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Parameters of the strategy for managing the economic growth of agricultural production in Russia

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Electronic supplementary material

Supplementary Tables S1–S4

Supplementary Figures S1–S3

Table S1. Content and method of calculation of FCM static analysis indicators

Indicator name	Indicator symbol	Method of calculation
Influence of i^{th} concept on j^{th}	p_{ij}	$p_{ij} = \text{sign}(z_{ij} + \bar{z}_{ij}) \max(z_{ij} , \bar{z}_{ij}), z_{ij} \neq \bar{z}_{ij} $ where z_{ij} is the force of positive influence of i -th concept on j -th, $\bar{z}_{ij}$ – the force of the negative influence of i -th concept on j -th, $\text{sign}(x)$ is a function that returns the sign of the expression x .
Influence (impact) of i -th concept on the system	$\bar{P}_i$	$\bar{P}_i = \frac{1}{n} \sum_{j=1}^n p_{ij}$ where n is the number of concepts; p_{ij} is impact of i -th concept on j -th
Influence of the system on j -th concept	$\bar{P}_j$	$\bar{P}_j = \frac{1}{n} \sum_{i=1}^n p_{ij}$ where n is the number of concepts; p_{ij} is influence of i -th concept on j -th
Mutual negative influence	$\vec{h}_{ij}, \vec{h}_{ji}$	$\vec{h}_{ij} = \vec{h}_{ji} = - \bar{z}_{ij} S \bar{z}_{ij} $ where $\bar{z}_{ij}$ is the force of the negative influence of i -th concept on j -th, S is the corresponding S-norm (operation of maximum).
Mutual positive influence	$\vec{p}_{ij}, \vec{p}_{ji}$	$\vec{p}_{ij} = \vec{p}_{ji} = z_{ij}S z_{ji}$ where z_{ij} is the force of positive influence of i -th concept on j -th, S is the corresponding S-norm (operation of maximum)
Centralization of influence	I_i^p	$I_i^p = \bar{P}_i - \bar{P}_i$ where $\bar{P}_i$ is the influence of i -th concept on the system, $\bar{P}_i$ – the influence of the system on i -th concept
Consonance of the influence of i -th concept on j -th	c_{ij}	$c_{ij} = \frac{ z_{ij} + \bar{z}_{ij} }{ z_{ij} + \bar{z}_{ij} }$
Consonance of influence of i -th concept on the system	$\vec{C}_i$	$\vec{C}_i = \frac{1}{n} \sum_{j=1}^n c_{ij}$ where c_{ij} is the consonance of influence of i -th concept on j -th; n is the number of concepts
Consonance of influence of the system on j -th concept	$\vec{C}_j$	$\vec{C}_j = \frac{1}{n} \sum_{i=1}^n c_{ij}$
Consonance of mutual influence of i -th and j -th concepts	$\vec{c}_{ij}, \vec{c}_{ji}$	$\vec{c}_{ij} = \vec{c}_{ji} = \frac{ (z_{ij} + z_{ji}) + (\bar{z}_{ij} + \bar{z}_{ji})}{ (z_{ij} + z_{ji}) + (\bar{z}_{ij} + \bar{z}_{ji})}$
Mutual consonance of i -th concept and system	I_i^{SC}	$I_i^{SC} = S(\vec{C}_i, \vec{C}_i)$ where $\vec{C}_i$ – consonance of influence of i – the concept on the system, $\vec{C}_i$ is the consonance of influence of the system on i -th concept
Centralization of consonance	I_i^C	$I_i^C = \vec{C}_i - \vec{C}_i$

Source: Systematized and compiled by author

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Table S2. FCM system indicators for structural block of agriculture economic growth management

Nº	Concepts	Consonance of influence of i-th concept on system	Consonance of influence of system on j-th concept	Dissonance of influence of i-th concept on system	Dissonance of influence of system on j-th concept	Influence of i-th concept on system	Influence of system on j-th concept	Centralization of consonance	Centralization of influence	Mutual consonance of i-th concept and system	Mutual dissonance of concept and system
1	Agricultural production index	0.927	0.7239	0.073	0.2761	0.1564	0.3414	0.2031	-0.185	0.927	0.2761
2	Gross added value per employee in agriculture	0.9052	0.7677	0.0948	0.2323	0.1642	0.313	0.1375	-0.1487	0.9052	0.2323
3	Profitability of agricultural organizations	0.8833	0.7896	0.1167	0.2104	0.1598	0.2791	0.0937	-0.1194	0.8833	0.2104
4	Number of employed in agriculture	0.9489	0.9489	0.0511	0.0511	0.1401	-0.0922	0.0	-0.2323	0.9489	0.0511
5	Level of competence of the agriculture personnel	0.927	0.8333	0.073	0.1667	0.1229	0.1167	0.0937	0.0062	0.927	0.1667
6	Material and technical situation in agriculture	0.9489	0.9361	0.0511	0.0639	0.1552	0.1978	0.0128	-0.0426	0.9489	0.0639
7	Livestock and poultry	0.9489	0.9478	0.0511	0.0522	0.1617	0.2597	0.0011	-0.098	0.9489	0.0522
8	Land resources of agriculture	0.9489	0.9558	0.0511	0.0422	0.1078	0.1851	-0.0069	-0.0773	0.9558	0.0511
9	Innovations in agriculture	0.7718	0.8333	0.2282	0.1667	0.271	0.1556	-0.0615	0.1154	0.8333	0.2282
10	Investments in agriculture	0.6547	0.8626	0.3453	0.1374	0.2012	0.1735	-0.2080	0.0277	0.8626	0.3453
11	Infrastructure support to agriculture	0.8614	0.8114	0.1386	0.1886	0.3402	0.1353	0.05	0.2049	0.8614	0.1886
12	Technological support to agriculture	0.7878	0.8626	0.2122	0.1374	0.25	0.1518	-0.0749	0.0982	0.8626	0.2122
13	Disparity in intersectoral relations	0.9582	0.9411	0.0418	0.0589	-0.1832	-0.1768	0.0172	-0.0063	0.9582	0.0589
14	Balanced development of agriculture	0.6883	0.8975	0.3117	0.1025	0.2022	0.1446	-0.2092	0.0576	0.8975	0.3117
15	Natural and climatic conditions of agricultural production	0.8359	0.8845	0.1641	0.1155	-0.1399	-0.0749	-0.0487	-0.065	0.8845	0.1641

Source: Own calculation using SSDS "IGLA" (2019)

4 Table S3. FCM system indicators for dynamic block of agriculture economic growth management

No	Concepts	Consonance of influence of i-th concept on the system	Consonance of influence of the system on j-th concept	Dissonance of influence of i-th concept on the system	Dissonance of influence of the system on j-th concept	Influence (impact) of i-th concept on the system	Influence of the system on j-th concept	Centralization of consonance	Centralization of influence	Mutual consonance of i-th concept and system	Mutual dissonance of concept and system
1	Agricultural production index	0.8972	0.9591	0.1028	0.0409	0.181	0.3638	-0.0619	-0.1827	0.9591	0.1028
2	Gross added value per employee in agriculture	0.891	0.9653	0.109	0.0347	0.2056	0.2918	-0.0742	-0.0862	0.9653	0.109
3	Profitability of agricultural organizations	0.9813	0.7882	0.0187	0.2118	0.2029	0.2808	0.1932	-0.0779	0.9813	0.2118
4	Milk production	0.9095	0.8683	0.0905	0.1317	0.1682	0.1414	0.0412	0.0268	0.9095	0.1317
5	Meat production	0.9095	0.8683	0.0905	0.1317	0.1802	0.1414	0.0412	0.0388	0.9095	0.1317
6	Gross harvest of main crops	0.9095	0.8689	0.0905	0.1311	0.1922	0.1237	0.0405	0.0608	0.9095	0.1311
7	Production of gross agricultural output in comparable prices	0.9033	0.9345	0.0967	0.0655	0.1873	0.2947	-0.0312	-0.1075	0.9345	0.0967
8	Yield of the main crops	0.9224	0.8623	0.0776	0.1377	0.2322	0.092	0.0601	0.1402	0.9224	0.1377
9	Productivity of livestock and poultry	0.9291	0.8617	0.0709	0.1383	0.2682	0.1125	0.0675	0.1557	0.9291	0.1383
10	Index of labor productivity in agriculture	0.9095	0.8915	0.0905	0.1085	0.1562	0.1481	0.0179	0.0081	0.9095	0.1085
11	Competitiveness of domestic agricultural production	0.9033	0.9182	0.0967	0.0818	0.1756	0.1627	-0.0149	0.0128	0.9182	0.0967
12	Differentiation of rural and urban population	0.6526	0.9776	0.3474	0.0224	-0.2191	-0.1145	-0.325	-0.1046	0.9776	0.3474
13	Quality of living of rural population	0.6921	0.9714	0.3079	0.0286	0.1446	0.1552	-0.2794	-0.0105	0.9714	0.3079
14	Greening of agricultural production and products	0.91	0.8558	0.09	0.1442	0.1265	0.0832	0.0543	0.0433	0.91	0.1442
15	Concentration of value added in science-intensive segments of agriculture	0.9748	0.8492	0.0252	0.1508	0.3975	0.1315	0.1256	0.266	0.9748	0.1508
16	Ratio of processing of agricultural products	0.91	0.8558	0.09	0.1442	0.138	0.1294	0.0543	0.0086	0.91	0.1442
17	Natural and climatic conditions of agricultural production	0.9467	0.8558	0.0533	0.1442	-0.2456	-0.0462	0.091	-0.1994	0.9467	0.1442

Source: Own calculation using SSDS "IGLA" (2019)

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Table S4 (ESM). Stage-by-stage change in the level of controllable concepts

Sr. No.	Concept name	Level of change by stages (%)		
		I stage	II stage	III stage
1	Innovations in agriculture	5	10	5
2	Investments in agriculture	5	5	5
3	Differentiation of rural and urban population	5	5	5
4	Concentration of value added in science-intensive segments of agriculture	5	5	5

Source: Developed by author

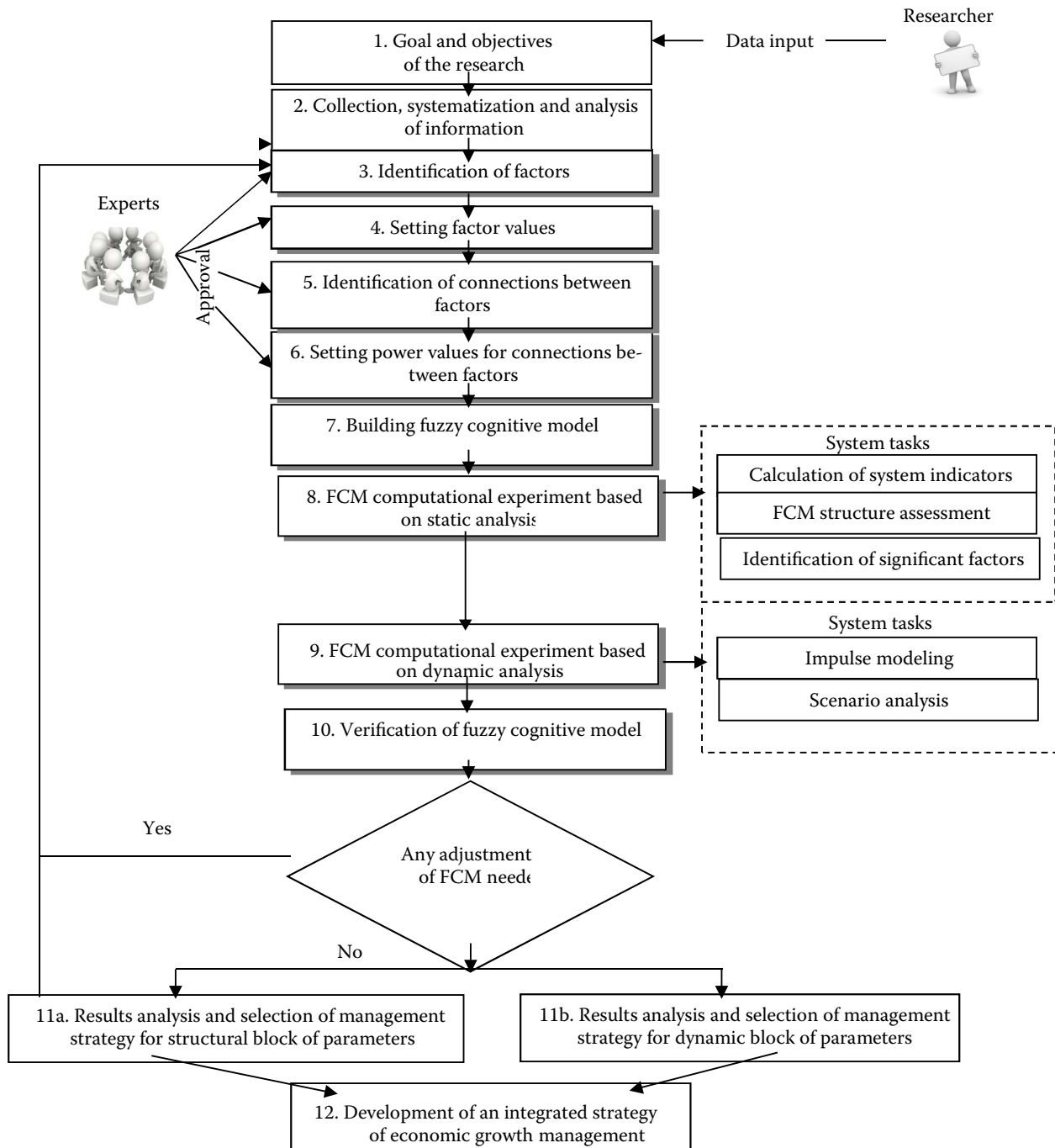


Figure S1. Methodological scheme for the cognitive modeling of agriculture economic growth management

Source: Developed by author

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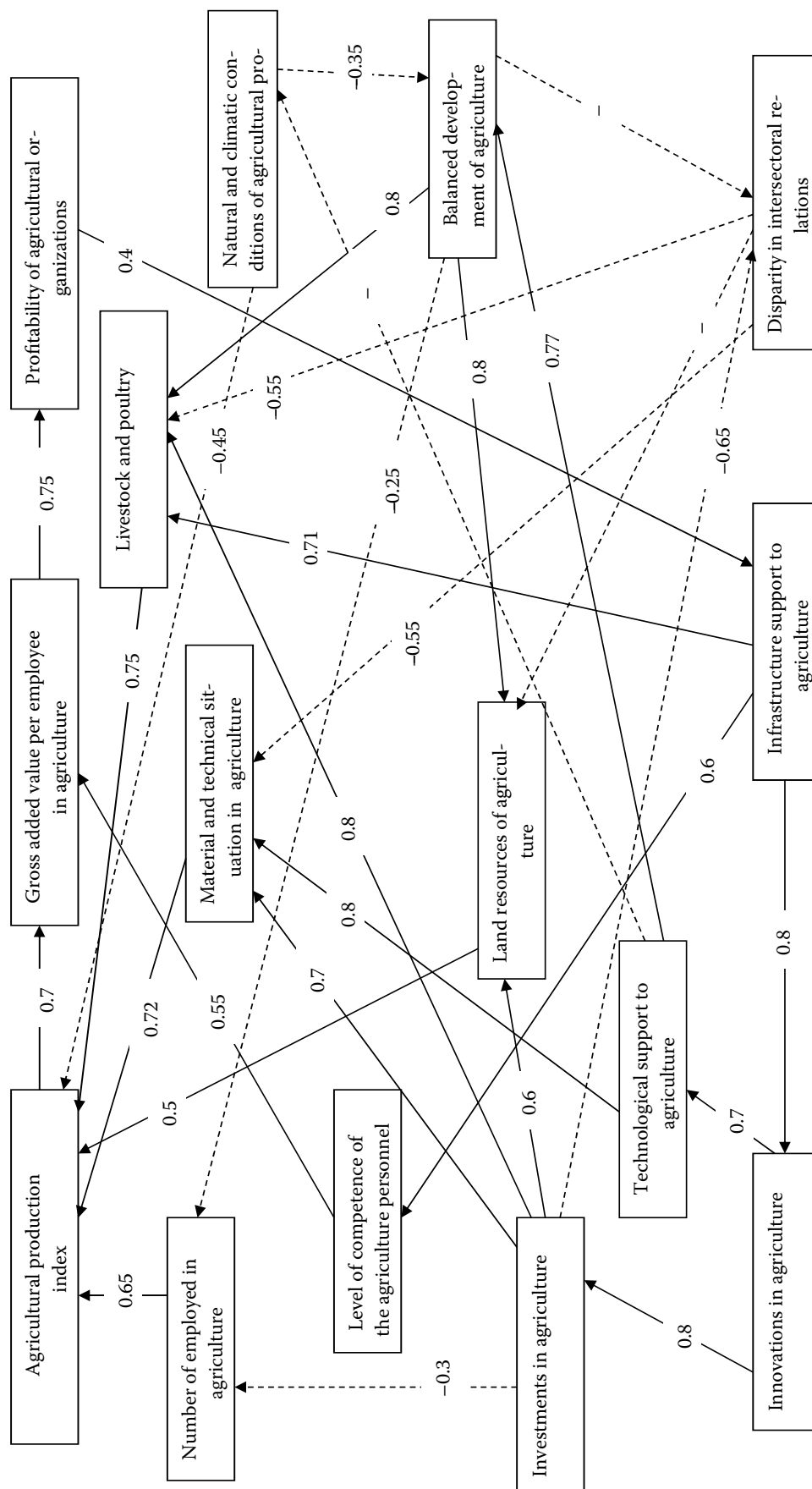


Figure S2. Fuzzy cognitive map for management of the economic growth of agriculture for structural block of concepts

Source: Developed by author

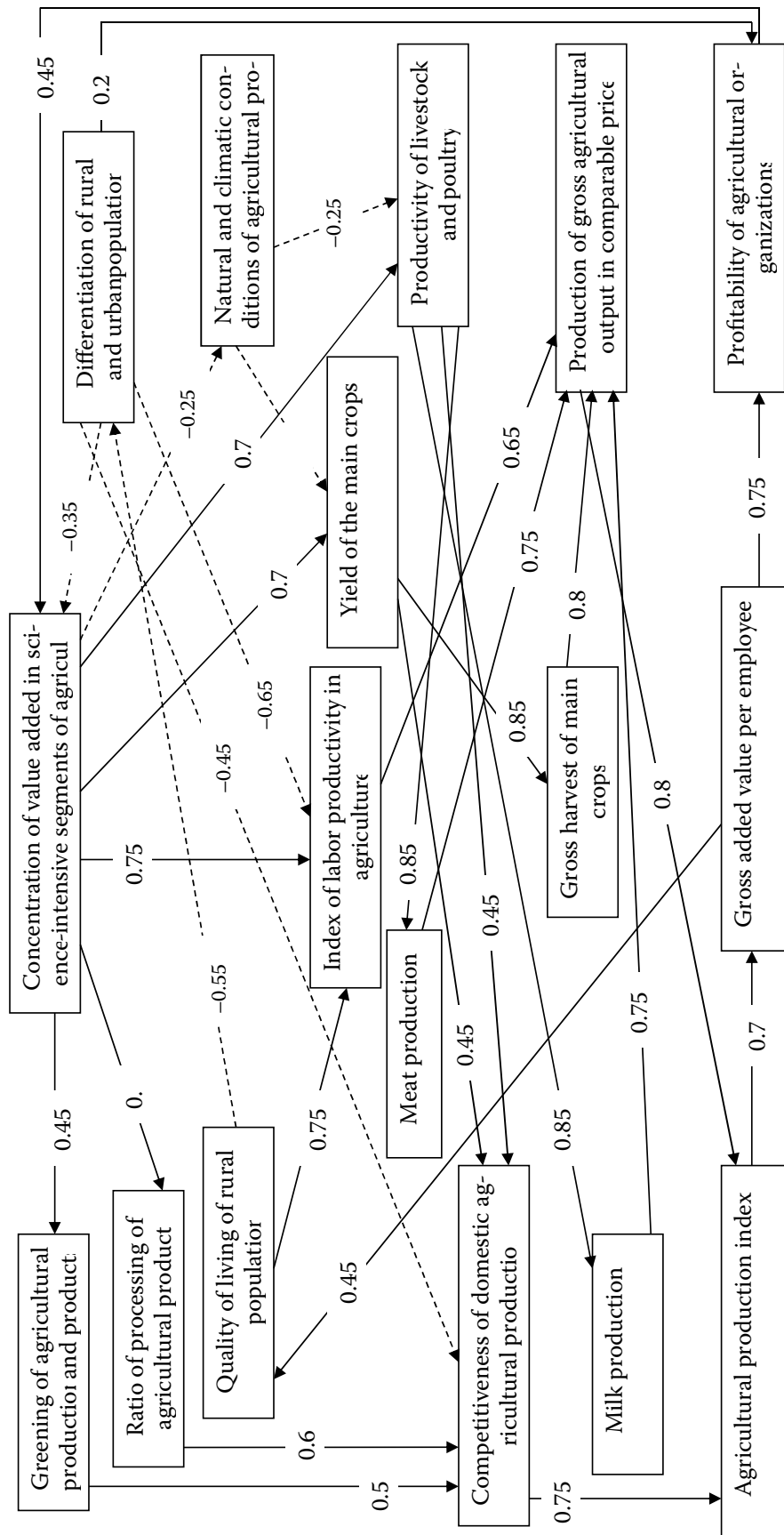


Figure S3. Fuzzy cognitive map for management of the economic growth of agriculture for dynamic block of concepts

Source: Developed by author