литературы и статистических данных. По итогам исследования авторами сформулированы основные тренды изменений на рынке труда и предлагаются возможные пути минимизации отрицательного эффекта, вызванного переходом к новому технологическому укладу. Определены основные вызовы и возможные направления решения данных проблем.

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