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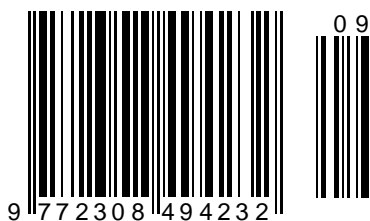
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## THE INFLUENCE OF ORGANIZATIONAL CULTURE AND WORK DISCIPLINE ON NURSES' ORGANIZATIONAL CITIZENSHIP BEHAVIOR AT ARIFIN ACHMAD REGIONAL HOSPITAL


**Abstract:** Organizational Citizenship Behavior (OCB) is a valuable managerial tool for organizations, having a positive effect on individual, group and organizational performance if managed correctly, this is the background to this research. Application Organizational culture and effective work discipline are supporting factors Organizational Citizenship Behavior. This study aims to determine The Influence of Organizational Culture and Work Discipline on Organizational Citizenship Behavior (Case Study: Arifin Achmad Hospital, Surgical Nursing Department). The method used in this research is quantitative, with the data source in this research coming from primary data obtained through the process of distributing questionnaires which were then tested statistically using the SPSS program and secondary data using data regarding the number of nurses, the number and field of work of nurses and the application of work discipline of nurses at the Surgical Installation at Arifin Achmad Regional Hospital in 2018-2022. The analytical method used in this research is simple and multiple regression analysis, and through validity and reliability tests. In this research, the results obtained are that Organizational Culture (X1) has a positive effect on Organizational Citizenship Behavior (Y), Work Discipline (X2) has a positive effect on Organizational Citizenship Behavior (Y) and Organizational Culture (X1) and Work Discipline (X2) have an effect positive towards Organizational Citizenship Behavior (Y) (Case Study: Arifin Achmad Hospital, Surgical Nursing Department).

**Key words:** Organizational Culture, Work Discipline, Organizational Citizenship Behavior.

**Language:** English

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### Introduction

Organizations are systems and human activities that work together. Therefore, the organization hopes that employees can excel and be able to create conducive situations and conditions. For every person who works or in a work group, performance is always expected to be of good quality and quantity. Many factors can influence employee performance. According to Setiyawan and Waridin (2006:181-198),

factors that can influence performance are work discipline and organizational culture.

Hospitals are one of the public service institutions that are at the forefront of public health development. Making the demand for good service a necessity that must be implemented for public services. One of the hospitals owned by the Riau regional government which is a center for public health services is Arifin Achmad Hospital.



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Basically, work discipline is always expected to be a characteristic of every human resource in an organization, because with discipline the organization will run well and can achieve its goals well too. (Budi & Waridin, 2006, p. 189). Organizational culture is a form of assumptions held, accepted implicitly by a group and determines how the group feels, thinks and reacts to its diverse environment. (Kreitner & Kinicki, 2005, p. 79).

As a health service provider, RSUD Arifin Achmad is obliged to provide one of the spearheads of

providing services directly to patients. One of them is through services carried out by nurses as the spearhead of providing services directly to patients who are expected to have good performance. The success of health services depends on the participation of nurses in providing quality nursing care for patients. Based on 2021 human resources data, Arifin Achmad Hospital has 662 nurses (Arifin Achmad Hospital, 2023).

**Table 1.1. Application of Work Discipline to Edelwis Surgical Nurses at Arifin Achmad Regional Hospital 2018-2022**

Year	Number of Employees	Information		Total Percent
		Late	Roll call	
2018	34	6	0	7.35 %
2019	34	11	0	13.48 %
2020	28	4	0	5.95%
2021	29	9	0	12.93 %
2022	30	9	0	12.50 %

Source: Arifin Achmad Regional Hospital, 2023

Based on the table 1.1 above, it is known that there were violations in the application of surgical nurse discipline at Arifin Achmad Regional Hospital which experienced increases and decreases from 2018 to 2022. Where the largest disciplinary violations occurred in 2019 as many as 11 people were late or equal to (13.48%) regarding the level of violations the lowest occurred in 2020 as many as 4 people (5.95%).

These results show that there is inappropriate disciplinary behavior from surgical nurses at Arifin Achmad Regional Hospital. Therefore, it is important for surgical nurses at Arifin Achmad Regional Hospital to understand the mechanism of Standard Operating Procedures for implementing discipline that has been established, as described in the table below:

**Table 1.2. Violations of Work Discipline for Surgical Nurses at Arifin Achmad Regional Hospital 2018-2022**

Year	Number of Nurses	Weekday/ Year	Alpha Average/ Day/ Year	Average Late Entry/ Day/ Year	Work Negligence	Number of Violations
2018	34	246	0	6	0	6
2019	34	246	0	11	0	11
2020	28	246	0	4	0	4
2021	29	246	0	9	0	9
2022	30	246	0	9	0	9

Source: Arifin Achmad Regional Hospital, 2023.

Based on Table 1.2 above, it can be seen that the level of work discipline violations of surgical installation nurses at Arifin Achmad Regional Hospital based on the last five years has fluctuated. The results of the pre-survey in the field found several phenomena that showed evidence that there were still indications of a decline in the work discipline of surgical installation nurses at Arifin Achmad Regional Hospital, including:

- There are still several nurses who come in not on time according to the work shift schedule.
- There are still several nurses who are out during office hours.
- There are still several nurses who go home not according to the work shift schedule.

Based on the background of the problem above, the problem formulation in this research is:

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1. How does organizational culture influence *Organizational Citizenship Behavior* surgical nurse at Arifin Achmad Regional Hospital?

2. How does disciplinary culture influence *Organizational Citizenship Behavior* surgical nurse at Arifin Achmad Regional Hospital?

3. What is the influence of organizational culture and work discipline on *Organizational Citizenship Behavior* of surgical nurses at Arifin Achmad Regional Hospital?

## LITERATURE REVIEW

### Organizational culture

According to Kreitner and Kinicki (2005), organizational culture is a form of assumptions held, accepted implicitly by a group and determines how the group feels, thinks and reacts to its diverse environment. As for Munandar (2012) explains that organizational culture is the way of thinking, the way of working and the way of behavior of employees of a company in carrying out their respective work tasks.

Organizational culture has a significant influence on employee performance. According to Herdiany (2015) organizational culture has a positive and significant effect on employee performance. This means that organizational culture also determines the high and low levels of employee performance.

### Work Discipline

According to Saydam (2005) work discipline is a person's willingness and willingness to obey and comply with all regulatory norms that apply around them.

Meanwhile, Siswanto Sastrohadiwiry'o's (2003) definition of work discipline can be defined as an attitude of respect, respect, obedience and obedience to applicable regulations, both written and unwritten,

as well as being able to carry them out and not avoiding receiving sanctions if they violate them. duties and authority given to him

According to Rivai (2005), work discipline has several indicators, namely:

1. Presence
2. Compliance with work regulations
3. Adherence to work standards
4. High level of alertness
5. Work ethically

### Organizational Citizenship Behavior (OCB)

Organizational Citizenship Behavior (OCB) is employee behavior that is carried out voluntarily, is not directly or indirectly related to the reward system and overall can support the effectiveness and efficiency of the organization (Organ, 1988 in Alotaibi, 2003: 371). According to Luthans (2005), the personality basis for OCB reflects the characteristics of employees who are cooperative, helpful, caring and serious..

Organizational citizenship behavior also defined as individual behavior that is functional, pro-social, extra-role which is directed or aimed at individuals, groups and/or organizations (Schnake, 1991 in Alotaibi, 2003: 373). Likewise, the definition of OCB according to Appelbaum et al. (2004), namely as employee behavior that is carried out freely which is not included in the employee's job requirements, however this behavior increases the effectiveness of organizational functions. Meanwhile, the definition of OCB according to Robbins (2006: 364) is chosen behavior that is not part of formal work obligations, but supports the effective functioning of the organization.

### Research Framework

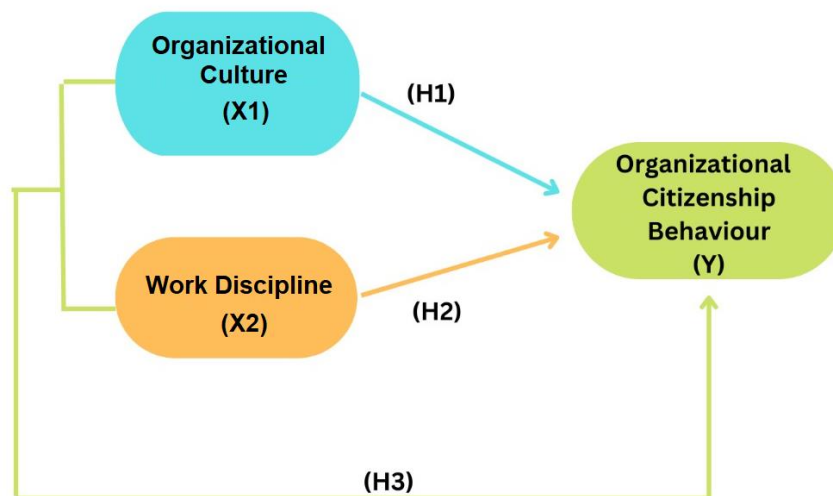


Figure 1. Research Framework



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### Research Hypothesis

Based on the background of the problem and the theoretical basis that has been put forward, the hypothesis for this research is as follows:

a. H1 :It is suspected that organizational culture has a partial influence on Organizational Citizenship Behavior (OCB) of nurses in the Surgical Installation section at Arifin Achmad Hospital Pekanbaru.

b. H2 :It is suspected that work discipline has a partial effect on the Organizational Citizenship Behavior (OCB) of nurses in the Surgical Installation section at Arifin Achmad Hospital Pekanbaru.

c. H3 :It is suspected that organizational culture and work discipline simultaneously influence the Organizational Citizenship Behavior (OCB) of nurses in the Surgical Installation section at Arifin Achmad Hospital Pekanbaru.

### RESEARCH METHODS

This research was conducted in Surgical Installation at Arifin Achmad Hospital Pekanbaru. The research method used to guide researchers is a quantitative research method. According to Hair et al. (2003), a quantitative approach is an approach that focuses more on measurement and sampling methods because it uses a deductive way of thinking that emphasizes detailed priorities in data collection and analysis. The deductive model shows that the thinking developed in research is based on general patterns, which then lead to more specific patterns (Prasetya & Jannah, 2005). The deductive nature indicates that research begins with a theory and then, so to speak, a concept. Next, it is formulated with assumptions. The aim of this method is to show relationships between variables, test the relevance of a theory, and obtain generalizations with predictive power. The population in this study were surgical installation nurses at Arifin Achmad Regional Hospital. This research uses Non Probability Sampling techniques with the Purposive Sampling method. Where researchers deliberately use their own judgment in selecting population members who are considered appropriate in providing the information needed for research (Sugiyono, 2010:218-219). In this study, researchers took samples from surgical nurses at Arifin Achmad Regional Hospital.

### RESEARCH RESULTS AND DISCUSSION

#### Data Instrument Test

##### 1. Validity test

From the validity test it is known  $r_{count} > r_{tabel}$  0.361, so that all statement items on the variables organizational culture, work discipline, and organizational citizenship behavior are declared valid and can be used in research.

##### 2. Reliability Test

Based on the results of the reliability test show that the organizational culture variable (X1), the work discipline variable (X2) and the organizational citizenship behavior variable (Y), have a Cronbach's alpha value  $> 0.600$ . So, it can be concluded that the answers to the statements for variables X1, X2 and Y have met the criteria values and can be declared reliable and suitable for use in research.

#### Classic Assumption Test

##### 1. Normality Test

From normality test results are said to be normal. The significance value is to see whether the data is normal or not, namely if the sig level is  $> 0.05$  it can be interpreted as normal and conversely if the sig level  $< 0.05$  it can be interpreted as abnormal. In table 5.3 it can be assessed that the significant value is  $0.990 > 0.05$  and from these results it can be said that the data above has a normal distribution.

##### 2. Multicollinearity Test

Based on the results of the multicollinearity test said that there was no multicollinearity. This happens if the tolerance value is  $> 0.10$ , then multicollinearity does not occur. If the VIF value is  $< 10.00$ , then multicollinearity does not occur. And if you look at the tolerance value, it is  $0.654 > 0.10$  and the VIF value is  $1.530 < 10.00$ , which means there is no multicollinearity.

##### 3. Heteroscedasticity Test

Based on the results of the heteroscedasticity test are said to have no heteroscedasticity. This happens because the Sig value is  $> 0.05$ , so there is no heteroscedasticity. It can be seen that the organizational culture variable has a significant value of  $0.755 > 0.05$  and the work discipline variable has a significant value of  $0.395 > 0.05$ , therefore this research model is said to have no heteroscedasticity.

#### Test Data Analysis

##### 1. Simple Linear Regression Analysis

The results of the simple linear regression analysis test with a constant ( $\alpha$ ) of 9.409 and a regression coefficient for the organizational culture variable of 0.421. Through the results of a simple linear regression test, a regression equation was obtained to understand the contribution of organizational culture variables to the Organizational Citizenship Behavior variable.  $a$

##### 2. Simple Coefficient of Determination Test ( $R^2$ )

Coefficient of determination test result simple ( $R^2$ ) obtained the obtained value is 0.418, which means the contribution of the influence of organizational culture variables to organizational citizenship behavior (Case Study: Arifin Achmad Hospital, Surgical Nursing Department) is 42% while the remaining 58% is influenced by other variables not included in this regression model.

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### Simultaneous Test (F Test)

From results Simultaneous test results obtained calculated F test results of 14,255 with a significance value of 0.000. It is known that the F table value can use the equation for degrees of freedom (df) with the following formula:

$F_{table} = k$  ;

$nk = (2 ; 28)$

Where:

n = number of respondents

k = number of independent variables

So the F table obtained is 3.34.

### Hypothesis test

The organizational culture and work discipline variables have an F count of  $14,255 > F_{table} 3.09$  and  $sig 0.000 < 0.05$ , which means  $H_a$  is accepted and  $H_o$  is rejected. From the results of this research, it can be concluded that the hypothesis states "it is suspected that organizational culture and work discipline influence organizational citizenship behavior (Case Study: Arifin Achmad Hospital, Surgical Nursing Department)" acceptable.

### Discussion

1. The Influence of Organizational Culture on Organizational Citizenship Behavior

The results of research conducted on organizational culture variables on Organizational Citizenship Behavior shows that the organizational culture variable has a t-count value of  $4.482 > t_{table} 1.701$  and  $sig 0.000 < 0.05$ . This means proving that organizational culture influences organizational citizenship behavior. So with these results, the first hypothesis in this research reads "it is suspected that organizational culture has an influence on organizational citizenship behavior (Case Study: Arifin Achmad Hospital, Surgical Nursing Department)" acceptable.

2. The Influence of Work Discipline on Organizational Citizenship Behavior

The results of research conducted on the work discipline variable on Organizational Citizenship Behavior show that the work discipline variable has a t-count value of  $4,301 > t_{table} 1.701$  and  $sig 0.000 < 0.05$ , which means  $H_a$  is accepted and  $H_o$  is rejected. From the results of this research, it can be concluded that the hypothesis which states "it is suspected that work discipline has an influence on Organizational Citizenship Behavior (Case Study: Arifin Achmad Hospital, Surgical Nursing Department)" acceptable.

3. The influence of organizational culture and work discipline on Organizational Citizenship Behavior

The results of research conducted on organizational culture and work discipline variables have an F count of  $14,225 > F_{table} 3.34$  and  $sig 0.000$

$< 0.05$ , which means that the variables of organizational culture and work discipline influence simultaneously on organizational citizenship behavior. From the results of this research, it can be concluded that the hypothesis which states "is suspected that organizational culture and work discipline have an influence." on organizational citizenship behavior (Case Study: Arifin Achmad Hospital, Surgical Nursing Department)" acceptable.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusion

Based on the results of research on surgical nurses at Arifin Regional Hospital Ahmad Pekanbaru regarding "The Influence of Organizational Culture and Work Discipline on Organizational Behavior at Arifin Achmad Regional Hospital Pekanbaru", the following conclusions are obtained:

1. Partially, it can be seen that the hypothesis which states "it is suspected that organizational culture has an influence on Organizational Behavior at Arifin Achmad Hospital Pekanbaru" is accepted. This condition indicates that the higher the organizational culture that is implemented, the better the Organizational Behavior will be.

2. Partially, it can be seen that the hypothesis reads "it is suspected that work discipline has an influence on Organizational Behavior at Arifin Achmad Regional Hospital" accepted. This condition indicates that the higher the work discipline applied, the better the Organizational Behavior will be.

3. Simultaneously, it can be seen that the hypothesis reads "it is suspected that organizational culture and work discipline have an influence on Organizational Behavior at Arifin Achmad Regional Hospital" accepted. This condition indicates that the higher the organizational culture and work discipline applied, the better the Organizational Behavior will be.

### Suggestion

From the research results and conclusions previously explained, the author provides the following suggestions:

1. From the results of the partial test (t test), it was found that organizational culture influences Organizational Behavior. Therefore, companies are expected to be able to improve and maintain a good organizational culture in order to form good organizational behavior.

2. From the results of the partial test (t test), it was found that work discipline influences Organizational Behavior. Therefore, companies are expected to be able to improve good work discipline in order to form good organizational behavior as well.

3. From the results of the simultaneous test (f test), it was found that organizational culture and work discipline influence Organizational Behavior.

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Therefore, companies are expected to be able to carry out regular evaluations and improvements and examine various problems arising from

Organizational Behavior variables which influence the achievement of company goals.

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**VALORIZATION OF MEDICINAL PLANTS FROM KORHOGO (CÔTE D'IVOIRE): PHYTOCHEMICAL SCREENING AND EVALUATION OF ANTIOXIDANT ACTIVITY OF LEAVES AND STEM BARK OF SABA SENEGALENSIS (A.DC.) PICHON (APOCYNACEAE)**

**Abstract:** *Saba senegalensis* is a plant commonly used in traditional medicine in Korhogo (Côte d'Ivoire) for treating diabetes and renal failure. This study is based on phytochemical screening and evaluation of the antioxidant activity of aqueous, hydroethanolic, and ethanolic extracts of *S. senegalensis* leaves and stem bark. Phytochemical screening of secondary metabolites using thin-layer chromatography (TLC) revealed the presence of flavonoids,



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tannins, phenolic acids, saponins, sterols, and terpenes in the plant's leaf and stem extracts. Coumarins were found only in the leaves, while alkaloids were absent from both organs studied. Antioxidant activity was highlighted in both organs by qualitative and quantitative methods with respect to the DPPH free radical. Quantitative spectrophotometric analysis showed that both leaves and stems possess antioxidant activity. The antioxidant activity of leaves was better than that of stems. Thus, the plant's leaves and stems could be used as antioxidants capable of preventing and/or treating diseases linked to oxidative stress.

**Key words:** *Saba senegalensis*, phytochemical screening, antioxidant activity, Korhogo, Côte d'Ivoire

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## Introduction

Humans are confronted with several diseases that constitute public health problems and whose treatments are proving increasingly complicated [1]. These public health problems include oxidative stress-related diseases such as cancer, cataracts, diabetes, Alzheimer's disease, rheumatism, cardiovascular disease, and accelerated skin aging [2, 3]. However, synthetic antioxidants are available for some treatments, but some are now responsible for undesirable effects on the body [4]. Moreover, access to conventional medicine remains problematic, on the one hand, because of the inadequacy of specialized health structures and qualified personnel, and the difficulty of transporting patients from rural areas to health centers in urban areas, and on the other because of the very high cost of certain treatments and the resistance of certain pathogens. Faced with this alarming situation, other treatment options are imperative. It is in this context that this study focuses on *Saba senegalensis*. Today, these plants are the subject of massive chemical and biological studies for their possible use as an alternative for protection against oxidation [5, 6]. This work aims to justify or refute the use of *Saba senegalensis* leaves and stems as antioxidants capable of preventing or treating diseases linked to oxidative stress.

## I. MATERIAL AND METHODS

### I.1. Material

#### I.1.1. Plant material

The plant material consisted of *Saba senegalensis* leaves and stem bark. The various organs were collected in October 2022 in Korhogo (9° 27' 28" North, 5° 37' 46" West). The various plant species were authenticated by botanists at Peleforo GON COULIBLY University. The various plant organs were dried for ten (10) days in a room at room temperature, away from the sun. Finally, these dried organs were pounded in a mortar and sieved to obtain fine powders, which were used to prepare the different extracts to be tested.

#### I.1.2. Laboratory materials and equipment

Laboratory equipment includes the usual glassware, an electronic balance (DENVER

INSTRUMENT SI-234), a water bath (Neo-Tech SA), a hot plate (Rommelsbcher), a drying oven (Memmert), and a spectrophotometer (JENWAY 7315).

#### I.1.3. Reagents and chemical products

The analytical-grade chemicals used were purchased from Polychimie (Côte d'Ivoire). For Thin Layer Chromatography (TLC) tests, we used silica gel 60 F254 chromatoplates on aluminium support. The developers and reagents used were 2% FeCl<sub>3</sub>, 5% KOH, 1% AlCl<sub>3</sub>, sulfuric vanillin, Dragendorff reagent, and DPPH.

### I.2. Methods

#### I.2.1. Extractions

##### I.2.1.1. Aqueous extracts

A mass of 7 g of powder from each organ was decocted in 70 mL of distilled water for 30 minutes at a temperature of 100 °C. After filtration, the different filtrates were placed in an oven at 50 °C for three (3) days. The various dry aqueous extracts of *S. senegalensis* obtained were used to assess antioxidant activity by spectrophotometry.

##### I.2.1.2. Ethanolic extracts

A mass of 7 g of powder from each organ (leaves and stem bark) of *S. senegalensis* was macerated in 70 mL of ethanol for 24 hours. After filtration, the different filtrates were placed in an oven at 50 °C for two (2) days to provide the ethanolic crude extracts. These extracts were then used to assess antioxidant activity by spectrophotometry.

##### I.2.1.3. Hydroethanolics extracts

A mass of 7 g of each organ powder was macerated in 70 mL of binary ethanol/water mixture (80 mL/20 mL) for 24 hours. After filtration, the macerates were placed in an oven at 50 °C for two hours to remove the ethanol. The extract obtained for each organ is kept for 24 hours in the refrigerator at 4°C to precipitate lipophilic compounds. After decantation and filtration, a quantity of these extracts was completely dried in an oven at 50 °C for two (2) days, and these crude hydroethanolic extracts were used to assess antioxidant activity by spectrophotometry. The other quantity was used to prepare the selective extracts.



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### I.2.1.4. Selective Extracts

A volume of 15 mL of each filtrate from the hydro-ethanol mixture of *S. senegalensis* leaves and stem bark was exhausted by successive fractionations with (3 × 10 mL) hexane (C<sub>6</sub>H<sub>14</sub>), dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>) and ethyl acetate (AcOEt). The various selective organic fractions were then concentrated in an oven at 50 °C. These concentrates were then used for phytochemical screening by TLC and evaluation of antioxidant activity on TLC plates.

### I.2.2. Phytochemical screening on TLC plates

Secondary metabolites (sterols-polyterpenes, alkaloids, coumarins, flavonoids, tannins, and phenolic acids) were identified using TLC plate tests. TLC screening of selective extracts was carried out using the methods described by Mamyrbékova-Békro *et al.* [7].

Using capillaries, 2 µL of each selective extract is deposited as a dot 0.5 cm from both edges of the chromatographic plate. The TLC plates are then placed in the migration tank containing the migration solvents (developer).

After development, chromatograms were visualized with visible and UV 365 nm developers. Colorations appearing as spots are recorded, and front ratios (R<sub>f</sub>) are calculated.

### I.2.3. Estimation of antioxidant power

#### I.2.3.1. DPPH screening of selective extracts by TLC

The antioxidant power evaluation by TLC used is that developed by the method described by Takao *et al.* [8].

A 10 µL volume of each plant extract solution is deposited on a chromatoplate (silica gel 60 F254, on aluminium support (Merck)), which is then placed in a chromatography tank saturated with migration solvent. After development, chromatograms are dried and then developed with an ethanolic solution of DPPH (0.2 mg/mL). After 30 minutes of optimal time, extract constituents with potential free radical scavenging activity are revealed as pale-yellow spots on a violet background. The frontal ratios (R<sub>f</sub>) associated with the yellow spots are calculated.

#### I.2.3.2. Assessment of antioxidant activity of aqueous, ethanolic, and hydroethanolic extracts and vitamin C by DPPH spectrophotometry

The antioxidant potential of the extracts was assessed using the Blois method [9].

DPPH is solubilized in absolute ethanol to obtain a solution with a 0.3 mg/mL concentration. Each extract has different concentration ranges (2 mg/mL, 1 mg/mL, 0.5 mg/mL, 0.25 mg/mL, 0.125 mg/mL, and 0.0625 mg/mL) prepared in absolute ethanol. 2.5 mL plant extract and 1 mL DPPH ethanolic solution are added to dry, sterile tubes. After shaking, the tubes are placed in a dark place for 30 minutes. The absorbance of the mixture is then measured at 517 nm against a blank consisting of 2.5 mL pure absolute ethanol and 1 mL DPPH solution. The positive reference control, ascorbic acid (vitamin C), was treated under the same conditions as the plant extracts. DPPH inhibition percentages are calculated according to the formula:

$$I(\%) = (A_b - A_e) / A_b \times 100$$

I: inhibition percentage

A<sub>b</sub>: absorbance of blank

A<sub>e</sub>: absorbance of sample

The concentrations required to trap 50% (IC<sub>50</sub>) of DPPH are determined from the graphs showing the percentage inhibition of DPPH as a function of extracts or vitamin C concentrations.

### I.2.4. Statistical analysis

Analyses of the measurements obtained during the various manipulations were done using EXCEL 2021 software (version 16.0). It was used to plot the various diagrams used to determine the IC<sub>50</sub> parameter for each extract.

## II. RESULTS AND DISCUSSION

### II.1. Results

#### II.1.1. Yields

The various extractions were carried out by decoction with water and maceration with ethanol and a water/ethanol mixture on *Saba senegalensis* leaf and stem bark powders. Yields based on the dry weight of the various plant powders were calculated using the following formula:

Extraction yield = (extracted mass/sample mass) \*100, and the results obtained were recorded in Table 1. Yield values ranged from 35.10 ±3.94% to 49.00 ±2.76%.

Table 1. Yields of various *Saba senegalensis* leaf and stem extracts

	SSF Aq	SSF Et	SSF H-Et	SST Aq	SST Et	SST H-Et
R1	40.57	41.00	49.00	47.14	50.29	49.00
R2	<b>46.43</b>	<b>34.29</b>	<b>45.87</b>	<b>50.00</b>	<b>51.86</b>	<b>42.45</b>
R3	46.14	30.00	43.22	42.29	44.86	47.73
Rmoy	44.38 ±2.54	35.10 ±3.94	46.03 ±1.98	46.48 ±2.79	49.00 ±2.76	46.39 ±2.63

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	<b>JIF = 1.500</b>	<b>SJIF (Morocco) = 7.184</b>	<b>OAJI (USA) = 0.350</b>

R1: yield 1; R2: yield 2; R3: yield 3; Rmoy: average yield; SS: *Saba senegalensis*; F: leaf; T: stem; Aq: Aqueous; Et: ethanol; H-Et: hydro-ethanol

### II.1.2. Phytochemical screening by TLC

Identification of the various secondary metabolites was carried out using the following migration or developing solvents:

- Hexane (C<sub>6</sub>H<sub>14</sub>) / ethyl acetate (AcOEt) (5 : 0,375; V/V) for hexane extracts;
- Dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>) / ethyl acetate (AcOEt) / hexane (C<sub>6</sub>H<sub>14</sub>) (2 : 2 : 1; V/V/V); CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/ C<sub>6</sub> H<sub>14</sub> (3:4:2) (V/V/V) and CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/ CH<sub>3</sub>COOH (1 : 3,5: 1) (V/V/V) for dichloromethane extracts ;
- CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/ C<sub>6</sub> H<sub>14</sub> (3 :4 :2) (V/V/V) and CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/ CH<sub>3</sub>COOH (1 : 3,5 :1) (V/V/V) for acetate-ethyl extracts;

- The same migration solvents were used to assess antioxidant potential by TLC.

The various target metabolites were investigated in hexanolic, dichloromethane, and acetate-ethyl extracts of *Saba senegalensis* leaves and stems. The results obtained are presented in Tables 2 to 6. The various tables provide information on the retention factor (R<sub>f</sub>), visible and ultraviolet (UV) observation of the various stains. The reagents: vanillin sulfuric acid, Dragendorff, KOH, AlCl<sub>3</sub>, and FeCl<sub>3</sub> were used to identify seven groups of secondary metabolites: (sterols, terpenes), alkaloids, coumarins, flavonoids, and (tannins, phenolic acids).

**Table 2. Visible detection of sterols and terpenes in C<sub>6</sub>H<sub>14</sub>/AcOEt (5: 0.375) (V/V/V) developer from hexane extracts**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (Hexane)	0.89 (purple): <b>terpene</b> ; 0.76 (blue): <b>sterol</b> ; 0.74 (blue): <b>sterol</b> ; 0.6 (blue): <b>sterol</b> ; 0.49 (blue): <b>sterol</b> ; 0.43 (blue): <b>sterol</b> ; 0.31 (blue): <b>sterol</b> ; 0.25 (blue): <b>sterol</b> ; 0.21 (blue): <b>sterol</b> ; 0.18 (blue): <b>sterol</b> ; 0.15 (blue): <b>sterol</b> ; 0.09 (blue): <b>sterol</b> ; 0.05 (blue): <b>sterol</b> ; 00 (blue): <b>sterol</b>
SST H-Et (Hexane)	<b>0.83 (purple)</b> : terpene; <b>0.7 (blue)</b> : sterol; <b>0.61 (blue)</b> : sterol; <b>0.56 (blue)</b> : sterol; <b>0.53 (blue)</b> : sterol; <b>0.49 (blue)</b> : sterol; <b>0.38 (blue)</b> : sterol; <b>0.29 (blue)</b> : sterol; <b>0.15 (blue)</b> : sterol; <b>0.14 (blue)</b> : sterol; <b>0.08 (blue)</b> : sterol; <b>00 (rose)</b> : terpene

**Table 3. Visible detection of alkaloids in CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/C<sub>6</sub>H<sub>14</sub> (2: 2: 1) (V/V/V) developer from visible dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>) extracts**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	<b>No alkaloid identified</b>
SST H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	No alkaloid identified

**Table 4. Visible (a) and UV (b) detection of coumarins in CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/C<sub>6</sub>H<sub>14</sub> (2: 2: 1) (V/V/V) developer from dichloromethane extracts CH<sub>2</sub>Cl<sub>2</sub>)**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	0.9 (Yellow <sup>a</sup> . blue <sup>b</sup> ): <b>coumarin</b> ; 0.78 (Yellow <sup>a</sup> ): <b>coumarin</b> ; 00 (Yellow <sup>b</sup> ): <b>coumarin</b>
SST H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	No coumarin identified <sup>a,b</sup>

**Table 5. Visible (a) and UV (b) detection of flavonoids in CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/C<sub>6</sub>H<sub>14</sub> (3:4:2) (V/V/V) developer from dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>) and acetate-ethyl (AcOEt) extracts**

SSF H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	0.98 (green <sup>a</sup> ): <b>flavonoid</b> ; 0.8 (Yellow <sup>a,b</sup> ): <b>flavonoid</b> ; 0.7 (Yellow <sup>a,b</sup> ): <b>flavonoid</b> ; 0.63 (Yellow <sup>a,b</sup> ): <b>flavonoid</b> ; 0.58 (Yellow <sup>a,b</sup> ): <b>flavonoid</b> ; 0.54 (Yellow <sup>a</sup> . Blue <sup>b</sup> ): <b>flavonoid</b> ; 0.39 (Blue <sup>b</sup> ):
Extracts	R <sub>f</sub> (Color): Possible compounds

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	<b>flavonoid</b> ; 0.35 (Yellow <sup>a</sup> ): <b>flavonoid</b> ; 0.24 (Blue <sup>b</sup> ): <b>flavonoid</b> ; 0.13 (Yellow <sup>a</sup> ): <b>flavonoid</b> ; 00 (Yellow <sup>b</sup> ): <b>flavonoid</b> .
SST H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	<b>0.9 (Blue<sup>b</sup>): flavonoid</b> ; <b>0.79 (Blue<sup>b</sup>): flavonoid</b> ; <b>0.68 (Blue<sup>b</sup>): flavonoid</b> ; <b>0.5 (Yellow<sup>a</sup>. Blue<sup>b</sup>): flavonoid</b> ; <b>0.4 (Blue<sup>b</sup>): flavonoid</b> ; <b>0.28 (Yellow<sup>a</sup>. Blue<sup>b</sup>): flavonoid</b> ; <b>0.20 (Blue<sup>b</sup>): flavonoid</b> ; <b>0.15 (Yellow<sup>a</sup>): flavonoid</b> ; <b>00 (Yellow<sup>b</sup>): flavonoid</b> .
SSF H-Et (AcOEt)	0.86 (Blue <sup>b</sup> ): <b>flavonoid</b> ; 0.81 (Yellow <sup>a</sup> ): <b>flavonoid</b> ; 0.75 (Yellow <sup>b</sup> ): <b>flavonoid</b> ; 0.71 (Yellow <sup>a</sup> ): <b>flavonoid</b> ; 0.65 (Yellow <sup>b</sup> ): <b>flavonoid</b> ; 0.6 (Yellow <sup>a,b</sup> ): <b>flavonoid</b> ; 0.46 (Yellow <sup>b</sup> ): <b>flavonoid</b> ; 0.38 (Yellow <sup>a</sup> ): <b>flavonoid</b> ; 0.36 (Yellow <sup>a</sup> ): <b>flavonoid</b> ; 0.25 (Yellow <sup>a,b</sup> ): <b>flavonoid</b> ; 0.23 (Yellow <sup>b</sup> ): <b>flavonoid</b> ; 0.13 (Yellow <sup>a,b</sup> ): <b>flavonoid</b> ; 00 (Yellow <sup>b</sup> ): <b>flavonoid</b> .
SST H-Et (AcOEt)	<b>0.95 (Blue<sup>b</sup>) : flavonoid</b> ; <b>0.74 (Blue<sup>b</sup>): flavonoid</b> ; <b>0.45 (Yellow<sup>a</sup>. Blue<sup>b</sup>): flavonoid</b> ; <b>0.25 (Yellow<sup>a</sup>): flavonoid</b> ; <b>0.18 (Blue<sup>b</sup>): flavonoid</b> ; <b>0.08 (Yellow<sup>a</sup>): flavonoid</b> .

**Table 6. Visible detection of tannins and phenolic acids in CH<sub>2</sub>Cl<sub>2</sub> / AcOEt / CH<sub>3</sub>COOH (1: 3,5:1) (V/V/V) developer from dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>) and acetate-ethyl (AcOEt) extracts.**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	0.96 (green): <b>phenolic acid</b> ; 0.65 (green): <b>phenolic acid</b> ; 0.56 (grey): <b>tannin</b> ; 0.49 (grey): <b>tannin</b> .
SST H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	<b>0.9 (green): phenolic acid</b> ; <b>0.68 (grey): tannin</b> ; <b>0.49 (grey): tannin</b> .
SSF H-Et (AcOEt)	0.68 (green): <b>phenolic acid</b> ; 0.6 (grey): <b>tannin</b> ; 0.55 (grey): <b>tannin</b> ; 0.46 (grey): <b>tannin</b> ; 0.36 (grey): <b>tannin</b> ; 0.26 (grey): <b>tannin</b> ; 0.19 (grey): <b>tannin</b> ; 0.09 (grey): <b>tannin</b> .
SST H-Et (AcOEt)	<b>0.9 (green): phenolic acid</b> ; <b>0.69 (grey): tannin</b> ; <b>0.42 (grey): tannin</b> ; <b>0.31 (grey): tannin</b> ; <b>0.2 (grey): tannin</b> ; <b>0.11 (grey): tannin</b> ; <b>00 (grey): tannin</b> .

The summary results of phytochemical screening on TLC plates of the various secondary metabolites of *Saba senegalensis* leaf and stem extracts are given in Table 7. Both organs were found to contain sterols,

terpenes, flavonoids, tannins, and phenolic acids. However, only the leaves contain coumarins, while alkaloids are absent in both plant organs.

**Table 7. Summary table of phytochemical screening of secondary metabolites**

	Sterols	Terpenes	Alkaloids	Coumarins	Flavonoids	Phenolics acids	Tannins
SSF	+	+	-	+	+	+	+
SST	+	+	-	-	+	+	+

Presence (+) ; absence (-)

### II.1.3. Evaluation of antioxidant activity

#### II.1.3.1. Evaluation of antioxidant activity by TLC

Analysis of the hexanolic, dichloromethane, and acetate-ethyl extracts of the two organs studied revealed the appearance of pale-yellow spots on a

violet background, and the values of their frontal ratios (R<sub>f</sub>) have been recorded in tables 8, 9, 10, and 11. It can thus be concluded that all these extracts contain significant antioxidant activity in view of the high number of pale-yellow spots observed.

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	JIF = <b>1.500</b>	SJIF (Morocco) = <b>7.184</b>	OAJI (USA) = <b>0.350</b>

**Table 8. DPPH radical scavenging phytochemicals in C<sub>6</sub>H<sub>14</sub>/AcOEt (5 : 0.375) (V/V/V) developer from hexane extracts**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (Hexane)	0.89 (yellow): <b>terpene</b> ; 0.25 (yellow): <b>sterol</b> ; 0.09 (yellow): <b>sterol</b> ; 0.00 (yellow): <b>sterol</b> .
SST H-Et (Hexane)	<b>0.99 (yellow): NI</b> ; <b>0.9 (yellow): NI</b> ; <b>0.83 (yellow): terpene</b> ; <b>0.38 (yellow): sterol</b> ; <b>0.29 (yellow): sterol</b> ; <b>0.08 (yellow): sterol</b> ; <b>0.00 (yellow): terpene</b> .

NI: unidentified compound

**Table 9. DPPH radical scavenging phytochemicals in CH<sub>2</sub>Cl<sub>2</sub>/AcOEt/ C<sub>6</sub>H<sub>14</sub> (2 : 2 : 1) (V/V/V) developer from dichloromethane extracts (CH<sub>2</sub>Cl<sub>2</sub>)**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	0.98 (yellow): NI; 0.9 (yellow): <b>coumarin</b> ; 0.85 (yellow): NI; 0.78 (yellow): <b>coumarin</b> ; 0.69 (yellow): NI; 0.61 (yellow): NI; 0.54 (yellow): NI; 0.48 (yellow): NI; 0.4 (yellow): NI; 0.35 (yellow): NI; 0.28 (yellow): NI; 0.2 (yellow): NI; 0.16 (yellow): NI; 0.1 (yellow): NI; 0.0 (yellow): <b>coumarin</b> .
SST H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	<b>0.98 (yellow): NI</b> ; <b>0.93 (yellow): NI</b> ; <b>0.85 (yellow): NI</b> ; <b>0.79 (yellow): NI</b> ; <b>0.71 (yellow): NI</b> ; <b>0.71 (yellow): NI</b> ; <b>0.66 (yellow): NI</b> ; <b>0.59 (yellow): NI</b> ; <b>0.55 (yellow): NI</b> ; <b>0.55 (yellow): NI</b> ; <b>0.48 (yellow): NI</b> ; <b>0.4 (yellow): NI</b> ; <b>0.35 (yellow): NI</b> ; <b>0.28 (yellow): NI</b> ; <b>0.21 (yellow): NI</b> ; <b>0.15 (yellow): NI</b> ; <b>0.1 (yellow): NI</b> ; <b>0.0 (yellow): NI</b> .

NI: unidentified compound

**Table 10. DPPH radical scavenging phytochemicals in CH<sub>2</sub>Cl<sub>2</sub>/ AcOEt/ C<sub>6</sub>H<sub>14</sub> (3 : 4 : 2) (V/V/V) developer from dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>) and acetate-ethyl (AcOEt) extracts**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	0.98 (yellow): <b>flavonoid</b> ; 0.8 (yellow): <b>flavonoid</b> ; 0.7 (yellow): <b>flavonoid</b> ; 0.69 (yellow): NI; 0.63 (yellow): <b>flavonoid</b> ; 0.54 (yellow): <b>flavonoid</b> ; 0.39 (yellow): <b>flavonoid</b> ; 0.24 (yellow): <b>flavonoid</b> ; 0.13 (yellow): <b>flavonoid</b> ; 0.1 (yellow): NI; 0.06 (yellow): NI; 0.0 (yellow): <b>flavonoid</b> .
SST H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	<b>0.94 (yellow): NI</b> ; <b>0.9 (yellow): flavonoid</b> ; <b>0.79 (yellow): flavonoid</b> ; <b>0.68 (yellow): flavonoid</b> ; <b>0.64 (yellow): NI</b> ; <b>0.5 (yellow): flavonoid</b> ; <b>0.45 (yellow): NI</b> ; <b>0.4 (yellow): flavonoid</b> ; <b>0.28 (yellow): flavonoid</b> ; <b>0.2 (yellow): flavonoid</b> ; <b>0.15 (yellow): flavonoid</b> ; <b>0.11 (yellow): NI</b> ; <b>0.08 (yellow): NI</b> ; <b>0.0 (yellow): flavonoid</b> .
SSF H-Et (AcOEt)	0.94 (yellow): NI; 0.86 (yellow): <b>flavonoid</b> ; 0.81 (yellow): <b>flavonoid</b> ; 0.75 (yellow): <b>flavonoid</b> ; 0.65 (yellow): <b>flavonoid</b> ; 0.6 (yellow): <b>flavonoid</b> ; 0.49 (yellow): NI; 0.46 (yellow): <b>flavonoid</b> ; 0.36 (yellow): <b>flavonoid</b> ; 0.25 (yellow): <b>flavonoid</b> ; 0.23 (yellow): <b>flavonoid</b> ; 0.13 (yellow): <b>flavonoid</b> ; 0.06 (yellow): NI; 0.0 (yellow): <b>flavonoid</b> .
SST H-Et (AcOEt)	<b>0.95 (yellow): flavonoid</b> ; <b>0.85 (yellow): NI</b> ; <b>0.78 (yellow): NI</b> ; <b>0.74 (yellow): flavonoid</b> ; <b>0.61 (yellow): NI</b> ; <b>0.54 (yellow): NI</b> ; <b>0.45 (yellow): flavonoid</b> ; <b>0.36 (yellow): NI</b> ; <b>0.25 (yellow): flavonoid</b> ; <b>0.18 (yellow): flavonoid</b> ; <b>0.13 (yellow): NI</b> ; <b>0.08 (yellow): flavonoid</b> ; <b>0.0 (yellow): NI</b> .

NI: unidentified compound

**Table 11. DPPH radical scavenging phytochemicals in CH<sub>2</sub>Cl<sub>2</sub>/ AcOEt/CH<sub>3</sub>COOH (1 : 3,5 : 1) (V/V/V) developer from dichloromethane (CH<sub>2</sub>Cl<sub>2</sub>) and acetate-ethyl (AcOEt) extracts**

Extracts	R <sub>f</sub> (Color): Possible compounds
SSF H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	0.96 (yellow): <b>phenolic acid</b> ; 0.84 (yellow): NI; 0.78 (yellow): NI; 0.71 (yellow): NI; 0.65 (yellow): <b>phenolic acid</b> ; 0.54 (yellow): NI; 0.58 (yellow): NI; 0.56 (yellow): <b>tannin</b> ; 0.49 (yellow): <b>tannin</b> ; 0.4 (yellow): NI; 0.35 (yellow): NI; 0.28 (yellow): NI; 0.23 (yellow): NI; 0.15 (yellow): NI; 0.08 (yellow): NI; 0.0 (yellow): NI.

<b>Impact Factor:</b>	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
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	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SST H-Et (CH <sub>2</sub> Cl <sub>2</sub> )	0.9 (yellow): phenolic acid; 0.84 (yellow): NI; 0.76 (yellow): NI; 0.68 (yellow): tannin; 0.63 (yellow): NI; 0.55 (yellow): NI; 0.49 (yellow): tannin; 0.39 (yellow): NI; 0.33 (yellow): NI; 0.25 (yellow): NI; 0.16 (yellow): NI; 0.11 (yellow): NI; 0.08 (yellow): NI; 00 (yellow): NI.
SSF H-Et (AcOEt)	0.96 (yellow): NI; 0.85 (yellow): NI; 0.78 (yellow): NI; 0.73 (yellow): NI; 0.68 (yellow): phenolic acid; 0.6 (yellow): tannin; 0.55 (yellow): tannin; 0.51 (yellow): NI; 0.46 (yellow): tannin; 0.36 (yellow): tannin; 0.31 (yellow): NI; 0.26 (yellow): tannin; 0.19 (yellow): tannin; 0.09 (yellow): tannin; 00 (yellow): NI
SST H-Et (AcOEt)	0.94 (yellow): NI; 0.9 (yellow): phenolic acid; 0.79 (yellow): NI; 0.7 (yellow): NI; 0.69 (yellow): tannin; 0.55 (yellow): NI; 0.45 (yellow): NI; 0.42 (yellow): tannin; 0.31 (yellow): tannin; 0.2 (yellow): tannin; 0.11 (yellow): tannin; 0.05 (yellow): NI; 00 (yellow): tannin.

NI: unidentified compound

### II.1.3.2. Assessment of antioxidant activity by spectrophotometry

#### II.1.3.2.1. Inhibition percentages for vitamin C, aqueous, ethanolic, and hydroethanolic crude extracts

Percentage inhibition is the ability of an extract to scavenge free radicals. The different percentages of

DPPH inhibition by aqueous, ethanolic, and hydroethanolic extracts and vitamin C are shown in Figures 1 and 2. Inhibition percentages for plant extracts range from 05.839 ± 03.499% to 79.774 ± 0.579%, and for vitamin C from 63.316 ± 0.405% to 84.201 ± 0.116%, at concentration ranges from C6=0.062 5mg/mL to C1=2 mg/mL.

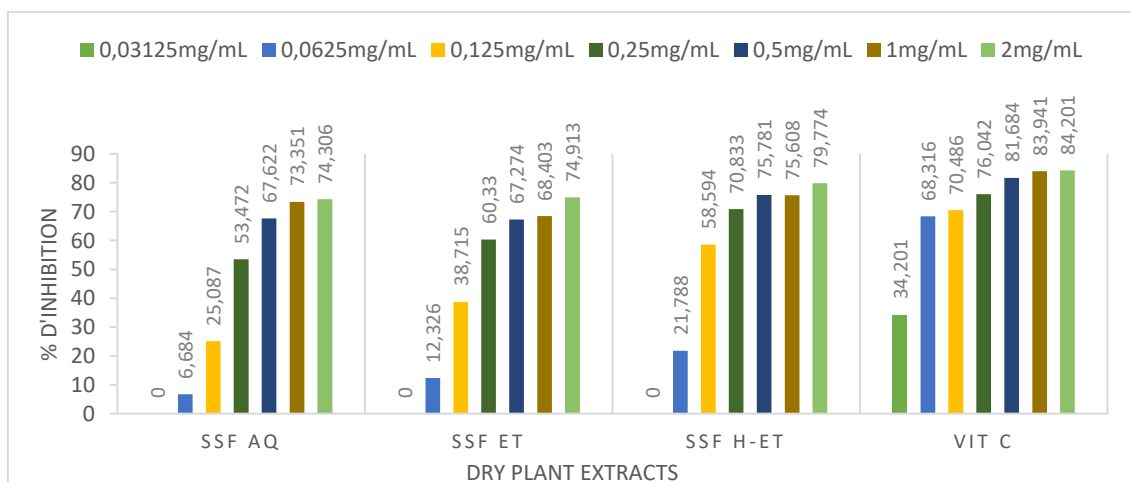


Figure 1. DPPH inhibition by aqueous, ethanolic and hydroethanolic extracts of *Saba senegalensis* leaves

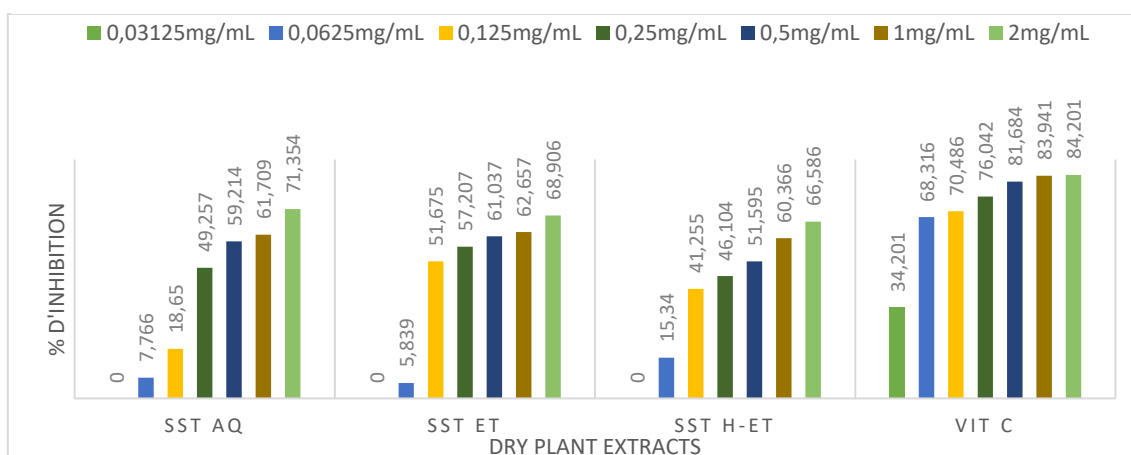


Figure 2. DPPH inhibition by aqueous, ethanolic and hydroethanolic extracts of *Saba senegalensis* stems



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### II.1.3.2.2. Determination of IC<sub>50</sub>s for vitamin C and aqueous, ethanolic, and hydroethanolic crude extracts

The 50% inhibitory concentrations were used to calculate the concentrations of the samples studied required to reduce 50% of DPPH radicals. The IC<sub>50</sub> of an extract is the concentration that results in a 50%

loss of DPPH activity [10]. The lower the IC<sub>50</sub>, the greater the antioxidant activity of the extract.

IC<sub>50</sub> values for aqueous and organic extracts range from 0.11041 mg/mL to 0.42738 mg/mL, while that for vitamin C is 0.04575 mg/mL. These mean values are shown in Table 12.

Table 12. Summary table of IC<sub>50</sub> values (mg/mL) for various extracts

Extracts	Right equations	IC <sub>50</sub> (mg/mL)
Vit C	Y= 1091 X + 0.086	0.04575
SSF Aq	Y= 227.08 X – 3.298	0.23471
SSF Et	Y= 172.92 X + 17.1	0.19026
SSF H-Et	Y= 588.9 X – 15.018	0.11041
SST Aq	Y= 39.828 X + 39.3	0.26865
SST Et	Y= 733.38 X – 39.997	0.12271
SST H-Et	Y= 21.964 X + 40.613	0.42738

## II.2. Discussion

Leaf yields ranged from 35.10 ±3.94 for the ethanolic extract to 46.03 ±1.98 for the hydroethanolic extract, while stem bark yields varied from 46.39 ±2.63 for the hydroethanolic extract to 49.00 ±2.76 for the ethanolic extract. The aqueous extracts of leaves and stems each achieved the second-highest yields for the different extractions of their respective organs. Yield values varied from one organ to another, depending on the solvent used, the extraction method and the extraction conditions. All extraction yields for stems are higher than those for leaves. However, these values are relatively high in comparison with the research work of several other authors [11, 12]. This may justify the routine use of these extraction methods in many research projects. In fact, extraction by maceration with alcohols (ethanol) is said to be more effective in extracting many groups of phytochemicals [13]. Moreover, the presence of water in extractions allows the permeability of plant tissues, and favors the phenomenon of mass diffusion in the extraction stage [14, 15, 16]. Therefore, the use of water, ethanol or a mixture of the two is partly responsible for these relatively high yields.

Phytochemical screening by TLC was carried out on *Saba senegalensis* leaves and stems. Sterols, terpenes, flavonoids, tannins and phenolic acids were identified in both organs studied, coumarins only in leaves, and alkaloids were absent in both organs. These results are in harmony with those of Serigne *et al.* [17] and Traoré [18] on *S. senegalensis* leaves. Indeed, the work of Serigne *et al.* showed the presence of non-hydrolyzable tannins, and flavonoids and the

absence of alkaloids in the ethanolic and aqueous extracts of the plant's leaves [17]. As for Traoré's work, he highlighted the presence of coumarins, flavonoids, tannins, sterols and triterpenes in *S. senegalensis* leaf extracts, and also noted the absence of alkaloids [18]. Phytochemical TLC screening of *S. senegalensis* leaves and stems revealed several secondary metabolites with numerous pharmacological properties. These include antibacterial [19, 20], antiparasitic [21], analgesic [22], anti-inflammatory [23, 24], antimicrobial [21], antiviral [20], hemostatic [25], and antioxidant [21] properties. This work could justify the use of *S. senegalensis* leaves and stems in the traditional treatment of numerous pathologies. Indeed, the leaves are used to treat headaches, rectal prolapse, otitis, anorexia, food poisoning, dysentery, and urinary schistosomiasis, while also having hemostatic properties [26]. Stems are used to treat infectious diseases (lung diseases, boils, diarrhea), parasites (urinary schistosomiasis), inflammatory diseases, and headaches [27].

Antioxidant activity was assessed by TLC and spectrophotometry. The TLC profile identified several compounds responsible for the antioxidant activity of the two organs studied. By comparing the chromatographic profiles of the phytochemical screening with those of the antioxidant activity screening, the correspondence between the active zones and the phytochemicals responsible for this activity was established. In hexane extracts, some yellow spots correspond to the antioxidant activity of sterols and terpenes (R<sub>f</sub>: 0.89; 0.25; 0.09; 0.0 for



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leaves / Rf: 0.83; 0.38; 0.29; 0.08; 0.0 for stems). Similarly, the antioxidant power of the dichloromethane and acetate-ethyl extracts from the two plant organs is deduced from flavonoids, phenolic acids, tannins, and coumarins only in the leaves. However, several other compounds with antioxidant activity could not be identified (NI) in the various selective extracts of the two *Saba senegalensis* organs studied.

As for the evaluation of antioxidant activity by spectrophotometry, the aim was to determine the inhibition percentages of the extracts with respect to DPPH and to determine their inhibitory IC<sub>50</sub> concentrations. The study showed that the various extracts exhibited antioxidant potential, irrespective of their concentration. This oxidizing activity observed for these aqueous and organic extracts is partly due to the synergistic action of all the secondary metabolites in *Saba senegalensis* leaves and stems. Indeed, a study by Kang et al. [28] attributed the extracts' anti-free radical activity to the richness of phenolic compounds detected within them. This study suggested that the polar molecules present in plant extracts contribute to increased anti-free radical activity [28]. In addition, other studies on certain plant extracts have shown a high, positive correlation between total phenolic compounds (flavonoids, phenolic acids, tannins, and coumarins) and anti-free radical activity [29, 30].

These inhibition percentages represent the extracts' capacity to trap free radicals and have been used to calculate the IC<sub>50</sub>, an even more precise constant for interpreting results. This concentration represents the capacity of an extract to cause a 50% loss of DPPH activity [10]. The lower the IC<sub>50</sub>, the greater the antioxidant activity of the extract.

By comparison: IC<sub>50</sub> (Vit C) < IC<sub>50</sub> (SSF H-Et) < IC<sub>50</sub> (SSF Et) < IC<sub>50</sub> (SSF Aq), so the antioxidant power of the hydroethanolic leaf extract is greater than that of the ethanolic extract, which in turn is greater than that of the aqueous extract. Similarly, we can see that IC<sub>50</sub> (Vit C) < IC<sub>50</sub> (SST Et) < IC<sub>50</sub> (SST Aq) < IC<sub>50</sub> (SST H-Et), so for stems, the antioxidant power of the ethanolic extract is greater than that of the aqueous extract, which in turn is greater than that of the hydroethanolic extract. Generally speaking, the

antioxidant power of leaves is greater than that of stems.

At the end of this quantitative analysis of antioxidant capacity, the crude aqueous, ethanolic, and hydroethanolic extracts of *Saba senegalensis* leaves and stems revealed significant DPPH neutralizing power. These results are in perfect harmony with those of Traoré, who had previously confirmed this activity by TLC but especially by spectrophotometry [18]. Therefore, these two *Saba senegalensis* organs are antioxidants that could be recommended to prevent or curb the damage caused by oxidative stress, namely cancer, accelerated aging, high blood pressure, Alzheimer's, Parkinson's, and diabetes [31, 32]. These results seem to justify the *de facto* use of these two plant organs in traditional medicine in Korhogo (Côte d'Ivoire).

## CONCLUSION

This work aimed to confirm or invalidate the use of *Saba senegalensis* leaves and stem bark as a good antioxidant capable of traditionally treating various pathologies.

The results of phytochemical screening of the various extracts using TLC highlighted the presence of flavonoids, tannins, phenolic acids, saponins, sterols, and terpenes in the extracts of *S. senegalensis* leaves and stem bark. Coumarins were found only in the leaves. Alkaloids, on the other hand, were absent in both organs studied.

Antioxidant activity towards DPPH was assessed using qualitative (TLC) and quantitative (spectrophotometry) methods on both organs' aqueous, ethanolic, and hydroethanolic extracts. The results showed that these organs have a good antioxidant profile, partly due to secondary metabolites detected in them. Quantitative analysis of antioxidant capacity showed that, in general, the antioxidant capacity of leaves was higher than that of stems. However, both organs can be considered antioxidants that could prevent or treat diseases linked to oxidative stress.

In the future, this work on *S. senegalensis* leaves and stems should continue to prove their safety for the human organism and produce an antioxidant phytomedicine within the reach of all social classes.

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Article



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## THE DEPENDENCE OF CHANGE IN THE PART THICKNESS ON THE DEPTH OF SHEET METAL DRAWING

**Abstract:** An analysis of change in the thickness of a hollow part obtained by plastic deformation was carried out in this article. It is noted that when deep drawing sheet metal, the thinning of the part walls can reach up to 12% of the initial thickness. At the same time, the increase in the thickness of the part walls during compression deformation reaches up to 22% of the initial thickness of the sheet metal.

**Key words:** deep drawing, blank, thickness, thinning.

**Language:** English

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### Introduction

Sheet metal drawing is the most common method for producing hollow metal parts of various configurations [1-3]. Since this technological process is accompanied by plastic deformation, the material is subjected to compression and tension, temperature deformation, etc. [4]. The intensity of sheet metal deformation during the drawing process can be analyzed through computer simulation [5]. When the blank material is deformed, the wall size of the part being formed changes from the initial thickness, i.e. thinning occurs [6-10]. The wall thickness of the part may increase or decrease depending on the type of deformation. Analysis of the degree of thinning of the part walls during deep drawing will allow us to draw a conclusion about the general stress and strain state of the material.

### Materials and methods

A model of a blank 1 mm thick, made with the properties of a deformable aluminum alloy, was subjected to plastic deformation. The formation of the part cavity was carried out with a cylindrical punch. The deep drawing process continued until the height of the hollow part was 60 mm. The values for change in the wall thickness of the semi-finished product were obtained over the entire range of movement of the

punch along the centerline of the sheet metal. The maximum values of the wall thickness of the semi-finished product under conditions of tension and compression were accepted.

### Results and discussion

The dependence of change in the initial thickness of the blank on the drawing depth is shown in the Fig. 1. In the graph, zero corresponds to the initial thickness of the sheet metal before plastic deformation. Positive thinning values are characterized by a decrease in the wall thickness of the formed semi-finished product, and negative thinning values are characterized by an increase in the wall thickness of the formed semi-finished product. Pulling sheet metal into the die to a depth of up to 12 mm does not change the initial thickness. When the drawing depth reaches 12 mm, the wall thickness of the semi-finished product begins to change, that is, at the same time there is a decrease and increase in the wall thickness of the semi-finished product in various contact zones of the die and the punch. At the same time, a constant reduction in the wall thickness of the part to the maximum value occurs up to a drawing depth of 40 mm. A constant increase in the wall thickness occurs up to a drawing depth of 60 mm.

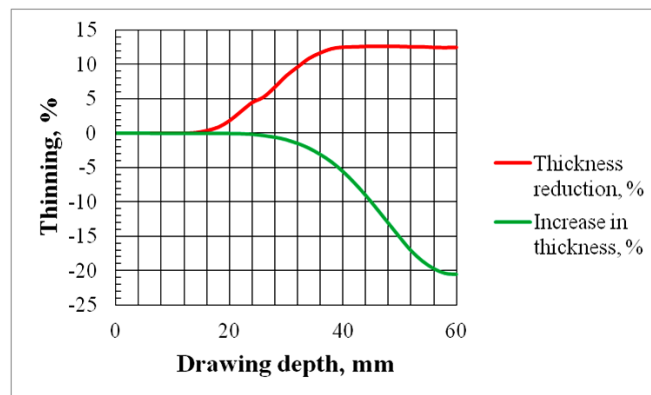


Figure 1 – The dependence of change in the initial thickness of the blank on the drawing depth.

Thus, the degree of compression of the material during drawing is approximately twice as great as the degree of stretching.

### Conclusion

Sheet metal undergoes greater compression deformation during deep drawing. The maximum

increase in wall thickness (approximately 22%) is observed when the part is drawn to its full height. The maximum reduction in wall thickness (approximately 13%) is observed when the part is drawn to 2/3 of the height.

### References:

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Article



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## SOCIO-POLITICAL TRANSFORMATIONS AND THEIR CONSEQUENCES (1986-1990)

**Abstract:** The article analyzes the socio-political situation of the Republic of Uzbekistan on the eve of achieving the independence of the Republic of Uzbekistan (1986-1990), the policy of the USSR government and the Communist Party's policy of tyranny towards Uzbekistan. The article also analyzes the socio-political and economic situation in Uzbekistan for the independence of Uzbekistan.

**Key words:** Reconstruction, Socialism, Ideological unity, Communist party, Capitalism, sovereignty paradigm, Administrative and command methods, Totalitarian regimes, Political life, CIS.

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### Introduction

The restructuring policy and reforms implemented by the Soviet Communist Party (CPSU) between the 80s of the 20<sup>th</sup> century entered all aspects of socio-political life in Uzbekistan. At that time some of the democratic changes were made as a result of the implementation of this policy announced by the Secretary General of the Central Committee of the Communist Party of the Soviet Socialist Republic M. Gorbachev: party censorship weakened, citizens were allowed to express their opinion freely and independently, the media was liberalized. Particular attention was given to transparency (1). As a result, prominent intellectuals-writers and poets have begun to strike strongly against the communist ideology in their coverage. The former Soviet socialist system was sharply criticized throughout the Soviet Union. Particularly, all the errors of party and state leaders, the process of administrative manipulation, repression of the country's original children. In the long run, this was seen as an ideological factor in the collapse of the Union. However, the democratic values emerging in Moscow and other Russian cities- fierce criticism of the old system, such as transparency, have come to Uzbekistan without any trace. The "democracy" creators in the center treated the allied republics as patriarchal societies.

For example, the process of "reconstruction of the old system as a result of centralized criticism campaigns started but in the Central Asian and regime is still living as it used to be", reflecting the views of the party elite at that time. In the central USSR mass media, there is a large number of "additions" in cotton production in Uzbekistan, "corrupt practices" of most officials, in crease "bribery" as well as the allegations of slander, as well as the support of the party's leadership in Moscow, the socio-political situation in the republic. In other words, the campaign of discrimination, which has not yet had its own socio-political foundation, has been regarded as a "sanction of punishment" for Uzbekistan. Traditionally, the party and the government of the USSR have traditionally been sent to Uzbekistan by officers of the Prime Minister's Office, the Ministry of Internal Affairs and State security committee. The results of their weekly and monthly investigation have begun to be published in the media by the "ala". In the short term, Uzbekistan has become a symbol of "corruption" among other USSR republics (2). From 1983 to 1989, as a result of the "trace" from the center, 60% of the heads of state-owned collective farms and state farmers, nearly 45% of leading agricultural specialists, and one third of all heads of cotton-breeding bureaucrats were removed from their posts.

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About 40,000 civilians who were working in that office were tortured by investigators from the center. They were kept in detention facilities during the investigations, and their polygamy was sent to prisons and Siberian camps. This situation dropped the spirit of the Uzbek people. The mood of the country has grown, the lack of trust in the future, social depression, and passivity have become one of the peculiarities of that time. Of course, during the same period in other republics of the USSR campaigns were started to disclose various "crimes". However, the "cotton case" in Uzbekistan was declared as the most extreme crime in the whole union. Investigation into the "cotton case" has become a criminal "bestseller". By the second half of the 20th century, it began to be described as "the work of the Uzbeks." Television screens featured gold, gold coins and other precious items and sacks found in senior officials. The scale of this press attack was behind the planned implementation of the "general director" of the campaign as the leadership of the KPSS. Because at that time the center was unprecedented - 6 mln. tons of raw cotton, as a result of lack of opportunities to grow cotton in this amount, there was a political, social and economic crisis in the country. It was the centerpiece of the "cotton business" and "the case of the Uzbeks" in order to put pressure on the Uzbek leadership and to minimize the tension between the CPSU and the leadership of the Soviet state in Uzbekistan. The KPSS was rumors that the Uzbek population was "rich" to justify their repressive policies. The use of "cotton business" and "the work of the Uzbeks" in relation to an entire Uzbek nation, the promotion of the Uzbek people as a "negative image" of the whole union was not just social or legal injustice, but also a slander against an entire nation. It was no secret that during this period, the Soviet Union had been extending its influence to all the nations of the USSR in order to demonstrate the superiority of the socialist system in the Soviet Union, and that such cases were common to all the allied republics, even to the Russian republic. Therefore, similar campaigns in Uzbekistan have formed a negative attitude towards the Uzbek nation against the CPSU, the USSR. The people of the Republic of Uzbekistan, who have no innocent "evil", began to form a tendency toward nationalism and national values. By the end of the 80's of the 20th century, as a result of the policy pursued by the people not only by the government, but also by the national interests that contradicted the colonial policy of the center, historic, political and economic conditions were being established to achieve the independence of Uzbekistan.

The "rebuilding" reforms announced by the center were initially implemented in the political sphere. The economic sphere was again politically governed by the previous one. As a result of ignoring the laws of economic development and transforming it into an appendix of the communist ideology, the

balance between the national economy and the socio-political life has been disrupted and as a result, there are problems with the state and local government. This situation has aggravated people's living conditions (3). The "reconstruction" reforms announced by the center were not supported by the people with economic difficulties; on the other hand, governance in the provinces, cities and districts was largely owned by local party organizations, and they also slowed down the deepening of reforms on the ground. After all, party organizations in the areas did not have the confidence that the reforms would have a positive effect. In Uzbekistan, which was a part of the Soviet Union at that time, the policy of "restructuring" was still under way. The tragedy of the 'restructuring' policy was that while the ruling party was in the hands of the party, it had begun to reform the representative bodies and self-governing bodies before rebuilding the party. To this end, the representative bodies sought to democratize the electoral system and improve the selection of candidates for the people's representation. The election of the first secretaries of the provincial, municipal and district party organizations as chairmen of the relevant representative bodies has further aggravated political life.

Because party leaders, who are not yet experienced by the representative bodies of the representative bodies, consider themselves the leader of the party organization, rather than the representative body. They sometimes did not have the power to govern and make decisions based on regular dialogue and debate with a parliamentary team that reminded them of street protests. Moreover, it was easy to manage the party organizations. Because, thousands of organizational organizations and their monthly salaried secretaries in each district and city were subordinate to the high party organizations on the basis of "democratic centralism." Similarly, enterprises, institutions, and educational institutions prefer to be in the hands of higher party bodies than the representative of the sentiments to the sentence, trying to keep their work teams stable. Also, on June 21, 1987, the election process for local representative bodies did not produce the expected results. In the first place, democratic principles were not included in the election process, as the party's organizations were weakened by the fact that the predominance of the majority of voters was prevalent in the pre-election campaign. As a result of the elections to local councils held in Uzbekistan, 106484 deputies were elected, 37709 (35.7%) workers and 29209 (27.7%) representatives of collective.

The majority of MPs represent Slavic nationalities and the majority of deputies in the large industrial enterprises due to the fact that the contribution of local minorities to the minority (more than 70% of the population of the republic was ethnic Uzbek, only 45.7% representatives of other Russian-speaking peoples. In 1987, there were more than

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<b>JIF</b>	<b>= 1.500</b>	<b>SJIF (Morocco)</b>	<b>= 7.184</b>	<b>OAJI (USA)</b>	<b>= 0.350</b>

642,000 party members in the Republican Party organization, representing 3.3% of the country's population. According to the results of the elections 105,494 deputies were elected, of which 44.6% were members of the party. The remaining 96.7 5 of the members of the population were only 55.4% (58448). These results have shown that the influence of the Communist Party in Uzbekistan still remains. The "restructuring" policy was sought to reform the system of elections to the supreme councils and local representative bodies of all USSR republics. In practice, however, the form of elections was changed furiously, but their essence and significance remained unchanged. In February and April 1990, elections to the Supreme Soviet of multi-mandate constituencies were held in Uzbekistan. This election was held under the monopoly of the Communist Party. The outcome of the election and its results were aimed at a great deal of silence on the country's economic and political reforms, but its results did not bring any public-political stability. The main focus was on promoting the declarative character of the election. For example, in most constituencies, candidates were alternatively nominated (174 alternate candidates from 50 single mandate constituencies were not nominated). Therefore, according to the results of the elections, the number of workers, collective farmers, women and youth fell sharply among the deputies. Approximately 95 percent of the elected deputies were Communists (4). Because all the sub-organizations of the party interfered with the electoral process and took all possible measures to be taken to select the candidates they wanted. While the democratic transformation of the "Reconstruction" period was characteristic of the declarative nature, the multiplicity and mass rallies and meetings, as well as the rise of some informal organizations, resulted in the problems that have been accumulated during the period of the totalitarianism of the 1970s, which are characterized by the signs of socio-political crises went out. Moreover, as a result of the USSR's failure to comply with its contractual obligations to Uzbekistan by other USSR importers - such as sugar, confectionery products, cereal products, clothing, oil products, and spare parts for machinery - became ridiculous for various informal organizations. In 1989-1990, inter-ethnic conflicts and clashes took place in Fergana region, Parkent district of Tashkent region and Andizhan. These events were published in the press in line with the will of the center throughout the Soviet Union. The socio-political situation in the republic has aggravated. The causes of conflicts and clashes have been accumulated for many years in the pursuit of social feelings, economic depression, moral instability, and feelings

of selfishness through the mobility of people who have lived under the slavery of a monotone for many years. On May 24, 1989, in Kuvasai, a form of "interethnic" ethnic tensions between the local youth and the young Meskhetian Turks came to an end. The collapse spread throughout the Fergana Valley as a result of the lack of impartial information about the conflict, learning by the authorities of "socialist stability" that they suddenly experienced these events, the skill of leaders and their pursuit of events. The clashes soon spread to the residents of Fergana, Margilan, Toshbol, Kokand, Andizhan, Namangan and Tashkent, leading to mass demonstrations of young people and to other ethnic conflicts (5). With the consent of the center, which was afraid of such protests, local leaders brought military units against demonstrators. On June 8, 1989 in Kokand, more than 50 demonstrators were killed and more than 200 demonstrators were wounded in a shootout by military men, mostly young men. Also, as a result of the firing of militants from other regions of Ferghana region on June 3-1, 1989, 103 people were killed, of which 1009 were injured. The houses and yards of 650 families were burned and destroyed (6). The tragic events in Ferghana and other cities have proven that the local party, the Soviet and the public organizations were separated from the people, completely passionate about the suffering and the interests of the people, and that the social sphere was abandoned. Meanwhile, the Government of the Republic has identified the following measures: elimination of cotton monopoly, stabilization of its cotton planting and cotton processing, revision of additional fees for cotton harvesting and cost of raw cotton, social protection of the poor, expansion of subsidiary farms and their lands, as well as implementation of measures that play an important role in eliminating the economic, social and political crisis in the other republic. As you can see from the analysis, all the political, social, and economic situations in which Uzbekistan gained independence were formed. The Uzbek nation and the government of the republic have united the interests of independence. In 1990, the government began to establish legal and economic foundations for achieving independence. On June 18, 1990 the 2nd session of the Supreme Soviet (Parliament) of the Republic adopted the Declaration of Independence (7). The adoption of this declaration without leaving the USSR was a turning point in the political life of the republic. The Declaration of Independence was a legal basis for proclaiming the independence of the Republic of Uzbekistan proclaimed on 31 August 1991.

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Article



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## INVESTIGATION OF HYDRODYNAMICS IN THE WALLS OF A LATTICE BASED ON A SCHWARTZ P TRIPLY PERIODIC MINIMAL SURFACE

**Abstract:** In this work, a study of hydrodynamics in the walls of a Schwartz P triply periodic minimal surface was performed. TPMS lattices consisting of 1, 8, and 27 unit cells were chosen as the initial geometry for CFD modeling. The fluid flow problem was solved using the Fluent module of the ANSYS software package. In the course of solving the problem, the vector fields of the velocity distribution were obtained and the pressure losses in the TPMS channels were determined. Based on the analysis of the graph of the dependence of pressure losses on the flow velocity, an analytical dependence was obtained to determine the pressure losses for Schwarz P an elementary cubic cell with a cube edge length  $a = 75 \text{ mm}$  and wall thickness  $\delta = 5 \text{ mm}$ .

**Key words:** minimal surface, ANSYS, CFD modeling, pressure drop, TPMS.

**Language:** Russian

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## ИССЛЕДОВАНИЕ ГИДРОДИНАМИКИ В СТЕНКАХ РЕШЕТКИ, ОСНОВАННОЙ НА ТРИЖДЫ ПЕРИОДИЧЕСКОЙ МИНИМАЛЬНОЙ ПОВЕРХНОСТИ ШВАРЦА P

**Аннотация:** В работе выполнено исследование гидродинамики в стенках трижды периодической минимальной поверхности Шварца P. В качестве исходной геометрии для CFD-моделирования выбраны TPMS решетки, состоящие из 1, 8 и 27 элементарных ячеек. Решение задачи течения жидкости выполнено при помощи модуля Fluent программного комплекса ANSYS. В ходе решения задачи получены векторные поля распределения скорости и определены потери давления в TPMS каналах. Исходя из анализа графика зависимости потерь давления от начальной скорости потока получена аналитическая зависимость для



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определения потерь давления для в элементарной кубической ячейке Шварца Р с длиной ребра куба  $a = 75$  мм и толщиной стенки  $\delta = 5$  мм.

**Ключевые слова:** минимальная поверхность, ANSYS, CFD-моделирование, потери давления, TPMS.

### Введение

УДК 532.5

Во множестве современных двигателей [1,2], холодильников [3], турбин [4] и других агрегатов [5,6] высокое тепловыделение является серьезной проблемой, которую необходимо решать. Недостаточный отвод тепла может привести к перегреву и повреждению компонентов, что может снизить эффективность и даже привести к поломке механизма [7].

Для эффективного отвода тепла применяются различные методы, одним из которых является использование тонких каналов для охлаждающей жидкости. Этот метод заключается в прохождении охлаждающей жидкости через узкие каналы, расположенные непосредственно внутри компонентов, выделяющих большое количество тепла. При прохождении жидкости через тонкие каналы происходит интенсивное охлаждение поверхностей компонентов и отвод тепла в окружающую среду.

В рамках данной работы в качестве архитектуры для охлаждающих каналов предлагается использовать трижды периодическую минимальную поверхность (TPMS, от англ. triply periodic minimal surface) Шварца Р.

Изучению свойств TPMS посвящено большое количество статей [8-20]. Главным преимуществом TPMS конструкций считается их высокая прочность, что подтверждается рядом

работ [8-11]. Также TPMS конструкции зарекомендовали себя в качестве биологических тканей и протезов [11,12]. Изучению гидравлических процессов, протекающих в объеме, ограниченном TPMS решеткой, посвящены работы [13-17]. Особенность TPMS делить пространство на два непересекающихся объема/лабиринта позволяет создавать рекуперативные теплообменники [18-20]. А высокая пористость материалов на основе TPMS позволяет использовать структуру в качестве теплоизоляционного материала [21,22].

Однако, процесс протекания жидкости через стенки/решетку TPMS структур остается малоизученным. В настоящей статье выполнено исследование гидродинамических характеристик каналов с TPMS архитектурой при помощи численного моделирования в программном комплексе ANSYS в модуле Fluent.

### Теоретическая часть

На рис. 1 представлена TPMS Шварца Р. Создание архитектуры TPMS Шварца Р, в первую очередь, осуществлялось в программе Surface Evolver [23,24], основанной на граничном методе генерации. При помощи функций итеративного уточнения исходной поверхности, определяемой ее границами, с учетом геометрических ограничений было получено облако точек, точно описывающее топологию TPMS структуры. Для получения фасетированной поверхности из облака точек применялся программный комплекс SolidWorks.

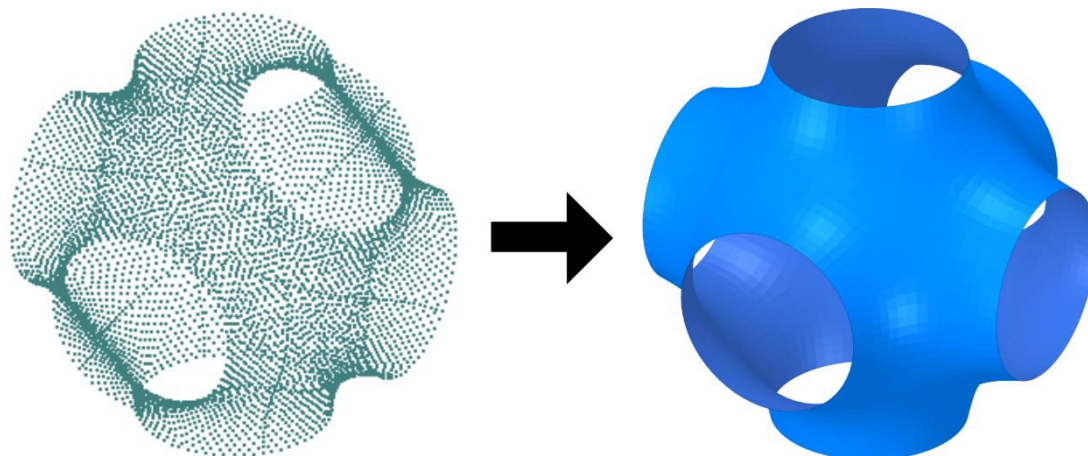


Рисунок 1. Трижды периодическая минимальная поверхность Шварца Р.

Дальнейшая обработка геометрии проводилась во встроенном в ANSYS редакторе

Space Claim. При помощи функции Thickness поверхности придается толщина  $\delta$ . Стоит

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отметить, что элементарная ячейка TPMS Шварца Р обладает кубической симметрией и вписывается в куб с длиной ребра  $a$  (рис. 2).

Для исследования были построены геометрии, состоящие из 1, 8 ( $2 \times 2 \times 2$ ) и 27 ( $3 \times 3 \times 3$ ) элементарных кубических ячеек. Характерны

геометрические размеры для всех указанных на рис. 2 элементарных ячеек одинаковые:  $a = 75 \text{ мм}$  и  $\delta = 5 \text{ мм}$ .

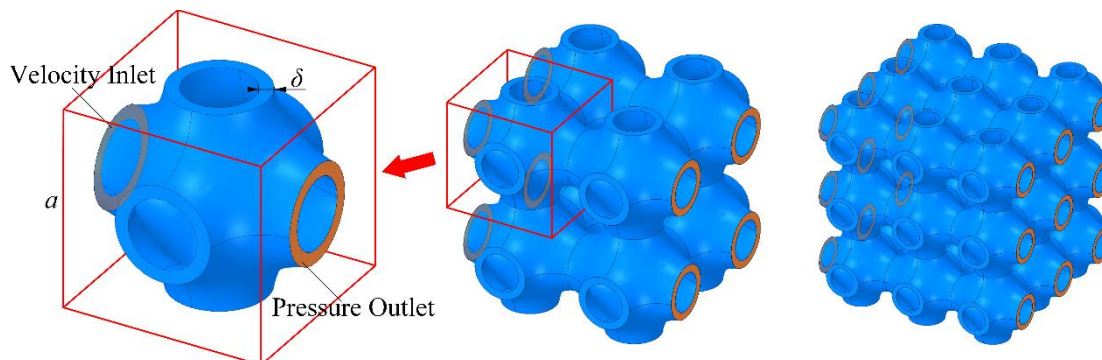


Рисунок 2. Расчетная геометрия, состоящая из 1, 8 и 27 ячеек.

В качестве рабочего тела в исследовании выбрана вода с плотностью  $\rho = 998,2 \text{ Кг/м}^3$  и динамической вязкостью  $\eta = 0.001003 \text{ Кг/м}\cdot\text{с}$ . Вход и выход для жидкости также отмечены на рис. 2. Исследование гидродинамики одной ячейки было выполнено при скоростях потока на входе в канал  $1 \leq v \leq 10 \text{ м/с}$  и при скорости  $1 \text{ м/с}$  для 8 и 27 ячеек.

Сетка для численного моделирования методом конечных элементов в модуле Fluent для 1, 8 и 27 ячеек изображена на рис. 3. В результате определения сеточной сходимости (рис. 4) было выявлено, что сетка, состоящая из 4500000 элементов пригодна для получения результатов с точностью до 98%.

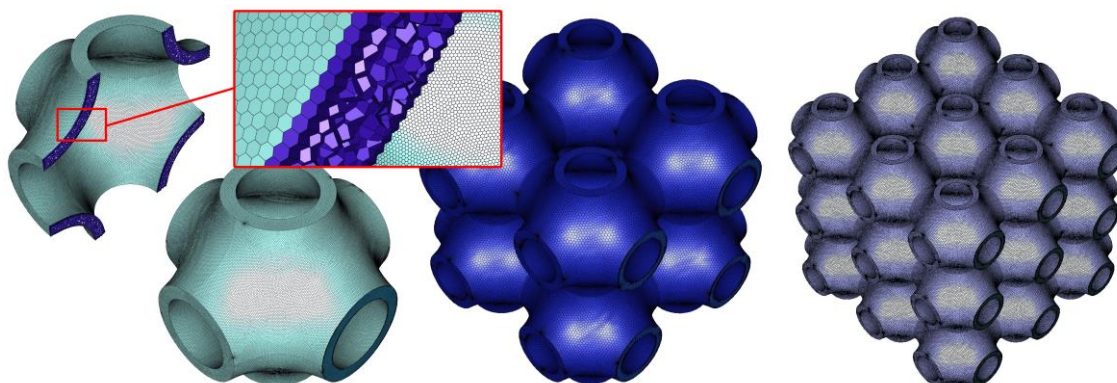


Рисунок 3. Конечно-элементная сетка.

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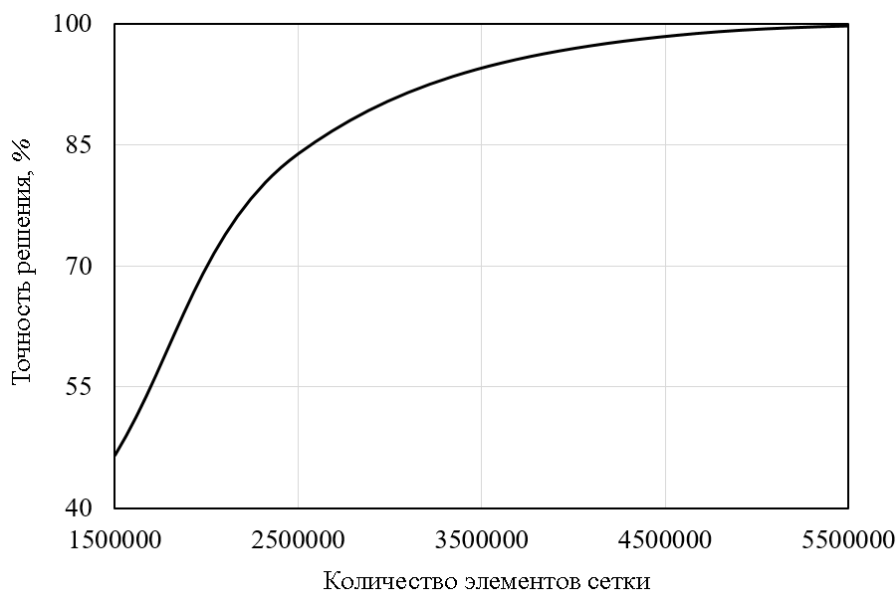


Рисунок 4. График сходимости сетки.

### Результаты

В результате компьютерного моделирования гидродинамики в стенках TPMS были получены векторные поля скоростей и потери давления. Исходя из анализа рис. 5 можно выделить области с наибольшими и наименьшими, скоростями потока, отмеченные красными и синим зонами соответственно.

Для одной ячейки было выполнено измерение падения давления при различных начальных скоростях потока.

На графике на рис. 6 изображена зависимость потерь давления в TPMS ячейке Шварца Р от начальной скорости потока, которая может быть аппроксимирована степенной функцией:

$$\Delta P = 324,63v^{2,0597}$$

Исходя из анализа полученных результатов можно заключить о теоретической возможности использования стенок TPMS Шварца Р в качестве

каналов для охлаждающей жидкости в механизмах с большим тепловыделением. Помпа в автомобильном двигателе способна создавать давление от 150 до 200 кПа в системе охлаждения, чего достаточно для циркуляции жидкости через каналы TPMS решеток при скорости потока  $1 < v < 2$  м/с.

### Заключение

В ходе работы было выполнено компьютерное моделирование течения жидкости через стенки TPMS решетки Шварца Р. Определены зоны, в которых поток воды достигает максимальную и минимальную скорость. Получена зависимость падения давления в одной ячейке TPMS Шварца Р при различных начальных скоростях потока.

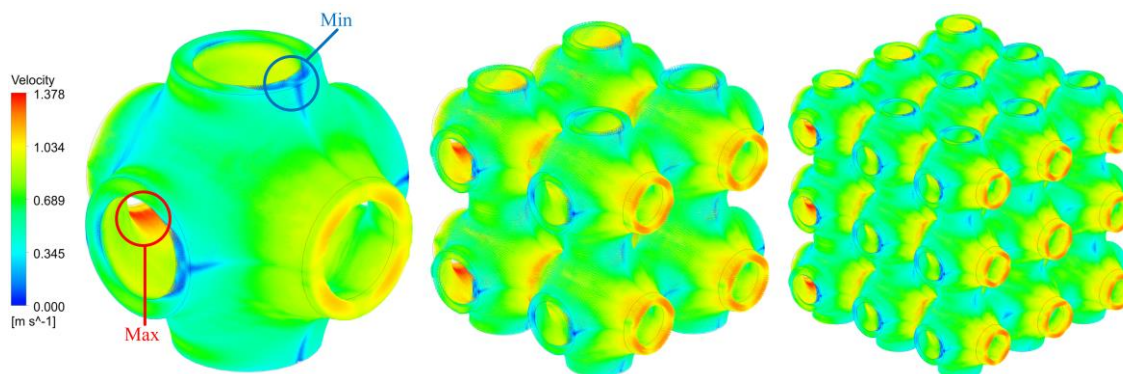


Рисунок 5. Векторное поле распределения скоростей.

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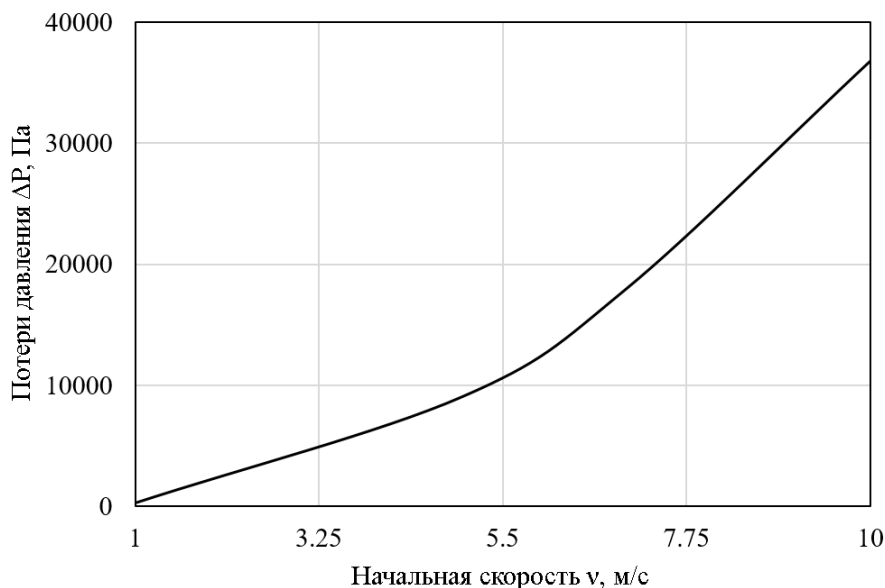


Рисунок 6. График зависимости потерь давления от начальной скорости потока.

Полученные результаты справедливы исключительно для ячейки, которая вписана в куб с длиной ребра  $a = 75$  мм и толщиной стенки  $\delta = 5$  мм. Для получения обобщенных результатов и универсальных зависимостей необходимо более детальное изучение TPMS решеток при различных геометрических параметрах. Однако, результаты настоящего исследования показывают возможность применения TPMS решеток в качестве каналов для охлаждающей жидкости во множестве агрегатов с высоким тепловыделением, поскольку современные автомобильные и другие помпы способны создавать достаточно высокое давление

в системе охлаждения для циркуляции жидкости через каналы с TPMS структурой.

Для учета теплообменных свойств совместно с массопереносом необходимо подключать уравнение энергии в решателе Fluent. Решение совмещенной задачи тепломассопереноса в стенках TPMS Шварца Р будет являться целью дальнейших исследований.

### Благодарности

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## COGNITIVE MODEL: CORRUPTION

**Abstract:** Zharov S.N. [1] for the first time conducted a scientific analysis (from a legal point of view) of a little-known publication proposed by I.P. Liprandi [2] on a number of special types of corruption. The article develops a Cognitive model of the phenomenon of "corruption" in 2 versions, differing in sets of meanings of factors and their quantities. In each version, a system of semantic equations has been developed, each system consists of 3 semantic equations. One semantic equation has 4 known z-sense (semantic z-variables) variables and 1 unknown y-sense (semantic y-variable) variable. The system of semantic equations has 12 parameters that are extracted from the model matrices  $C_{55}$ ,  $C_{99}$ ; the matrices  $C_{55}$ ,  $C_{99}$  are modeled when solving Optimization Problems:  $(I_{55}, I_{55}) \Rightarrow (A_{55}, C_{55})$ ,  $(I_{99}, I_{99}) \Rightarrow (A_{99}, C_{99})$ . Due to the discrepancy between the number of z-variables and the number of y-variables:  $4 \neq 5$ ,  $4 \neq 9$ , there was a need for cognitive modeling of semantic equality meaning  $(ZZ_{m4}) = \text{meaning}(YY_{m3}CC^T_{34})$  instead of equality meaning  $(ZZ_{m5}) = \text{meaning}(YY_{m5}CC^T_{55})$ . An algorithm has been developed for calculating the values of 4 zz-variables (instead of z-variables), depending on 24 values of 3 y-variables  $y_2, y_3, y_4$  (which have values of their variances close to 0). Random values of 3 y-variables  $y_2, y_3, y_4$  are modeled separately and independently of other model matrices. Constructing new meanings of y-factors of the phenomenon of "corruption" with the 1st option of the composition of corruption factors (4 zz-factors (for the "bottom") and 5 y-factors (for the "top") and construction with the 2nd option of the composition of corruption factors (4 zz-factors (for the "bottom") and 9 y-factors (for the "tops") made it possible to clarify situations of corruption, to understand new additional factors of corruption ((extract knowledge)). Visualization of the mutual dynamics of corruption factors showed the sameness of the model results of 2 variants of the corruption model. In terms of meanings and mutual dynamics of their values, the factors quantitatively reflect real situations of the phenomenon of corruption.

**Key words:** multisense equation with known and unknown semantic variables, Cognitive Model of the Phenomenon "Corruption".

**Language:** Russian

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## КОГНИТИВНАЯ МОДЕЛЬ: КОРРУПЦИЯ

**Аннотация:** Жаров С. Н. [1] впервые провел научный анализ (с юридической точки зрения) малоизвестной публикации предложенной И. П. Липранди [2] целый ряд особенных видов коррупции. В статье разработана Когнитивная модель явления «коррупция» в 2-х вариантах, отличающихся наборами смыслов факторов и их количествами. В каждом варианте разработана система смысловых уравнений, каждая система состоит из 3-х смысловых уравнений. Одно смысловое уравнение имеет 4 известных z-смысловых (семантических z-переменных) переменных и 1 неизвестную y-смысловую (семантических y-переменную) переменную. Система смысловых уравнений имеет 12 параметров, которые выделяются из

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модельных матриц  $C_{55}$ ,  $C_{99}$ , матрицы  $C_{55}, C_{99}$  моделируются при решении Оптимизационных Задач:  $(I_{55}, I_{55}) \Rightarrow (A_{55}, C_{55})$ ,  $(I_{99}, I_{99}) \Rightarrow (A_{99}, C_{99})$ . Из-за несовпадения количества  $z$ -переменных и количества  $y$ -переменных:  $4 \neq 5$ ,  $4 \neq 9$ , возникла необходимость когнитивного моделирования смыслового равенства  $\text{смысл}(ZZ_{m4}) = \text{смысл}(YY_{m3}CC_{34}^T)$ , вместо равенства  $\text{смысл}(ZZ_{m5}) = \text{смысл}(YY_{m5}CC_{55}^T)$ . Разработан алгоритм вычисления значений 4-х  $zz$ -переменных (вместо  $z$ -переменных), зависящих от 24 значений 3-х  $y$ -переменных  $y_2, y_3, y_4$  (имеющих близкие к 0 значения своих дисперсий). Случайные значения 3-х  $y$ -переменных  $y_2, y_3, y_4$  моделируются отдельно и независимо от других матриц модели. Конструирование новых смыслов  $y$ -факторов явления «коррупция» при 1-ом варианте состава факторов коррупции (4  $zz$ -факторов (для «низов») и 5  $y$ -факторов (для «верхов») и конструирование при 2-ом варианте состава факторов коррупции (4  $zz$ -факторов (для «низов») и 9  $y$ -факторов (для «верхов») позволили прояснить ситуации коррупции, познать новые дополнительные факторы коррупции (извлечь знания). Визуализация взаимных динамик факторов коррупции показала одинаковость модельных результатов 2-х вариантов модели коррупции. По смыслам и по взаимным динамикам своих значений факторы количественно отражают реальные ситуации явления коррупции.

**Ключевые слова:** многосмысловое уравнение с известными и неизвестными семантическими переменными, Когнитивная Модель Явления «Коррупция».

### Введение

В статье [1] указан «основной способ защиты крупных коррупционеров от ответственности: «образовывать молву», формировать общественное мнение против своих следователей». «И если современники И.П. Липранди защищались при помощи «голословных доносов», то позднее активно использовали средства массовой информации. Именно так было развалено дело банкиров и сахарозаводчиков, расследованное комиссией генерала Н. С. Батюшина в 1916 г. [15] Те же методы использовались против следственной бригады Т. Х. Гдяна и Н. В. Иванова в 1980-х, а уже в начале нынешнего века в делах Б. А. Березовского, В. А.» [1].

«Отнеся страсть к обогащению, являющуюся основой взяточничества, к одной из самых сильных страстей человека, Липранди формулирует основные принципы борьбы с ней» [1].

Ниже предлагается защищаться от приманок коррупции при помощи познающей модели, проверившей алгеброй явление «коррупция». Введены «веса» для факторов Липранди, найдены их изменчивости (отклонения вправо\влево от 0), вычислена парная корреляция фактора из низов с фактором из верхов, приведены на рисунках кривые взаимных динамик факторов коррупции, показывающих, что с чем и как сильно связано. Как изменятся в связи с полученными числовыми данными фразы новых смыслов оцифрованных  $y$ -факторов, присущих (по Липранди И.П.) «верхам» явлению «коррупция». С позиции психологии коррупционное поведение является разновидностью социального поведения [3], частным случаем которого является социальная лень [4], ложное соавторство [5], населения для имиджа страны [6], избирателей, подверженных давлению со стороны претендентов в президенты [7].

Юридический смысл словесной модели не

удовлетворяет требованиям, предъявляемых к фразам пунктов законов. Приведенные ниже фразы не удовлетворяют тем же требованиям. Но разработанная Когнитивная Модель Явления «Коррупция» проясняет детали (не рассматриваемые в практике юристов) явления «коррупция». Она познала (выявила из формул) новые дополняющие знания о факторах коррупции (извлекла знания). Визуализация взаимных динамик факторов коррупции показала одинаковость модельных результатов в 2-х примененных вариантах Когнитивная Модель Явления «Коррупция». По смыслам и по взаимным динамикам своих значений факторы количественно отражают реальные ситуации явления коррупции.

Описание 9 факторов Липранди приведены в статьях [1,2], здесь мы их используем в качестве исходных данных для Когнитивной Модели Явления «Коррупция», их смыслы являются определяющими для алгебры смыслов и чисел. 9 факторов Липранди применяем далее в качестве 9 имен-смыслов вводимых в математическую модель  $y$ - и  $z$ -переменных.

### Исходные данные

Исходными данными является словесная модель и исходных значений сил влияния  $c_{kj} = \text{сог}(y_j, z_k), k \in \{1, \dots, 4\}, j \in \{1, \dots, 5\}$  и 4 индикатора наличия знаний). Словесная модель (смотрите пример из [1,2]) может быть сформулирована по разному. Мозаика  $\{c_{kj}\}$  из элементов будущей матрицы задается экспертом в соответствии со смыслами и силами парной связи  $c_{kj} = \text{сог}(y_j, z_k)$  ниже перечисленных смыслов факторов коррупции. Словесная модель имеет зависимые по смыслам показатели. сформулированные ниже 9 неизмеряемых 9 показателей приняты приводимые ниже 9 смыслов после осмысления 2-х вариантов реализации когнитивной модели коррупции без когнитивного диссонанса конструируемых фраз. Исходной

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информацией для модели являются смыслы 5 (или 9) у-факторов, характеризующих индивидов из «верхов», которые способствуют появлению коррупционных побуждений и 4 z-факторов, характеризующих индивидов из «низов».

1-ый вариант формализации факторов коррупции. Основные у-факторы, влияющие на коррупцию разделены на 2 группы. Группа тех же 4 z-факторов (присущих индивидам из «низов») влияют на 5 у-факторов, присущих индивидам «верхов»:

1) Простое лихоимство, под которым понимается присущие индивидам воровство ( $z_1$ ), обман (на доступном им низком уровне);

2) Простое вымогательство, на которое способны бессовестные индивиды ( $z_2$ );

3) Простой подкуп, вследствие которого недобросовестные индивиды из низов совершают ненаказуемые нарушения законов ( $z_3$ );

4) влезание индивидом из низов в долги с намерением дать взятку «на верх» за их содействие ( $z_4$ ).

Основные 5 у-факторов, присущие индивидам из «верхов», влияющие на 4 z-факторы, присущих индивидам из «низов»:

1) Назначение на «так называемые теплые должности» по собственному произволу ( $y_1$ ) – также возможно лишь высоким чинам;

2) Отдача под залог в откупа и подряды своих имений за процент ( $y_2$ ), во много раз превышающий среднерыночный – как способ получения взятки;

3) Вступление в акционерные общества без взноса капитала ( $y_3$ );

4) Использование высшими чиновниками политической и коммерческой информации в личных целях ( $y_4$ );

5) Самоуправство, превышение и бездействие власти ( $y_5$ ), в том числе и не приносящее дохода, а лишь удовлетворяющее самолюбие, доказывая тем свой статус в административной сфере, и прочие виды злоупотребления служебным положением.

Во 2-ом варианте 9 факторов коррупции разделены на части: из 4-х z-факторов (для «низов») и 5 у-факторов (для «верхов»).

2-ой вариант формализации факторов коррупции. Основные z-факторы, присущие индивидам из «низов», стремящихся попасть в «верхи»:

1) Простое лихоимство, под которым понимается присущие индивидам воровство ( $z_1$ ), обман (на доступном им низком уровне);

2) Простое вымогательство, на которое способны бессовестные индивиды ( $z_2$ );

3) Простой подкуп, вследствие которого недобросовестные индивиды из низов совершают ненаказуемые нарушения законов ( $z_3$ );

4) влезание индивидом из низов в долги с

намерением дать взятку «на верх» за их содействие ( $z_4$ ).

Основные 4 z-факторы, присущие индивидам из «низов», стремящихся попасть в «верхи», перефразируем так, чтобы они отражали психологию индивидов из «верхов» (лихоимство и другие качества всем индивидам, независимо от их статуса). Тогда в состав у-факторов, влияющих на коррупцию в «верхах» входят 9 смыслов, выражаемых фразами:

1) Лихоимство, под которым он понимает казнокрадство ( $y_1$ ), видит общественную опасность его не только в расхищении государственных средств, но и в развращении народа ( $y_1$ );

2) Вымогательство, которое способны совершать бессовестные следователи ( $y_2$ );

3) Подкуп, вследствие которого недобросовестные чиновники ( $y_3$ ) совершают должностные преступления, как правило, ненаказуемые ( $y_3$ );

4) Сребролюбие, проявляемое представителями высших сословий, обладателями высоких должностей ( $y_4$ ) и выражающееся в исполнении долговых обязательств перед кредиторами назначением их на «доходные» должности ( $y_4$ ).

5) Назначение на «так называемые теплые должности» по собственному произволу ( $y_5$ ) – также возможно лишь высоким чинам ( $y_5$ );

6) Отдача под залог в откупа и подряды своих имений за процент, во много раз превышающий среднерыночный – как способ получения взятки ( $y_6$ );

7) Вступление в акционерные общества без взноса капитала ( $y_7$ );

8) Использование высшими чиновниками политической и коммерческой информации в личных целях ( $y_8$ );

9) Самоуправство, превышение и бездействие власти, в том числе и не приносящее дохода ( $y_9$ ), а лишь удовлетворяющее самолюбие, доказывая тем свой статус в административной сфере, и прочие виды злоупотребления служебным положением ( $y_9$ ).

### Применяемая система многосмысловых уравнений

Многосмысловое уравнение [8-10] конструируется из многомерной математической модели [10], где уже введены числовые параметры, переменные, функции связи, соответствующие реальным свойствам реальных многомерных объектов разных типов. Тип объектов, их свойств отражается в смыслах свойств объектов [5-13]. Суммы смыслов свойств (z-переменных) объекта могут образовать новый смысл (у-переменную) или нет [5]. В многомерной математической модели

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переменные делятся на 2 вида: z-переменные с известными именами-смыслами  $\text{смысл}(z_1), \dots, \text{смысл}(z_n)$  и u-переменные с неизвестными именами-смыслами  $\text{смысл}(y_1), \dots, \text{смысл}(y_n)$ . Количество n переменных равно количеству дисперсий  $\text{disp}(y_1)=\lambda_1, \text{disp}(y_2)=\lambda_2, \dots, \text{disp}(y_n)=\lambda_n$ . В соответствии с значениями  $\lambda_1, \lambda_2, \dots, \lambda_n$ , взятыми из пары смоделированных матриц  $(C_{55}, \Lambda_{55})$  проставляются числовые параметры  $c_{11}, \dots, c_{55}$  в n уравнения системы многосмысловых уравнений:  $\text{смысл}(y_1)=\text{смысл}(z_1)*c_{11} \oplus \text{смысл}(z_2)*c_{21} \oplus \text{смысл}(z_3)*c_{31} \oplus \text{смысл}(z_4)*c_{41} \oplus \text{смысл}(z_5)*c_{51}$ .

После удаления слагаемых с «весами»  $c_{ij}$ , величины которых не удовлетворяют критерию быть индикатором скрытых знаний [9-10], количество слагаемых в уравнениях с неизвестными новыми смыслами  $\text{смысл}(y_1), \text{смысл}(y_2), \text{смысл}(y_5)$  сократится. И система многосмысловых уравнений будет содержать меньшее число известных z-смыслов. Более «короткие» суммы смыслов легче осмысливать для конструирования 6 фраз для 6 новых смыслов (новых семантических u-переменных)  $\text{новый смысл}(y_1), \text{новый смысл}(y_2), \text{новый смысл}(y_5)$ , существенно дополняющих исходные смыслы (исходные семантические переменные)  $\text{смысл}(y_1), \text{смысл}(y_2), \text{смысл}(y_3), \text{смысл}(y_4), \text{смысл}(y_5)$ . Метод смыслового преобразования исходных семантических переменных в новые семантические переменные называется когнитивной моделью коррупции.

Требуемые фразы, отражающие смыслы неизвестных 5 новых смыслов u-переменных, можно сконструировать, если смоделировать:

а) пару матриц собственной структуры  $(\Lambda_{55}, C_{55})$ , где  $C_{55}$  – матрица псевдосо собственных векторов,

$C_{55}C^T=I_{55}, C^T_{55}C_{55} \neq I_{55}, \Lambda_{55}=\text{diag}(\lambda_1, \dots, \lambda_5), \text{tr}(\Lambda_{55})=\lambda_1+\dots+\lambda_5=n, \lambda_1 \geq \dots \geq \lambda_5 \geq 0, \text{tr}(\Lambda_{nn})=\lambda_1+\dots+\lambda_n=n$ , условие упорядоченности  $\lambda_1 \geq \dots \geq \lambda_n \geq 0$  не требуется;

б) матрицы значений некоррелированных изменчивостей  $Y_{m5}$ , коррелированных изменчивостей (отклонений от 0)  $Z_{m5}$ , соответствующих своим системам многосмысловых уравнений с известными и неизвестными семантическими (смысловыми) переменными.

Иное название [11] элементов матрицы  $C_{55}$  введено в статьях [9-10], оно отражает смысл «весов», моделируемых в нашей модели, наш метод моделирования отличается от методов из [9-13].

Новые моделируемые 2 матрицы в нашей модели должны обладать свойствами: ортогональная (не ортонормированная) матрица  $C_{nn}$  собственных векторов  $c_j=(c_{1j}, c_{2j}, \dots, c_{nj})^T$ , расположенных по столбцам матрицы

$C_{nn}=[c_1|c_2|\dots|c_n]$  согласована со своим спектром  $\Lambda_{nn}$  корреляционной матрицы  $R_{nn}=(1/m)Z^T_{nn}Z_{nn}$ ,  $\Lambda_{nn}=\text{diag}(\lambda_1, \dots, \lambda_n)$  таким образом, что выполняются равенства  $R_{nn}C_{nn}=C_{nn}\Lambda_{nn}, C^T C \neq I_{nn}, CC^T=I_{nn}, \text{tr}(\Lambda_{nn})=\lambda_1+\dots+\lambda_n=n$ . В решаемой ниже Оптимизационной Задаче:  $(I_{55}, I_{55}) \Rightarrow (C_{55}, \Lambda_{55})$  (другие методы смотрите в [12-14]) целевая функция  $\lambda_1+\dots+\lambda_n$  равна 5 при изменяемых значениях элементов 2-х матриц  $C_{55}, \Lambda_{55}$ , а ограничения:  $\text{diag}(R_{nn})=(1, \dots, 1), C^T C \neq I_{55}, C_{55}C^T_{55}=I_{55}$ , Матрицы  $U_{m5}$  и  $Y_{m5}$  такие, что  $(1/m)U^T_{m5}U_{m5}=I_{55}, Y_{m5}=U_{m5}\Lambda^{1/2}_{55}, Z_{m5}=Y_{m5}C^T_{55}$ , в матрице  $Y_{m5}$  элементы j-го столбца  $y_{1j}, y_{2j}, \dots, y_{mj}$  (j-ая u-переменная,  $j=1, \dots, 5$ ) имеют среднее арифметическое, равное нулю:  $(1/m)(y_{1j}+y_{2j}+\dots+y_{mj})=0$ , и дисперсию равную  $\lambda_j$ :  $(1/m)(y^2_{1j}+y^2_{2j}+\dots+y^2_{mj})=\lambda_j$ , сумма дисперсий равна n:  $\lambda_1+\dots+\lambda_n=5$ . Матрицы  $Y_{m5}=U_{m5}\Lambda^{1/2}_{55}, Z_{m5}=Y_{m5}C^T_{55}$ , интерпретируются как многомерные выборки [14]. В нашей модели мы моделируем нестандартизованные ( $C^T C \neq I_{55}$ ) коррелированные z-переменные являются многомерными данными, объединенных в матрицу  $Z_{m5}$ , в которой элементы j-го столбца  $z_{1j}, z_{2j}, \dots, z_{mj}$  (j-ая переменная,  $j=1, \dots, 5$ ) имеют среднее арифметическое равное нулю:  $(1/m)(z_{1j}+z_{2j}+\dots+z_{mj})=0$ , и дисперсию не равную 1:  $(1/m)(z^2_{1j}+z^2_{2j}+\dots+z^2_{mj}) \neq 1$ , сумма дисперсий не равна 5. Элементы матрицы  $C_{55}$  интерпретируются как индикаторы знаний [15,16]. Матрица  $Y_{m5}=Z_{m5}C_{55}$ , в которой элементы j-го столбца  $y_{1j}, y_{2j}, \dots, y_{mj}$  (j-ая u-переменная,  $j=1, \dots, 5$ ) имеют среднее арифметическое равное нулю:  $(1/m)(y_{1j}+y_{2j}+\dots+y_{mj})=0$ , и дисперсию равную  $\lambda_j$ :  $(1/m)(y^2_{1j}+y^2_{2j}+\dots+y^2_{mj})=\lambda_j$ , сумма дисперсий равна 5:  $\lambda_1+\dots+\lambda_5=5$ . Матрица  $Y_{m5}=Z_{m5}C_{55}$ , интерпретируется как многомерная выборка. Нестандартизованные коррелированные z-переменные-данные, объединенные в матрицу  $Z_{m5}$ , в которой элементы j-го столбца  $z_{1j}, z_{2j}, \dots, z_{mj}$  (j-ая zz-переменная,  $j=1, \dots, 5$ ) имеют среднее арифметическое равное нулю:  $(1/m)(z_{1j}+z_{2j}+\dots+z_{mj})=0$  и дисперсию, не равную 1:  $(1/m)(z^2_{1j}+z^2_{2j}+\dots+z^2_{mj})=1$ , сумма дисперсий не равна 5. Матрица  $ZZ_{m5}$  интерпретируется как многомерная нестандартизованная выборка.

### Когнитивная модель явления «коррупция»

Информационными компонентами когнитивной модели «коррупция» являются:

1. Модельная пара матриц  $(C_{55}, \Lambda_{55})$ : матрица собственных чисел  $\Lambda_{55}$ , матрица псевдосо собственных векторов  $C_{55}$  таких, что выполняются условие:  $C_{55}C^T=I_{55}, C^T_{55}C_{55} \neq I_{55}, \Lambda_{55}=\text{diag}(\lambda_1, \dots, \lambda_5), \text{tr}(\Lambda_{55})=\lambda_1+\dots+\lambda_5=5, \text{tr}(\Lambda_{55})=\lambda_1+\dots+\lambda_5=5, \Lambda_{55}=\text{diag}(4.2500, 0.0250, 0.0250, 0.0250, 0.5750)$ .

2. Матрица псевдосо собственных векторов  $C_{55}$



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имеет вид, приведенный в Таблице 1.

3. Три смысловые формулы: смыслы  
 $\text{смысл}(y_2) = \text{смысл}(z_2) * 0.5000 + \text{смысл}(z_3) * (-0.3511)$ ;  
 $\text{смысл}(y_3) = \text{смысл}(z_1) * 0.5000 \oplus \text{смысл}(z_2) * 0.5004 \oplus$   
 $\text{смысл}(z_3) * 0.5929 \oplus \text{смысл}(z_4) * (-0.0958)$ ;  
 $\text{смысл}(y_4) = \text{смысл}(z_1) * 0.5000 \oplus \text{смысл}(z_2) * 0.4998 \oplus$   
 $\text{смысл}(z_3) * (-0.5241) \oplus \text{смысл}(z_4) * 0.7053$ .

4. Соответствующие матрице псевдосообственных векторов  $C_{55}$  3 (из 5) числовые формулы  $y$ -переменных  $y_2, y_3, y_4$  зависят (или влияют) от значений  $zz$ -переменных:

$y_2 = z_2 * 0.5000 + z_3 * (-0.3511)$ ;  
 $y_3 = z_1 * 0.5000 + z_2 * 0.5004 + z_3 * 0.5929 + z_4 * (-0.0958)$ ;  
 $y_4 = z_1 * 0.5000 + z_2 * 0.4998 + z_3 * (-0.5241) + z_4 * 0.7053$ .

Значения новых  $zz$ -переменных  $zz_1, zz_2, zz_3, zz_4$ , соответствующих смысловому равенству  $\text{смысл}(Y_{m3}) = \text{смысл}(Z_{m4}) * C_{43}$ , вычисляются по формулам:

$zz_1 = y_{12} * 0.0000 + y_{13} * 0.5000 + y_{14} * 0.5000$ ;  
 $zz_2 = y_{12} * 0.5000 + y_{13} * 0.5004 + y_{14} * 0.4998$ ;  
 $zz_3 = y_{12} * (-0.3511) + y_{13} * 0.5929 + y_{14} * (-0.5241)$ ;  
 $zz_4 = y_{12} * 0.0000 + y_{13} * (-0.0958) + y_{14} * 0.7053$ .

5. Эти дисперсии  $\lambda_2 = 0.0250, \lambda_3 = 0.02500, \lambda_4 = 0.02500$  из модельного спектра  $\Lambda_{55} = \text{diag}(4.2500, 0.0250, 0.0250, 0.0250, 0.5750)$  равны значениям алгебраических формул  $y$ -изменчивостей  $y_{i2}, y_{i3}, y_{i4}, i = 1, \dots, 24$ , имеют, почему-то равные значения. Других значений не удалось получить при решении Оптимизационной

Задачи 1.

6. Вычисленные в рамках модели  $5 * 5 = 25$  индикаторов наличия модельных знаний, адекватных реальным знаниям явления «коррупция».

7. Каждая из трех смысловых формул из пункта 3 когнитивно сконструирована из смыслов 4 неизмеряемых и зависимых друг от друга  $zz$ -показателей явления «коррупция». Три смысла:  $\text{новый\_смысл}(y_2), \text{новый\_смысл}(y_3), \text{новый\_смысл}(y_4)$  (свойственные индивидам из «верхов») но не влияют по построению в модели считаем, что они по смыслам друг на друга не влияют. Смыслы  $zz$ -показателей являются входными данными модели, они сформулированы в пункте «Исходные данные» статьи.

9. Состав исходных индикаторов (4 штуки, Таблица 2, Таблица 10) не отличен по значениям от смоделированных индикаторов, формально найденных при решении 2-х Оптимизационных Задач 1 и 2.

8. Модельные матрицы  $Y_{m5}, ZZ_{m5}$  (полученные путем вычисления по алгоритму и путем компьютерного моделирования случайных матриц  $V_{m5}^0, U_{m5}$  удовлетворяю равенствам алгебраической системы уравнений, соответствуют найденным выше 3 многосмысловым уравнениям (матрицы приведены в Таблицах 3-4).

**Таблица 1. Модельная матрица  $C_{55}$  псевдосообственных Векторов с 3 исходными или модельными индикаторами  $\Lambda_{55} = \text{diag}(4.2500, 0.0250, 0.0250, 0.0250, 0.5750)$**

1	0,5000	0,0000	0,5000	<b>0,5000</b>	0,5000	<b>1,0000</b>
2	0,0000	<b>0,5000</b>	0,5004	<b>0,4998</b>	0,4998	<b>1,0000</b>
3	0,0000	<b>-0,3511</b>	0,5929	<b>-0,5241</b>	0,0000	<b>1,0000</b>
4	0,0000	0,0000	-0,0958	<b>0,7053</b>	-0,7014	<b>1,0000</b>
5	0,0000	0,0000	0,0000	-0,0044	1,0000	<b>1,0000</b>
	<b>0,2500</b>	<b>0,3804</b>	<b>0,9898</b>	<b>1,3881</b>	<b>1,9918</b>	<b>5,0000</b>

### Оптимизационные Задачи

Решаются 2 Оптимизационные Задачи:  $(I_{55}, I_{55}) \Rightarrow (C_{55}, \Lambda_{55})$  целевая функция  $\lambda_1 + \dots + \lambda_n$  равна 5 при изменяемых значениях  $5 * 5 + 5$  элементов 2-х матриц  $C_{55}, \Lambda_{55}$ , а ограничения:  $C^T C \neq I_{55}, C_{55} C_{55}^T = I_{55}, \Lambda_{55} = \text{diag}(\lambda_1, \dots, \lambda_n), \text{tr}(\Lambda_{55}) = \lambda_1 + \dots + \lambda_n = n, \lambda_1 \geq \dots \geq \lambda_n \geq 0$ .

Мы проведем моделирование матрицы псевдосообственных векторов  $C_{55}: (I_{55}, I_{55}) \Rightarrow$

$(C_{55}, \Lambda_{55}), C_{55}^T C_{55} \neq I_{55}, C_{55} C_{55}^T = I_{55}$  и моделирование для нее диагональной матрицы  $\Lambda_{55}$ . Особенность матрицы псевдосообственных векторов  $C_{55}$  состоит в том, что и позволяют моделировать коррелированные  $z$ -переменные с дисперсиями, большими 1. Такая  $z$ -переменная более изменчива, чем  $y$ -переменная  $y_4, y_5, y_5$ . Сильно изменчивые  $z$ -переменные  $(z_1, z_2, z_3, z_4, z_5, z_5)$  через формулы дают  $y$ -переменные  $y_4, y_5, y_5$ , имеющие нулевые



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дисперсии. Значения z-переменных ( $z_1, z_2, z_3, z_4, z_5, z_5$ ) являются многомерными данными, объединенных в матрицу  $Z_{m5}$ , в которой элементы j-го столбца  $z_{1j}, z_{2j}, \dots, z_{mj}$  (j-ая переменная,  $j=1, \dots, 5$ ) имеют среднее арифметическое равное нулю:  $(1/m)(z_{1j}+z_{2j}+\dots+z_{mj})=0$ , и дисперсию не равную 1:  $(1/m)(z_{1j}^2+z_{2j}^2+\dots+z_{mj}^2) \neq 1$ , сумма дисперсий не равна 5.

Решая Оптимизационную Задачу:  $(I_{55}, I_{55}) \Rightarrow (C_{55}, \Lambda_{55})$ , мы надеемся получить другие значения элементов матрицы  $\Lambda_{55}$ , отличающиеся от диагональной матрицы  $\Lambda_{55}$  из статьи [1]. Чтобы принудить процедуру GRD2 (программа в надстройке «Поиск решения») автор применил облегчающие его работу ограничения, например, вводил в окно «Ограничения» условие  $\lambda_1 \geq 2$  (расширяющее область поиска) или  $\lambda_1 \leq 2$  (сужающее область поиска). Основным вычислительным регулятором является мозаика исходных индикаторов и назначенные экспертом значения 18 индикаторов. Вид таблицы-программы Оптимизационной задачи с 18 исходными индикаторами приведен в Таблице 4. Матрица  $C_{55} = \{c_{ij} = \text{corr}(z_i, y_j)\}$  (z,y)-корреляций) приведена в Таблицах 2, 5.

### Конструирование смыслов у-факторов явления «коррупция» при 1-ом варианте состава факторов коррупции (с 4 исходными или модельными индикаторами) (4 z-факторов (для «низов») и 5 у-факторов (для «верхов»))

Рассмотрим 1-ую смысловую неизвестную  $\text{смысл}(y_2) = \text{«Вымогательство следователями»}$   
 $\text{смысл}(y_2) = \text{смысл}(z_1) * 0.5 \oplus \text{смысл}(z_2) * 0.5004 \oplus$   
 $\text{смысл}(z_3) * 0.592943555 + \text{смысл}(z_4) * (-$   
 $0.095795834)$ . конструируем сумму смыслов (новый\_смысл( $y_2$ )) из правой части равенства. Проверим фразу из вновь сконструированного ниже смысла новый\_смысл( $y_2$ ) и фразу из  $\text{смысл}(y_2)$  на отсутствие противоречия по их смыслам. Если есть отсутствие противоречия по их смыслам, то считаем, что смысловое уравнение  $\text{смысл}(y_2) = \text{смысл}(z_1) * 0.5 \oplus \text{смысл}(z_2) * 0.5004 \oplus$   
 $\text{смысл}(z_3) * 0.592943555 \oplus \text{смысл}(z_4) * (-$   
 $0.095795834)$  имеет семантическое решение. Проводим конструирование суммарной фразы для новый\_смысл( $y_2$ ). В анализируемом уравнении присутствуют 3 смысла 4-х z-переменных: лихоимство ( $z_1$ ), вымогательство ( $z_2$ ), подкуп со стороны чиновников ( $z_3$ ), и отсутствие «сребролюбия, проявляемого представителями высших сословий, обладателями высоких должностей ( $z_4$ )». Знак минус при «весе» ( $=(-0.005394155)$ ) и учет исходного смысла  $\text{смысл}(y_2) = \text{«вымогательство, на которое способны...»}$  позволяет нам сконструировать суммарную фразу.

### Две системы из 3-х алгебраических равенств с 4 неизвестными для вариантов формализации факторов коррупции

Так как количество у-факторов равно 5, то решаем ОЗ1 при размерности 5:  $(I_{55}, I_{55}) \Rightarrow (\Lambda_{55}, C_{55})$

При этом получаем модельную матрицу собственных векторов  $C_{55}$  и модельную матрицу  $\Lambda_{55} = \text{diag}(4.2500, 0.0250, 0.0250, 0.0250, 0.5750)$ .

Моделируем случайную выборку: матрицы  $U_{m5}$  и  $Y_{m5}$  [14] такие, что  $(1/m)U_{m5}^T U_{m5} = I_{55}$ ,  $Y_{m5} = U_{m5} \Lambda_{55}^{1/2}$ , затем моделируем матрицу  $Z_{m5} = Y_{m5} C_{55}^T$ . Ниже изложим алгоритм формирования матричного равенства  $ZZ_{m4} = YY_{m3} CC_{34}^T$  для вычисления новых zz-переменных  $zz_1, zz_2, zz_3, zz_4$  со смыслами  $\text{смысл}(zz_1) = \text{смысл}(z_1)$ ,  $\text{смысл}(zz_2) = \text{смысл}(z_2)$ ,  $\text{смысл}(zz_3) = \text{смысл}(z_3)$ ,  $\text{смысл}(zz_4) = \text{смысл}(z_4)$ .

Для конструирования смыслов у-факторов явления «коррупция» при 1-ом варианте состава факторов коррупции (с 3 исходными модельными индикаторами) необходимо приравнять количество z-факторов 4.

Нас не устраивает решение Оптимизационной Задачи 1 при размерности 5:  $(I_{55}, I_{55}) \Rightarrow (\Lambda_{55}, C_{55})$ . При этой Оптимизационной Задаче 1 возможно моделирование 5 z-факторов для каждой из 5 у-факторов, а нам надо иметь 4 z-фактора. Пятого смысла  $\text{смысл}(z_5)$  нам не дано по тексту словесной модели коррупции.

Мы должны вычислить переменные системы линейных равенств вида  $ZZ_{m4} = YY_{m3} CC_{34}^T$ , а не вида  $Z_{m5} = Y_{m5} C_{55}^T$ , к которой приводит задача математического моделирования при 5 у-факторах, 5 z-факторах. У нас исходными данными служат 4 смысла 4-х zz-факторов, а не смыслы 5 z-факторов (как требуется для равенства  $Z_{m5} = Y_{m5} C_{55}^T$ ).

Введем новые zz-переменные, которые подчиняются системе линейных равенств вида  $Z_{m5} = Y_{m5} C_{55}^T$ , где матрица  $YY_{m3}$  равна 3-м столбцам №2, №3, №4 известной матрице  $Y_{m5}$  – новые (уу-) и старые (у-) переменные равны друг другу по смыслам, по обозначениям:  $уу_1 = у_2$ ,  $уу_2 = у_3$ ,  $уу_3 = у_4$ , по значениям, смоделированным по формуле  $Y_{m5} = U_{m5} \Lambda_{55}^{1/2}$  из Обратной Модели Анализа Главных Компонент [9]. Многомерная выборка  $Y_{m5} = U_{m5} \Lambda_{55}^{1/2}$  обеспечивает случайность многомерной выборки  $ZZ_{m4} = Y_{m3} CC_{34}^T$ .

Так как  $\lambda_2 = \lambda_3 = \lambda_4 = 0.0250$  (в 1-ом варианте), то количество уу-переменных равно 3, а количество новых zz-переменных равно 4:  $zz_1, zz_2, zz_3, zz_4$ . При этом  $\text{смысл}(zz_1) = \text{смысл}(z_1)$ ,  $\text{смысл}(zz_2) = \text{смысл}(z_2)$ ,  $\text{смысл}(zz_3) = \text{смысл}(z_3)$ ,  $\text{смысл}(zz_4) = \text{смысл}(z_4)$ , а их значения  $zz_{ij}$ ,  $j=1, \dots, 4$ , разнятся в моментах времени  $i=1, \dots, m$ . Эти новые zz-переменные должны подчиняться системе линейных равенств вида  $ZZ_{m4} = YY_{m3} CC_{34}^T$  ( $CC_{43} CC_{34}^T \neq I_{44}$ , при этом  $C_{55} C_{55}^T = I_{55}$ ). Матрица  $ZZ_{m4} = YY_{m3} CC_{34}^T$  легко вычисляется в ЭТ Excel. Из

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равенства  $ZZ_{m4}=YY_{m3}CC_{34}^T$  не следует равенство  $YY_{m3}=ZZ_{m4}CC_{43}$ . Эти разные системы равенств имеют разные решения. Мы не решаем систему уравнений  $ZZ_{m4}=YY_{m3}CC_{34}^T$ . Не увеличиваем степень случайности (для модельных переменных (неизмеряемых свойств) явления «коррупция») для случайной матрицы  $Y_{m5}=U_{m5}\Lambda^{1/2}_{55}$ , а просто вычисляем другую случайную матрицу  $ZZ_{m4}=YY_{m3}CC_{34}^T$ , зависящую от случайной матрицы  $YY_{m3}$ .

Выделенная часть, т.е. матричное равенство  $ZZ_{m4}=YY_{m3}CC_{34}^T$  имеет постоянную матрицу  $CC_{34}^T$ , элементы которой равны элементам 3-х столбцов матрицы  $C_{55}^T$  (значениям «весов» при новых переменных  $zz1, zz2, zz3, zz4$ ). Тройки значений 3-х уу-переменных  $уу1, уу2, уу3$  с 4 «весами» из 3-х столбцов полной матрицы  $CC_{34}^T$  соответствуют неполной матрице  $CC_{34}^T$ . При этом столбцам №2, №3, №4 матрицы  $C_{55}^T$  соответствуют столбцам №1, №2, №3 матрицы  $CC_{34}^T$ .

Перечень поэлементного соответствия столбцов №2, №3, №4 из матрицы  $C_{55}^T$  столбцам №1, №2, №3 из матрицы  $CC_{34}^T$  следующий.

$cc_{11}^T=c_{12}^T, cc_{12}^T=c_{13}^T, cc_{13}^T=c_{14}^T$  (3 «веса» при значениях  $уу1, уу2, уу3$  из строки №1 матрицы  $CC_{34}^T$  или из столбца № 1 матрицы  $C_{55}^T$ , определяют одно значение  $zz1$ ),  $cc_{22}^T=c_{23}^T, cc_{23}^T=c_{24}^T$  (3 «веса» при значениях  $zz1, zz2, zz3$  из строки №2 матрицы  $CC_{34}^T$  или из столбца № 2 матрицы  $C_{55}^T$ , определяют одно значение  $zz2$ ),  $cc_{33}^T=c_{34}^T$  (3 «веса» при значениях  $уу1, уу2, уу3$  из строки № 3 матрицы  $CC_{34}^T$  или из столбца № 3 матрицы  $C_{55}^T$ , определяют одно значение  $zz3$ ),

$cc_{14}^T=c_{42}^T, cc_{24}^T=c_{43}^T, cc_{34}^T=c_{44}^T$  (3 «веса» при значениях  $уу1, уу2, уу3$  расположены в строке №4 матрицы  $CC_{34}^T$  или в столбце № 4 матрицы  $C_{55}^T$ , они определяют одно значение переменной  $zz4$ ),  $cc$ -коэффициенты при переменных  $уу1, уу2, уу3$  из столбцов полной матрицы  $CC_{34}^T$  соответствуют элементам столбцов №2, №3, №4 матрицы  $C_{55}^T$ .

Размерность известной матрицы  $YY_{m3}$  равна ( $m$ -на-3), размерность известной матрицы  $CC_{43}^T$  равна (3-на-4). Размерность известной матрицы произведения этих матриц равна ( $m$ -на-3)\*(3-на-4)=( $m$ -на-4). Видим наличие требуемого количества 4 новых  $zz$ -переменных  $zz1, zz2, zz3, zz4$ . Этим мы обеспечиваем вычисление модельных значений элементов матрицы  $ZZ_{m4}$ , содержащей значения  $zz$ -отклонений  $zz$ -переменных  $zz1, zz2, zz3, zz4$  из 1-го и 2-го вариантов формализации факторов коррупции. Эти 4  $zz$ -факторы присущи индивидам из «низов», стремящихся перейти в «верхи». Ниже в разделе «Две системы алгебраических равенств из 3-х равенств с 4 неизвестными» изложено описание алгоритма нахождения значений параметров ( $CC_{34}^T$ ) и значений  $zz$ -переменных (из  $ZZ_{m4}$ ) для

вычисления равенства  $ZZ_{m4}=YY_{m3}CC_{34}^T$ . Смыслы  $zz$ -переменных равны смыслам  $z$ -переменных, а их значения разные. В Таблицах 1 и 10 приведены вид матрицы  $CC_{43}$ , в Таблице 5 - вид матрицы  $C_{99}$ , в Таблицах 3 и 4 приведены виды матриц  $Y_{m3}=YY_{m3}$  и  $ZZ_{m4}=YY_{m3}CC_{34}^T$  (для 1-го варианта формализации факторов коррупции). В Таблицах 7 и 8 приведены виды матриц  $YY_{m3}$  и  $ZZ_{m4}=YY_{m3}CC_{34}^T$  (для 2-го варианта формализации факторов коррупции).

Используя известные модельные значения «весов»  $CC_{43}^T$  (из указанного раздела) и искомые смыслы 4-х  $zz$ -переменных  $zz1, zz2, zz3, zz4$  из 1-го варианта формализации факторов коррупции будем конструировать фразы 3-х смысловых уравнений.

В 1-ом варианте формализации факторов коррупции каждая стабильная  $у$ -переменная  $у2, у3, у4$  зависит от  $zz$ -переменных  $zz1, zz2, zz3, zz4$ . Каждая  $zz$ -переменная в 4-х равенствах для  $zz$ -переменных  $zz1, zz2, zz3, zz4$  имеет свой «вес» (являющимся элементом транспонированной матрицы  $CC_{34}^T$ ), взятый из модельной матрицы  $C_{55}$ .

Составим систему числовых равенств (для смыслового равенства  $смысл(ZZ_{m4})=смысл(YY_{m3}CC_{34}^T)$ ) с неизвестными  $zz$ -переменными  $zz1, zz2, zz3, zz4$  и известными значениями  $уу$ -переменных  $уу2, уу3, уу4$ . Система состоит из 4 равенств с неизвестными правыми частями ( $ZZ_{m4}=YY_{m3}CC_{34}^T$ ). В уравнения этой системы подставим полученные ранее значения «весов» и получим полную матрицу  $CC_{34}^T$ :  $cc_{11}^T=c_{12}^T=0.0000, cc_{12}^T=c_{13}^T=0.5000, cc_{13}^T=c_{14}^T=0.5000; cc_{22}^T=c_{23}^T=0.5000, cc_{23}^T=c_{24}^T=0.5004, cc_{32}^T=c_{34}^T=0.4998, cc_{13}^T=c_{32}^T=(-0.3511), cc_{24}^T=c_{33}^T=0.5929, cc_{34}^T=c_{34}^T=(-0.5241), cc_{14}^T=c_{42}^T=0.0000, cc_{24}^T=c_{43}^T=(-0.0958), cc_{34}^T=c_{44}^T=0.7053$ .

Формулы вычисления значений  $zz$ -переменных  $zz1, zz2, zz3, zz4$  имеют вид:

$$zz1=y_{12} * cc_{11} + y_{13} * cc_{21} + y_{14} * cc_{31};$$

$$zz2=y_{12} * cc_{12} + y_{13} * cc_{22} + y_{14} * cc_{32};$$

$$zz3=y_{12} * cc_{13} + y_{13} * cc_{23} + y_{14} * cc_{33};$$

$$zz4=y_{12} * cc_{14} + y_{13} * cc_{24} + y_{14} * cc_{34};$$

Подставим значения «весов» (1-го варианта модели) в формулы вычисления значений  $zz$ -переменных  $zz1, zz2, zz3, zz4$  имеем математическую модель коррупции (1-ый вариант).

$$zz1=y_{12} * 0.0000 + y_{13} * 0.5000 + y_{14} * 0.5000,$$

$$zz2=y_{12} * 0.5000 + y_{13} * 0.5004 + y_{14} * 0.4998,$$

$$zz3=y_{12} * (-0.3511) + y_{13} * 0.5929 + y_{14} * (-0.5241)$$

$$zz4=y_{12} * 0.0000 + y_{13} * (-0.0958) + y_{14} * 0.7053$$

Три столбца  $c_2, c_3, c_4$  из модельной матрицы  $C_{55}$  псевдособственных векторов соответствуют трем используемым элементам  $\lambda_2=\lambda_3=\lambda_4=0.0250$  из ранее смоделированного спектра  $\Lambda_{55}=\text{diag}(4.2500, 0.0250, 0.0250, 0.0250, 0.5750)$ .

Общее решение системы из 3-х уравнений является матричным решением матричного

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уравнения вида  $YY_{m3}=ZZ_{m4}C_{43}$ . Решение  $ZZ_{m4}$  при известных значениях  $YY_{m3}=ZZ$ ,  $C_{43}$  получено нами с применением программы-таблицы (Таблица 10) для надстройки «Поиск решения» (Рисунок 11).

Аналогично доказывается (2-ой вариант) вид системы линейных уравнений  $YY_{m3}=ZZ_{m4}CC_{43}$ , (выделенная часть из системы уравнений  $Y_{m9}=Z_{m9}C_{99}$ ), где элементы матрицы  $CC_{43}$  равны элементам 3-х столбцов матрицы  $C_{99}$  («весов» при переменных  $zz_1, zz_2, zz_3, zz_4$ ).

Составляется система равенств с неизвестными  $zz_1, zz_2, zz_3, zz_4$  и известными у-переменными  $у_2, у_3, у_4$ , состоящая из 4 равенств с неизвестными правыми частями равенства ( $ZZ_{m4}=YY_{m3}CC_{43}$ ). Для этой системы подставим полученные ранее значения «весов» и получим полную матрицу  $CC_{43}$ :

$cc_{T11}=c_{T12}=0.5000$ ,  $cc_{T12}=c_{T13}=0.5000$ ,  $cc_{T13}=c_{T14}=0.0041$ ;

$cc_{T12}=c_{T22}=0.5000$ ,  $cc_{22}=c_{T23}=0.5004$ ,  $cc_{32}=c_{T24}=(-0.0054)$ ,  $cc_{T13}=c_{T32}=0.2291$ ,  $cc_{24}=c_{T33}=0.5000$ ,  $cc_{34}=c_{T34}=0.0043$ ,  $cc_{T14}=c_{T42}=(-0.0001)$ ,  $cc_{24}=c_{T43}=0.0040$ ,  $cc_{34}=c_{T44}=0.5000$ .

Для 2-го варианта формулы вычисления значений  $zz$ -переменных  $zz_1, zz_2, zz_3, zz_4$  имеют вид, совпадающий с формулами для 1-го варианта модели коррупции:

$$zz_1=y_{i2}*cc_{11}+y_{i3}*cc_{21}+y_{i4}*cc_{31};$$

$$zz_2=y_{i2}*cc_{12}+y_{i3}*cc_{22}+y_{i4}*cc_{32};$$

$$zz_3=y_{i2}*cc_{13}+y_{i3}*cc_{23}+y_{i4}*cc_{33};$$

$$zz_4=y_{i2}*cc_{14}+y_{i3}*cc_{24}+y_{i4}*cc_{34}.$$

Подставим значения «весов» (2-го варианта модели) из матрицы  $C_{99}$  в формулы вычисления значений  $zz$ -переменных  $zz_1, zz_2, zz_3, zz_4$  имеем математическую модель коррупции (1-ый вариант).

$$zz_1=y_{i2}*0.5000+y_{i3}*0.5000+y_{i4}*0.0041;$$

$$zz_2=y_{i2}*0.5000+y_{i3}*0.5000+y_{i4}*(-0.0054);$$

$$zz_3=y_{i2}*0.2291+y_{i3}*0.5000+y_{i4}*0.0043;$$

$$zz_4=y_{i2}*(-0.0001)+y_{i3}*0.0040+y_{i4}*0.5000.$$

Математическая модель коррупции 2-го варианта отличается от математической модели коррупции 1-го варианта:

$$zz_1=y_{i2}*0.0000+y_{i3}*0.5000+y_{i4}*0.5000;$$

$$zz_2=y_{i2}*0.5000+y_{i3}*0.5004+y_{i4}*0.4998;$$

$$zz_3=y_{i2}*(-0.3511)+y_{i3}*0.5929+y_{i4}*(-0.5241);$$

$$zz_4=y_{i2}*0.0000+y_{i3}*(-0.0958)+y_{i4}*0.7053.$$

**Конструирование смыслов у-факторов явления «коррупция» при 1-ом варианте состава факторов коррупции (4 z-факторов (для «низов») и 5 у-факторов (для «низов»))**

Выше мы вычислили изменчивости 4-х z-переменных, зависящих от модельных значений у-изменчивостей и от значений «весов» 0.7053, (-0.0044) из матрицы  $C_{55}$ . Отдельно смоделированная случайная матрица  $Y_{m5}=U_{m5}\Lambda^{1/2}_{55}$  содержит 3 выделенных столбца с

номерами 2,3,4. Из равенства нашей модели  $ZZ_{m4}=YY_{m3}CC_{43}$  ( $CC_{43}CC_{43} \neq I_{44}$ , ибо  $C_{55}C_{55}^T=I_{55}$ )  $Y_{m5}=Z_{m4}C_{45}$   $ZZ_{m4}CC_{43}=YY_{m3}CC_{43}CC_{43}$

Равенство  $Y_{m5}=Z_{m4}C_{45}$  соблюдается по построению модели, так как пара матриц ( $\Lambda_{55}, C_{55}$ ) удовлетворяют равенству  $(1/m)Y_{m5}Y_{m5}^T=\Lambda_{55}$ ,  $C_{55}^T C_{55}=I_{55}$ ,  $C_{55}C_{55}^T=I_{55}$ .

Вместо смыслового равенства  $\text{смысл}(Y_{m5})=\text{смысл}(Z_{m4}) * C_{45}$  рассмотрим смысловое равенство  $\text{смысл}(Y_{m3})=\text{смысл}(Z_{m4}) * C_{43}$ . Здесь формула  $\text{смысл}(Y_{m3})$  определим как сумму смыслов 3-х у-переменных  $у_2, у_3, у_4$ , значения  $y_{i2}, y_{i3}, y_{i4}$ ,  $i=1, \dots, m$ , которых расположены в 2-ом, 3-ем, 4-ом столбцах матрицы  $Y_{m5}=U_{m5}\Lambda^{1/2}_{55}$ . А формулу вида  $\text{смысл}(Z_{m4})$  определим как сумму смыслов 4-х z-переменных  $z_1, z_2, z_3, z_4$ , значения  $z_{i1}, z_{i2}, z_{i3}, z_{i4}$ ,  $i=1, \dots, m$ , которых расположены в 1-ом, 2-ом, 3-ем, 4-ом столбцах матрицы  $Z_{m4}$ . Смысловая формула для смысла столбцов  $\text{смысл}(Y_{m3})$  матрицы  $Y_{m3}$  определим так:  $\text{смысл}(Y_{m3})=\text{смысл}(y_1) \oplus \text{смысл}(y_2) \oplus \text{смысл}(y_3)$  и  $\text{смысл}(Z_{m4})=\text{смысл}(z_1) \oplus \text{смысл}(z_2) \oplus \text{смысл}(z_3) \oplus \text{смысл}(z_4)$ , где  $y_1, y_2, y_3$  ( $z_1, z_2, z_3, z_4$ ) обозначают переменные из столбцов №2, №3, №4 из матрицы  $Y_{m3}$  (из столбцов №1, №2, №3, №4 из матрицы  $Z_{m4}$ ). Здесь мы внедряем в смысловые формулы теории многосмысловых уравнений с семантическими переменными тезис «числа важнее слов, смыслы слов важнее чисел и их формул» [2].

Рассмотрим смысловое равенство  $\text{смысл}(Y_{m3})=\text{смысл}(ZZ_{m4})CC_{43}$ . Эта смысловая формула обоснована 4-мя исходными смыслами 4-х  $zz$ -переменных и неизвестными смыслами 3-х выделенных в модели у-переменных. Для каждой у-переменной требуется найти новые смыслы, решая систему смысловых уравнений вида:  $\text{смысл}(y_2)=\text{смысл}(zz_2)*0,5000 \oplus \text{смысл}(zz_3)*(-0,3511)$ ;  $\text{смысл}(y_3)=\text{смысл}(zz_1)*0,5000 \oplus \text{смысл}(zz_2)*0,5004 \oplus \text{смысл}(zz_3)*0,5929 \oplus \text{смысл}(zz_4)*(-0,0958)$ ;  $\text{смысл}(y_4)=\text{смысл}(zz_1)*0,5000 \oplus \text{смысл}(zz_2)*0,4998 \oplus \text{смысл}(zz_3)*(-0,5241) \oplus \text{смысл}(zz_4)*0,7053$ . В модели остался неучтенным практически равный 0 «вес»  $c_{54}=(-0,0044)$ .

Рассмотрим 1-ую смысловую неизвестную  $\text{смысл}(y_2)=$ «отдача под залог в качестве откупа и отдача по договору подряда своих имений за процент ( $\text{смысл}(y_2)$ ), во много раз превышающий среднерыночный уровень – как способ получения взятки». Правая часть уравнения  $\text{смысл}(y_2)=\text{смысл}(zz_2)*0,5000 \oplus \text{смысл}(zz_3)*(-0,3511)$  равна сумме смыслов 2-х  $zz$ -переменных  $zz_2, zz_3$ . Простые вымогательство и подкуп передают  $\text{смысл}$  новый  $\text{смысл}(y_2)$ . Фраза «индивид в «верхах» реализует для себя способ получения взятки путем простого вымогательства и подкупа» подходит для передачи смысла:



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новый\_смысл( $y_2$ )=«индивид в «верхах» реализует для себя отдачу под залог в качестве откупа за счет вымогательства (смысл( $zz_2$ )) с «весом»  $c_{22}=0.5004$ , подкупа (смысл( $zz_3$ )) с «весом»  $c_{32}=0.0,5929$ ».

Рассмотрим 2-ую смысловую неизвестную  $\text{смысл}(y_3)$ =«Вступление в акционерные общества без взноса капитала ( $y_3$ )». Правая часть уравнения  $\text{смысл}(y_3)=\text{смысл}(zz_1)*0,5000\oplus\text{смысл}(zz_2)*0,5004\oplus\text{смысл}(zz_3)*0,5929\oplus\text{смысл}(zz_4)*(-0,0958)$  равна сумме смыслов 4-х  $zz$ -переменных  $zz_1,zz_2,zz_3,zz_4$ . Простые лихоимство, вымогательство, подкуп и отрицание «влезания индивидом из низов в долги» передают смысл новый\_смысл( $y_3$ ). Фраза «индивид в «верхах» реализует для себя» подходит для передачи смысла  $\text{новый\_смысл}(y_3)$ =«индивид в «верхах» реализует для себя вступление в АО без взноса капитала за счет лихоимства (смысл( $z_1$ )) с «весом»  $c_{13}=0.5$ ), вымогательства (смысл( $zz_2$ )) с «весом»  $c_{23}=0.5004$ ), подкупа (смысл( $zz_3$ )) с «весом»  $c_{33}=0.0,5929$ ) без влезания в долги (смысл( $zz_4$ )) проявлен со «знаком минус при значении веса»  $c_{43}=(-0,0958)$ ».

Рассмотрим 3-ую смысловую неизвестную  $\text{смысл}(y_4)$ =«Использование высшими чиновниками политической и коммерческой информации в личных целях ( $y_4$ )». Этот смысл обновляется, если найти решение уравнения  $\text{смысл}(y_3)=\text{смысл}(z_1)*0,5000\oplus\text{смысл}(z_2)*0,5004\oplus\text{смысл}(z_3)*0,5929\oplus\text{смысл}(z_4)*(-0,0958)$ .

Правая часть уравнения  $\text{смысл}(y_4)=\text{смысл}(zz_1)*0,5000+\text{смысл}(zz_2)*0,4998\oplus\text{смысл}(zz_3)*(-0,5241)\oplus\text{смысл}(zz_4)*0,7053$  равна сумме смыслов 4-х  $zz$ -переменных  $zz_1,zz_2,zz_3,zz_4$ . Простые лихоимство (смысл( $zz_1$ )) с «весом»  $c_{13}=0.5000$ ), вымогательство (смысл( $zz_2$ )) с «весом»  $c_{23}=0,4998$ ), без подкупа (смысл( $zz_3$ )) с отрицательным «весом»  $c_{34}=(-0,5241)$ ), но с «влезанием индивидом из низов в долги» передают смысл новый\_смысл( $y_4$ ). Фраза для передачи смысла имеет вид:  $\text{новый\_смысл}(y_4)$ =«высшие чиновники используют политическую и коммерческую информации в личных целях, используя усиленно: лихоимство (смысл( $zz_1$ )) с «весом»  $c_{13}=0.5000$ ), вымогательство (смысл( $zz_2$ )) с «весом»  $c_{23}=0,4998$ ), с «влезанием индивидом из низов в долги, но без подкупа (смысл( $zz_3$ )) с отрицательным «весом»  $c_{34}=(-0,5241)$ ».

**Конструирование новых смыслов у-факторов явления «коррупция» при 2-ом варианте состава факторов коррупции (4 z-факторов (для «низов») и 9 у-факторов (для «верхов»))**

Рассмотрим 1-ую смысловую неизвестную  $\text{смысл}(y_2)$ = «Вымогательство, на которое способны совершать бессовестные следователи»:  $\text{смысл}(y_2)=\text{смысл}(z_1)*0.5\oplus\text{смысл}(z_2)*0.5\oplus$

$\text{смысл}(z_3)*0.5\oplus\text{смысл}(z_4)*(-0.005394155)$ .

Сконструируем сумму смыслов ( $\text{новый\_смысл}(y_2)$ ) из правой части равенства. Проверим фразу из вновь сконструированного ниже смысла  $\text{новый\_смысл}(y_2)$  и фразу из смысла ( $y_2$ ) на отсутствие противоречия по их смыслам. Если есть отсутствие противоречия по их смыслам, то считаем, что смысловое уравнение  $\text{смысл}(y_2)=\text{смысл}(zz_1)*0.5\oplus\text{смысл}(zz_2)*0.5\oplus\text{смысл}(zz_3)*0.5\oplus\text{смысл}(zz_4)*(-0.005394155)$  имеет семантическое решение. Проведем конструирование суммарной фразы для  $\text{новый\_смысл}(y_2)$ . В анализируемом уравнении присутствуют 3 смысла 3-х ( $z$ -переменных: лихоимство ( $zz_1$ ), вымогательство ( $zz_2$ ), подкуп со стороны чиновников ( $zz_3$ ), и отсутствие «сребролюбия, проявляемого представителями индивидами из «низов» ( $zz_4$ )). Знак минус при «весе» ( $=(-0.005394155)$ ) и учет исходного смысла  $\text{смысл}(y_2)$ =«вымогательство, на которое способны...» позволяет нам сконструировать суммарную фразу «вымогательство с применением лихоимства ( $zz_1$ ), вымогательства ( $zz_2$ ), подкупа со стороны чиновников ( $zz_3$ ), но без «влезания высокопоставленных индивидов в долги ( $zz_4$ )», (знак минус при «весе»  $c_{42}=(-0.005394155)$ )». Проще говоря  $\text{новый\_смысл}(y_2)$ =«вымогательство со стороны индивидов из «низов» с применением лихоимства ( $zz_1$ ), вымогательства ( $zz_2$ ), подкупа со стороны чиновников ( $zz_3$ ) невысокого ранга». Фраза «чиновников ( $z_3$ ) невысокого ранга» мы применили из-за отрицательной величины «веса»  $c_{42}=(-0.005394155)$ , далеко отклоняющего от значения 0.5 («веса» смыслов  $c_{12}=c_{22}=c_{32}=0.5$   $zz$ -переменных  $zz_1,zz_2,zz_3$  со смыслами лихоимство ( $zz_1$ ), вымогательство ( $zz_2$ ), подкуп со стороны чиновников ( $zz_3$ ), входящими в смысл переменной  $y_2$ ). «Вымогательство, которое способны совершать бессовестные» высокого ранга давит на индивидов из «низов» нижнего ранга, вовлеченных в лихоимство (с «весом»  $c_{12}=0.5$ ) ( $zz_1$ ), вымогательство (с «весом»  $c_{22}=0.5$ ), подкуп со стороны чиновников (с «весом»  $c_{32}=0.5$ ), но без «влезания индивидов из «низов» в долги (степень влезания в долги не выражена, так как «вес»  $c_{42}=(-0.005394155)$  отдален от нуля, от 0.5 и от 1)».

Рассмотрим 2-ую смысловую неизвестную  $\text{смысл}(y_3)=\text{смысл}(zz_1)*(-0.707057454)\oplus\text{смысл}(zz_2)*0.229097897\oplus\text{смысл}(zz_3)*0.5\oplus\text{смысл}(zz_4)*0.004281292$ . Найдем сумму смыслов 4 смыслов  $zz$ -переменных из правой части уравнения и, если найденный суммарный смысл дополняет исходный  $\text{смысл}(y_3)$ , то суммарный смысл считаем решением рассматриваемого смыслового уравнения.

$\text{смысл}(y_3)$ =«подкуп, вследствие которого недобросовестные чиновники совершают

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должностные преступления, как правило, ненаказуемые». Выясним, равен или нет смысл левой части смыслу правой части нашего смыслового уравнения  $\text{смысл}(y_3) = \text{смысл}(z_1) * (-0.707057454) \oplus \text{смысл}(z_2) * 0.229097897 \oplus \text{смысл}(z_3) * 0.5 \oplus \text{смысл}(z_4) * 0.004281292$ .

Сконструируем сумму смыслов (новый\_смысл( $y_3$ )) из правой части равенства. Проверим фразу из вновь сконструированного ниже смысла новый\_смысл( $y_3$ ) и фразу из  $\text{смысл}(y_3)$  на отсутствие противоречия по их смыслам. Если есть отсутствие противоречия по их смыслам, то считаем, что смысловое уравнение  $\text{смысл}(y_3) = \text{смысл}(z_1) * (-0.707057454) \oplus \text{смысл}(z_2) * 0.229097897 \oplus \text{смысл}(z_3) * 0.5 \oplus \text{смысл}(z_4) * 0.004281292$  имеет семантическое решение.

Проводим конструирование суммарной фразы для переменной новый\_смысл( $y_3$ ). В анализируемом уравнении присутствуют 3 смысла 3-х zz-переменных: поощрение (смысл( $zz_1$ )), вымогательство ( $zz_2$ ), подкуп со стороны чиновников ( $zz_3$ ), и небольшое присутствие «влезание высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности» небольшим «весом»  $c_{43} = 0.004281292$ . Знак плюс при «весе»  $c_{43} = 0.004281292$  указывает на небольшую степень проявления силы влияния «влезания высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности» (смысл( $zz_4$ )). Знак минус при значении «веса»  $c_{13} = (-0.707057454)$  означает отсутствие лихоимства (процесса взимания, мягкого вымогательства чужой собственности, денег или плодов чужих трудов), присутствие обратного качества – процес сильного поощрения (вознаграждения) в той или иной виде (моральном или материальном).

Проводим конструирование суммарной фразы для новый\_смысл( $y_3$ ). В анализируемом уравнении присутствуют 4 смысла 4-х zz-переменных: поощрение ( $zz_1$ ), вымогательство ( $zz_2$ ), подкуп со стороны чиновников ( $zz_3$ ) и отсутствие «влезание высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности ( $zz_4$ )». Знак минус при «весе» ( $=(-0.005394155)$ ) и учет исходного смысла  $\text{смысл}(y_2) = \text{«вымогательство, на которое способны...»}$  позволяет нам сконструировать суммарную фразу «вымогательство с применением лихоимства ( $zz_1$ ), вымогательства ( $zz_2$ ), подкупа со стороны чиновников ( $zz_3$ ), с проявлением слабой степени влезание высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности, «смысл ( $zz_4$ )», (знак минус при «весе»  $c_{43} = (-0.005394155)$ )».

Рассмотрим 3-ю смысловую неизвестную  $\text{смысл}(y_4) = \text{смысл}(zz_1) * 0.004852744 + \text{смысл}(zz_2) * (-0.0001) + \text{смысл}(zz_3) * 0.003958555 + (zz_4) * 0.5$ .

Найдем сумму смыслов 3 смыслов («вес»  $c_{24} = 0$  zz-переменной  $zz_2$ ) zz-переменных из правой части уравнения и, если найденный суммарный смысл дополняет исходный  $\text{смысл}(y_4)$ , то суммарный смысл считаем решением рассматриваемого смыслового уравнения.  $\text{смысл}(y_4) = \text{«Сребролюбие, проявляемое представителями высших сословий, обладателями высоких должностей и выражающееся в исполнении долговых обязательств перед кредиторами назначением их на «доходные» должности»}$ . Эта фраза отлична от фразы, выражающей смысл zz-переменной  $zz_4$ . Эти y- и zz-переменные  $y_4$ ,  $zz_2$  содержат одно общее слово в фразах, выражающих их смыслы, но одна из них входит в другую фразу. Выясним, равен или нет смысл левой части (сумма 3-х слагаемых смыслов zz-переменные  $zz_1$ ,  $zz_3$ ,  $zz_4$ ) смыслу правой части нашего смыслового уравнения  $\text{смысл}(y_4) = \text{смысл}(zz_1) * 0.004852744 \oplus \text{смысл}(zz_3) * 0.003958555 \oplus (zz_4) * 0.5$ .

Сконструируем сумму смыслов (новый\_смысл( $y_4$ )) из правой части равенства. Проверим фразу из вновь сконструированного ниже смысла новый\_смысл( $y_4$ ) и фразу из  $\text{смысл}(y_4)$  на отсутствие противоречия по их смыслам. Если есть отсутствие противоречия по их смыслам, то считаем, что смысловое уравнение  $\text{смысл}(y_4) = \text{смысл}(zz_1) * 0.004852744 \oplus \text{смысл}(zz_3) * 0.003958555 \oplus \text{смысл}(zz_4) * 0.5$  имеет семантическое решение.

Проводим конструирование суммарной фразы для переменной новый\_смысл( $y_4$ ). В анализируемом уравнении присутствуют 3 смысла 3-х zz-переменных: лихоимство (смысл( $zz_1$ )), вымогательство ( $zz_2$ ), подкуп со стороны чиновников ( $zz_3$ ), и заметное (большое) присутствие «влезание высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности (смысл( $zz_4$ ))» (с большим «весом»  $c_{44} = 0.5$ ). Знак плюс при «весе»  $c_{44} = 0.5$  указывает на большую степень проявления силы влияния влезания высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности (смысл( $zz_4$ ))». Знак плюс при значении «веса»  $c_{14} = 0.004852744$  означает присутствие очень малой степени лихоимства (процесса взимания, мягкого вымогательства чужой собственности, денег или плодов чужих трудов), малое значение  $c_{34} = 0.003958555$  означает очень малую степень присутствия подкупа со стороны чиновников ( $zz_3$ ). Среди 4-х «вес» существенно доминирует «вес»  $c_{44} = 0.5$ . Значит смысл zz-переменной  $zz_4$  составляет новый смысл y-переменной  $y_4$ .

Ясно, что новый смысл как новый y-фактор, перешедший (извлеченное нашей моделью новое



## Impact Factor:

ISRA (India) = 6.317  
 ISI (Dubai, UAE) = 1.582  
 GIF (Australia) = 0.564  
 JIF = 1.500

SIS (USA) = 0.912  
 ПИИЦ (Russia) = 3.939  
 ESJI (KZ) = 8.771  
 SJIF (Morocco) = 7.184

ICV (Poland) = 6.630  
 PIF (India) = 1.940  
 IBI (India) = 4.260  
 OAJI (USA) = 0.350

знание) из z-фактора нижнего уровня перешел на верхний уровень. Изменивший свой статус фактор со смыслом «Влезание высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности» стал главным фактором явления «коррупция». Этот фактор, согласно решению смыслового уравнения  $\text{смысл}(y_4) = \text{смысл}(zz_1) * 0.004852744 + \text{смысл}(zz_3) * 0.003958555 + (zz_4) * 0.5$ .

Выявленный нашей моделью факт незыблемости «силы власть имущих» является известным всем фактом. Для у-переменной  $y_4$  наша модель извлекла дополнительное новое знание: ««Влезание должностных лиц в долги» является движущей силой общества. Под термином «» надо подразумевать индивидов, психологические свойства которых выражены в смыслах  $4+9=13$  z- и у-переменных.

Когнитивная модель явления «коррупция» количественно вычислила:

1. доля z-фактора коррупции  $\text{смысл}(z_4) = \text{«Влезание высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности»}$  равна 25% ( $0.5 * 0.5 = 0.25$ ) в у-факторе со смыслом «Влезание высокопоставленных должностных лиц в долги с дальнейшим назначением кредиторов на «доходные должности». Это свидетельствует о том, что 25% индивидов из нижнего уровня коррупции переходит на верхний уровень коррупции. А нижний уровень коррупции дополняются новыми внемоделными индивидами. Почему?

**Таблица 2. Вид таблицы-программы Оптимизационной задачи 2: (I99I99)=>(C99 A 99) в модели с 4 z-переменными, 9 у-переменными**

	1	2	3	4	5	5	7	8	9	
z1	0,5000	0,5000	0,4000	0,4000	0,1428	0,0384	-0,0072	-0,0112	0,4000	1,0000
z2	0,5000	0,5000	-0,4018	0,8273	-0,0007	-0,0821	0,0154	-0,0004	-0,2537	1,0000
z3	0,5000	0,5000	0,5000	0,4000	-0,0012	-0,0140	0,0143	0,0008	0,4000	1,0000
z4	-0,5581	1,0051	-0,3723	0,5000	-0,0053	-0,1425	-0,0003	0,0000	0,0112	1,0000
z5	0,0042	-0,0097	0,0084	-0,0938	1,0508	-0,0589	0,0101	0,0008	0,4000	1,0000
z5	-0,5282	0,3000	0,4000	0,4000	0,1159	0,4244	0,0394	0,0000	0,0135	1,0000
z7	0,0003	0,0051	-0,0055	-0,0005	-0,0077	-0,0125	0,9998	-0,0077	-0,0050	1,0000
z8	0,0094	-0,0417	-0,1355	0,0045	0,0049	0,0089	0,0077	0,9898	0,0017	1,0000
z9	0,0225	0,0189	-0,0021	0,0054	0,0322	0,2058	-0,0089	0,0021	0,9774	1,0000
	1,4558	1,8544	0,8885	1,4232	1,1503	0,2553	1,0020	0,9798	1,4999	9,0000
	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	9,0000
lambda	5,770000	0,000000	0,000000	0,000000	0,557317	0,552583	0,300000	0,300000	0,300000	9,0000
c11	0,5		0,82550							
c21	0,5					0,01000	0,9			
c33	0,5									
c44	0,5									

**Моделирование числовых матриц  $Y^{(t)}_{m5}$ .  $Z^{(t)}_{m5}$  у- и z-отклонений для 3-х многосмысловых уравнений по математической модели, где отдельно моделировались матрицы  $U_{m5}$  и  $Y_{m5}$  [20] такие, что  $(1/m)U^T_{m5}U_{m5}=I_{55}$ ,  $Y_{m5}=U_{m5}\Lambda^{1/2}_{m5}$ , затем моделировалась матрица  $Z_{m5}=Y_{m5}C^T_{55}$ . Матрица значений zz-переменных**

$zz_1, zz_2, zz_3, zz_4$   $ZZ_{m4}=YY_{m3}CC^T_{34}$  ( $CC_{43}CC^T_{34} \neq I_{44}$ , при этом  $C_{55}C^T_{55}=I_{55}$ ). легко вычисляется в ЭТ Excel. Матрицы  $ZZ_{m4}$  и  $Y_{m5}$  содержат модельные значения неизмеряемых изменчивостей (отклонений от 0), соответствующих неизмеряемым факторам коррупции.

Матрица  $Y^{(t)}_{m5}$  или  $Y^{(t)}_{m9}$   $t=1, \dots, \infty$ ,

## Impact Factor:

<b>ISRA (India)</b> = <b>6.317</b>	<b>SIS (USA)</b> = <b>0.912</b>	<b>ICV (Poland)</b> = <b>6.630</b>
<b>ISI (Dubai, UAE)</b> = <b>1.582</b>	<b>РИИЦ (Russia)</b> = <b>3.939</b>	<b>PIF (India)</b> = <b>1.940</b>
<b>GIF (Australia)</b> = <b>0.564</b>	<b>ESJI (KZ)</b> = <b>8.771</b>	<b>IBI (India)</b> = <b>4.260</b>
<b>JIF</b> = <b>1.500</b>	<b>SJIF (Morocco)</b> = <b>7.184</b>	<b>OAJI (USA)</b> = <b>0.350</b>

обеспечивает случайность будущих значений  $y$ - и  $z$ -отклонений из матриц  $(Y_{m5}^{(0)}, ZZ_{m4}^{(0)}, (Y_{m9}^{(0)}, ZZ_{m4}^{(0)})$ . В матрице  $Y_{m5}$  элементы  $j$ -го столбца  $y_{1j}, y_{2j}, \dots, y_{mj}$  ( $j$ -ая  $y$ -переменная,  $j=1, \dots, 5$ ) имеют среднее арифметическое, равное нулю:  $(1/m)(y_{1j}+y_{2j}+ \dots +y_{mj})=0$ , и дисперсию равную  $\lambda_j$ :

$(1/m)(y_{1j}^2+y_{2j}^2+ \dots +y_{mj}^2)=\lambda_j$ , при этом сумма дисперсий равна 5:  $\lambda_1+\dots+\lambda_5=5$ . Матрицы  $ZZ_{m4}, Y_{m3}$  приведены в Таблицах 7 и 8.

Таблица 3. Матрица  $Y_{m5}$   $y$ -изменчивостей (1-й вариант)

№	y 1	y 2	y 3	y 4	y 5
1	-1.4454	-0.1477	0.3153	0.0592	-1.1381
2	0.7375	-0.0354	0.1055	-0.2505	-0.1254
3	-1.1529	0.0047	-0.2340	0.0099	1.4724
4	0.8518	0.0983	-0.2220	0.2350	-0.4588
5	5.2100	0.0179	-0.2099	-0.1555	-0.4939
5	-0.1575	0.1555	0.1011	-0.3100	0.5143
7	-0.5550	0.1301	-0.2483	0.1125	0.2352
8	0.5105	0.0573	-0.0280	0.1408	0.5283
9	3.2789	-0.1079	-0.0105	0.2704	0.2351
10	1.2454	0.0314	-0.0024	-0.0753	1.5009
11	-0.9557	-0.1899	-0.2402	-0.1312	-0.1783
12	-1.7285	0.3103	0.0405	-0.0585	-0.3255
13	-2.5529	0.3592	-0.0224	0.0295	-0.5499
14	-1.4535	0.0319	0.1204	0.1795	1.3524
15	-1.2388	-0.1104	0.1758	0.2555	0.3340
15	-0.9785	-0.2571	0.1225	-0.0553	0.5473
17	-2.5455	-0.2242	-0.0253	0.0182	-0.8338
18	-1.1209	0.1759	0.1792	-0.1454	0.0802
19	1.1042	-0.1574	0.0093	-0.1583	0.9558
20	3.1544	0.0953	0.2507	0.1593	0.2545
21	-3.5095	-0.1198	-0.1552	-0.0905	-0.3289
22	-0.8710	-0.0910	-0.1418	0.1022	-1.2535
23	2.3720	0.0894	0.0592	0.0045	-1.5800
24	1.9424	-0.1254	0.0485	-0.1371	-0.7452
	0.0000	0.0000	0.0000	0.0000	0.0000
	<b>4.250</b>	<b>0.0250</b>	<b>0.0250</b>	<b>0.0250</b>	<b>0.5750</b>

Таблица 4. Матрица  $ZZ_{m4}$   $z$ -изменчивостей (1-й вариант)

№	zz 1	zz 2	zz 3	zz 4
1	-0.1435	-0.1045	-0.2533	0.0433
2	0.2551	0.1101	0.4272	-0.0288
3	0.0219	0.0013	0.0345	0.0023
4	-0.0020	-0.1152	0.0509	0.0118
5	0.1531	0.0575	0.1728	0.0433
5	0.0405	0.2478	-0.3540	0.1559
7	0.1957	0.2732	-0.1958	0.2145
8	0.0537	0.0827	-0.1398	0.1074
9	0.0215	-0.0935	-0.1942	0.1830

**Impact Factor:**

<b>ISRA (India)</b> = <b>6.317</b>	<b>SIS (USA)</b> = <b>0.912</b>	<b>ICV (Poland)</b> = <b>6.630</b>
<b>ISI (Dubai, UAE)</b> = <b>1.582</b>	<b>ПИИЦ (Russia)</b> = <b>3.939</b>	<b>PIF (India)</b> = <b>1.940</b>
<b>GIF (Australia)</b> = <b>0.564</b>	<b>ESJI (KZ)</b> = <b>8.771</b>	<b>IBI (India)</b> = <b>4.260</b>
<b>JIF</b> = <b>1.500</b>	<b>SJIF (Morocco)</b> = <b>7.184</b>	<b>OAJI (USA)</b> = <b>0.350</b>

10	0.2181	0.4142	-0.1701	0.1595
11	-0.2008	-0.2145	0.0721	-0.1589
12	0.0528	0.0000	-0.0099	0.0535
13	0.0422	0.0558	0.0231	0.0075
14	-0.0555	-0.1258	-0.0444	0.0112
15	-0.1579	-0.2829	-0.1457	0.0303
15	-0.1985	-0.2113	0.3255	-0.3222
17	-0.0750	-0.1042	-0.0142	-0.0285
18	0.2409	0.3209	-0.1545	0.2151
19	-0.0734	-0.0894	0.3571	-0.2583
20	0.0554	0.1422	0.0501	-0.0375
21	-0.0111	-0.0841	-0.1717	0.1294
22	-0.1255	-0.2815	0.0123	-0.0208
23	0.0573	0.1152	0.4504	-0.2523
24	-0.3559	-0.1220	-0.1358	-0.2529
	0.0000	0.0000	0.0000	0.0000
	0.0225	0.0338	0.0450	0.0229

**Таблица 5. Матрица  $C_{99}=\{c_{ij}=\text{corr}(z_i,y_j)\}$  (z,y)-корреляций} (2-ой вариант)**

	1	2	3	4	5	5	7	8	9	
z1	0.5000	0.5000	-0.7071	0.0051	0.0045	0.0032	0.0033	0.0018	0.0023	1.0000
z2	0.5000	0.5000	0.2255	-0.0001	0.0481	0.0809	0.0001	0.0000	-0.2043	1.0000
z3	0.5000	0.5000	0.5000	0.0040	0.0292	0.0498	0.0005	0.0000	0.0037	1.0000
z4	0.0041	-0.0054	0.0043	0.5000	0.0787	0.1487	0.0012	0.0000	0.0012	1.0000
z5	0.5085	-0.5010	0.0102	-0.0498	0.7941	-0.0285	-0.0005	0.0000	0.0028	1.0000
z5	0.7035	-0.7039	0.0055	0.0010	0.0523	0.0709	-0.0253	0.0000	-0.0002	1.0000
z7	0.0019	0.0011	0.0034	0.0032	0.0022	0.0012	1.0000	-0.0047	0.0019	1.0000
z8	0.0437	0.0027	0.0032	0.0007	0.0035	0.0038	0.0042	0.9955	-0.0597	1.0000
z9	-0.0024	0.0521	-0.0005	-0.0008	0.0204	0.0574	0.0055	0.0597	0.9958	1.0000
	1.5054	1.4993	0.8015	0.2525	0.5442	0.0403	1.0007	0.9981	1.0401	9.0000

**Таблица 6. Матрица  $V_m^0$  значений равномерно распределенных в интервале [-1;1] случайных чисел (2-ой вариант)**

	1	2	3	4	5	5	7	8	9
1	-0.0729	-0.1954	0.3345	0.2589	0.0559	-0.012	0.3005	-0.1443	-0.2297
2	0.3873	-0.4745	-0.155	-0.1025	0.3784	0.0923	-0.0513	-0.4519	0.2805
3	0.4253	0.3235	0.1344	0.5209	0.4475	0.1555	0.4227	-0.0011	0.4402
4	-0.4579	0.0125	0.171	0.0739	-0.3545	-0.3195	0.2991	-0.357	0.0257
5	-0.1145	-0.1454	-0.1041	-0.2239	-0.0053	0.2799	-0.1554	-0.3215	0.1415

<b>Impact Factor:</b>	<b>ISRA (India) = 6.317</b>	<b>SIS (USA) = 0.912</b>	<b>ICV (Poland) = 6.630</b>
	<b>ISI (Dubai, UAE) = 1.582</b>	<b>ПИИЦ (Russia) = 3.939</b>	<b>PIF (India) = 1.940</b>
	<b>GIF (Australia) = 0.564</b>	<b>ESJI (KZ) = 8.771</b>	<b>IBI (India) = 4.260</b>
	<b>JIF = 1.500</b>	<b>SJIF (Morocco) = 7.184</b>	<b>OAJI (USA) = 0.350</b>

5	-0.404	-0.024	-0.4013	0.4738	0.43	0.2577	0.0005	-0.4009	-0.3475
7	0.1795	-0.3515	0.1915	-0.2331	0.3975	0.3987	-0.1038	0.3274	0.2297
8	0.1799	0.1007	-0.0059	-0.0855	0.3455	0.1395	-0.2385	0.2328	-0.0215
9	-0.1523	0.4421	-0.4595	-0.2973	0.4203	-0.0113	-0.1875	-0.1117	-0.3295
10	-0.512	-0.1555	-0.218	-0.0312	-0.0942	-0.4573	-0.0554	0.3258	0.0579
11	0.0994	0.4272	-0.0059	-0.1204	-0.3474	0.2439	-0.4047	0.1512	-0.1755
12	-0.4551	0.2915	0.5021	0.1795	-0.4549	-0.1923	0.2748	0.0505	0.411
13	-0.3753	-0.2515	-0.1853	-0.0819	-0.1779	0.3179	-0.1254	-0.451	-0.1731
14	0.3911	0.4835	-0.4941	-0.4229	0.3799	-0.1599	-0.3795	0.435	-0.2759
15	-0.4015	-0.1239	0.1521	-0.4215	-0.4485	0.4001	0.172	-0.2593	-0.2585
15	-0.0258	-0.1293	-0.3111	0.3211	-0.4035	-0.4847	0.304	-0.4585	-0.2529
17	0.4781	-0.3551	0.4537	-0.0514	0.091	-0.1529	0.3715	0.3359	0.1524
18	-0.3503	-0.1025	0.2085	0.0597	0.0539	-0.4118	-0.025	0.2209	0.2182
19	0.3533	0.5005	-0.3434	0.4	0.0375	-0.0057	-0.2422	-0.1884	0.0457
20	-0.297	0.4347	0.3228	0.4392	-0.4025	0.3505	-0.1099	0.0093	0.4529
21	0.0955	0.0208	0.0548	-0.4081	0.1725	-0.3985	0.031	0.4084	-0.1323
22	0.2835	-0.0081	0.4795	0.0144	0.0725	-0.1397	0.1472	-0.0541	-0.0502
23	0.2885	-0.328	-0.2559	-0.3549	-0.4479	-0.2184	-0.4072	0.3423	0.1282
24	0.4571	-0.3585	-0.0524	0.0942	-0.1559	0.2991	0.1843	0.3791	-0.3459
	0.000004	-0.000008	0.000000	-0.000004	0.000000	0.000008	-0.000004	-0.000008	0.000000

Таблица 7. Матрица  $U_{m9}$ –изменчивостей (2-ой вариант)

	1	2	3	4	5	5	7	8	9
1	-0.21705	-0.5525093	1.13584772	0.938843	0.2058807	-0.04232	1.224379	-0.4713101	-0.91727
2	1.153075	-1.575825	-0.5535793	-0.35785	1.1879158	0.325231	-0.24955	-1.5087095	1.120131
3	1.25521	1.07518538	0.45537548	1.818558	1.4051552	0.583537	1.7217	-0.0035558	1.757857
4	-1.35329	0.04189105	0.58055758	0.258027	-1.1132	-1.12528	1.218259	-1.198731	0.105522
5	-0.34091	-0.4853848	-0.353488	-0.7817	-0.015538	0.985325	-0.53294	-1.0501111	0.555455
5	-1.20282	-0.0797121	-1.3525777	1.554224	1.3499043	0.943333	0.002451	-1.309451	-1.38808
7	0.534403	-1.2013845	0.55025858	-0.81382	1.2481905	1.404971	-0.42277	1.05943715	0.917259
8	0.535594	0.33450241	-0.02343	-0.30234	1.0880857	0.491914	-0.97182	0.75043844	-0.08525
9	-0.45345	1.45890041	-1.550305	-1.03797	1.319453	-0.03985	-0.75358	-0.3548254	-1.3152
10	-1.52435	-0.519942	-0.7402535	-0.10892	-0.295723	-1.51153	-0.25535	1.05421095	0.271148
11	0.295925	1.41939531	-0.02343	-0.42035	-1.090597	0.859453	-1.54835	0.52555525	-0.70522
12	-1.35495	0.9588557	1.70495007	0.527054	-1.459455	-0.57759	1.119294	0.15497897	1.541251
13	-1.11737	-0.8591355	-0.5292155	-0.28593	-0.558484	1.120235	-0.51482	-1.5057599	-0.59125
14	1.154389	1.50578374	-1.5777948	-1.47548	1.1925248	-0.55351	-1.54571	1.42415507	-1.10575
15	-1.19557	-0.4115288	0.55043522	-1.47195	-1.408295	1.409904	0.700583	-0.8459428	-1.03258
15	-0.0798	-0.4295702	-1.0553893	1.121093	-1.257025	-1.70809	1.238227	-1.4979305	-1.00991
17	1.423409	-1.2153358	1.5405102	-0.21435	0.2855774	-0.53884	1.513159	1.09720131	0.508584
18	-1.07271	-0.3405275	0.70799477	0.243353	0.2005021	-1.45119	-0.10588	0.72155852	0.871345
19	1.051849	1.55293381	-1.1550591	1.395551	0.1180381	-0.02354	-0.98548	-0.5153571	0.182495
20	-0.88425	1.44431399	1.09511852	1.533423	-1.253573	1.270708	-0.44751	0.03040447	1.808582
21	0.28759	0.05913547	0.18508208	-1.42481	0.5415314	-1.40458	0.125282	1.33401322	-0.52832
22	0.844335	-0.0258845	1.52821819	0.05029	0.2275001	-0.49233	0.599571	-0.1755835	-0.20047
23	0.859221	-1.089749	-0.858949	-1.27399	-1.405098	-0.75955	-1.55853	1.11810509	0.511945
24	1.390559	-1.1914171	-0.2118891	0.328901	-0.492558	1.053985	0.750582	1.23830855	-1.3813
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

<b>Impact Factor:</b>	<b>ISRA (India) = 6.317</b>	<b>SIS (USA) = 0.912</b>	<b>ICV (Poland) = 6.630</b>
	<b>ISI (Dubai, UAE) = 1.582</b>	<b>РИИЦ (Russia) = 3.939</b>	<b>PIF (India) = 1.940</b>
	<b>GIF (Australia) = 0.564</b>	<b>ESJI (KZ) = 8.771</b>	<b>IBI (India) = 4.260</b>
	<b>JIF = 1.500</b>	<b>SJIF (Morocco) = 7.184</b>	<b>OAJI (USA) = 0.350</b>

Таблица 8. Матрица  $Y_{m9}$  у–изменчивостей (2-ой вариант)

	5.5000	0.0450	0.0450	0.0450	0.5833	0.5817	0.3000	0.3000	0.3000
Y2409	y 1	y 2	y 3	y 4	y 5	y 5	y 7	y 8	y 9
1	4.15547954	<b>0.078424841</b>	<b>-0.305973</b>	<b>0.01973352</b>	-0.47553	-0.53409	0.333727	-0.2503325	-0.41905
2	0.50533145	<b>-0.292310772</b>	<b>0.48590878</b>	<b>0.02529285</b>	-0.138289	-1.54054	0.592581	-0.0345151	0.340574
3	-5.85514153	<b>-0.041185773</b>	<b>0.03579519</b>	<b>0.00805315</b>	-0.278395	0.737953	1.43328	-0.5721104	0.080295
4	-0.59955137	<b>-0.228293525</b>	<b>-0.018227</b>	<b>0.01421552</b>	-0.717058	0.018907	-0.27304	0.11934875	-0.95107
5	-1.08131158	<b>-0.191435395</b>	<b>0.23330117</b>	<b>0.09291731</b>	0.8827998	-0.59931	0.027277	0.359155	-0.05535
5	1.4025994	<b>0.414722274</b>	<b>-0.1242788</b>	<b>0.20527108</b>	-0.503229	-0.52832	0.885557	1.02752752	-0.18223
7	-0.40975292	<b>0.153093948</b>	<b>0.07895531</b>	<b>0.31444202</b>	1.1259003	-0.804	0.130248	-0.5795	0.543779
8	2.55250452	<b>0.058118409</b>	<b>-0.0393397</b>	<b>0.14574951</b>	0.3875051	0.25535	0.155531	-0.0522527	0.594224
9	-2.02415175	<b>-0.230255877</b>	<b>-0.1901208</b>	<b>0.23334351</b>	-0.394449	0.480107	0.041079	0.99154215	0.548818
10	-1.87453324	<b>0.392155544</b>	<b>0.18507074</b>	<b>0.25110378</b>	-1.015881	0.374343	-0.83517	0.11995124	-0.18518
11	3.31997881	<b>-0.027372307</b>	<b>-0.1430574</b>	<b>-0.25853038</b>	1.32825	1.015852	-0.33051	0.32557583	0.225155
12	-2.08375353	<b>-0.105478855</b>	<b>0.01355884</b>	<b>0.09194124</b>	0.219708	1.250573	-0.25581	-0.5237323	-1.02385
13	0.75170301	<b>0.027117581</b>	<b>0.05503575</b>	<b>0.01943545</b>	0.725325	-1.09999	-0.08555	0.78707732	-0.39528
14	-1.55350243	<b>-0.122411502</b>	<b>-0.1294137</b>	<b>-0.00173995</b>	-0.395258	1.05541	-0.30859	0.43078379	1.297007
15	-3.74721125	<b>-0.229530312</b>	<b>-0.3334541</b>	<b>-0.00237551</b>	1.3451124	-0.95477	-0.55487	0.35713843	-0.55892
15	-1.03995003	<b>-0.025738455</b>	<b>0.05204982</b>	<b>-0.4490958</b>	-1.825445	-0.41827	-0.05154	0.41795708	-0.5985
17	-0.55433515	<b>-0.055293589</b>	<b>-0.098222</b>	<b>-0.05381098</b>	-0.398582	-0.53747	-0.00815	-1.2702234	0.190552
18	3.12318985	<b>0.159958852</b>	<b>0.15487533</b>	<b>0.32700358</b>	-0.751702	0.457155	-0.39595	-0.3510902	-0.28399
19	1.74284115	<b>-0.032337515</b>	<b>0.19270953</b>	<b>-0.33954392</b>	-0.235157	1.158522	0.728854	0.45121384	0.271725
20	0.4537129	<b>0.171353371</b>	<b>0.14509173</b>	<b>-0.03327114</b>	1.5088778	1.502327	0.355577	-0.1405552	-0.73992
21	-0.47219075	<b>-0.145921979</b>	<b>-0.180827</b>	<b>0.15871594</b>	-0.825185	0.231573	-0.57255	-0.3404095	0.495575
22	5.87309724	<b>-0.311747232</b>	<b>-0.195085</b>	<b>-0.05593287</b>	-0.249879	-0.1212	0.187978	-0.5117513	-0.04119
23	0.22222252	<b>0.115388055</b>	<b>0.42787795</b>	<b>-0.31335985</b>	0.2505243	-0.1955	-1.08285	-0.1555755	0.455125
24	-2.52710597	<b>0.470018577</b>	<b>-0.3132538</b>	<b>-0.40059052</b>	0.3221227	-0.91489	-0.008	-0.4050408	0.391403
	0.0000	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>	0.0000	0.0000	0.0000	0.0000	0.0000
	5.5999	<b>0.0450</b>	<b>0.0450</b>	<b>0.0450</b>	0.5832	0.5817	0.3000	0.3000	0.3000

Таблица 9. Матрица  $ZZ_{m4}$  z–изменчивостей (2-ой вариант)

№	zz 1	zz 2	zz 3	zz 4
1	0,0210	0,0220	0,0374	-0,0438
2	-0,1747	-0,1750	-0,1158	0,0135
3	0,1078	0,1088	0,0925	-0,0471
4	0,2155	0,2157	0,2149	0,0453
5	-0,1455	-0,1424	-0,0837	-0,1953
5	-0,2570	-0,2588	-0,2405	0,0843
7	-0,0933	-0,0929	-0,1113	-0,0242
8	0,1327	0,1335	0,1023	-0,0345
9	-0,1905	-0,1914	-0,0583	0,0374



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10	-0,1573	-0,1558	-0,1999	-0,0703
11	0,0741	0,0717	0,0341	0,1138
12	0,0023	-0,0011	-0,0148	0,1520
13	-0,0338	-0,0382	-0,0079	0,2111
14	-0,1028	-0,1018	-0,0855	-0,0479
15	0,1549	0,1534	0,1122	0,0729
15	0,2299	0,2311	0,1285	-0,0501
17	0,1020	0,1047	0,0277	-0,1255
18	-0,0939	-0,0902	-0,0785	-0,1771
19	0,2753	0,2754	0,1522	-0,0527
20	0,1334	0,1321	0,1358	0,0504
21	-0,1212	-0,1224	-0,1239	0,0580
22	-0,1513	-0,1489	-0,0250	-0,1145
23	-0,0484	-0,0525	-0,0294	0,2007
24	0,1310	0,1324	0,1458	-0,0552
	0,0000	0,0000	0,0000	0,0000
	0,0225	0,0225	0,0135	0,0113

### Визуализация знаний о «весах» и z-, y- изменчивостях в модели с 4 z-переменными, 5 y-переменными (1-й вариант)

Точки на Рисунке 1 показывают взаимные динамики «скачки-падения» точек переменных (zz<sub>1</sub>, zz<sub>2</sub>, zz<sub>3</sub>, zz<sub>4</sub>, y<sub>2</sub>). Визуализация динамик факторов коррупции отличается от визуализаций динамик факторов из других предметных областей [18-23]. На Рисунке наблюдаем разное количество усиления проявлений 4-х zz-факторов: число пиков вверх не равно числу пиков вниз. На постоянную динамику ведущего фактора y<sub>2</sub> со смыслом «индивид в «верхах» реализует для себя отдачу под залог в качестве откупа» (постоянная динамика изменчивости на кривой «y<sub>2</sub>») за счет воровства (5 пиков на кривой «z<sub>1</sub>»), вымогательства (1 пик на кривой «zz<sub>2</sub>»), подкупа (неоднократные сильно выраженные по результатам: пики на кривой «zz<sub>3</sub>») и влезания в долги (мало заметная на кривой «zz<sub>4</sub>»). На Рисунке видны различия амплитуд взаимных динамик 4-х кривых. Они отражают реальную ситуацию явления коррупция.

На Рисунке 7 наблюдаем особенности взаимных динамик y-фактора y<sub>3</sub> на 4 z-фактора. На постоянную динамику y-фактора y<sub>3</sub> со смыслом «индивид в «верхах» вступает в акционерное общество без взноса капитала» (постоянная динамика изменчивости на кривой «y<sub>3</sub>») воровства (5 пик на кривой «zz<sub>1</sub>»), за счет вымогательства (1

пик на кривой «zz<sub>2</sub>»), подкупа (слабо выраженных: нет пиков на кривой «zz<sub>3</sub>») и частого влезания в долги (заметная на кривой «zz<sub>4</sub>»). На Рисунке видны различия амплитуд взаимных динамик 4-х кривых. Значения сил выраженности факторов (значения «весов» из матрицы C<sup>T</sup><sub>34</sub>) приведены в параграфе «Конструирование смыслов y-факторов явления «коррупция» при 1-ом варианте состава факторов коррупции (4 zz-факторов (для «низов») и 5 y-факторов (для «верхов»)). Они по другому отражают реальную ситуацию явления коррупция.

Рисунок 7 более информативен: наблюдаем более значимые различия амплитуд взаимных динамик y-фактора y<sub>4</sub> и 4-х z-факторов. Так как дисперсия y-переменной y<sub>4</sub> равна 0.0250, то на постоянную динамику фактора y<sub>4</sub> со смыслом «высшие чиновники в «верхах» использует политическую и коммерческую информации в личных целях (постоянную динамику изменчивости на кривой «y<sub>4</sub>»), за счет воровства (5 пиков на кривой «zz<sub>1</sub>»), за счет вымогательства (3 пика на кривой «zz<sub>2</sub>»), подкупа (2 сильно выраженных пика на кривой «zz<sub>3</sub>») и частого влезания в долги (4 пика, большая амплитуда колебаний точек на кривой «zz<sub>4</sub>»). На Рисунке видны более значимые различия амплитуд взаимных динамик 4-х кривых. Значения сил выраженности (значения «весов») приведены в параграфе «Конструирование смыслов y-

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факторов явления «коррупция» при 1-ом варианте состава факторов коррупции (4 zz-факторов (для «низов») и 5 y-факторов (для «верхов»)). Они по другому отражают реальную ситуации явления

коррупция.

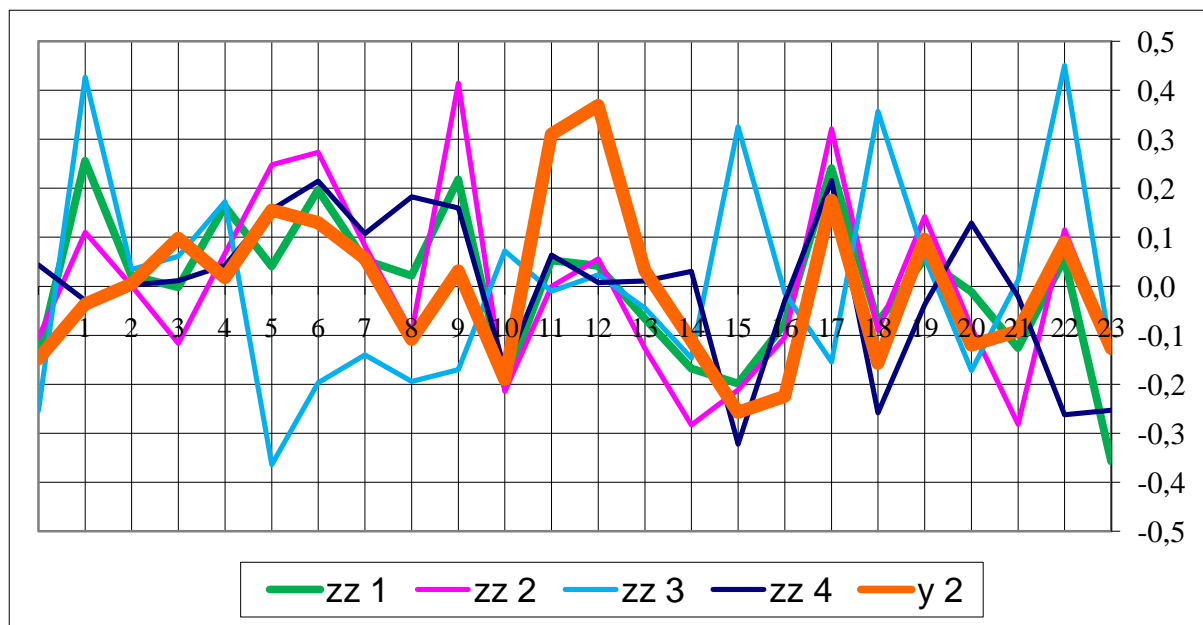


Рисунок 1. Взаимная динамика 3-х z -изменчивостей z2, z3, z4, влияющих на на возрастающую динамику изменчивость на у –изменчивости фактора у2 со смыслом «» (1-й вариант)

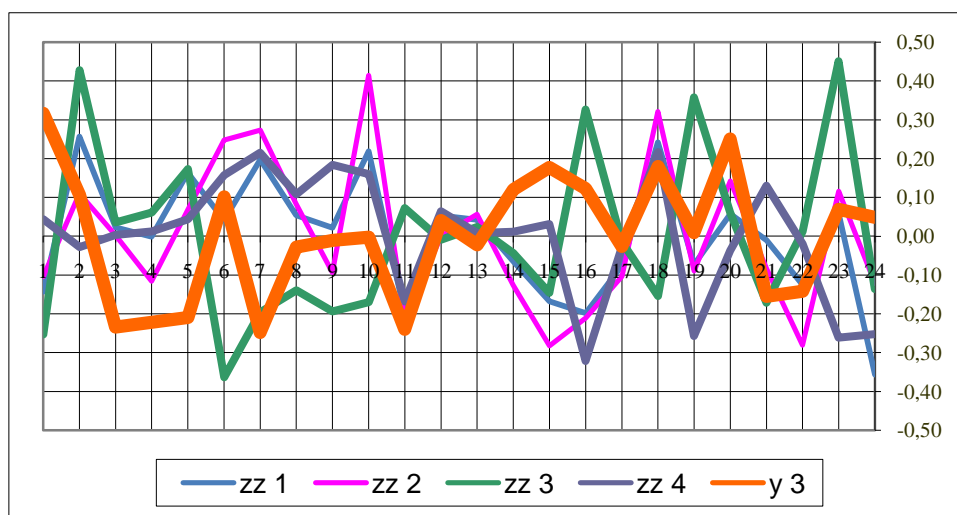


Рисунок 2. Взаимная динамика 3-х z -изменчивостей z2, z3, z4, влияющих на изменчивость на возрастающую динамику у –изменчивости фактора у3 со смыслом «»(1-й вариант)

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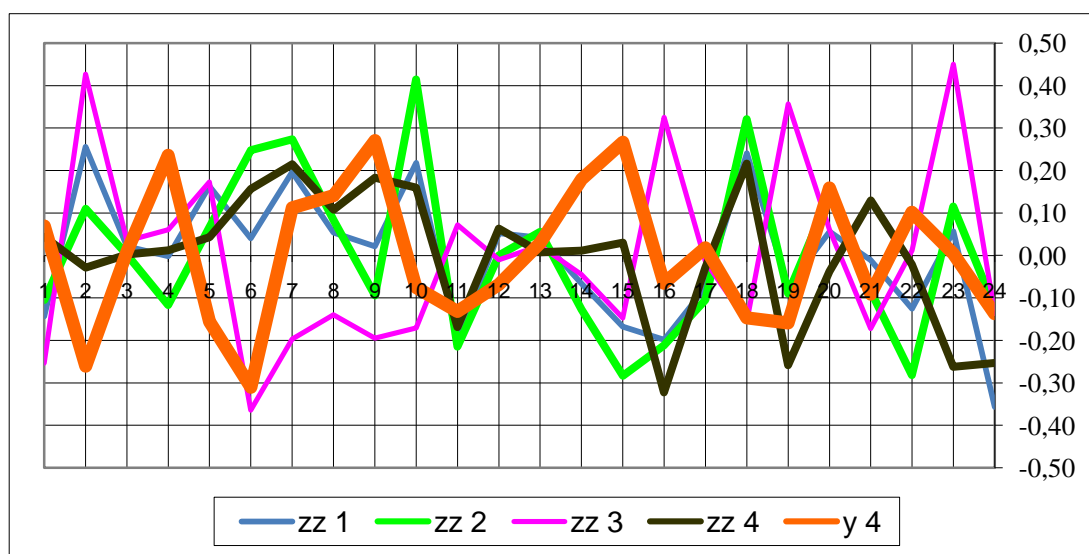


Рисунок 3. Взаимная динамика 3-х  $z$  – изменчивостей  $z_2, z_3, z_4$ , влияющих на возрастающую динамику  $y$  – изменчивости фактора  $y_4$  со смыслом (1-й вариант) «...»

### Визуализация знаний о «весах» и $z$ -, $y$ -изменчивостях в модели с 4 $z$ -переменными, 9 $y$ -переменными (2-ой вариант)

Точки на Рисунке 1 показывают взаимные динамики «скачки-падения» точек переменных ( $zz_2, zz_1, zz_3, zz_4, y_2$ ). Значения переменной  $zz_1$  близки к значениям переменной  $zz_2$ , кривая « $zz_1$ » на рисунке совпадает с кривой « $zz_2$ », поэтому мы показываем одну из них.

На постоянную динамику фактора  $y_2$  со смыслом «индивид в «верхах» занимается вымогательством, которое способны совершать бессовестные следователи (постоянная динамика изменчивости на кривой « $y_2$ ») за счет вымогательства (1 пик на кривой « $zz_2$ », подкупа (неоднократных сильно выраженных результатов: пики на кривой « $zz_3$ » и влезания в долги (мало заметная на кривой « $zz_4$ »). На Рисунке 1 для 1-го варианта различия амплитуд взаимных динамик 4-х кривых совпадают с различиям амплитуд взаимных динамик 4-х кривых, наблюдаемых на Рисунке 4 для 2-го варианта. Это – свидетельство одинаковости результатов 2-х вариантов модели коррупции. Они отражают реальную ситуации явления «коррупция».

На постоянную динамику фактора  $y_3$  со смыслом «индивид в «верхах» совершает подкуп, вследствие которого недобросовестные чиновники совершают должностные преступления, как правило, ненаказуемые» (постоянная динамика изменчивости на кривой « $y_4$ »). Индивид в «верхах» совершает подкуп, пользуясь вымогательством у индивидов из «низов» (1 пик на кривой « $zz_2$ », подкупа (слабо выраженных: нет пиков на кривой « $zz_3$ » и частого

влезания в долги (заметная на кривой « $zz_4$ »). На Рисунке 2 для 1-го варианта различия амплитуд взаимных динамик 4-х кривых совпадают с различиям амплитуд взаимных динамик 4-х кривых, наблюдаемых на Рисунке 5 для 2-го варианта. Это – другое свидетельство одинаковости результатов 2-х вариантов модели коррупции. Они отражают реальную ситуации явления «коррупция».

На постоянную динамику фактора  $y_4$  со смыслом «высшие чиновники в «верхах» сребролюбивы, обладают высокими должностями и руководствуются должными обязательствами перед кредиторами перед назначением их на «доходные» должности (постоянная динамика изменчивости на кривой « $y_4$ »). Индивид в «верхах» совершает вымогательство (3 пика на кривой « $zz_2$ », подкупа (2 сильно выраженных пика на кривой « $zz_3$ » и частого влезания в долги (4 пика, большая амплитуда колебаний точек на кривой « $zz_4$ »). На Рисунке 3 для 1-го варианта различия амплитуд взаимных динамик 4-х кривых совпадают с различиям амплитуд взаимных динамик 4-х кривых, наблюдаемых на Рисунке 5 для 2-го варианта. Это – такое же свидетельство одинаковости результатов 2-х вариантов модели коррупции. Они отражают реальную ситуацию явления «коррупция».

Меня просят показать пример. Простой пример добычи чисел, касающихся совершенных (извлеченных моделью) преступлений. В 1-ом варианте модели будем интерпретировать свойства динамик следующим образом: допустим, произошли преступления 3-х типов: типа « $y_2$ », типа « $y_3$ », типа « $y_4$ ». В рамках

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 OAJI (USA) = 0.350

преступлений типа « $y_2$ » произошли 8 преступлений «вида  $zz_1$ ». На кривой « $zz_2$ » со смыслом «вымогательство» – 7 пиков, на кривой « $zz_3$ » со смыслом «подкуп» – 11, на кривой « $zz_4$ » со смыслом «влезания в долги» – 7. По преступлениям «типа  $y_3$ » зарегистрировано: на кривой « $zz_1$ » со смыслом воровство (вид « $zz_1$ ») - 5, на кривой « $zz_2$ » со смыслом «вымогательство» вида « $zz_2$ » - 5, на кривой « $zz_3$ » со смыслом «подкуп» (вид « $zz_3$ ») 8, на кривой « $zz_4$ » со смыслом «влезания в долги» (преступление вида « $zz_4$ ») – 5. По преступлению «типа  $y_4$ » зарегистрировано: 5 - со смыслом воровство (вид

« $zz_1$ »), 11 - со смыслом «вымогательство» (вид « $zz_2$ »), 2 - со смыслом подкуп (вид « $zz_3$ »), 4 - со смыслом влезания в долги (вид « $zz_4$ »).

В итоге имеем цифровую картину (91 за 24 месяца) по 3 типам коррупционных преступлений: по типу « $y_2$ » совершено  $8+7+11+7=33$  преступлений по 4 своим видам, по типу « $y_3$ » -  $8+7+11+7=33$  преступлений по 4 своим видам, по типу « $y_4$ » -  $5+5+8+5=25$  преступлений по 4 своим видам.

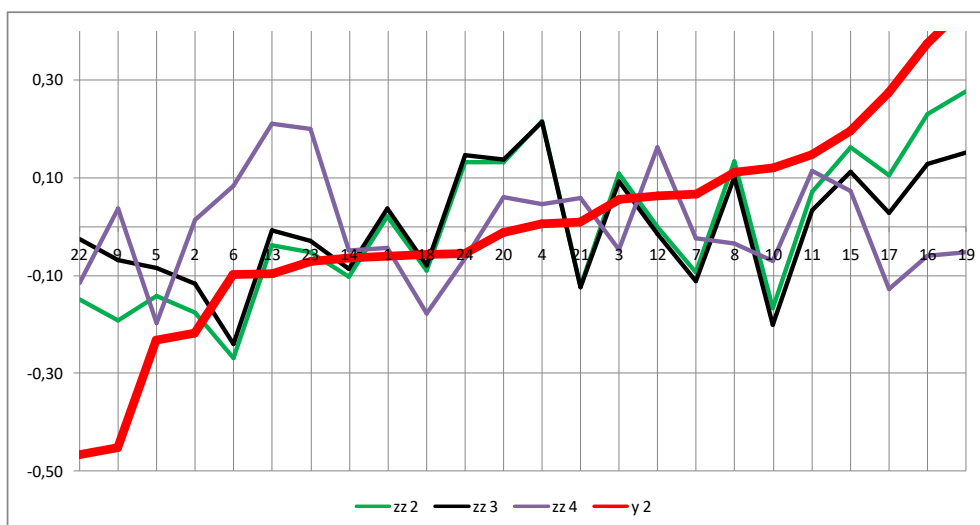


Рисунок 4. Взаимная динамика 3-х  $z$ -изменчивостей  $z_2, z_3, z_4$ , влияющих на возрастающую динамику  $y$ -изменчивости фактора  $y_2$  со смыслом «...»(2-ой вариант)

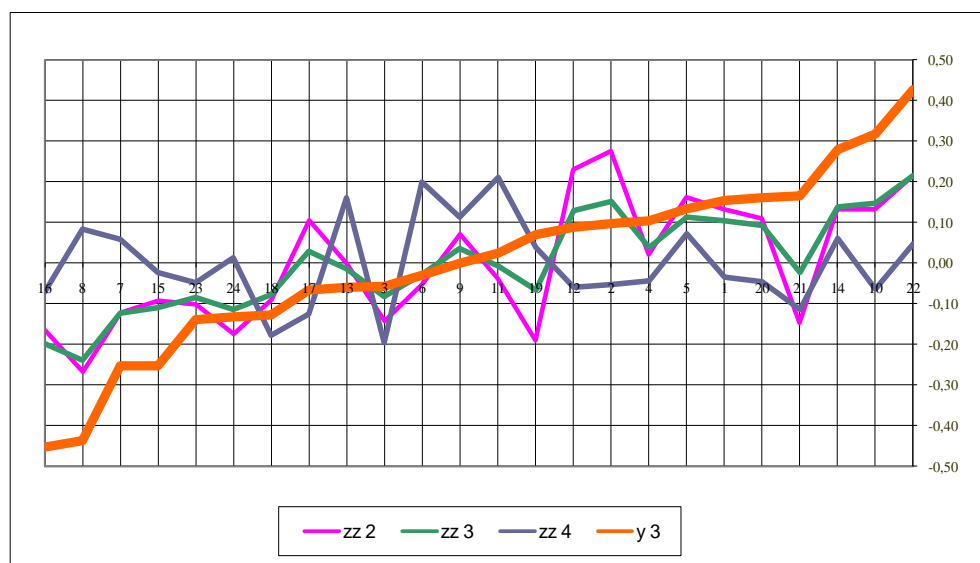
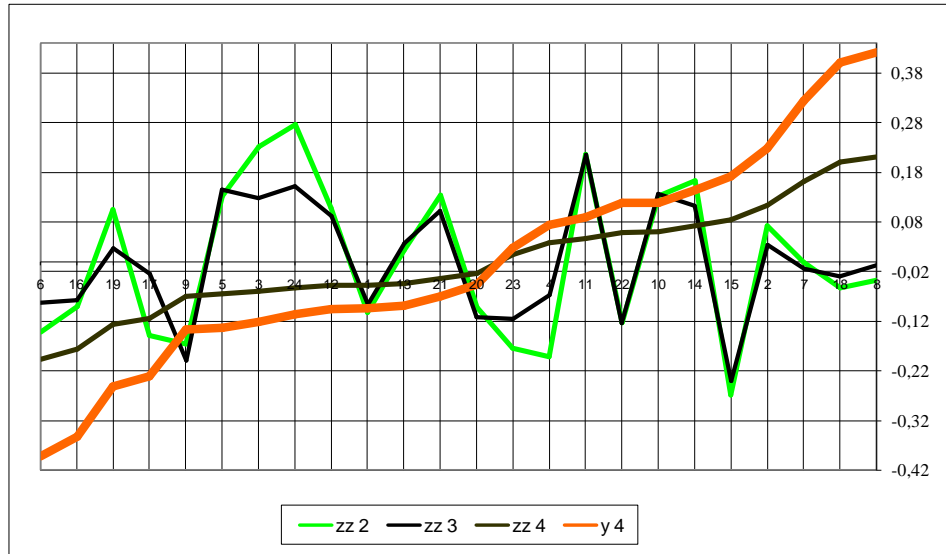


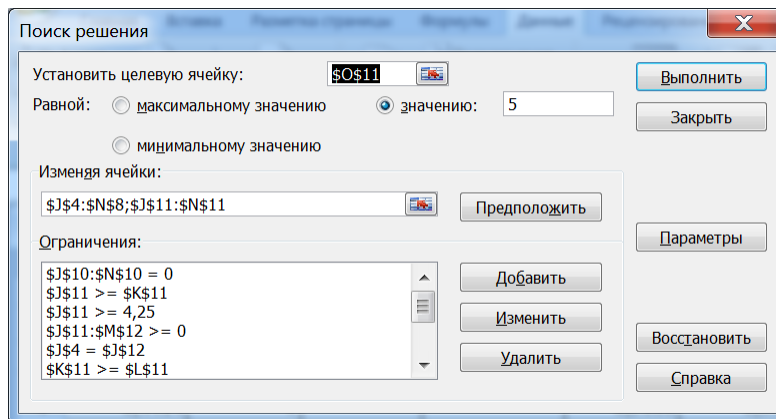
Рисунок 5. Тесная связь отражена в взаимной динамике 3-х  $z$ -изменчивостей  $z_2, z_3, z_4$ : «(смысл( $z_2$ ))» и «(смысл( $z_3$ ))», и «(смысл( $z_4$ ))», влияющих на возрастающую динамику  $y$ -изменчивости фактора  $y_3$  явления коррупции (2-ой вариант)

**Impact Factor:**

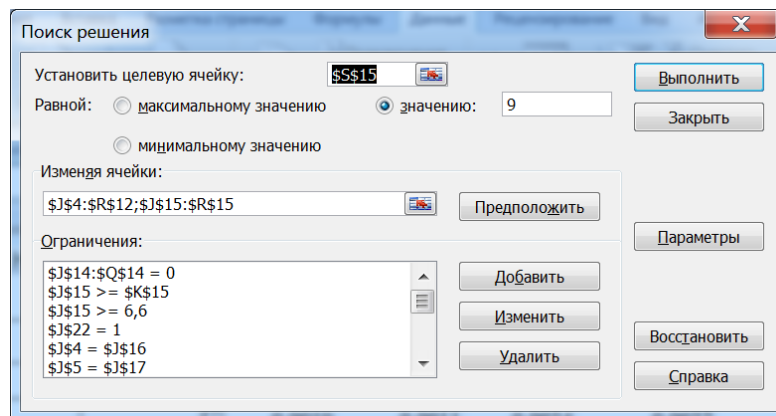
ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
ISI (Dubai, UAE) = 1.582	РИИЦ (Russia) = 3.939	PIF (India) = 1.940
GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350



**Рисунок 6.** Тесная связь отражена в взаимной динамике 3-х z-изменчивостей z2, z3, z4: «(смысл(z2))» и «(смысл(z3))», и «(смысл(z4))», влияющих на постоянную динамику у-изменчивости фактора у4 явления коррупции (2-ой вариант)



**Рисунок 7.** Окно надстройки «Поиск решения» с операторами таблицы-программы решения оптимизационной Задачи:  $(I_{ss}I_{55})=>(C_{55} \Lambda_{55})$  в модели с 4 z-переменными, 5 y-переменными



**Рисунок 8.** Окно надстройки «Поиск решения» с операторами таблицы-программы решения оптимизационной Задачи:  $(I_{ss}I_{55})=>(C_{55} \Lambda_{55})$  в модели с 4 z-переменными, 9 y-переменными



<b>Impact Factor:</b>	<b>SISRA (India) = 6.317</b>	<b>SIS (USA) = 0.912</b>	<b>ICV (Poland) = 6.630</b>
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	<b>JIF = 1.500</b>	<b>SJIF (Morocco) = 7.184</b>	<b>OAJI (USA) = 0.350</b>

**Таблица 10. Вид таблицы-программы Оптимизационной задачи (I<sub>ss</sub>I<sub>ss</sub>)=>(C<sub>ss</sub> Λ<sub>ss</sub>) в модели с 4 z-переменными, 5 y-переменными**

	1	2	3	4	5	
z1	0,5000	0,0000	0,5000	0,5000	0,5000	1,0000
z2	0,0000	0,5000	0,5004	0,4998	0,4998	1,0000
z3	0,0000	-0,3511	0,5929	-0,5241	0,0000	1,0000
z4	0,0000	0,0000	-0,0958	0,7053	-0,7014	1,0000
z5	0,0000	0,0000	0,0000	-0,0044	1,0000	1,0000
	0,2500	0,3804	0,9898	1,3881	1,9918	5,0000
	0,0000	0,0000	0,0000	0,0000	0,0000	
lambda	4,2500	0,0250	0,0250	0,0250	0,5750	5,0000
c11	0,5	0	0,82550	0		
c21	0,5					0,01000
c33	0,5					
c44	0,5					

**Таблица 11. Вид таблицы-программы Оптимизационной задачи (I<sub>99</sub>I<sub>99</sub>)=>(C<sub>99</sub> Λ<sub>99</sub>) в модели с 4 z-переменными, 9 y-переменными**

	1	2	3	4	5	5	7	8	9	
z1	0,5000	0,5000	-0,7071	0,0049	0,0045	0,0032	0,0033	0,0018	0,0023	1,0000
z2	0,5000	0,5000	0,2291	-0,0001	0,0515	0,0985	0,0001	0,0133	-0,5595	1,0000
z3	0,5000	0,5000	0,5000	0,0040	0,0312	0,1054	0,0005	2,3289	0,0037	1,0000
z4	0,0041	-0,0054	0,0043	0,5000	0,0855	0,4052	0,0012	-0,7599	0,0012	1,0000
z5	0,4828	-0,5333	0,0110	-0,0532	0,5878	-0,0725	-0,0005	0,0004	0,0028	1,0000
z5	0,5731	-0,7317	0,0070	0,0010	0,0520	0,0831	-0,0258	0,0081	-0,0002	1,0000
z7	0,0019	0,0011	0,0034	0,0032	0,0022	0,0012	1,0000	-0,0047	0,0019	1,0000
z8	0,0437	0,0027	0,0032	0,0007	0,0035	0,0038	0,0042	0,9955	-0,0591	1,0000
z9	-0,0024	0,0521	-0,0005	-0,0008	0,0204	0,0573	0,0055	0,0703	0,9943	1,0000
	1,4381	1,5725	0,8025	0,2540	0,4885	0,2015	1,0007	5,9998	1,4284	9,0000
	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	
lambda	5,5000	0,0450	0,0450	0,0450	0,5833	0,5817	0,3000	0,3000	0,3000	9,0000
c11	0,5		0,82550							
c21	0,5					0,01000	0,9			
c33	0,5									
c44	0,5									

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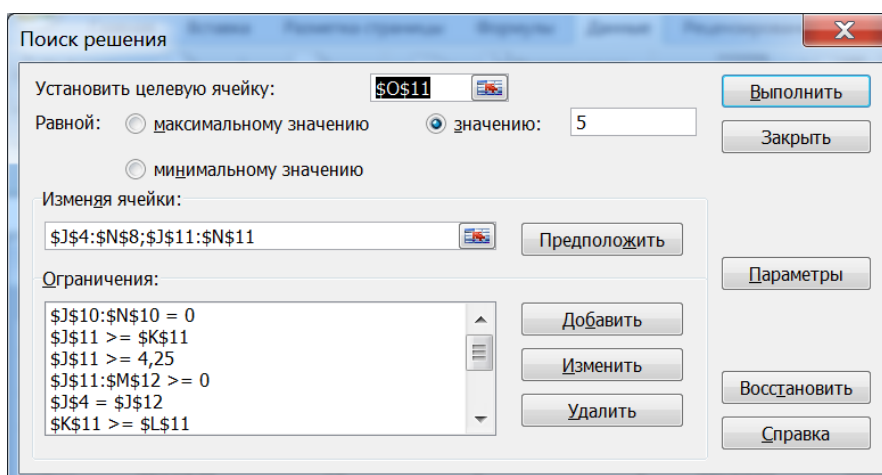


Рисунок 9. Окно надстройки «Поиск решения» с операторами таблицы-программы решения оптимизационной Задачи:  $(I_{99}I_{99}) \Rightarrow (C_{99} A_{99})$  в модели с 4 z-переменными, 9 y-переменными

### Заключение

Выше разработанная формализация явления «коррупция» словесной модели Липранди И. П. [2], позволила соответствующей Когнитивной модели с смысловыми (семантическими) переменными и многомерной математической модели (с числовыми переменными) реализовать, обосновать их формульное, фразеологическое, визуализированное на графиках описание поведения 2 субъектов модели: индивидов из «верхов» и индивидов из «низов». Введены в модель (в соответствии с описанием словесной модели Липранди): в 1-ом варианте –  $9=4+5$  переменных, во 2-ом –  $4+9$  переменных. Они являются семантическими переменными и делятся по смыслам и по математическим свойствам на 2 множества: 4 z-переменных и 5 y-переменных (в 1-ом варианте), 9 y-переменных (во 2-ом варианте). 4 - по смыслам статистически взаимозависимые, 5 и 9 – статистически независимые. Введенные переменные наделены математическими и статистическими свойствами, а параметры постоянны. Они смоделированы в 2-х Оптимизационных Задачах и зависят количества переменных и от значений индикаторов, образующих мозаику внутри квадрата. Как некоррелированные (y-), так коррелированные (z-) изменчивости умножаются на свои «веса» - силы проявления фактора. Для проверки алгеброй реального явления «коррупция» сформулирована словесная модель, определены смысловые равенства для числовых переменных, для матриц переменных, разработана Когнитивная Модель Явления «коррупция». Модель обнаружила пропорции между долями информации, присущими переменным  $(y_1, y_2, y_3, y_4, y_5, \dots, y_n)$ ,  $n=5, n=9$ .

В каждом варианте разработана система

смысловых уравнений, каждая система состоит из 3-х смысловых уравнений. Одно смысловое уравнение имеет 4 известных z-смысловых (семантических z-переменных) переменных и 1 неизвестную y-смысловую (семантических y-переменную) переменную. Система смысловых уравнений имеет 12 параметров, которые выделяются из модельных матриц  $C_{55}, C_{99}$ , матрицы  $C_{55}, C_{99}$  моделируются при решении Задач:  $(I_{55}, I_{55}) \Rightarrow (A_{55}, C_{55})$ ,  $(I_{99}, I_{99}) \Rightarrow (A_{99}, C_{99})$ . Из-за несоответствия количества z-переменных количества y-переменных:  $4 \neq 5, 4 \neq 9$ , возникла необходимость когнитивного моделирования смыслового равенства  $\text{смысл}(Y_{m3}) = \text{смысл}(Z_{m4}) * C_{43}$  вместо  $\text{смысл}(Y_{m5}) = \text{смысл}(Z_{m5}) * C_{55}$ . Разработан алгоритм вычисления значений 4-х zz-переменных (вместо z-переменных), зависящих от 24 значений 3-х y-переменных  $y_2, y_3, y_4$  (имеющих близкие к 0 значения своих дисперсий). Случайные значения 3-х y-переменных  $y_2, y_3, y_4$  моделируются отдельно и независимо от других матриц модели. Конструирование новых смыслов y-факторов явления «коррупция» при 1-ом варианте состава факторов коррупции (4 zz-факторов (для «низов») и 5 y-факторов (для «верхов») и конструирование при 2-ом варианте состава факторов коррупции (4 zz-факторов (для «низов») и 9 y-факторов (для «верхов») позволили прояснить ситуации коррупции, познать новые дополнительные факторы коррупции. Визуализация взаимных динамик факторов коррупции показала одинаковость модельных результатов 2-х вариантов модели коррупции. По смыслам и по взаимным динамикам своих значений факторы количественно отражают реальные ситуации явления коррупция.

## Impact Factor:

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Получены интересные знания после визуализации. На динамику кривой «у2» в 1-ом во 2-ом вариантах одинаково влияют 3 динамики 3-х кривых «zz2», «zz3», «zz4». На динамику кривой «у3» в 1-ом во 2-ом вариантах одинаково влияют 3 динамики 3-х кривых «zz2», «zz3», «zz4». На динамику кривой «у4» в 1-ом во 2-ом вариантах по другому, но одинаково влияют свои 3 динамики 3-х кривых «zz2», «zz3», «zz4». А zz-переменная влияет по-разному на кривые «у2», «у3», «у4» только в 1-ом варианте. Во 2-ом варианте ее динамики для 3-х кривых «у2», «у3», «у4» визуально совпадают с динамиками кривой «zz2» из 1-го варианта.

Следовательно z-фактор воровство (zz1) имеет разную значимость. В 1-ом варианте модели он имеет для индивида из низов особую роль, а во 2-ом варианте модели его динамика совпадает с динамикой кривой «zz2» (смысл(zz2)=«вымогательство»): «воровство» (смысл (zz1)) и «вымогательство» (смысл (zz2)) в модели практически одинаково измеряются. Индивид в «верхах» совершает вымогательство (3 пика на кривой «zz2», подкупа (2 сильно выраженных пика на кривой «zz3» и из-за частого влезания в долги (4 пика, большая амплитуда колебаний точек на кривой «zz4»). На Рисунке для 1-го варианта различия амплитуд взаимных динамик 4-х кривых совпадают с различиями амплитуд взаимных динамик 4-х кривых, наблюдаемых на Рисунке для 2-го варианта. Это – свидетельство одинаковости результатов 2-х вариантов модели коррупции. Они отражают реальную ситуацию явления «коррупция».

Результаты моделирования будут изучены с более интеллектуальных точек зрения. Необходимо использовать смысловые уравнения с смысловыми переменными, числовые параметры и переменные, ориентированные на оценку

коррупционных преступлений в контексте смыслов факторов Липранди применить для моделирования оценок ущербов, исчисления сроков отбывания наказаний и прочего. Опираясь на виртуальный свод законов. Я не занимаюсь борьбой с коррупцией и не призываю других, моя цель как сказано во введении «защищаться от приманок коррупции при помощи познающей модели», если, иначе в стране с диктаторской формой власти могут назначить 0.25 ставки (один пирожок вместо четырех). Цифровая картина из 91 преступлений по 3 модельным типам коррупционных преступлений обеспечит работой добросовестных следователей-профессионалов (не бессовестных из фразы смысла(у2)).

Семантические переменные являются имеющими юридические смыслы решениями Когнитивной Модели, фразы которых я не смог сформулировать. Модель извлекла новые знания и адекватны реальным представлениям людей о субъектах коррупции. Модель исправляет неправильно назначенные экспертом значения индикаторов. Свои замены значений индикаторов модель «обосновывает» как смысловыми (с семантическими переменными), так и алгебраическими (с числовыми переменными) равенствами.

Три смысловых уравнения дают более точный познающий эффект явлению «коррупция» через формульное и фразеологическое описание поведения 2 субъектов (индивид из «низов» и индивид из «верхов»). Мы не выходим за рамки факторов Липранди, не исследуем факторы, порождающие само явление «коррупция».

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## CHINESE AND GLOBAL MANAGEMENT OF RENEWABLE ENERGY: RISK AND RESOURCE SECURITY

**Abstract:** The article analyzed the geopolitical direction of China's development in the context of the establishment of the "new world order" and the country's risk. China's resource security policies related to the reshaping of the geopolitical map are analyzed. The study concluded that in the long term, a new bipolar balance will be established with the centers of power in the US and China.

**Key words:** Country risk, the measurement of political risk, US and China, country-specific perspective, inappropriate economic policies, high political risk, key indicators of country risk.

**Language:** English

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### Introduction

In the last few decades, Eurasia, Central Asia, Asia-Pacific (ATR), Africa and other regions have become an increasingly important part of the world economically and politically. The People's Republic of China (PRC) occupies a special place in world politics and in shaping the global political and economic climate.

Although China has close economic ties with the United States, it occupies an independent position on the international agenda.

In 1949, the PRC's declaration of independence was called "The Loss of China" in the West, and in 2016, the yuan received the status of a reserve currency. The rapid growth of the Chinese economy makes it necessary to analyze the prospects of China's international relations and the development of its competition with the United States in terms of global and regional hegemony[1].

In the context of developing globalization and the increasingly global nature of investment portfolios, the ability to consider country risk is important [2]. First of all, such consideration is necessary for investors of politically, economically and socially unstable developing markets (emerging markets), which are attractive to investors mainly

from the point of view of obtaining high profits and achieving further diversification of the global investment portfolio.

The nature of the risk can be different and is determined by the underlying factors: political, economic, financial, social, etc. An investor may face political instability, foreign conflicts, corruption, civil unrest and wars, exchange rate controls, unexpected inflation, various defaults, expropriation of private capital, etc. The commonality of such phenomena must be taken into account in order to operate successfully in emerging markets.

For this purpose, the concept of "country risk" was introduced. At the moment, there is no clear definition of "country risk". Country risk includes separate elements of other types of external risks (political, sovereign, currency, etc.) and it is defined as an integral result of the interaction of international activity events and situations (political, economic, social, etc.) independently of the subject. The following definition of country risk can be given [3].

Country risk is the risk of financial loss in business transactions directly or indirectly related to international activities and cross-border movement of funds. It is determined by the current and prospective development conditions (political, economic, social,



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etc.) of a foreign country and the degree of influence of these conditions on the ability of customers or counterparties located in this country to fulfill their external obligations.

Risk management is a process and methodology necessary for the implementation of an investment strategy, and also implies the existence of certain organizational structures. The problem of risk management is the "risk-benefit" ratio and optimization of the organization according to the found optimal planning and business financing. Such management is the most important means of ensuring profitability, it is necessary to control the change of future expenses and income due to uncertainty factors, to influence the process of making management decisions. Without measuring risk, it is impossible to analyze the effectiveness of operations in the context of tools, customers, company divisions [4]. However, while demonstrating potential benefits, effective risk management simultaneously requires addressing a number of conceptual and practical challenges. First of all, it depends on the ability to quantify risks. In turn, measuring risk requires identifying both the uncertainty itself and its potential impact.

### **The measurement of political risk**

#### I. Measurement of political risk

##### A. Country-specific perspective

##### B. Political stability

##### 1. Measurement factors:

a. Frequency of change of government

b. Level of violence

c. Number of armed uprisings

d. Conflict with other countries and its level

### **Economic factors (Factors).**

#### 1. Indicators of political unrest

a. Strong inflation

b. Balance of payments deficit

c. Slow growth of GDP per capita.

#### 2. Capital

a. Description:

b. Exporting the savings of the country's citizens due to the fear of capital security.

c. Measurement: Using the balance of payments account

d. S. Reasons for the withdrawal of capital

e. 1.) Inappropriate economic policies.

f. 2.) Devaluation (lat. de "decreasing" + lat. valeo "gains importance" devaluation of the national currency compared to free currencies in systems with a fixed exchange rate established by monetary authorities) Expectation of devaluation)

### **Country risk components**

National currency devaluations, failure of economic plans, legislative changes, defaults and other financial shocks (shocks) are difficult to predict and adversely affect the portfolios of global investors and often determine the difference between investing in capital markets. developed and developing countries [5].

Indeed, for example, according to the opinion of managers of multinational companies, the relative importance of political risks (as a rule, the main component of country risk), according to the results of a survey conducted among managers for developing and developed countries. 80 Multinational Companies (1982) ranking political risk by category - from highest (1) to lowest (6). [6].

### **The measurement of political risk**

#### I. Measurement of political risk

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### **Economic factors (Factors)**

#### 1. Indicators of political unrest:

a. Strong inflation;

b. Balance of payments deficit;

c. Slow growth of GDP per capita.

#### 2. Capital:

a. Description;

b. Exporting the savings of the country's citizens due to the fear of capital security;

c. Measurement: Using the balance of payments account;

d. S. Reasons for the withdrawal of capital;

e. Inappropriate economic policies.

f. Devaluation (lat. de "decreasing" + lat. valeo "gains importance" devaluation of the national currency compared to free currencies in systems with a fixed exchange rate established by monetary authorities) Expectation of devaluation)

g. High political risk (High political risk).

#### II. Economic and political factors

Focus: How well is the country doing economically?

A. Fiscal irresponsibility - high government deficit

B. Monetary instability

C. Controlled exchange rate system-currency is usually overvalued

D. Government wasteful spending-failure to service foreign debt

E. Economic and political factors

F. D. Resource Base (Resource Base)

G. - lack of a strong work ethic

H. Country risk and ability to adapt to external shocks

I. 1. How do external shocks affect:

J. How well a nation responds varies

### **Key Indicators of Country Risk**

a. Relative size of public debt

b. Money expansion (Money expansion)

c. Existence of state-imposed barriers to market relations

d. Key indicators of country risk (continued)

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- e. The level of tax rates
- f. Number of state-owned firms (enterprises).
- g. Political and financial responsibility
- h. Amount and level of corruption

### China's resource security is reshaping the geopolitical map

China's economic prospects for the next 10-15 years China is rightfully considered to be the main "factory of the world" and the main contender for achieving undeniable dominance in the world economy. Formally, this idea is correct. Although in terms of nominal GDP, China (\$14.72 trillion for 2020) is still inferior to the United States (\$20.6 trillion), in terms of purchasing power parity, the Chinese economy (\$24.142 trillion) has already undeniably surpassed the American one. Its share in the total world economy reached 18.33% while the United States' share is 15.9%. Next come: India – 6.76%, Japan – 4.03%, and Germany – 3.41%. Russia ranks sixth in this ranking (3.11%). Although, if we take into account the results of the European Union, as an economic union with a total GDP at PPP of \$16.1 trillion, it must be recognized as third place. China also occupies a leading position in terms of foreign trade volume. At the end of 2020, it amounted to \$4.65 trillion (an increase of 1.5% compared to the 2019 result). Including exports of 2.59 trillion dollars (an increase of 3.6%), imports of 2.06 trillion dollars (decrease by 1.1%). The foreign trade balance is positive – \$535 billion or 11.5% of the country's foreign trade turnover. Against the backdrop of a total US foreign trade turnover of 3.835 trillion (\$1.43 trillion – exports, 2.405 trillion – imports, compared to 2019, a drop of 13.01% and 6.31%, respectively), China has already achieved clear leadership, which will only ramp up. Which is already causing rapidly expanding economic and geopolitical tensions in relations with the United States. However, the effect of large numbers remains behind the scenes, inattention to which leads to a distortion of the final conclusions. The Chinese share in the world economy is growing not because Beijing is trying with all its might to "buy up the whole world." This result is a consequence of the increase in the size of China's own economic weight, while the share of foreign trade in the country's final GDP, on the contrary, is declining. The stage of achieving the status of "factory of the world" in China began in 1970, when foreign trade formed only 2.52% of national GDP, and in 1987 it reached 12.1%, then 21.5 (1994), and at its peak at the end of 2006 amounted to 35.6%. Further growth continued only in absolute figures of foreign trade turnover, calculated in monetary or physical terms. While in the structure of GDP its contribution began to steadily decline. In 2010, it formed only 26.1%, in 2018 – 19.5%, and at the end of 2020 it dropped even more – to 18.1%. On the one hand, this confirms the statements of the Chinese leadership about increasing

the level of material well-being of the country's population and its success in defeating poverty. The average statistical nominal monthly income per capita in China in 2018 was \$4,161, real - \$3,850, which is 1.38 times higher than the level in 2015 and 2 times higher than in 2011. But on the other hand, this means an accelerating transfer of the bulk of the Chinese economy from the external to the domestic market. In other words, China continues to be the largest "factory on the planet," but it is starting to work more and more for its own population, and not to meet the needs of residents of foreign countries. Exports in the average Chinese enterprise form only 20% of final sales, and this share continues to decline. However, the geographical structure of China's foreign trade has also undergone significant changes over the past decade. If in the middle of the first decade of the current century more than a quarter, and for some product groups more than 40%, of Chinese exports went to the United States, and another 15-18% to European countries, then in 2020 only 17.4% went to the United States Chinese goods and services. But the second largest export partner of China was Hong Kong (10.5%), the third was Japan (5.5%), the fourth was Vietnam (4.39%), the fifth was South Korea (4.34%). The rest of Asia formed 2.32%, which is slightly less than the share of "rich" Germany (3.35%), the Netherlands (3.04%) or Britain (2.8%). Thus, it is clear that, while continuing to remain the largest player in international markets, China is clearly demonstrating a tendency to increase its "coverage" of Asian countries, and a gradual cooling of interest in the until recently key world markets of Europe and America. Strategic program of the Belt and Road The conclusion of the previous section is confirmed by a noticeable decrease in the media activity of the PRC in the direction of supporting and "pushing" the program for the formation of a transcontinental logistics corridor to Europe. [7].

If China has a weakness, it is its dependence on external natural resources. Filling this gap by diversifying its hydrocarbon and mineral supply chains has become a strategic priority as Beijing pursues self-sufficiency. As China moves the "geopolitical sands" to do so, the consequences are far-reaching, not only for its suppliers of strategic commodities, but also for the mining companies that have invested heavily in them [8].

Some data suggests that China is turning to more authoritarian regimes that represent more stability in its supply chains than democracies that are or may be hostile to Beijing. But it also uses its huge market as a source of diplomatic influence. By diversifying resources, China will be in a better position to leverage trade with geopolitical rivals, while increasing economic dependence on new and existing partners.

China takes a comprehensive approach to import diversification

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China's primary resource import structure is highly concentrated in a small group of trading partners, and Australia is a major exception among them.

It is known that Australia is a close ally of the US, but remains a major supplier of strategic resources such as coal, iron ore and SPG (compressed natural gas).

According to the conclusions of US research centers, China is not as industrially and technologically developed as others think, so it does not have the ability to independently absorb new technologies. Proof of this can be observed in the example of the large amount of new weapons that China buys from Russia every year. The US, on the other hand, is rapidly developing new military technologies.

So, although China has expanded its economic and political influence in Asia, it cannot pose a direct threat to US interests in the region. However, the US still continues to use the lofty fiction of the "China threat" to increase its military power in the region. Professor Pao-yu Tsing said that China's rise as a force protecting the interests of the Third World, that is, developing countries and peoples, is far from the truth.

By insisting that trade relations are mutually beneficial, China is only building its image as a "positive power". The foreign policy pursued by the leaders in Beijing is not in reality. Currently, China wants to convince the world community that it is a country based on socialist principles. However, in the last two decades, it has become clear that the reforms

of the capitalist form carried out in China are only in China's interests and are aimed at increasing the country's gross domestic product. China's capitalist economy, which is developing dynamically and rapidly, is mainly troubled by two problems: competition for natural resources and the issue of selling its products in consumer markets. While China is fueling the core of its economic growth strategy through increased exports, its demand for energy and raw materials is also automatically increasing. From 1990 to 2001, China's demand for oil consumption increased by 100%. In 2005, China's oil demand surpassed that of Japan, and China became the second largest oil consumer in the world after the United States. According to some data, China's domestic oil reserves will last another 14 years. It is this message that prompts official Beijing to be active in opening the way to new sources of oil. It is for this purpose that China has signed oil contracts with many countries. Including Indonesia, Kazakhstan and even geographically distant countries like Sudan, Ecuador, Colombia. As a result, China's economic system is forced to compete with other major countries - USA, Japan, South Korea and India - depending on oil imports. China has also launched geological exploration and drilling operations in countries rich in oil reserves. According to the agreement signed between China and the United States on October 4, 1994, China has committed itself to the non-proliferation of ballistic missiles. In return, the US will lift sanctions on the supply of high technology to China.

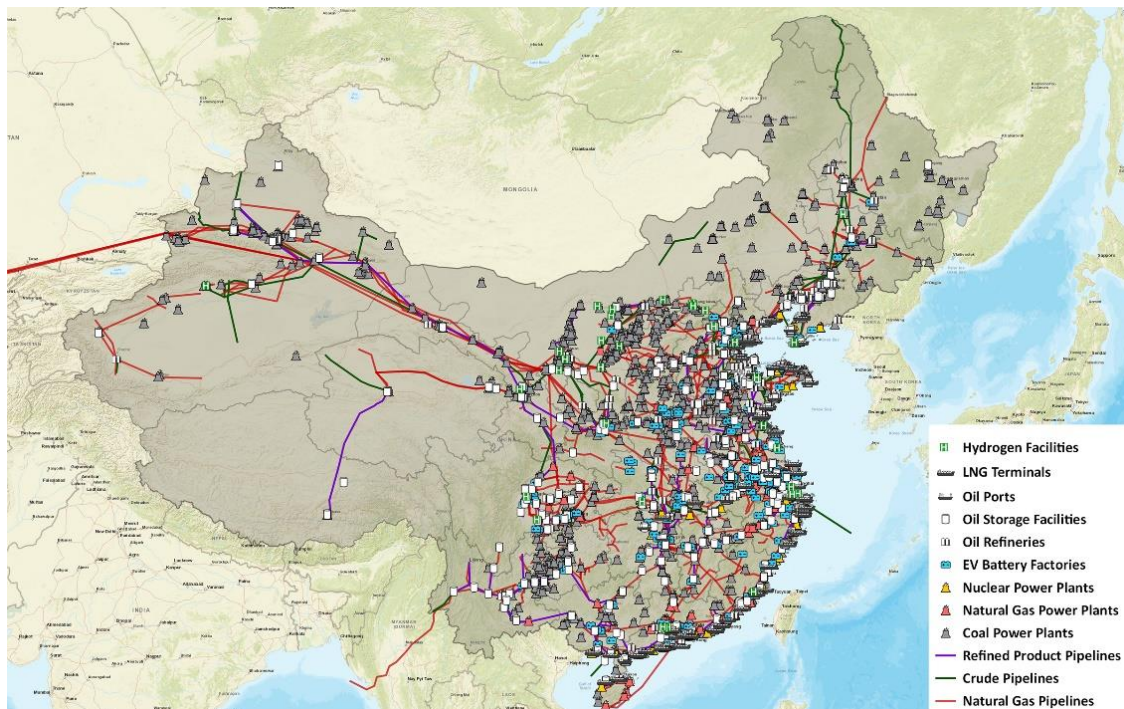


Figure 1. Baker Institute snapshot of China's energy map.  
Map compiled by Elsie Hung, Center for Energy Research.



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As of April 2023, China's energy map had the following overall coverage by infrastructure type:

- Oil pipelines: 101 pipelines with a total length of 25,943 km and a total throughput of 23 million barrels per day (MBD);
- Product pipelines: 89 oil pipelines with a total network length of 25,574 km and a total throughput capacity of 7.9 million barrels per day;
- Oil refineries: 212 facilities with a refining capacity of 23.1 million barrels per day;
- Oil storage facilities: 299 facilities with a total capacity of approximately 1.23 billion barrels (crude oil: 83 facilities with a capacity of 871.9 million barrels; petroleum products: 216 facilities with a capacity of 365.2 million barrels);
- Oil ports: 64 berths for oil tankers with a total capacity of 15.5 million barrels per day;
- Gas pipelines: 414 gas pipelines totaling 110,433 km and a total capacity of 145 billion cubic feet per day (BCFD);
- LNG terminals: 78 facilities with a capacity of 260 million tons per year. Currently, 26 facilities are operating;
- Coal-fired power plants: 3,703 power plants with a total installed capacity of 1,458 GW, of which 1,093 GW are in operation;
- Nuclear power plants: 151 reactors with a total installed capacity of 170 GW. 57 GW are in operation;
- Gas power plants: 243 power plants with a total installed capacity of 168 GW. 113 GW are in operation;
- Electric vehicle battery plants: 319 facilities, 243 in operation, 56 under construction (greenfield) and 20 announced. This means that the total production capacity is 2676 GWh, of which 1445 GWh is in operation; And Hydrogen facilities: 37 facilities, 23 of which are in operation.

Given the deterioration of bilateral relations and China's restrictions on coal imports from Australia in recent years, we believe that Beijing has identified its dependence on Australian resources as one area in need of diversification [9].

**China falls into four strategies on how to diversify its imports and achieve other resource security priorities.**

### 1. Diversification of suppliers:

Apart from cordial relations with China, political stability and regime type are the two main non-commercial factors that Beijing always considers when diversifying its supply.

Most of China's key resource providers show that they are politically stable, as reflected in their medium to low risk rating in the Government Stability Index for the first quarter of 2021 [10].

The Beijing government prefers suppliers from stable authoritarian regimes to democracies, which are

subject to frequent change and possible policy changes.

Autocracy is a system of government that is convenient and can influence him.

Beijing can take advantage of this when it comes to oil and gas imports, as most major hydrocarbon producers such as Saudi Arabia and Russia are either autocracies or illiberal democracies.

### 2. Diversification of investments:

China is seeking to strengthen its control over global supply chains through foreign investment and partnerships with major international companies. Beijing has supported Chinese state-owned enterprises since the late 1990s as they seek to "go global" and control overseas resource bases. For example, it shows that the number of Chinese-owned base metals and gold mining companies in Oceania has risen from zero in 2000 to 59 in 2020. This approach aims to increase the share of Chinese-owned resources in China's total imports.

### 3. Diversification of transit routes:

Geopolitical instability in the Middle East and the South China Sea has prompted China to diversify its maritime imports into land-based imports over the past decade, as evidenced by its large investments in energy pipelines with Russia and Central Asia. The Myanmar-China oil and gas pipeline is another example of China's attempt to reduce its dependence on strategic links, particularly the sea route through the Straits of Malacca.

### 4. Diversification of resources:

For goods that do not have an alternative supplier, Beijing is actively seeking replacement strategies. One approach is to increase imports of steel ore for feedstock use to reduce dependence on imported Australian iron ore.

**Increasing resource security has major geopolitical implications**

By diversifying its suppliers of natural resources, China is increasingly reducing key vulnerabilities and increasing its geopolitical influence. Beijing sees three areas in particular that tip the balance in its favor.

### Beijing uses trade as a tool of coercion

Through measures such as import restrictions, China will be able to use its huge market as diplomatic leverage in the great power rivalry. Resource companies located in countries with frosty diplomatic relations with Beijing may fall victim to economic pressure. This diplomatic tool is most effective when applied to goods where China has a diversified import profile and the target country is dependent on the Chinese market.

**Closer Sino-Russian ties will balance the West.**

**A much closer Sino-Russian relationship will balance against the West**

Despite a history of mutual mistrust, the economic and political interests of Russia and China have converged over the past decade. The

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deterioration of relations with the West has prompted the two countries to cooperate closely in many areas, especially in the field of energy. Increased energy imports from Russia support both Beijing's import diversification strategy and Moscow's "pivot to Asia."

### Chinese-backed multilateral initiatives benefit Belt and Road partners:

Beijing's diversification strategy increases Chinese investment and trade with selected countries, mainly Belt and Road partners, which in turn increases their economic dependence on China. Financing terms such as lower interest rates and reduced ESG requirements are more attractive to countries prioritizing a quick economic recovery than a green post-Covid-19 recovery. These partnerships will reshape multilateral relations with a China-centric economic order [11].

Companies and investors await Beijing's diplomatic moves...

### Companies and investors in the line of fire

Geopolitical tensions are not likely to subside anytime soon, so China is stepping up its efforts to reduce its reliance on adversary suppliers' resources. Australia's ban on coal imports has been a clear example of this, but others are likely to follow suit, with significant implications for global commodity trade and the geopolitical landscape. Companies and investors expect diplomatic moves from Beijing and should prepare accordingly.

### Summary.

In recent years, Russia and China have been implementing two geopolitical strategies related to the Eurasian region through the trade and energy routes passing through Central Asia in order to develop economic cooperation between the East and the West.

**As a result of the research, the following conclusions were drawn.**

1. In the post-bipolar period, international relations are characterized by the emergence of new large entities with both economic potential and political ambitions. In turn, the internal problems of the hegemonic state - the United States of America - force them to reduce their foreign political activity in strategic regions of the world.

2. Based on the criteria of hegemony proposed by Z. Brzezinski, it can be said that China can become a regional hegemon in the short term because it has the necessary potential and has a strategically favorable location.

3. China's national interests are to achieve regional hegemony that can lead to a global scale through the implementation of "soft power" policy, ensuring the economic security of the state, as well as the development of strategic cooperation with EOI and ASEAN.

4. To implement China's foreign policy strategy, it should address the issues that threaten national security.

In the long run, a new bipolar balance can be established, taking into account the antagonistic geopolitical interests of the US and China.

Several scenarios were selected for the development of the geopolitical and geoeconomic situation in the region. It should be noted that both positive and negative scenarios can appear in each model.

In our opinion, the modern geopolitical position of Central Asia was formed under the influence of the West, Russia and China, and such a geopolitical structure based on these power centers will remain relevant in the future.

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Article



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## FURTHER STRENGTHENING OF SOCIAL SPIRITUAL STABILITY AND IMPROVING THE RELIGIOUS ENVIRONMENT

**Abstract:** This article is devoted to further strengthening spiritual stability in society and improving the religious environment. The relevance of spiritual education and education, especially among young people, is of high priority in the modern world. Globalization and technological progress, despite their advantages, also bring new threats, including the loss of national and spiritual values. To solve complex economic and social problems, it is necessary to develop spirituality and education, as they are the foundation of progress and stability. The desire for spiritual education and literary development of young people plays a key role in this process. Such efforts also contribute to the reintegration of children and women, which contributes to strengthening society and reducing poverty.

**Key words:** globalization, values, education, peace, youth, literary development, society.

**Language:** English

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### Introduction

**Any state, any nation is powerful with intellectual potential, high morale.**

**Sh.M.Mirziyoev**

As the head of our state said, today it is more important than ever for the public to wake up and become active in the reform process. Why is this so? It's no secret that in the current era of globalization, humanity faces significant challenges. While we reap the benefits of modern science and technology, negative influences seep into our families and consciousness, creating confusion. This threat impacts many, especially our youth. In such a scenario, one way to counter this global threat is through enlightenment. Raising our children with a strong spiritual foundation isn't just the responsibility of schools, neighborhoods, or families; it's a universal task.

### Materials and Methods

In recent years, several decisions aimed at the further development of spirituality and enlightenment

have been made in our country [1]. Consistent reforms aim to create a new chapter in Uzbekistan's history. This shift has elevated the importance of spiritual and educational work in our state's politics. However, as global competition intensifies and conflicts of interest escalate, globalization also brings unforeseen challenges alongside its many opportunities. Threats against national identity and spiritual values are on the rise. In this precarious situation, it's crucial to foster spirituality in young people, encourage them to read books, and support the growth of Mutola culture among the youth. Books play an unparalleled role in nurturing a balanced generation, as Mutola imparts knowledge and enriches one's spiritual realm.

Given this, there's an urgent need to publish literature that enhances the intellectual potential of the youth across various genres. We must also rejuvenate our libraries, increasing the repertoire of socially significant literary works and elevating their quality.

Challenges in the economic and socio-political spheres can be addressed through the advancement of spirituality. A nation's progress and the power of the state are significantly influenced by its spiritual depth.

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In countries with a strong spiritual foundation, negative traits like ignorance, jealousy, negligence, selfishness, laziness, gossip, and betrayal find no foothold.

Why do some families today lack kindness and harmony, with increasing disinterest in maintaining relationships? Why are some parents indifferent to their children's upbringing? The future of our homeland is intrinsically linked to how we raise our children. Traditionally, fathers have been seen as the pillars of families, embodying wisdom and righteousness. However, today, in some families, the pivotal role and wisdom of fathers are absent. The growing instances of family discord, divorces, crimes, and property disputes are concerning [2].

To address this, we must foster kindness and harmony within families and communities, curtail vices, prevent family breakdowns, and bolster collaboration between state and public organizations on pressing issues. An individual's character is shaped by qualities like purity, generosity, sincerity, benevolence, honesty, faithfulness, respect for parents, and loyalty to family. Similarly, one's national identity is built on pride, patriotism, responsibility for the nation's destiny, respect for the national language, history, literature, arts, customs, traditions, and adherence to the state's laws and systems. Being proficient in one's profession and being socially aware and supportive are also paramount.

Luminaries from our past, such as Farghani, Khwarazmi, Farabi, Ibn Sina, Ulughbek, Bukhari, Termiziy, Marghilani, Motrudi, Zamakhshari, and others, not only excelled in science but also disseminated it. They widely promoted Enlightenment, taught, and mentored disciples. The Turkestan School of Enlightenment boasts a rich history and vast heritage. Figures like Mahmudhaja Behbudi, Munavwar Qori Abdurashid Khan's son, Ashurali Zahiri, Saidrasul Saidaziziy, Ishaq Khan Ibrat, Ahmad Donish, and others believed that Enlightenment was the key to freeing the country and its people from national oppression and ignorance. Abdullah Avloni, one of the shining beacons of the Enlightenment movement, famously asserted, "Science is the mentor, life, leader, and salvation of men." This sentiment became a cornerstone of the Enlightenment Movement's ideology.

An enlightened individual is well-informed. Knowledge elevates a person's virtue. Being educated and enlightened is vital for overcoming challenges, both financial and spiritual. A person lacking knowledge and education is vulnerable. Broadly speaking, enlightenment imparts knowledge, skills, and competencies. It shapes spirituality, enhancing society's creative capacity. Thus, enlightenment is a multifaceted concept that fulfills society's educational needs. Spirituality and knowledge, intrinsically linked, thrive in harmony. Achieving this balance

ensures our youth develop into spiritually grounded, patriotic, humane, and genuine individuals.

Abu Hamid Muhammad Ghazzali once remarked on the importance of acting upon one's knowledge, cautioning against mere theoretical understanding devoid of practical application. Many luminaries from our land showcased an exalted blend of spirituality and enlightenment, serving as beacons of knowledge and wisdom. Thanks to their elevated spirituality and enlightenment, their legacies shine brightly. It underscores that, in today's era, the path to national enlightenment is through spiritual and educational growth. For a prosperous future, our people need spirituality and enlightenment as much as they need water and air. Education and upbringing must proceed hand in hand, for the journey to the human soul begins with education.

Mahmudhaja Behbudi, in the early 20th century, emphasized the importance of education for progress, asserting that "to make a mark in the world, worldly science and knowledge are essential." The rapid advancements in today's technological age underscore the veracity of his statement. Balancing both secular and religious values is crucial as they enrich and complement one another. A society bereft of spiritual and educational wealth will never realize economic and socio-political progress. In today's fast-paced era of globalization, spiritual education holds paramount importance. Issues in one domain often have their roots in shortcomings in another.

Without a solid foundation in spiritual education, challenges across socio-political, economic, and environmental domains remain insurmountable. Scientific advancements can be misdirected when devoid of ethical considerations. It's disheartening to note that some of today's brightest minds, instead of addressing global issues like healthcare and environmental conservation, are contributing to the creation of advanced weaponry. Regrettably, the vast expanse of the internet, a testament to human ingenuity, is riddled with content promoting vice and harm.

A spiritually grounded individual, even with modest means, is content and considerate of others. It becomes evident that our world's salvation lies in spirituality and education, not just in power, wealth, or weaponry. When analyzing global complexities, it's vital to view them through the lens of spirituality, understanding foreign influences and assessing their impact.

It's worth noting that we're committed to building a secular state, a principle enshrined in our Constitution. A secular state ensures equal rights for all religions, guarantees education for its citizens, and upholds the freedom of creative expression in science and cultural realms. Education in a secular state shapes its society's identity, fostering informed and active citizens who support the state, propelling society forward.

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The experience of most countries, especially developed ones, indicates that religion can not only coexist with a secular state system but also effectively collaborate with it towards national upliftment [4]. Democratic states don't just respect the religious beliefs of the majority but also ensure equal regard for minority religions and those who choose not to follow any faith. The Quran underscores this spirit with the profound phrase, "There is no coercion in religion."

In the evolving social fabric of Uzbekistan, the role of religion has been primarily defined by its constitutional status. The Constitution of Uzbekistan guarantees freedom of conscience for all citizens. Every individual has the right to follow any religion or none at all. It establishes the separation of religious organizations from the state and ensures their equality before the law.

However, what do we witness in our society, particularly on social networks? Regrettably, many, including the revered "qori" brothers and the youth, publicly and knowingly interfere in state affairs. They mislead the public with claims that certain activities aren't in line with Sharia, thus creating confusion and misguidance.

Another concerning issue arises from recent statistics that indicate a decline in legally registered marriages in Uzbekistan during the pandemic. This drop, coupled with a reported surge in divorces and births, could be attributed to problematic religious propaganda. Online platforms and series glamorize the idea of polygamous marriages over legally recognized unions, contributing to societal complications. As a consequence, we see an alarming number of cases involving unpaid alimonies, suggesting that many children are financially unsupported.

The decline in legal marriages, rise in Sharia marriages, and the increase in orphans can largely be attributed to a lack of legal awareness, especially among women. When will we address these concerns? How long will we allow false teachings to prevail? Misconceptions, like discouraging women from seeking education and pushing them towards domestic roles, only hinder our progress. Our nation, soon to have a population of 40 million, can't be held back by such regressive beliefs. We must resist the views of radicals and fanatics.

Progress can only be achieved through secular education. Our youth must delve deep into subjects like chemistry, physics, mathematics, history, and geography. The ultimate goal of educators should be to ignite critical thinking in students. After all, thought shapes an individual's inner essence. Where there's a lack of critical thinking, ignorance prevails.

It's lamentable that the offspring of those who refuse to think for themselves often inherit this mindset. One of the significant flaws in the Uzbek educational system is the emergence of young people lacking independent opinions. A society that

encourages diverse thoughts thrives, while stagnation in thinking leads to both economic and spiritual decline. Before Europe's ascent, it embraced diverse thoughts and ideas, including economic, technical, and scientific insights, paving the way for progress. We must reflect on our own history and evolution, drawing from the wisdom of our ancestors.

In our journey towards building a secular society in Uzbekistan, it's paramount to ensure that the relationship between the state and religion is based on mutual respect. The state acknowledges the positive potential of religion in shaping its citizens but strictly prohibits its use for ulterior motives, like power grabs or political gains. Our president, in a meeting discussing the referendum results, unequivocally stated, "Uzbekistan is a secular state, and it will remain so. That is the will, the firm choice of our people expressed by the referendum!" [5]. Going forward, every citizen, regardless of nationality, language, or religious belief, is guaranteed freedom of conscience. The policy of fostering harmony between various ethnicities and religions will be consistently pursued. Radicalization or the exploitation of religion for political ends will never be tolerated.

It's evident from the statements that the concept of a secular state in our societal renewal program does not negate the role of religion in socio-cultural life. It's also apparent that the secular state system staunchly opposes any attempts, cloaked in religious claims, that threaten societal harmony, interethnic and interreligious unity, and political and social stability, especially when they have no genuine connection with impartial religious faith.

We reside in a secular state, and while this is paramount, we must also emphasize the other side of the coin. Forces that oppose constitutional rights and freedoms and aim to forcefully alter the constitutional system threatening the sovereignty, integrity, and security of the Republic cannot be tolerated.

Today, it's no exaggeration to say that combating violent extremism and radicalism is among the top priorities not just for individual nations but for the global community. The world is in a state of flux, transitioning from the old world order to a new one, amidst significant tension. In such times, it's crucial to correctly analyze and impartially assess the political, legal, and economic global events.

Given the current global scenario, the challenge of countering fanaticism and extremism remains urgent. Uzbekistan is no exception. Historically, Uzbekistan has been a peaceful abode for diverse nationalities and religions. Historical records laud our ancestors for their respectful treatment of representatives from other religions and their united efforts towards nation-building.

### Survey and Findings

Today, over 94% of Uzbekistan's population practices Islam. The country is home to more than 130

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nationalities, 2,241 religious organizations spanning 16 religious denominations, and notable institutions like the Imam Bukhari International Center, Imam Termiziy International Research Center, and Tashkent Islamic Institute named after Imam Bukhari, among others. Moreover, the International Islamic Academy of Uzbekistan is gaining global renown [6].

Several majestic mosques and religious complexes across Uzbekistan stand as testament to our rich religious heritage. Places like “Minor,” “Islamic father,” “Hazrati Imam,” “Imam Bukhari,” “Bahauddin Naqshbandi,” and “Imam Termiziy,” among others, have undergone significant renovations. The emerging Center of Islamic Civilization in Tashkent evokes admiration [7].

Throughout our years of independence, consistent efforts have been made to develop a system of religious education. Recently, there’s been a surge in initiatives aimed at highlighting the humanitarian essence of the Islamic religion, combatting ignorance with knowledge, instilling humanistic ideals in the youth, and delving deeper into the teachings of great thinkers. All these endeavors are geared towards ensuring peace, tranquility, and fostering interconfessional dialogue.

The legislation of the Independent Republic of Uzbekistan aligns with international law norms. During our years of independence, over 60,000 Uzbekistani citizens undertook the Hajj pilgrimage, and more than 1,000 citizens visited sacred Christian and Jewish sites. The state offers considerable support to pilgrims. Notably, religious texts like the Quran, Old Testament, and New Testament have been translated into Uzbek and published. Today, numerous religious institutions operate across the Republic of Uzbekistan, exemplifying our deep-rooted tradition of religious tolerance.

Uzbekistan has historically been a harmonious homeland for diverse nationalities and religions. This enduring legacy persists, and religious tolerance remains robust.

Unfortunately, the global landscape today is fraught with challenges as malevolent forces and destructive ideologies threaten the stability of nations. President Shavkat Mirziyoev, in his 2017 conference speech, emphasized that “Islam champions a radiant life, science, and benevolence. It never advocates treason, murder, or violence.” Upholding this belief, the Committee on Religious Affairs collaborates with various organizations to counter religious extremism in society through diverse media initiatives. The focus remains on educating the youth, guiding them away from extremist ideologies, and ensuring the general populace is actively involved in this mission.

Of particular note is our efforts to rehabilitate citizens swayed by misguided ideologies. By providing them with guidance and support, we aim to reintegrate them into society, helping them lead constructive lives.

Independence ushered in a process of renewal across all spheres of social life, including the spiritual domain, marking a period of fundamental change. The stance on religion underwent a radical shift: the atheistic aggression towards religion from the former Soviet system ceased, and freedom of conscience became enshrined in law.

The main peculiarity of the state’s relation to religion lies in ensuring that religion remains separate from politics. After all, every religion primarily emphasizes spiritual and moral ascension. It has been emphasized that cultivating a culture of tolerance in the youth is crucial in the ideological battle against religious extremism and intolerance. For without peace, there can be no progress or democracy, and without tolerance, there can be no peace.

On July 1, 2021, the Presidential decree “On Approval of the National Strategy of the Republic of Uzbekistan for the Fight Against Extremism and Terrorism for 2021-2026” was adopted [9]. The “roadmap” accompanying the decree and the “National Strategy” outline the following priorities and goals:

- Promoting patriotism, traditional values, and tolerance to counteract extremist and terrorist ideologies;
- Preventing the spread of extremist and terrorist ideas among minors and young adults;
- Empowering women and amplifying their role in counteracting extremism and terrorism;
- Safeguarding long-term overseas residents from extremist and terrorist influences;
- Countering the misuse of the internet for extremist and terrorist purposes;
- Actively involving civil society institutions and media in the fight against extremism and terrorism;
- Enhancing legal sanctions against those involved in extremist and terrorist activities and their financing;
- Refining the legislative framework to combat extremism and terrorism;
- Bolstering international and regional cooperation in this domain.

The document ensures continued comprehensive support for individuals who were once influenced by divisive ideologies for religious reasons. It also underscores the importance of elevating the legal and educational literacy of the populace. An emphasis is placed on training experts in both religious and secular domains who can foster resilience against religious extremism and on harnessing the media’s influence to combat extremism and terrorism.

Furthermore, the “New Uzbekistan Development Strategy for 2022-2026” prioritizes addressing universal challenges through a lens of national interest. Notably, the 82nd goal, titled “The Formation of Effective Mechanisms for the Fight Against Extremism and Terrorism,” carries special



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significance. As part of this development strategy, efforts include:

- Enhancing preventive mechanisms against extremism and terrorism while refining the socio-spiritual environment;
- Cultivating strong resilience against extremist ideologies, especially among the younger generation;
- Broadening the international legal framework for countering extremism and terrorism, and enhancing collaboration with foreign countries and international entities;
- Strengthening personnel and resources for entities engaged with citizens traveling or residing abroad for long durations;
- Promoting information exchange and collaboration with international organizations focused on combating extremism and terrorism;
- Enhancing Uzbekistan's participation in international initiatives centered on information sharing and collaboration in Central Asia's fight against extremism and terrorism;
- Taking a proactive role in global efforts to ensure peace in Afghanistan and integrating the country into regional cooperation initiatives, including those targeting extremism and terrorism.

Uzbekistan has supported the UN's global counterterrorism strategy and has ratified 14 international conventions and protocols to combat terrorism and religious extremism. Furthermore, in this context, Uzbekistan has adopted laws titled "On Combating Extremism," "On Combating Terrorism," and "On Combating the Legalization of Income from Criminal Activity, Financing Terrorism, and Financing the Distribution of Weapons of Mass Destruction," among other regulatory legal acts.

It's worth noting that, during the 47th Session of the UN Human Rights Council, representatives of Uzbekistan participated in an online event organized on July 5, 2021, on the topic "Rehabilitation and Reintegration of Women and Children Returned from Syria and Iraq." During this seminar, there was significant concern regarding the nearly 70,000 individuals primarily women and children who are citizens of 57 countries being held in precarious conditions in the "Al-Hol" and "Roj" camps situated in northeastern Syria.

Moreover, Uzbekistan has conducted five operations since 2019, focused on the return of women and children from conflict zones in Syria, Iraq, and Afghanistan. In total, 531 individuals were repatriated from these areas.

### Conclusion

The global community has lauded Uzbekistan's endeavors to repatriate and reintegrate its citizens from conflict zones, including Iraq and Syria. Few countries have been as proactive in these efforts as Uzbekistan. According to international experts, these efforts are of immense significance. They underscore the recognition of children as victims and emphasize the imperative to safeguard their individual interests via community-level reintegration programs that consider gender-specific issues for both women and children.

The reintegration of repatriated children, women, and families into society serves a dual purpose: it terminates their social isolation and concurrently bolsters peace and stability by mitigating societal poverty.

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Article



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## RELEVANCE OF THE CLUSTER MOVEMENT IN THE INNOVATIVE DEVELOPMENT OF AGRICULTURE

**Abstract:** This article examines the relevance of the cluster movement and its significance in the innovative development of the agricultural network of our country. Foreign experience of the cluster movement in agriculture, the advantages of its use, scientific and practical proposals for introducing innovations into the network have been developed.

**Key words:** agriculture, clustering, food security, pricing policy, introduction of innovative technologies, production, competition.

**Language:** English

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### Introduction

It is known that reforms implemented in the field of agriculture in recent years do not leave any of us indifferent. In the first years of independence, special attention was paid to the emergence of farms and the creation of legal bases for their activities. In this regard, separate legal documents were adopted, and legal mechanisms for resolving conflicting relations arising in the field were created [1], [2].

However, the existence of problems related to the reforms implemented in agriculture is the reason for the determination of different directions of legal regulation by the state. For this reason, special attention is being paid to establishing the activity of clusters in agriculture, giving up planning-administrative resources.

At the initial stage of cluster formation, the most difficult thing is to reach an agreement among entrepreneurs on the formation of its assets. Factors unifying the economic interests of creating a cluster are: 1) implementation of a single price policy in the commodity market; 2) expansion of production and services by its participants; 3) implementation of a unified marketing policy; 4) introduction of innovative technologies - integration and cooperation

in the production of products and their sale in commodity markets.

It should be noted that the growth and spread of agricultural entrepreneurship in economically developing countries, the activity of agriculture in food production can be seen as a positive step for small-scale agricultural producers. Opportunities to open new markets can provide incentives for infrastructure investment in rural areas, and the provision of agricultural extension services can improve productivity and knowledge transfer opportunities for smallholder farmers. However, there is another side to the issue, which is that the inclusion of small producers in commodity export activities is explained by the over-dependence of vulnerable farmers on unstable markets and over-dependence on large buying firms. Thus, while increased agri-food activity is an important policy tool that allows hitherto marginalized farming communities to gain a foothold in expanding markets, the dynamics may be quite different at the small scale [3].

Clusters affect competition in three ways: increasing static productivity, increasing innovation capacity, and stimulating new business forms. If a firm innovates, a competing firm cannot keep up.

## Impact Factor:

<b>SISRA (India)</b>	<b>= 6.317</b>	<b>SIS (USA)</b>	<b>= 0.912</b>	<b>ICV (Poland)</b>	<b>= 6.630</b>
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<b>GIF (Australia)</b>	<b>= 0.564</b>	<b>ESJI (KZ)</b>	<b>= 8.771</b>	<b>IBI (India)</b>	<b>= 4.260</b>
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Firms isolated from the cluster are less likely to innovate. Firms in a cluster have specific information about customer needs due to knowledge and relationships. Cluster participants learn about technology changes and technical capabilities, so they have greater opportunities for innovation. Another advantage of clustering is the possibility of rapid innovation, since the firms supplying the information are located in close proximity.

The advantage of clusters in the medium and long term is seen in innovation and productivity growth in agricultural production compared to local agricultural producers. Agricultural enterprises in the cluster benefit from the concentration of primary agricultural producers (including farmers and farms), as well as food processing and trading enterprises that know the needs of customers and have established relationships with them.

If we pay attention, in the conditions of the initial reforms (after 2017), attention was paid to the introduction of the cluster system in the agricultural sector in our country. In this regard, separate normative legal documents were adopted. In particular, firstly, in Annex 10 of the decision of the President of the Republic of Uzbekistan "On measures to fundamentally improve and develop the system of implementation of work related to household waste in 2017-2021" dated April 21, 2017 DP-2916, and then in the Decree of the President of the Republic of Uzbekistan dated January 29, 2022 According to the Decree No. DP-60 "On the new development strategy of Uzbekistan for 2022-2026" goal 30 is to increase the income of farmers and farmers by intensive development of agriculture on a scientific basis at least 2 times, to bring the annual growth of agriculture to at least 5%, and in this to clusters allocation of land on the basis of open competition was envisaged [4].

Today, other sectors considered important for the economy of our country, the copper industry, automotive industry, pharmaceuticals, housing construction, ITCluster and other industries, have been prioritized for implementation (President of the Republic of Uzbekistan dated January 29, 2022 "Development of the new Uzbekistan for 2022-2026 Decree No. DP-60 "on the strategy") [5].

Therefore, the introduction of the cluster system is considered not only a narrow field, but also one of the important and optimal directions for the development of all important sectors of the economy, opening the way to the world market. This makes special studies on modern trends of cluster system implementation in the field, existing problems and their legal support relevant [6], [7].

Focusing on the experience of foreign countries, there is no standard way to identify, define or describe a cluster. The overall cluster analysis is based on local and regional employment statistics in various industry categories. There are two important databases that provide data on clusters and industrial

agglomerations: the Cluster Mapping Project (for the US) by the Institute for Strategy and Competitiveness at Harvard Business School; The Cluster Mapping Project has compiled a detailed picture of the location and performance of industries in the United States, focusing on the linkages or externalities between industries that give rise to clusters.

The European Cluster Observatory (for Europe), managed by the Center for Strategy and Competitiveness at the Stockholm School of Economics; The European Cluster Observatory is a platform providing a single access point to information and analysis of clusters and cluster policy in Europe. The observatory provides data and analysis on clusters and competitiveness, the cluster library, and the classroom for cluster education. The observatory focuses on three main target groups: politicians and government officials at the European, national, regional and local levels; Cluster management staff; Academics and researchers.

The European Cluster Observatory also produces analyzes and reports on regional competitiveness conditions, transnational cluster networks, clusters in emerging industries and good practices in cluster organizations [8].

Brazil's agricultural sector has a strong influence. This impact is related to both socio-economic and geographical issues and is characterized by the diversity of production chains in agricultural and livestock activities. In addition, exports of products such as meat, coffee and soybeans place Brazil in an important position in the external sector and affect the indicators of the Trade balance. Such an important position of agriculture can be observed on a global scale. Data shows that 78 percent of the world's poor people live in rural areas, mostly dependent on agriculture. As a World Bank report (2017, p. 15) states, "Improving agricultural productivity and sustainability, strengthening farmers' linkages to markets, and providing food in an economically viable way are proven tools to alleviate poverty and increase overall prosperity".

Data from the 2017 agricultural census are disaggregated to assess the behavior of family farming in the Northeast, which dominates Brazil's agricultural sector in terms of number of businesses, people employed, and food production. It can more accurately reflect possible conditions of vulnerability and poverty. It is known that family farming has different dynamics and characteristics compared to non-family farming, especially in the management of property owned by family members. In addition, the main source of income in these enterprises comes from the agricultural production activity itself, which indicates the need to analyze the socio-economic and production conditions in this segment, to monitor its profile and forms of social reproduction and the dynamics of differences between different places.

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In the analysis using data from the 2017 agricultural census, in general, about 76.71% of the producers of the participation of the major regions of Brazil in the number of enterprises in agriculture are men between the ages of 45 and 55. In addition, in the education category, it was found that 23.38 percent of agricultural enterprises had never attended school. Thus, in addition to excessive land fragmentation, there is an aging tendency and low education of those responsible for agricultural enterprises [9].

Focusing on the Chinese experience, under China's unique institutional constraints, industrial clusters developed rapidly in rural areas during economic reforms. Industrial clusters simultaneously raise incomes and reduce household income inequality in rural China. Industrial clusters contribute to rural income growth mainly by increasing non-agricultural income. Clusters reduce rural inequality by creating more opportunities for disadvantaged groups to engage in off-farm activities. Specialization, urbanization and industrialization are not as affected as industrial clusters.

In China, industrial clusters have contributed to increased rural incomes, reduced poverty, and reduced income inequality.

First, rural household incomes, especially non-agricultural incomes, were higher than those in districts without industrial clusters. Similarly, counties with industrial clusters had significantly lower poverty rates than counties without industrial clusters.

Second, rural household income inequality was significantly lower in counties with industrial clusters than in counties without clusters. Interestingly, while a similar result holds for non-farm income inequality, it does not for farm income.

Third, households with more low-income members, including those who are elderly, less educated, and/or have health problems, benefit more from clustering than others. Finally, systematic evidence is provided that measured specialization, urbanization, and industrialization do not have such effects on farm household incomes or inequality. Evidence suggests that in the Chinese context, industrial clusters developed in the early stages of economic reforms under the joint efforts of entrepreneurs and local governments have reduced institutional constraints and created relatively equal opportunities for rural residents to participate in off-farm activities. As a result, agricultural incomes in those areas will increase and income inequality will decrease [10].

If we focus on the analysis conducted in the field of agriculture in Germany, 238 farmers participated in it, and they were 45 years old on average. Of all participants with a degree, only 3.4% completed an agricultural apprenticeship, while 43.9% completed a bachelor's or master's degree. Almost a quarter of them have completed an apprenticeship and only

around 10% have attended university [11]. 89.1% of all survey respondents work full-time on their farm. This contrasts with the main farming population, where only 53% work full time [12]. Most of the farmers participating in the survey are from southern Germany (30.7%), followed by northern Germany (27.7%). Almost a quarter of farms (24.8%) are located in West Germany and 16.8% in East Germany. This again differs from the situation across the country, as almost half of all farms are located in the south of Germany and only 9% in the east. Thus, the northern and eastern regions are overrepresented and the southern region is underrepresented in the data. The average area of farms is 309.0 ha, of which an average of 259.7 ha is cropland, 45.2 ha is pasture and 4.1 ha is permanent cropland. The average share of leased land is 47.9 percent. The mentioned farms are thus quite large and the share of rented land is slightly smaller than the average for farms among the main population [13].

In Sardinia, which is another territory of the European Union, measures were taken for farmers, especially in the context of mitigating climate change, the latest technological requirements and awareness of the role of the farmer in environmental protection. Agroecological policy incorporates the core concept of 'good farming', emphasizing its relevance to the concerns of rural sociology. Agroecological schemes are an effective way of delivering public funds to farmers that reduce the negative environmental aspects of agricultural production. The farmer embodies environmental protection, especially in the intensive agricultural sectors typical of the Italian landscape.

Based on the Spatial Fuzzy Partitioning Around Medoids (SFPAM) approach, EU funds focus on the distribution of resources in the most needed area. Funds are mostly distributed in areas with low demographics and varying between development and stagnation. Funds have reached areas of economic or socio-demographic stagnation, introducing new paradigms to sustain agricultural production and related activities, fuel supply, and increase organic production [13].

Analyzes carried out in Spain highlight that agriculture is now the main locomotive of efficient land use and environmental change, and therefore agricultural landscapes are considered key to achieving the United Nations Sustainable Development Goals, such as food security and environmental sustainability. As socio-ecological systems, agricultural landscapes reflect the interdependence between people (farmers) and nature over time. The contribution of agricultural landscapes to society goes beyond the provision of ecosystem services (such as food, forage and fiber production). Agricultural land can contribute a wide range of other key ecosystem services, including regulation (for example, climate regulation, pollination) and cultural



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(for example, aesthetic and/or tourism values) as well as providing habitat for biodiversity. However, the socio-ecological outcomes of agricultural land are related to the characteristics (structure and composition) of the supporting landscapes, which ultimately reflect the management practices, that is the farming systems prevailing at the landscape level.

The European Union's Common Agricultural Policy, which has existed since the early 1960s, continues to evolve. Increasing agricultural productivity is one of its founding principles. Article 39 of the Treaty on the Functioning of the European Union or the Treaty of Rome states that "The objectives of the common agricultural policy [...] shall be to increase agricultural productivity by promoting technical progress and ensuring the rational operation of agriculture. Agricultural productivity is the relationship, measured in physical quantities, between the products produced and the materials needed in the production process. A series of reforms aimed at increasing agricultural productivity while responding to environmental and social challenges. Environmental challenges pose additional constraints to agricultural production, forcing the sector to adopt more sustainable practices. In addition, the enlargement of the European Union brought new challenges and a wider set of geographical, environmental and socio-economic conditions, revised policy objectives and the need to respond to external factors of change such as global integration.

The current concern is the need to adapt the New Deal and the Common Agricultural Policy to smart growth and high productivity from 2023, while maintaining the vitality of the rural population and adapting agricultural activities to climate change and global market conditions. All of this relies on the development of effective policies and programs that can be applied flexibly. Good policy design requires a solid evidence base, but a key challenge facing EU policymakers is the lack of clarity on the impact of Common Agricultural Policy support on agricultural performance, as shown by recent literature surveys. Potential budget cuts, reductions in direct subsidies, and a focus on improving the capacity of models to provide quality data that can inform policy decisions. Without high-quality and reliable data, policymakers are at a disadvantage in determining the future direction of Common Agricultural Policy and programs.

There are two broad modeling approaches commonly used to estimate the impact of agricultural subsidies on farm productivity. These two approaches are defined as "incremental accounting" and "boundary approaches". Growth accounting approaches use regression analysis to estimate productivity growth. These approaches treat subsidies in the production function as traditional inputs, yielding a consistent measurement of productivity because subsidies by themselves cannot produce

output unlike traditional factors of production. Threshold approaches can be parametric or nonparametric.

The reform of the new EU Common Agricultural Policy will begin in 2023, aimed at promoting a sustainable and competitive agricultural sector. The new reform is central to the European Green Deal and focuses on supporting farmers' livelihoods, ensuring the availability of healthy and sustainable food and developing rural areas. The results show that the new reform aims to direct more spending to invest in agricultural innovations aimed at increasing productivity using environmentally friendly and sustainable agricultural practices.

The European Union's Common Agricultural Policy recognizes the role of agricultural landscapes in addressing society's environmental challenges, particularly by specifying specific practices that farmers must follow. In general, Common Agricultural Policy instruments are compatible with other EU policy instruments, such as the Nature Directives and the EU Biodiversity Strategy, which aim, among other things, to include agricultural areas in highly diverse landscape features and aimed at managing organic farming through the use of agrotechnical tools.

Understanding the relationships between farming systems and the resulting biodiversity and ecosystem services under different management practices is key to achieving socioecological viability in agricultural landscapes. Such understanding provides relevant knowledge to support decision-making on adaptive management programs that enable the development and implementation of actions to enhance biodiversity and/or ecosystem services according to the characteristics of target landscapes and dominant farming systems. However, the pursuit of such knowledge requires access to high-resolution data and investment in making relevant information on biodiversity and ecosystem services available at appropriate temporal and spatial scales. Nevertheless, further research on how biodiversity is linked to agricultural systems is particularly important in high-nature agriculture, which is associated with high levels of biodiversity (and the provision of many ecosystem services) but is seriously threatened by ongoing processes. is especially important in lands. Among other reasons, scrutinizing such relationships allows for detailed analysis of agricultural practices that promote specific levels of biodiversity and ecosystem services, and helps identify farm-level indicators that can be used in biodiversity or agricultural design and monitoring [14].

Based on the above, the following conclusions can be drawn: Agriculture, as the main link of the agro-industrial complex of our country, has always been a unique field for the implementation of one or another reforms carried out by our state. The reasons for this are that, on the one hand, food security

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depends on the level of industrial development, on the other hand, the efficiency of economic reform can increase agricultural production, on the contrary, if the path is wrong, it can gradually reduce it.

In the management of any field, certain criteria are required, depending on the level of management and the goals of the decision-making bodies. Choosing such a criterion, in particular, the need to ensure sustainable socio-economic development, development and integration of agricultural production in regions, and the creation of systematic agriculture, clusters occupy a special and unique place.

The cluster approach to increase the competitiveness of agricultural producers in our country allows for the introduction of regional and inter-sectoral management, which allows to stimulate integration processes. Agricultural clusters are characterized by complex processes of competition and cooperation, contractual relations. In the market, agricultural clusters as a representative of the regional network allow to act on an equal basis and to resist the destructive tendencies of competition to a certain extent. This allows the development of the industry by ensuring competition, reducing the existing bureaucratic obstacles.

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SIS (USA)	0.438	0.912								
РИИЦ (Russia)		0.179	0.224	0.207	0.156	0.126		3.939	0.671	
ESJI (KZ)		1.042	1.950	3.860	4.102	6.015	8.716	8.997	9.035	8.771
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ICV (Poland)		6.630								
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IBI (India)			4.260							
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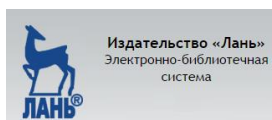
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