European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2021.04.43

CDSES 2020

IV International Scientific Conference "Competitiveness and the development of socio-economic systems" dedicated to the memory of Alexander Tatarkin

SEMIOTIC METHODOLOGY IN ASSESSING THE DIGITAL DEVELOPMENT OF THE REGION ECONOMY

Anna Urasova (a)*
*Corresponding author

(a) Ural Branch of the Russian Academy of Sciences, 29, Moskovskaya St., Yekaterinburg, Russia, Perm State National Research University, 5, Genkel St., Perm, Russia, annaalexandrowna@mail.ru

Abstract

In Russia's modern scientific and technological development, there is a tendency to prioritize solutions to the problems of transition to advanced digital, smart manufacturing technologies, robotic complexes, and creation of systems for processing large amounts of data, machine learning, and artificial intelligence. This brings up the question of developing appropriate methods and techniques that can assess these transients. The methodology of the semiotic approach can provide a wide range of tools and mechanisms. The author sets a goal to assess the scope of the semiotic analysis and interpretation of its results in the conditions of total digitalization of the region's economy. A feature of this paper's methodology is a comparative analysis of the quantification capabilities of semiotic techniques and methods concerning the regional economy. The author concludes that the semiotic approach allows to analyze how the economic process is described in the categories of signs; what the sign structure of economic interaction is; what types and forms of signs are used to analyze economic phenomena. These facts also allow to identify the applied aspects of the semiotic approach for planning and forecasting the region's economy. This is especially significant in the context of modern digital reality. The changing nature of inter-object, subject-subject, and inter-subject relations is based on actant networks' activities and emerging dependencies between people and things, things and people, things and things, people and people, transforming the process of economic development of the region.

Keywords: Cyber-physical systems, regional economy, semiotic methodology

https://doi.org/10.15405/epsbs.2021.04.43
Corresponding Author: Anna Urasova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

The semiotic approach assumes consideration of the phenomenon, process in categories: as a sign and as a sign system. In this regard, there is a division of the research areas into:

– syntactic area (it studies the formal aspects of a phenomenon, process (Kletzl, 2020; Keunen, 2020; Zlatev, 2020);

– semantic area (it considers the general meaning, general aspects of the phenomenon (Bueno, 2020; Chen, 2020; Gilyazova, 2020);

– pragmatic area (it focuses on the situational manifestation of the object of research (Bankov, 2020; George, 2020; Monforte et al., 2020).

Due to this division, the semiotic approach allows to limit the scope of research and combines various data sources with high reliability and a variety of situational significance of common semantic concepts.

Among the founders of the semiotic approach, we note Leibniz, who developed the key logical principles; de Saussure and Pierce, who are the representatives of the logical-pragmatic school. Pierce, who is the author of the term "semiotics", also developed the first classification of signs. Since the second half of the XX century, scientific schools of this approach have been formed, and scientists (Ogden and Richards, Barthes and van Dyck, etc.) built various concepts.

2. Problem Statement

Having a purely philological origin, the semiotic approach spread gradually to other fields of knowledge (Gomez, 2020) such as Psychology (Picione, 2020), Sociology, and Political Science (Zahariadis, 2020). In particular, it is an economic reality, which we understand as a system of interactions expressed in signs, sign systems, codes, etc. The content of such interaction consists of the transformation of the information flow, which has acquired a sign, encoded form with the use of various communication tools. As a result, this process was decoded, acquiring a new meaning, content. Thus, a new meaning arises; the boundaries of the existing concept, phenomenon, and process expand. One can designate the following means of communication: words, phrases, sentences, i.e. verbal means. The non-verbal means are voice characteristics, facial expressions, body language, etc.; various kinds of material objects. As a result, the information becomes crucial in the semiotic approach. At the same time, the constructed semiotic models have a non-linear character. The movement of processes and phenomena are considered from the position of expanding meaning and sense. To conclude, this approach is based on the economic process as information interaction.

In Economics, the semiotic approach allows us to analyze how the economic process is described in the categories of signs; what is the sign structure of economic interaction; what types of signs are used for the analysis of economic phenomena and helps to identify the applied aspects of the semiotic approach for planning and forecasting the economy.

https://doi.org/10.15405/epsbs.2021.04.43
Corresponding Author: Anna Urasova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

3. Research Questions

Taking into account some economic issues from the position of the semiotic approach, Arkhipov et al. (2020) reveal the evolutionary and genetic mechanisms of economic growth and development. They suggest considering each mechanism as a set of signs at all stages of the research. In addition, Olyanitch (2019) focuses on the semi-linguistic aspect in the development of information technologies in the economy. He considers formulae, indices, prices, etc. in various situations as a system of signs that characterize certain periods of economic development. There are works that reveal the features of periods of uncertainty in the distribution and consumption of economic resources (in particular, natural resources) (LaRiviere et al., 2018). One can also name articles that consider the possibilities of the Internet as an information field for development, including economic interaction (Teixeira, 2020).

In this context, one can speak about the applied aspects of the semiotic approach and note the methodology of the Analytical center TAdviser and state corporation Rostec[1] related to the assessment of the industrial Internet market of things in Russia. The main methods are a semiotic analysis of various analytical agencies' and consulting companies' reports and vendors through parsing. It is noteworthy that the person is generally excluded from the process at this stage. The researcher steps in the process only at the stage of processing the selected data and their interpretation.

4. Purpose of the Study

The author sets a goal to evaluate the possibilities of semiotic analysis and interpretation of its results in the conditions of total digitalization of the region's economy.

5. Research Methods

A specific feature of the methodological foundations of this work is a comparative analysis of the quantification capabilities of semiotic techniques and methods in relation to the regional economy. In particular, the paper uses one of the quantification methods: data ranking.

The rank values for the subjects of the Russian Federation are determined according to the indicator on the basis of the converted value rather than their own one. The main reason is connected with the fact that the information about which industry software complexes and digital platforms are implemented in the territory of the Russian Federation was used as the source data for this indicator. The subjects of the Russian Federation were ranked according to the following scheme:

At the first stage, the converted value (weight) of each platform was determined on the basis of the indicator "number of implemented projects " (the values are shown in the table).

During the second stage, the total converted value of the "Digital platforms" indicator was calculated for each Russian subject on the basis of the information about whether a particular platform is used in this subject (the values are also presented in table 1).

[1] Official website of the TAdviser analytical center and Rostec state Corporation: https://www.tadviser.ru

https://doi.org/10.15405/epsbs.2021.04.43
Corresponding Author: Anna Urasova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Table 1. Determination of the converted value (weight) of indicators included in the synthetic indicator as the development level of software systems industry and digital platforms

Criterion [2]	Number of implemented projects	Converted value (weight)
Software complex maintenance of oil drilling "Geonaft"	11	0.040
Complex of digital technologies "Intellectual quarry"	2	0.007
Digital platform for accounting purchases of non-ferrous and ferrous scrap "CUZ. RF"	63	0.227
Digital platform for wholesale purchases and sales of SME products "Supl.biz" (regardless of industry)	8	0.029
Cloud platform for the mining industry "SKYEER"	12	0.043
"ASC - Mountain logistics" (mining industry)	6	0.022
Neosynthesis	7	0.025
Real-time digital adviser and management system	5	0.018
The monitoring system of industrial equipment "DISPATCHER"	16	0.058
Data mining platform Clover SmartMaintenace	51	0.183
Digital educational platform "Digital production"	85	0.306
Technologies "Factories Of The Future"	9	0.032
"1C: MES Operational production management"	2	0.007
"1C: PDM engineering data Management"	1	0.004

Finally, at the third stage the subjects were ranked according to the total converted value of the quality indicator.

[2] Data are taken from the official website of the ANO "Digital economy": https://data-economy.ru/organization

https://doi.org/10.15405/epsbs.2021.04.43
Corresponding Author: Anna Urasova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

6. Findings

We will try to assess the regional level of technological efficiency of the industrial structure. To do this, we quantify nonparametric data that will allow us to calculate a particular synthetic indicator that includes data on the development of software systems industry and digital platforms: industry and universal character, the number of implemented projects, the cost and implementation period, and performance indicators.

As a result of the calculations in the development of industry complexes and digital platforms in the regions of the Russian Federation, we can note several trends:

– there are three groups of subjects that are concentrated; in the range of rank ratings (0;25) symmetrically relative to both industries; in the range of rank ratings (25;55) and the range (55;75) respectively;

– most of the subjects have the largest variation in rank ratings (within 30);

– the general trend of translatory movement of subjects centering around the bisector of the first coordinate angle is obvious;

– the synthetic indicator has a greater spread and variability in the development of Russian regions due to significant differences in the level and specialization of industrial development in the region.

This grouping of subjects reflects the overall picture of the technologization of regional industrial structures. However, it requires detailed information from the point of view of the ratio and direction of the subject's technologization and its industrial structure, the actual amount of indicators that determine the proportions of the country's technologization as a whole.

A detailed description of the results gives us the basis for suggesting a typology of manufacturability of industrial structures in Russia's regions, which has certain characteristics, a level of universalism and excludes particular regional characteristics (table 2).

Table 2. Typology of manufacturability of industrial structures in Russia's subjects

Type name	Characteristics	Federal subjects of Russia
Lagging	The level of technological efficiency of the industrial structure is low in the conditions of low scientific-innovative and technological potential of the region as a whole. Within the quadrant, the subjects are asymmetrically developed on both axes.	Altai territory, Kurgan region, Amur region, Jewish Autonomous region, Sevastopol, Republic of Dagestan, Tuva, the Crimea, North Ossetia-Alania, the Karachay-Cherkess and Chechen republics
Unpromising (lack of potential)	The level of technological efficiency of the industrial structure is low against the background of a relatively high scientific, innovative and technological level of development of the region as a whole. Within the quadrant, the subjects are asymmetrically developed on both axes.	Vologda, Magadan, Kaliningrad regions, the Republic of Sakha (Yakutia), Altai, Zabaykalsky Krai
Difficult (presence of environmental barriers)	The relatively high level of technological capability of the industrial structure faces barriers to development due to the lack and insufficient level of	The republics of Ingushetia, Mari El, Buryatia, Mordovia, Komi, Kabardino-Balkaria, Nenets Autonomous district, Pskov,

https://doi.org/10.15405/epsbs.2021.04.43
Corresponding Author: Anna Urasova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

	implementation of the scientific, innovative and technological potential of the region as a whole. Within the quadrant, the subjects are asymmetrically developed on both axes.	Oryol, Tambov, Astrakhan, Kursk, and Smolensk regions.
Balanced	The technological level of the industrial structure corresponds to the level of implementation of scientific, innovative and technological potential in the region as a whole. Within the quadrant, the subjects are asymmetrically developed on both axes.	Kemerovo, Bryansk, Lipetsk, Sakhalin regions, Chukotka Autonomous region, The Republic of Chuvashia, Adygea, Kamchatka territory
Investment-consuming (resource-consuming)	The high level of technologicality of the industrial structure faces barriers to development associated with the lack and insufficient level of implementation of scientific, innovative and technological potential of the region as a whole, which requires significant costs to create appropriate conditions and maintain the current level of development	There are none
Investment-attractive	The high level of technological efficiency of the industrial structure makes it possible to attract significant investments in creating conditions for the implementation of scientific, innovative and technological potential of the region as a whole, which ensures the progressive growth of this group	Khabarovsk, Stavropol territory, Voronezh, Leningrad, Ryazan, Vladimir, Orenburg, Tyumen, Tomsk, Kaluga regions, Khanty-Mansiysk JSC-Yugra
Prospective	The level of technological efficiency of the industrial structure is low against the background of a high scientific, innovative and technological level of development of the region as a whole, which makes a wide range of possible growth points. Within the quadrant, the subjects are asymmetrically developed on both axes.	Kirov, Omsk, Kostroma, Ivanovo regions, the Republic of Karelia
Growing (progressive)	A relatively high level of manufacturability of the industrial structure is provided by a high level of implementation of scientific, innovative and technological potential of the region as a whole, which ensures the progressive growth of this group. Within the quadrant, the subjects are asymmetrically developed on both axes.	Novgorod, Samara, Saratov, Arkhangelsk, Ulyanovsk regions, Yamalo-Nenets Autonomous Okrug, Primorye territory, the Republic of Khakassia, Tula, Tver, Novosibirsk regions
Advanced	A relatively high level of manufacturability of the industrial structure is provided by a high level of implementation of scientific, innovative and technological potential of the region as a whole, which ensures the progressive growth of this group. Within the quadrant, the subjects are asymmetrically developed on both axes.	Moscow, Saint Petersburg, the Republic of Tatarstan and Bashkortostan, Moscow, Sverdlovsk, Nizhny Novgorod regions, Perm territory, Yaroslavl, Irkutsk, Chelyabinsk, Belgorod, Murmansk, Penza, Rostov regions, Krasnoyarsk, Krasnodar territory, the Republic of Kalmykia, Udmurtia

https://doi.org/10.15405/epsbs.2021.04.43
Corresponding Author: Anna Urasova
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

The criteria of the presented typology are the level, balance and proportionality of the technological capacity of the region and the industrial structure of the subject of the Russian Federation.

Positioning of the regions in the technological space allows us:

– to identify potentially attractive subjects that require investment in the scientific and innovation infrastructure of industry, or the development of an industrial structure;

– to define the boundaries of technological transformation of regions, without excluding significant relationships with related industries and areas of development;

– to consider each of the regional industrial structures as a part of a single countries' technological system.

Thus, in relation to the economic reality, in our case, to the regional industrial complex, the process of semiotic analysis can be presented as follows (figure 1).

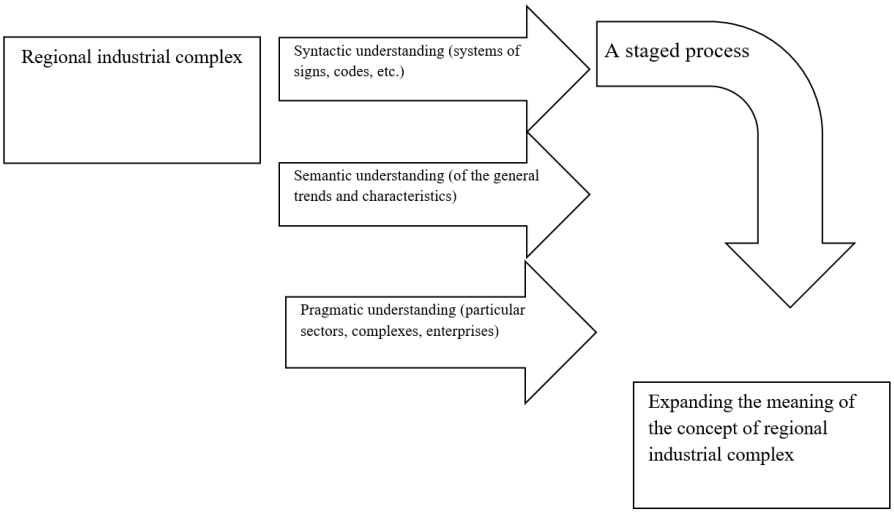

Figure 1. Semiotic approach to the analysis of the regional industrial complex

Thus, the presented calculations and the selected method of quantification of aggregated data produced during the stages are the consistent representation of the development of regional industrial structures as systems of signs in the form of a system of indices, indicators, etc., which form a formal representation of the subject of the research. According to the obtained data, one can conclude that the industrial complex of the region can be represented as a phenomenon by means of diagnostics of general quantitative trends and properties.

7. Conclusion

In conclusion, the main disadvantages of the semiotic approach are the absolutization of the quantitative side of the studied phenomena and processes; the need to search for the quantification methods; the formalization of the analysis process based on the secondary role of connections between signs and codes.

The paper shows the possibilities of the semiotic approach in relation to economic phenomena (in particular, the development of regional industrial structures). The author demonstrates that the approach

tools allow to analyze how the economic process can be described; the applied aspects of applying certain semiotic tools for planning and forecasting the region's economy can be identified. This is especially significant in the context of modern digital reality.

Acknowledgments

The article was prepared in accordance with the Research Plan of the Institute of Economics of the Ural Branch of the Russian Academy of Sciences for 2019–2021.

References

Arkhipov, A. Y., Martishin, E. M., & Zotova, T. A. (2020). Evolutionary genetic Mechanisms of Economic growth and Development. *Journal of institutional Studies*, *12*(2), 100-118. https://doi.org/10.17835/2076-6297.2020.12.2.100-118

Bankov, K. (2020). Cyberbullying and hate speech in the debate around the ratification of the Istanbul convention in Bulgaria: a semiotic analysis of the communication dynamics. *Social Semiotics*, *30*(3), 344-364. https://doi.org/10.1080/10350330.2020.1731175

Bueno, A. M. (2020). On intolerance: semiotic paths. *Entrepalavras*, *10*(8), 40-56.

Chen, W. (2020). War and Its Ideologies: A Social-Semiotic Theory and Description. *Discourse & Society*, *31*(4), 450-452.

George, R. (2020). Simultaneity and the refusal to choose: The semiotics of Serbian youth identity on Facebook. *Language in Society*, *49*(3), 399-423. https://doi.org/10.1017/S004740451900099X

Gilyazova, O. S. (2020). On the Notion of Text and Its Boundaries in the Context of Semiotics and Communication. *Tarih Kultur ve Sanat arastirmalari Dergisi-Journal of history Culture and art Research*, *9*(2), 279-287. https://doi.org/10.7596/taksad.v9i2.2627

Gomez, S. R. (2020). Develop creative intelligence in design: rethinking semiotics. *Bitacora urbano Territorial*, *30*(2), 141-150. https://doi.org/10.15446/bitacora.v30n2.81537

Kletzl, S. (2020). On the Outside of Semiotics. *Constructivist Foundations*, *15*(3), 289-290.

Keunen, B. (2020). Storyworlds and the Semiotic Rules of Narrative Imagination: Peirce and Cassirer as a Starting Point for the Study of Literary World Experience. *Primerjalna Knjizevnost*, *43*(1), 9-30.

LaRiviere, J., Kling, D., & Sanchirico, J. N. (2018). The Treatment of Uncertainty and Learning in the Economics of Natural Resource and Environmental Management. *Review of environmental Economics and Policy*, *1*(12), 92-112. https://doi.org/10.1093/reep/rex021

Monforte, J., Perez-Samaniego, V., & Smith, B. (2020). Traveling Material <-> Semiotic Environments of Disability, Rehabilitation, and Physical Activity. *Qualitative health Research*, *30*(8), 1249-1261. https://doi.org/10.1177/1049732318820520

Olyanitch, A. V. (2019). Information Technologies in Economics: Semiolinguistic Aspect. In E. Popkova, V. Ostrovskaya (eds), Perspectives on the Use of New Information and Communication Technology (ICT) in the Modern Economy. ISC 2017. *Advances in Intelligent Systems and Computing*, *726,* (pp. 630-638). New York, NY: Springer, Cham. https://doi.org/10.1007/978-3-319-90835-9_73

Picione, R. D. L. (2020). The Semiotic Paradigm in Psychology. A Mature Weltanschauung for the Definition of Semiotic Mind. *Integrative psychological and behavioral Science*, *54*(3), 639-650. https://doi.org/10.1007/s12124-020-09555-y

Teixeira, L. (2020). Contributions of Semiotics for the analysis of discourses on the Internet. *Entrepalavras*, *10*(8), 27-39.

Zahariadis, N. (2020). Semiotic analysis and public policy: Connecting theory and practice. *Governance-an international Journal of policy Administration and Institutions*, *33*(3), 722-724. https://doi.org/10.4324/9781351205993

Zlatev, J. (2020). Breaking Out of the Recursive Loop with Cognitive Semiotics. *Constructivist Foundations*, *15*(3), 283-285.