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A scenario-based model of the reproduction of institutional sectors' investment potential in Sverdlovsk oblast

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Abstract. The article aims to resolve the methodological problems in the sphere of scenario planning of the reproduction of institutional sectors' investment potential in regions. These problems are due to the complexity of accounting for multilateral financial relationships between sectors in the processes of the reproduction of their investment potential and the labour intensive assessment of the factors affecting their investment activities. Methodologically the study relies on the theoretical provisions of the scenario approach and the formation of balance models using the System of National Accounts. At the first stage, the presented methodological approach to scenario planning of the reproduction of institutional sectors' investment potential suggests creating a matrix of financial flows moving between the sectors and examining the regularities of their investment potential reproduction. At the next stage, the approach offers a regression model of the cross-sectional relationships emerging in the course of the reproduction of the institutional sectors' investment potential by various financial instruments taking into account the influence of internal and external factors. At the last stage, the approach develops a system of the most probable scenarios for the transformation of the reproduction processes of institutional sectors' investment potential. It also entails a search for the most favourable scenario that increases the financial sustainability of the sectors and provides the regions with resources necessary for the implementation of the crucial infrastructure projects and strategic programs of the socio-economic development. The methodological tools and scenarios for the reproduction of institutional sectors' investment potential in Sverdlovsk oblast developed in the study can be of interest to public authorities when framing the concept of the regional investment policy.

Keywords: scenario planning; investment potential; matrix of financial flows; institutional sector; modelling.

JEL Classification: G01, G17, C58

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INTRODUCTION

Investment resources play a crucial role in the socio-economic development of territorial systems at various levels and lay the foundation for the functioning of their institutional sectors. According to the methodology for the formation of the System of National Accounts, these sectors are a set of institutional units that are homogeneous in terms of their economic functions and sources of financing, which determine their similar economic behaviour¹. They act as the financial basis for the modernization and technological renewal of production processes at enterprises of the real sector of the economy, which belongs to the institutional sector of non-financial corporations. Budgets of territorial systems (the sector of public administration) are provided with additional funds through investment resources so as to implement capital-intensive projects on the development of transport, logistics, energy and engineering infrastructure and urban facilities, as well as to conduct the major strategic programs and projects on the socio-economic development. Financial corporations, such as banks, insurance organizations,

pension funds, financial management companies and investment funds play an important part in providing institutional sectors with investment resources. Bank lending, as well as investing in corporate and government debt securities, raise the inflow of long-term financial resources into the real sector of the economy and form the financial basis for the healthy socio-economic development of territorial systems. In the context of today's economic turmoil, financial instability, lack of working capital for performing companies' current activities and inability to ensure the successful implementation of strategic programs for the economic development of territories due to the insufficient amount of financial resources, it is becoming increasingly relevant to investigate the processes of investment resources reproduction and prepare a multivariate forecast for them. The relevance of the study is also associated with the need to find the most effective mechanisms for reproducing the investment potential of institutional sectors. The purpose of the paper is to work out the methodological toolkit for producing scenarios and choosing the optimal thrust of the reproduction of institutional sectors' investment potential in order to

¹ The System of National Accounts 2008. The European Commission, IMF, OECD, the UN, the World Bank. New York, 2012.

achieve a positive dynamics in the socio-economic development of territories.

METHODOLOGICAL PRINCIPLES OF SCENARIO MODELLING

Scenario analysis, forecasting, modelling and planning are the most widespread methods for constructing multivariate forecasts of the development of socio-economic processes. The main objective of these methods is to construct not individual, but multiple trajectories of these processes' development, as well as to assess the influence of various factors, even uncertain and poorly predictable ones [Geiman, 2009, p. 14]. They represent the tools for examining the unpredictable external environment of the research objects and allow evaluating the effectiveness and consistency of numerous management decisions [Gaisin, 2009, p. 4]. As far back as the 1950s, Herman Kahn, the author of the scenario approach, discussed the need for formulating a variety of different scenarios for the development of the studied processes instead of a single traditional one that took into account only the trends of the past [Kahn, 1976]. This approach was also shared by Ringland [1998], Lindgren and Bandhold [2003], van der Heijden [2011], Bai et al. [2002], Pereverza [2011], Kovalev [2009], Laeva [2006], et al. According to Frumin and Stepanova [2007, p. 92], classical explicative and expert forecasting methods focus on the desired variant of a phenomenon's development, whereas scenario modelling proceeds from the idea that the trajectory of this development is uncertain and ambiguous.

While sharing Kahn's views, Schwartz and Ogilvy [1998], however, argue that only the most possible scenarios out of an infinite number of possible futures should be selected. As they put it, scenario analysis implies presenting some plots of the studied processes' development in the form of a hypothesis, which is then subjected to a comprehensive analysis to identify two or three skeletal ones. The proponents of this approach highlight that creating a plethora of scenarios impedes decision-making, and there is a need to develop a set of scenarios producing a fairly probable range of results [Cherkassova, 2009]. Such a simplified comprehension of the essence of the scenario approach resulted in the formation of three basic forecast scenarios: inertial, pessimistic and optimistic. Scant attention was paid to the uncertainty of change in the external environment.

We support Ringland's views, who claims that the main purpose of scenario planning is to establish key and uncertain factors in the development of the external environment and, using them as a basis, to build a whole system of alternative scenarios of the future [Ringland, 1998]. We believe that the primary theoretical-methodological principle of scenario planning of a model for reproducing the investment potential of institutional sectors in the regional systems is the modelling of a variety of scenarios accompanied by studying the factors contributing to their implementation. The distinguishing features of

such a methodological approach are discussed in detail in [Naumov, 2019a].

The second methodological principle of the given approach is the use of key controllable variables while designing a scenario-based model. Such variables reflect the influence of external and internal environmental factors on the formation and the use of institutional sectors' investment potential. Ignoring controllable variables while producing scenario-based forecasts makes it impossible to consider the effect of various factors, limits the number of possible plots, and leads to the emergence of "passive scenarios" that cannot be utilized to develop sound decision-making mechanisms for correcting these scenarios, if implemented. The given methodological principles of the scenario-based approach are viewed as the fundamental ones when devising a method for proposing a scenario-based model reproduce the investment potential of institutional sectors.

METHODOLOGICAL APPROACH TO DEVELOPING A SCENARIO-BASED MODEL FOR REPRODUCING THE INVESTMENT POTENTIAL OF INSTITUTIONAL SECTORS

Since the 1960s, the methodological toolkit of scenario planning has undergone a serious transformation. Early work on scenario forecasting was carried out using the methods of Delphi's expert assessments [Kahn, 1976], forging a general consensus and developing mutual influence matrices [Gordon, Helmer, 1964]. In the 1970s, representatives of the Roman club [Meadows, Meadows, Randers, 1972] invented a system analysis method for scenario-based planning of the dynamics of natural resources and demographic processes in the future. In the 1980s, representatives of the Stanford School implemented a regression analysis technique in scenario modelling using controllable variables, which, if changed, affect the implementation and the outcome of the scenario [Wack, 1984; van der Heijden, 2011; Hawken, Ogilvy, Schwartz, 1983]. Representatives of the English school took the path of integrating expert research methods, special computer programs and random number sensors, followed by cutting off impossible situations in order to generate alternative scenarios [Abt, Foster, Rea, 1977]. In the 1990s, American researchers developed a method of unstructured decision-making, which takes into account expert opinion and hierarchical networks to calculate the probabilities of each scenario in the future [Bell, Raiffa, Tversky, 1988; Merkhofer, 1993; Keeney, 1992; Kahneman, Tversky, 1979]. Dynamic PEST analysis applied in [Mercer, 1995; Bourgeois 1998; Schoemaker, 1993] combined modelling methods (cause-and-effect diagrams, probability matrices – Bayesian model) with expert research methods (SWOT analysis and brainstorming). The current development stage of the methodological tools of the scenario approach is characterized by disregarding expert research methods and the excessive use of mathematical analysis tools: imitation, neural network and agent-based

modelling. Designing a scenario model for reproducing the investment potential of institutional sectors is a complex, system-wide task that requires: a thorough analysis of the trends in the formation, use and spatial movement of sectors' investment potential; modelling the processes of cross-sectoral movement of investment resources and the influence of internal and external factors; developing a system of possible and the most probable scenarios for the reproduction of investment potential; and determining the optimal mechanisms for scenario control. The presented methodological toolkit implies, therefore, combining expert research methods and regression modelling with the use of controllable variables.

The initial stage of scenario planning suggests studying the patterns in the reproduction of investment potential of institutional sectors interacting with each other. To do so, it is necessary to design a regional matrix for the movement of financial flows across institutional sectors (financial and non-financial corporations, the sector of public administration, households and foreign institutions) for the period from 1998 to 2019. The methodological particularities of the matrix's construction are discussed in detail in [Naumov, 2019b]. To create such a matrix, data from the primary reports of regional credit institutions are used: the turnover balance sheet (Form No. 101), as well as the financial account of the System of National Accounts and its basic "double entry" principle. According to this principle, the matrix balances all the processes of the cross-sectoral movement of financial flows for various investment instruments, such as monetary gold, foreign exchange, government and corporate debt securities, derivatives, deposits, and lending. The matrix formed will make it possible not only to identify trends in the dynamics of the cross-sectoral movement of financial flows and establish the relationships between these institutional sectors, but also trace distinctive patterns in the reproduction of their investment potential, on which scenarios will be based on.

At the stage of patterns identification, it is necessary to analyse the internal and external factors that affect the way, in which institutional sectors form and utilize the investment potential in order to pinpoint the most important key controllable variables for scenario modelling. The analysis implies using the correlation method and is designed to assess the influence of the dynamics of the volatility index in the stock market; quotations of currency, gold and other metals; bank interest rates on loans and deposits; the key refinancing rate; the consumer price index; household income; etc. To study the specificity of the spatial movement of institutional sectors' investment potential and inter-territorial relationships in the processes of its reproduction, one should calculate and analyze the global and local indices of spatial autocorrelation by Moran [1948], Geary [1954], Getis and Ord [1996], as well as to construct a matrix by Anselin [1995] applying various methods for measuring distances between regional systems.

The second stage of scenario planning implies modelling the processes of institutional sectors' investment potential reproduction. This stage suggests building a system regression model that reflects the functional relationships typical of the financial resources movement for all investment vehicles between the banking sector accumulating and managing investment resources and institutional sectors. Regression modelling allows establishing the most stable relationships between sectors in the processes of financial flows movement that are required for the further development of scenarios. Proposing a regression model of the correlation between the reproduction of the banking sector's investment resources and the factors of the internal and external environment will make it possible to find those important controllable variables described by Wack [1984], Schwartz and Ogilvy [1998], van der Heijden [2011], and Godet [2006]. At this stage of the study, it is planned to carry out spatial autoregressive modelling of interregional movements of the banking sector's investment resources with the help of the least squares method and analysis of spatial autocorrelation between residuals. This is essential to confirm the patterns of investment resources spatial movement identified at the previous stage of the study.

At the third stage of scenario planning, the plots for the reproduction of institutional sectors' investment potential are outlined, such as:

- planning scenarios for the dynamics of the key controllable variables (search for averaged high and low values of the variables to produce pessimistic and optimistic scenarios; exponential smoothing of the dynamics of a variable to build an inertial scenario; search for moderately low and high values of a variable with respect to exponentially smoothed one using the median);
- developing the most probable scenarios (optimistic, moderately positive, inertial, moderately negative and pessimistic) for the reproduction of institutional sectors' investment potential using the projected key controllable variables, as well as building a reserve of probable scenarios as a result of variables combination.

The proposed methodological approach retains the substance and main purpose of the scenario approach that is not limited to producing two or three basic scenarios, but consists in the formation of a multitude of optimal alternative management decisions. An important stage of the presented methodological approach to scenario planning is to forecast the consequences of the implementation of the most probable scenarios for the reproduction of institutional sectors' investment potential in the dynamics of the socio-economic development of the territorial system. The optimal method for projecting these consequences is a regression analysis using the least squares method. It will allow establishing the influence of the reproduction of households' investment potential on the level of their incomes, the effect of the public admin-

istration sector – on the dynamics of GRP, etc. This stage is essential for the subsequent search for a preferred scenario for the reproduction of institutional sectors' investment potential, in which a transition to the progressive socio-economic development of the territory and the creation of its implementation mechanisms are possible.

We suppose that the implementation of the last stages of scenario planning is impossible without experts expressing the agreed opinion. Therefore, the application of expert research methods, such as SWOT analysis and the Foresight method, is of high importance when selecting the optimal scenario for the reproduction of institutional sectors' investment potential and its implementation mechanisms. A central feature of the presented methodological approach is the study and modelling of the investment resources movement between institutional sectors and regional systems, as well as the study of the influence that the factors exert on the sectors' investment activity (search for the key controllable variables). The novelty of the approach lies in the possibility to construct "active" scenarios depending on the dynamics of change in controllable variables, to design an unlimited number of scenarios and to model inter-territorial

relationships in the reproduction of institutional sectors' investment potential.

TRENDS IN THE REPRODUCTION OF THE INVESTMENT POTENTIAL OF SVERDLOVSK OBLAST'S INSTITUTIONAL SECTORS

The testing of the developed methodological approach and the formation of a matrix of financial flows moving between institutional sectors for the period of 1998–2019 were carried out on the basis of the primary reports of credit institutions registered in the regions of the Ural, Southern, Siberian, Far Eastern and North Caucasian Federal Districts. A wide array of data allowed us to identify the strong patterns in the reproduction of institutional sectors' investment potential. Look at them in more detail using the case study of Sverdlovsk oblast. The developed matrix of the financial flows movement between the sectors made it possible to discover a significant reduction in the investment potential of households, the public administration sector, as well as financial and non-financial corporations, and the outflow of part of their investment potential to foreign countries during the periods of economic recessions of 1998–1999, 2003–2004, 2008–2009, and 2014–2019 (Table 1).

Table 1 – Matrix of financial flows moving between institutional sectors in 2009, million rubles
Таблица 1 – Матрица движения финансовых потоков между институциональными секторами в 2009 г., млн р.

Financial instruments	Financial corporations			Public administration	Non-financial corporations	Households	The rest of the world
	Central Bank of the RF	Banks	Other financial organizations				
1. Investments in monetary gold	28	-332	50	28	28	0	198
2. Foreign exchange	352	-938	-23	-8	44	-776	1,348
3. Deposits:	1,792	19,602	-5,883	4,791	-10,503	-11,817	2,018
- fixed-term (up to 30 days)	386	5,032	-5,775	7	60	2	287
- short-term (30 days to 1 year)	0	5,781	-292	-138	-10,930	3,835	1,744
- mid-term (1 to 3 years)	0	16,133	-1,549	116	1,884	-16,765	181
- long-term (over 3 years)	0	-1,619	108	5	1,510	417	-421
- on demand	1,405	-5,726	1,625	4,801	-3,027	693	227
4. Investments in debt securities:	4,478	-28,606	8,157	5,016	5,359	60	5,535
- available-for-sale securities	2,522	-12,910	2,395	2,166	2,522	37	3,269
- with a maturity of less than 1 year	-203	-1,029	1,435	0	-203	0	0
- with a maturity of 1 to 3 years	0	-343	343	0	0	0	0
- on demand	2,160	-14,323	3,985	2,850	3,040	23	2,266
5. Loans:	21,464	13,038	-15,769	-217	-4,984	-21,714	8,182
- fixed-term (up to 30 days)	10,766	-9,609	-3,175	-31	-1,302	176	3,175
- short-term (up to 1 year)	10,698	-1,717	-3,940	-151	-4,716	-2,116	1,943
- mid-term (1 to 3 years)	0	13,820	-6,780	-3	20	-10,359	3,302
- long-term (over 3 years)	0	9,942	-1,867	-45	1,434	-8,997	-467
- on demand	0	602	-8	13	-420	-417	229
6. Investments in derivatives	0	-566	566	0	0	0	0
7. Investments in stocks	-471	32,096	-6,859	-5,751	-7,087	-6,570	-5,358
8. Debt, including overdue	-118	-8,311	40	-118	6,006	2,255	246
9. Taxes and duties payments	0	-319	0	319	0	0	0
10. Payroll payments	0	61	0	0	0	-61	0
11. Settlements with suppliers	0	-24,583	0	0	24,630	0	-47
12. Fixed asset investments	0	-1,143	-28	-21	1,216	-25	0
Investment potential	27,524	0	-19,748	4,039	14,709	-38,646	12,122

The outflow of financial resources took the form of investing in foreign currencies. In 2009, the volume of investments by households amounted to 776 million rubles, and by financial corporations – 938 million rubles. Institutional sectors actively invested in international debt securities. In 2019, the oblast's banking sector purchased international debt securities worth 5,535 million rubles, and the volume of investments in high-risk derivatives such as futures contracts and options witnessed a sharp increase (566 million rubles). The outflow of investment resources was also due to credit organizations placing the accumulated resources of the institutional sectors on deposits of foreign financial institutions. In 2009, bank deposits opened by non-financial corporations were worth 10,503 million rubles and by households – 11,817 million rubles, of which 2,018 million rubles were placed on deposits of foreign credit institutions. There was a significant decline in the volume of lending to households and non-financial corporations, while the volume of lending to foreign institutions in 2009 increased by 8,182 million rubles.

During the periods of economic downturn, there was also an increase in institutional sectors' debt to be settled with financial institutions (for the sector of non-financial

corporations – by 6,006 million rubles, and for households – by 2,255 million rubles). The periods of economic recovery (2000–2002, 2005–2007, 2010–2013) were characterized by the opposite trends, such as a repayment of a significant share of financial resources transferred during the periods of economic downturn to accounts of foreign companies (Table 2). Deposits placed in foreign financial institutions were closed (in 2013, deposits in the amount of 7,293 million rubles were returned). Institutional sectors actively sold foreign currency (the volume of foreign currency sold by households amounted to 2,669 million rubles), invested money in shares of domestic enterprises (the volume of investments in foreign shares decreased by 9,890 million rubles) and in government debt securities (8,380 million rubles).

In addition, institutional sectors evinced little interest in high-risk and volatile derivatives, and the level of their accounts payable to financial institutions decreased by 4,782 million rubles. The presented trends were recorded during the entire period under consideration (from 1998 to 2019) in 54 constituent territories of the Russian Federation, but not only in Sverdlovsk oblast.

Table 2 – Matrix of financial flows moving between institutional sectors in 2013, million rubles
Таблица 2 – Матрица движения финансовых потоков между институциональными секторами в 2013 г., млн р.

Financial instruments	Financial corporations			Public administration	Non-financial corporations	Households	The rest of the world
	Central Bank of the RF	Banks	Other financial organizations				
1. Investments in monetary gold	98	69	22	–9	–9	–107	–65
2. Foreign exchange	–147	–1,905	634	38	–67	2,669	–1,221
3. Deposits:	–4,234	44,669	–6,636	596	9,722	–36,824	–7,293
- fixed-term (up to 30 days)	3,799	5,135	–7,147	0	–1,057	10	–740
- short-term (up to 1 year)	0	–9,349	1,164	262	4,092	5,612	–1,782
- mid-term (1 to 3 years)	0	29,590	–1,765	488	–7,207	–20,535	–571
- long-term (over 3 years)	0	23,438	37	77	336	–20,028	–3,860
- on demand	–8,033	–4,145	1,076	–232	13,558	–1,884	–340
4. Investments in debt securities:	3,334	–12,268	–6,019	8,380	–2,566	247	8,891
- available-for-sale securities	–1,225	1,634	–1,935	4,415	–1,225	100	–1,764
- with a maturity of less than 1 year	–21	6,520	–6,478	0	–21	0	0
- with a maturity of 1 to 3 years	0	1,082	–1,082	0	0	0	0
- on demand	4,580	–21,504	3,476	3,964	–1,320	148	10,655
5. Loans:	272	–37,492	–2,643	–134	4,395	40,917	–5,315
- fixed-term (up to 30 days)	800	6,021	–4,745	0	–816	4	–1,264
- short-term (up to 1 year)	–528	8,360	0	0	–1,096	–113	–6,623
- mid-term (1 to 3 years)	0	–6,883	1,907	–128	304	5,644	–842
- long-term (over 3 years)	0	–42,775	192	–7	5,384	33,796	3,410
- on demand	0	–2,214	3	1	619	1,587	4
6. Investments in derivatives	0	332	–332	0	0	0	0
7. Investments in stocks	–467	56,776	–10,261	–10,628	–10,661	–14,868	–9,890
8. Debt	17	–4,782	–23	19	440	2,446	1,883
9. Taxes and duties payments	0	392	0	–392	0	0	0
10. Payroll payments	0	–132	0	0	0	132	0
11. Settlements with suppliers	0	–43,886	0	0	43,832	0	53
12. Fixed asset investments	0	–1,773	–9	–6	1,799	–12	0
Investment potential	–1,127	0	–25,267	–2,136	46,887	–5,400	–12,957

SCENARIO MODEL FOR THE REPRODUCTION OF THE INVESTMENT POTENTIAL OF SVERDLOVSK OBLAST'S INSTITUTIONAL SECTORS

Regression modelling of financial flows moving between the banking and other institutional sectors for various investment instruments, as well as modelling the dependence of the sectors' investment activities on internal and external factors allowed us to design a scenario model for reproducing the investment potential of institutional sectors in Sverdlovsk oblast (Table 3). Having performed a regression analysis of the factors affecting the sectors' investment activities, we established the key controllable variables for the development of the scenarios. Among these variables are quotations of precious metals and foreign currency, the size of the interest rate on deposits for individuals, on business and personal loans, the stock market volatility index and indices its development (RTS and MICEX), the size of the real accrued wages in the region, the regional consumer price index, the cost of fixed assets of enterprises and their financial performance. The parameters of the scenario's regression dependences in the movement of financial flows between institutional sectors are statistically significant (the P -values of the regression coefficients are less than 0.05). There is a close relationship between the modelled processes, the coefficient of determination R^2 exceeds 0.9 (F -value < 0.05). In the presented regression model, all Gauss-Markov assumptions are met, there is no autocorrelation between the residuals. As a result of the combination of the key controllable variables, the constructed model can be used to form a wide variety of scenarios. Within the framework of this research, we have designed five most probable scenarios for the reproduction of the investment potential of institutional

sectors: inertial, pessimistic, optimistic, moderately negative and positive.

According to the inertial scenario for the reproduction of institutional sectors' investment potential by 2021, the trends recorded in the recent years are expected to continue (Table 4). Among these trends are investments of the banking sector in foreign currency (786.5 million rubles), debt securities of foreign issuers (1,594.9 million rubles) and high-risk derivatives (1,085.9 million rubles).

It is possible to implement this scenario while maintaining the present dynamics of the factors, which affect the investment activities of the sectors:

- growing quotations of gold if compared to the beginning of 2020 by 6.7 % (3,234 rubles per 1 gram of gold), platinum – by 3 % (1,988 rubles per 1 gram of platinum), the dollar exchange rate – by 4.1 % (up to 64.4 rubles per 1 US dollar);
- the falling interest rate on personal deposits (from 7.0 % to 6.5 %), on business loans (from 9.4 % to 8.5 %) and personal loans (from 14.8 % to 13.8 %);
- the growing volatility of the stock market up to 17.1 % and stock market indices (RTS – by 12 % to 1,696 rubles, and MICEX – by 4 % to 3,076 rubles);
- the growing real accrued wages of employees in the companies of Sverdlovsk oblast by 5.2 %, and the falling CPI in the region if compared to January 1, 2020 by 0.8 % (to 103.1 %).

The likelihood of this scenario being realized is seriously constrained today by a significant increase in currency quotations, volatility in the stock market, and an increase in the consumer price index. Our calculations showed that in the context of the active spread of the coronavirus infection and the forced decline in economic activity in the region, this is the most pessimistic scenario for the

Table 4 – Inertial scenario for the reproduction of institutional sectors' investment potential by 2021, million rubles
Таблица 4 – Инерционный сценарий воспроизводства инвестиционного потенциала институциональных секторов к 2021 г., млн р.

Financial instruments	Financial corporations			Public administration	Non-financial corporations	Households	The rest of the world
	Central Bank of the RF	Banks	Other financial organizations				
1. Investments in monetary gold	–5	17	–6	–3	–3	0	0
2. Foreign exchange	0	–787	148	0	0	530	108
3. Deposits	3,801	8,354	–7,643	–743	0	–3,767	0
4. Investments in debt securities	1,028	–6,996	1,777	1,357	1,378	–140	1,595
5. Loans	0	–3,067	362	0	3,917	–1,211	0
6. Investments in derivatives	0	–1,086	1,086	0	0	0	0
7. Investments in stocks	–15	2,465	–463	–454	–559	–569	–404
8. Debt	–17	–1,379	0	215	542	639	0
9. Taxes and duties payments	0	–288	0	288	0	0	0
10. Payroll payments	0	–9	0	1	0	8	0
11. Settlements with suppliers	0	–8,855	0	0	8,899	0	–44
12. Fixed asset investments	0	–2,587	88	419	1,637	442	0
Investment potential	4,792	–14,217	–4,652	1,080	15,811	–4,069	1,255

Table 3 – Scenario model of the reproduction of the investment potential of institutional sectors in Sverdlovsk oblast
Таблица 3 – Сценарная модель воспроизводства инвестиционного потенциала институциональных секторов в Свердловской области

Financial instruments	Financial corporations			Public administration (PA)	Non-financial corporations (NFC)	Households (H)	The rest of the world (RW)
	Central Bank of the RF (CB)	Banking sector (BS)	Other financial organizations (OFO)				
1. Investments in monetary gold (MG)	$CB_{MG} = -0,316 \times BS_{MG}$	$BS_{MG} = 248,91 \times G - 371,83 \times PI$	$OFO_{MG} = -0,338 \times BS_{MG}$	$PA_{MG} = -0,173 \times BS_{MG}$	$NFC_{MG} = -0,173 \times BS_{MG}$		
2. Cash, investments in foreign currency (FC)		$BS_{FC} = -1407809 + 244292 \times USD$	$OFO_{FC} = -0,188 \times BS_{FC}$			$H_{FC} = 67\,2071,05 + 0,18 \times BS_{FC}$	$RW_{FC} = -884\,200,65 - 1,262 \times BS_{FC}$
3. Deposits (D)	$CB_D = 5387776,8 - 0,19 \times BS_D$	$BS_D = 1283697,92 \times DI$	$OFO_D = -0,915 \times BS_D$	$PA_D = -0,089 \times BS_D$		$H_D = -0,451 \times BS_D$	
4. Investments in debt securities (DS)	$CB_{DS} = -0,147 \times BS_{DS}$	$BS_{DS} = -407988,46 \times VI$	$OFO_{DS} = -0,254 \times BS_{DS}$	$PA_{DS} = -0,194 \times BS_{DS}$	$NFC_{DS} = -0,197 \times BS_{DS}$	$H_{DS} = 0,02 \times BS_{DS}$	$RW_{DS} = -0,228 \times BS_{DS}$
5. Loans (L)		$BS_L = 2892585,28 \times BL - 2002414,38 \times LI$	$OFO_L = -0,118 \times BS_L$		$NFC_L = -1,277 \times BS_L$	$H_L = -3\,787\,730,4 - 0,84 \times BS_L$	
6. Investments in derivatives (ID)			$OFO_{ID} = -BS_{ID}$				
7. Investments in stocks (S)	$CB_S = -0,006 \times BS_S$	$BS_S = 88246,17 \times MOEX - 81964,53 \times RTS$	$OFO_S = -0,188 \times BS_S$	$PA_S = -0,199 \times BS_S$	$NFC_S = -0,227 \times BS_S$	$H_S = -0,231 \times BS_S$	$RW_S = -0,164 \times BS_S$
8. Accounts receivable / payable (A)	$CB_A = 0,012 \times BS_A$	$BS_A = 17452355 + 152122,19 \times \times RW - 90882,3 \times CPI$		$PA_A = -0,156 \times BS_A$	$NFC_A = -0,393 \times BS_A$	$H_A = -0,463 \times BS_A$	
9. Taxes and duties payments (TD)		$BS_{TD} = -183794 + 0,01 \times BS_{DS} + 0,01 \times BS_S$		$PA_{TD} = -BS_{TD}$			
10. Payroll payments (PP)				$PA_{PP} = -0,124 \times BS_{PP}$		$H_{PP} = -0,876 \times BS_{PP}$	
11. Settlements with suppliers (SS)		$BS_{SS} = -11904203,77 + 203,72 \times FP$			$NFC_{SS} = -1,005 \times BS_{SS}$		$RW_{SS} = 0,005 \times BS_{SS}$
12. Fixed asset investments (FA)		$BS_{FA} = -0,426 \times VFA$	$OFO_{FA} = -0,034 \times BS_{FA}$	$PA_{FA} = -0,162 \times BS_{FA}$	$NFC_{FA} = -0,633 \times BS_{FA}$	$H_{FA} = -0,171 \times BS_{FA}$	

Note: **G** is an absolute increase in the value of 1 gram of gold, rubles; **PI** is an absolute increase in the value of 1 gram of platinum, rubles; **USD** is an absolute increase in the value of 1 US dollar, rubles; **DI** is the interest rate on deposits for individuals, %; **VI** is S&P500VIX stock market volatility index, %; **BL** is the interest rate on business loans, %; **LI** is the interest rate on loans for individuals, %; **RTS** is an absolute increase in the RTS index (RTSI), rubles; **MOEX** is an absolute increase in the MOEX index (IMOEX), rubles; **RW** is the real accrued wages of workers in Sverdlovsk oblast, in % to the previous year; **CPI** is an absolute increase in the CPI in Sverdlovsk oblast, %; **FP** is an absolute increase in the financial performance of enterprises in Sverdlovsk oblast, million rubles; **VFA** is an absolute increase in the value of fixed assets of enterprises in Sverdlovsk oblast, million rubles.

reproduction of the investment potential of institutional sectors to unfold (Table 5).

Similar to the scenario of the financial crises, this one assumes a large outflow of investment resources to foreign economies (2,318 million rubles). The outflow of resources is possible in the form of investments in foreign exchange (2,546.7 million rubles) and debt securities of foreign issuers (2,169.9 million rubles). This scenario implies a significant decline in the volume of mortgage lending (by 3,683.5 million rubles), and a sharp rise in investments of the banking sector in highly risky derivatives (10,835.4 million rubles). A moderately negative scenario also forecasts an outflow of investment resources from the Russian economy, and a decline in the investment potential of financial corporations and, to a lesser extent, of households.

The major triggers for the implementation of the pessimistic scenario are the following: the growth of the average weighted interest rate on business loans from 9.5 % to 14.4 % and on personal loans – from 14.8 % to 20.9 %; an increase in the regional consumer price index from

103.9 % to 116.3 %; stock market volatility index – from 16.6 % to 23.3 %; a decrease in the real accrued wages of employees in companies of the region from 106.8 % to 93.4 %; a fall in the balanced financial performance of the enterprises by 17.0 %, as well as the RTS and MICEX stock market indices reflecting the dynamics of the Russian companies' stock value. The deterioration of the macroeconomic situation will lead not only to a significant reduction in the investment potential of institutional sectors, but also to the loss of their financial stability.

The moderately positive and optimistic scenarios for the reproduction of institutional sectors' investment potential (Table 6) imply the strengthening demand for domestic currency; raising funds in the real sector of the economy and the public administration sector through investments in Russian debt securities; growth in lending to households and non-financial corporations; and a decreasing interest in highly volatile financial derivatives. However, the implementation of these two scenarios is unlikely. To move to the optimistic scenario of reproducing the investment potential, it is necessary to reduce the

Table 5 – Moderately negative (MN) and pessimistic (P) scenarios for the reproduction of the sectors' investment potential by 2021, million rubles

Таблица 5 – Умеренно негативный и пессимистичный сценарии воспроизводства инвестиционного потенциала секторов к 2021 г., млн р.

Financial instruments		Financial corporations			Public administration	Non-financial corporations	Households	The rest of the world
		Central Bank of the RF	Banks	Other financial organizations				
1. Investments in monetary gold	MN	5	-16	6	3	3	0	0
	P	16	-49	17	9	9	0	0
2. Foreign exchange	MN	0	-1,753	68	0	0	357	1,328
	P	0	-2,719	-11	0	0	183	2,547
3. Deposits	MN	3,484	10,018	-8,093	-892	0	-4,518	0
	P	3,168	11,682	-8,542	-1,040	0	-5,269	0
4. Investments in debt securities	MN	1,179	-8,021	2,037	1,556	1,580	-160	1,829
	P	1,399	-9,517	2,417	1,846	1,875	-190	2,170
5. Loans	MN	0	-1,595	188	0	3,855	-2,448	0
	P	0	-124	15	0	3,793	-3,684	0
6. Investments in derivatives	MN	0	-4,875	4,875	0	0	0	0
	P	0	-10,835	10,835	0	0	0	0
7. Investments in stocks	MN	-49	8,196	-1,541	-1,508	-1,861	-1,893	-1,344
	P	-84	13,928	-2,618	-2,563	-3,162	-3,217	-2,284
8. Debt, including overdue	MN	-34	-2,873	0	448	1,129	1,330	0
	P	-52	-4,368	0	681	1,717	2,022	0
9. Taxes and duties payments	MN	0	-207	0	207	0	0	0
	P	0	-132	0	132	0	0	0
10. Payroll payments	MN	0	117	0	-14	0	-102	0
	P	0	242	0	-30	0	-212	0
11. Settlements with suppliers	MN	0	-15,821	0	0	15,900	0	-79
	P	0	-22,786	0	0	22,900	0	-114
12. Fixed asset investments	MN	0	-3,007	102	487	1,904	514	0
	P	0	-3,428	117	555	2,170	586	0
Investment potential	MN	4,585	-19,838	-2,357	287	22,510	-6,920	1,733
	P	4,447	-28,106	2,229	-409	29,301	-9,781	2,318

Table 6 – Moderately positive (MP) and optimistic (O) scenarios of the reproduction of the sectors' investment potential by 2021, million rubles
Таблица 6 – Умеренно позитивный и оптимистичный сценарии воспроизводства инвестиционного потенциала секторов к 2021 г., млн р.

Financial instruments		Financial corporations			Public administration	Non-financial corporations	Households	The rest of the world
		Central Bank of the RF	Banks	Other financial organizations				
1. Investments in monetary gold	MP	-7	23	-8	-4	-4	0	0
	O	-12	38	-13	-7	-7	0	0
2. Foreign exchange	MP	0	179	227	0	0	704	-1,111
	O	0	1,145	306	0	0	878	-2,330
3. Deposits	MP	4,117	6,689	-7,194	-595	0	-3,017	0
	O	4,433	5,025	-6,744	-447	0	-2,266	0
4. Investments in debt securities	MP	874	-5,945	1,510	1,153	1,171	-119	1,355
	O	719	-4,894	1,243	949	964	-98	1,116
5. Loans	MP	0	-3,806	449	0	3,948	-591	0
	O	0	-4,544	536	0	3,979	29	0
6. Investments in derivatives	MP	0	3,789	-3,789	0	0	0	0
	O	0	8,664	-8,664	0	0	0	0
7. Investments in stocks	MP	6	-936	176	172	212	216	153
	O	26	-4,337	815	798	984	1,002	711
8. Debt, including overdue	MP	1	115	0	-18	-45	-53	0
	O	19	1,609	0	-251	-633	-745	0
9. Taxes and duties payments	MP	0	-314	0	314	0	0	0
	O	0	-340	0	340	0	0	0
10. Payroll payments	MP	0	-61	0	8	0	53	0
	O	0	-113	0	14	0	99	0
11. Settlements with suppliers	MP	0	-6,069	0	0	6,099	0	-30
	O	0	-3,283	0	0	3,299	0	-16
12. Fixed asset investments	MP	0	-2,166	74	351	1,371	370	0
	O	0	-1,745	59	283	1,105	298	0
Investment potential	MP	4,990	-8,500	-8,555	1,381	12,752	-2,436	368
	O	5,186	-2,774	-12,461	1,680	9,692	-803	-519

average weighted interest rate on business loans from 9.5 % to 5.7 % and on personal loans – from 14.8 % to 10.6 %, and reduce the interest rate on deposits for individuals from 6.9 % to 3.9 %.

The abovementioned measures will allow directing household savings into securities, which contribute to the inflow of financial resources into the real sector of the economy and public administration. To fulfil this scenario, it is necessary to ensure an increase in the real accrued wages of employees from 106.9 % to 116.9 % and a decrease in the regional consumer price index from 103.9 % to 89.9 %.

Our calculations have showed that no optimal conditions had formed to implement a favourable scenario for the reproduction of institutional sectors' investment potential, and today there is no way out of the protracted recession of the Russian economy. For this scenario to unfold, the investment policy of the state and its central financial regulator should be changed. The main conceptual approaches to implementing this policy, as well as the development of mechanisms for enacting the most

positive scenarios for the reproduction of institutional sectors' investment potential will be the subject of further research.

CONCLUSION

The present research has substantiated the need for multivariate scenario planning of the reproduction of institutional sectors' investment potential in regional systems and the use of controllable variables in the modelling process. The special feature of the methodological approach is the construction of a matrix of financial flows moving between sectors that demonstrates the patterns in the processes of their investment potential reproduction. In the current study, we have also built a system regression model that reflects the cross-sectoral relationships emerging as part of the investment resources movement according to various financial instruments and taking into account the effect of external and internal factors, as well as the peculiarities of investment resources spatial movement. The formulated approach made it possible to design five most probable scenarios for the reproduction

of the investment potential of institutional sectors and determine the conditions for their successful implementation. Further studies imply the search for mechanisms for managing these scenarios so as to move to the most

favourable one, increasing the financial sustainability of the sectors and the region's progressive socio-economic development. ■

References

- Abt C., Foster R., Rea R. (1977). *A scenario generating methodology* (Russ. ed.: Abt C., Foster R., Rea R. Metodika sostavleniya stszenariyev. Rukovodstvo po nauchno-tekhnicheskomu prognozirovaniyu. Moscow: Progress).
- Gaisin T.F. (2009). Stsenarnoe planirovanie razvitiya regional'nykh otraslevykh kompleksov kak instrument predotvrashcheniya negativnykh posledstviy krizisa [Scenario planning of the development of regional industrial complexes as a tool to prevent the negative consequences of a crisis]. *Vestnik moskovskogo gosudarstvennogo oblastnogo universiteta. Ser.: Ekonomika – Bulletin of the Moscow Region State University. Series: Economics*, no. 1, pp. 3–9.
- Geiman O.A. (2009). Teoreticheskie aspekty stsenarnogo modelirovaniya razvitiya regionov [Theoretical aspects of scenario modelling of regional development]. *Ekonomika promyshlennosti – Industrial Economics*, no. 5(48), pp. 14–18.
- Kovalev P.P. (2009). Stsenarnyy analiz, metodologicheskie aspekty [Scenario analysis, methodological aspects]. *Bankovskiy menedzhment – Banking Management*, no. 44(380), pp. 9–13.
- Laeva T.V. (2006). Stsenarnyy analiz kak osnova strategicheskogo planirovaniya v organizatsii [Scenario analysis as the basis for strategic planning in an organization]. *Menedzhment v Rossii i za rubezhom – Management in Russia and Abroad*, no. 2, pp. 56–63.
- Naumov I.V. (2019a). Teoretiko-metodologicheskie osnovy proektirovaniya balansovoy modeli vosproizvodstva investitsionnogo potentsiala institutsional'nykh sektorov v regional'noy sisteme [Theoretical and methodological foundations of designing a balance model for reproducing investment potential of institutional sectors in the regional system]. *Finansy: teoriya i praktika – Finance: Theory and Practice*, vol. 23, no. 5, pp. 101–114. DOI: 10.26794/2587-5671-2019-23-5-101-114.
- Naumov I.V. (2019b). Teoretiko-metodologicheskie osnovy stsenarnogo proektirovaniya modeli vosproizvodstva investitsionnogo potentsiala institutsional'nykh sektorov v regional'noy sisteme [Methodology for a scenario model of the reproduction of investment potential in institutional sectors]. *Zhurnal ekonomicheskoy teorii – Russian Journal of Economic Theory*, vol. 16, no. 4, pp. 730–745. DOI: 10.31063/2073-6517/2019.16-4.10.
- Pereverza E.V. (2011). Stsenarnyy podkhod v zadachakh analiza slozhnykh sotsial'nykh sistem [A scenario approach to problems of analysis of complex social systems]. *Sistemnye dostizheniya i informatsionnye tekhnologii – System Achievements and Information Technologies*, no. 1, pp. 133–143.
- Frumin I.L., Stepanova M.N. (2007). Stsenarnoe prognozirovanie, ego prilozheniya k issledovaniyu nekotorykh problem agrarnoy ekonomiki [Scenario planning, its applications to the study of some problems of the agricultural economy]. *Izvestiya Chelyabinskogo nauchnogo tsentra – Izvestiya of the Chelyabinsk Scientific Center*, no. 2(36), pp. 91–95.
- Hawken P., Ogilvy J., Schwartz P. (1983). *Seven tomorrows: Toward a voluntary history* (Russ. ed.: Hawken P., Ogilvy J., Schwartz P. Sem' stszenariyev budushchego. Na puti k soznatel'nomu postroeniyu istorii. Moscow: Progress).
- Cherkassova V.A. (2009). Formirovanie korporativnoy strategii na osnove stsenarnogo planirovaniya [Formation of corporate strategy based on scenario planning]. *Ekonomicheskii analiz: teoriya i praktika – Economic Analysis: Theory and Practice*, no. 6(135), pp. 19–27.
- Anselin L. (1995). Local indicators of spatial association – LISA. *Geographical Analysis*, vol. 2, no. 27, pp. 93–115. DOI: <https://doi.org/10.1111/j.1538-4632.1995.tb00338.x>.
- Bai X., Tsai W.-T., Feng K., Yu L., Paul R. (2002). Scenario-based modelling and its applications. *Proceedings of the Seventh IEEE International Workshop on Object-Oriented Real-Time Dependable Systems*, vol. 1, pp. 2–53. DOI: 10.1109/WORDS.2002.1000060.
- Bell D.E., Raiffa H., Tversky A. (1988). *Decision making: Descriptive, normative, and prescriptive interactions*. Cambridge: Cambridge University Press.
- Bourgeois L.J. (1998). *Strategic management from concept to implementation*. Charlottesville: University of Virginia, Darden Graduate School of business.
- Geary R. (1954). The contiguity ratio and statistical mapping. *The Incorporated Statistician*, vol. 5, pp. 115–145. DOI: 10.2307/2986645.
- Getis A., Ord J.K. (1996). Local spatial statistics: An overview (pp. 261–277). In: P. Longley, M. Batty (eds.). *Spatial analysis: Modelling in a GIS environment*. UK: John Wiley & Sons.
- Godet M. (2006). *Creating futures: Scenario planning as a strategic management tool*. Paris: Economica.
- Gordon T.Y., Helmer O. (1964). *Report on a long-range forecasting study*. California: RAND Corporation.
- Kahn H. (1976). *The next two hundred years: A scenario for America and the world*. New York: William Morrow & Company.
- Kahneman D., Tversky A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, vol. 47, pp. 313–327.
- Keeney R. (1992). *Value-focused thinking: A path to creative decision making*. London: Harvard university press.
- Lindgren M., Bandhold H. (2003). *Scenario planning: The link between future and strategy*. New York: Palgrave MacMillan.
- Meadows D.H., Meadows D.L., Randers J., William W. (1972). *The limits to growth. A report for the club of Rome's project on the predicament of mankind*. New York: Universe Books.

- Mercer D. (1995). Scenarios made easy. *Long Range Planning*, vol. 28, pp. 81–86. DOI: 10.1016/0024-6301(95)00015-B.
- Merkhofer M. (1993). *Risk assessment methods: Approaches for assessing health and environmental risks*. London: Plenum Press. DOI: 10.1007/978-1-4899-1216-9.
- Moran P. (1948). The interpretation of statistical maps. *Journal of the Royal Statistical Society*, vol. 10, Series B, pp. 243–251. DOI: <https://doi.org/10.1111/j.2517-6161.1948.tb00012.x>.
- Ringland G. (1998). *Scenario planning: Managing for the future*. UK: John Wiley & Sons.
- Schoemaker P.J.H. (1993). Multiple scenario development: Its conceptual and behavioral foundation. *Strategic Management Journal*, vol. 3, no. 14, pp. 193–213. DOI: <https://doi.org/10.1002/smj.4250140304>.
- Schwartz P., Ogilvy J. (1998). Plotting your scenarios (pp. 57–80). In: L. Fahey, R.M. Randall (eds.). *Learning from the future: Competitive foresight scenarios*. New York: John Wiley & Sons.
- Van der Heijden K. (2011). *Scenarios: The art of strategic conversation*. 2nd ed. England: John Wiley & Sons.
- Wack P. (1984). *Scenarios: The gentle art of re-perceiving, a thing or two learned while developing planning scenarios for royal Dutch/shell*. Cambridge: Harvard Business School, Division of Research.

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Прогнозная сценарная модель воспроизводства инвестиционного потенциала институциональных секторов в Свердловской области

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Аннотация. Статья посвящена решению методических проблем проектирования прогнозных сценариев воспроизводства инвестиционного потенциала институциональных секторов в региональных системах. Данные проблемы обусловлены сложностью учета многосторонних финансовых взаимосвязей между секторами в процессах воспроизводства их инвестиционного потенциала и трудоемкостью оценки влияния факторов на осуществляемую ими инвестиционную деятельность. Методологическую базу исследования составляют теоретические положения сценарного подхода, формирования балансовых моделей с использованием системы национальных счетов. Представленный в работе методический подход к сценарному проектированию модели воспроизводства инвестиционного потенциала институциональных секторов включает три этапа. На начальном этапе создается матрица движения финансовых потоков между секторами, исследуются закономерности воспроизводства их инвестиционного потенциала. На следующем этапе разрабатывается регрессионная модель взаимосвязей между институциональными секторами в процессах воспроизводства их инвестиционного потенциала по различным финансовым инструментам с учетом влияния факторов внутренней и внешней среды. Заключительный этап предполагает разработку системы наиболее вероятных прогнозных сценариев трансформации процессов воспроизводства инвестиционного потенциала институциональных секторов. Предусматривается также поиск наиболее благоприятного сценария, способствующего повышению финансовой устойчивости секторов и обеспечивающего региональные ресурсы для реализации важнейших инфраструктурных проектов и стратегических программ социально-экономического развития. Представленный методический инструментарий и сценарии воспроизводства инвестиционного потенциала институциональных секторов Свердловской области могут быть интересны органам государственной власти при формировании концепции региональной инвестиционной политики.

Ключевые слова: сценарное проектирование; инвестиционный потенциал; матрица финансовых потоков; институциональные сектора; моделирование.

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Источники

- Абт К.Ч., Фостер Р.Н., Ри Р.Г. (1977). Методика составления сценариев. Руководство по научно-техническому прогнозированию. М.: Прогресс.
- Гайсин Т.Ф. (2009). Сценарное планирование развития региональных отраслевых комплексов как инструмент предотвращения негативных последствий кризиса // Вестник Московского государственного областного университета. Сер.: Экономика. № 1. С. 3–9.
- Гейман О.А. (2009). Теоретические аспекты сценарного моделирования развития регионов // Экономика промышленности. № 5 (48). С. 14–18.
- Ковалев П.П. (2009). Сценарный анализ, методологические аспекты // Банковский менеджмент. № 44(380). С. 9–13.
- Лаева Т.В. (2006). Сценарный анализ как основа стратегического планирования в организации // Менеджмент в России и за рубежом. № 2. С. 56–63.
- Наумов И.В. (2019а). Теоретико-методологические основы проектирования балансовой модели воспроизводства инвестиционного потенциала институциональных секторов в региональной системе // Финансы: теория и практика. Т. 23, № 5. С. 101–114. DOI: 10.26794/2587-5671-2019-23-5-101-114.
- Наумов И.В. (2019б). Теоретико-методологические основы сценарного проектирования модели воспроизводства инвестиционного потенциала институциональных секторов в региональной системе // Журнал экономической теории. Т. 16, № 4. С. 730–745. DOI: 10.31063/2073-6517/2019.16-4.10.
- Переверза Е.В. (2011). Сценарный подход в задачах анализа сложных социальных систем // Системные достижения и информационные технологии. № 1. С. 133–143.
- Фрумин И.Л., Степанова М.Н. (2007). Сценарное прогнозирование, его приложения к исследованию некоторых проблем аграрной экономики // Известия Челябинского научного центра. № 2(36). С. 91–95.
- Хаукен П., Огилви Дж., Шварц П. (1983). Семь сценариев будущего. На пути к сознательному построению истории: пер. с англ. М.: Прогресс.
- Черкасская В.А. (2009). Формирование корпоративной стратегии на основе сценарного планирования // Экономический анализ: теория и практика. № 6(135). С. 19–27.
- Anselin L. (1995). Local indicators of spatial association – LISA. *Geographical Analysis*, vol. 2, no. 27, pp. 93–115. DOI: <https://doi.org/10.1111/j.1538-4632.1995.tb00338.x>.
- Bai X., Tsai W.-T., Feng K., Yu L., Paul R. (2002). Scenario-based modelling and its applications. *Proceedings of the Seventh IEEE International Workshop on Object-Oriented Real-Time Dependable Systems*, vol. 1, pp. 2–53. DOI: 10.1109/WORDS.2002.1000060.
- Bell D.E., Raiffa H., Tversky A. (1988). *Decision making: Descriptive, normative, and prescriptive interactions*. Cambridge: Cambridge University Press.
- Bourgeois L.J. (1998). *Strategic management from concept to implementation*. Charlottesville: University of Virginia, Darden Graduate School of business.
- Geary R. (1954). The contiguity ratio and statistical mapping. *The Incorporated Statistician*, vol. 5, pp. 115–145. DOI: 10.2307/2986645.
- Getis A., Ord J.K. (1996). Local spatial statistics: An overview (pp. 261–277). In: P. Longley, M. Batty (eds.). *Spatial analysis: Modelling in a GIS environment*. UK: John Wiley & Sons.
- Godet M. (2006). *Creating futures: Scenario planning as a strategic management tool*. Paris: Economica.
- Gordon T.Y., Helmer O. (1964). *Report on a long-range forecasting study*. California: RAND Corporation.
- Kahn H. (1976). *The next two hundred years: A scenario for America and the world*. New York: William Morrow & Company.
- Kahneman D., Tversky A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, vol. 47, pp. 313–327.
- Keeney R. (1992). *Value-focused thinking: A path to creative decision making*. London: Harvard university press.
- Lindgren M., Bandhold H. (2003). *Scenario planning: The link between future and strategy*. New York: Palgrave MacMillan.
- Meadows D.H., Meadows D.L., Randers J., William W. (1972). *The limits to growth. A report for the club of Rome's project on the predicament of mankind*. New York: Universe Books.
- Mercer D. (1995). Scenarios made easy. *Long Range Planning*, vol. 28, pp. 81–86. DOI: 10.1016/0024-6301(95)00015-B.
- Merkhofer M. (1993). *Risk assessment methods: Approaches for assessing health and environmental risks*. London: Plenum Press. DOI: 10.1007/978-1-4899-1216-9.
- Moran P. (1948). The interpretation of statistical maps. *Journal of the Royal Statistical Society*, vol. 10, Series B, pp. 243–251. DOI: <https://doi.org/10.1111/j.2517-6161.1948.tb00012.x>.
- Ringland G. (1998). *Scenario planning: Managing for the future*. UK: John Wiley & Sons.
- Schoemaker P.J.H. (1993). Multiple scenario development: Its conceptual and behavioral foundation. *Strategic Management Journal*, vol. 3, no. 14, pp. 193–213. DOI: <https://doi.org/10.1002/smj.4250140304>.
- Schwartz P., Ogilvy J. (1998). Plotting your scenarios (pp. 57–80). In: L. Fahey, R.M. Randall (eds.). *Learning from the future: Competitive foresight scenarios*. New York: John Wiley & Sons.
- Van der Heijden K. (2011). *Scenarios: The art of strategic conversation*. 2nd ed. England: John Wiley & Sons.
- Wack P. (1984). *Scenarios: The gentle art of re-perceiving, a thing or two learned while developing planning scenarios for royal Dutch/shell*. Cambridge: Harvard Business School, Division of Research.

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