ISSN 0798 1015

REVISTA ESPACIOS

HOME Revista ESPACIOS ÍNDICES A LOS AUTORES

Vol. 38 (Nº 43) Año 2017. Pág. 25

Predicting the Future of Old Industrial Regions, Based on Foresight Studies

Predicción del futuro de las antiguas regiones industriales, basada en estudios prospectivos

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Recibido: 15/06/2017 • Aprobado: 28/06/2017

Content

ABSTRACT:

The paper presents results of the conducted research for predicting the scientific, technological, and economic development of an old industrial region of the Republic of Kazakhstan, such as the Pavlodar region, based on regional foresight studies. The Pavlodar region falls into the category of old industrial regions of the Republic of Kazakhstan and requires technological modernization of large and medium enterprises, which will increase the ratio of manufacturers, focused on advanced processing of raw materials and manufacturing of products with high added value. The paper presents an assessment of the established structure of the region's economy, which confirms the dominance of raw material orientation and an insignificant percentage of sectors that produce end products. The improvement of functioning efficiency and competitiveness of regions in the long term, dictates the need for organizing a consistent vision of the technological future. In world practice, the foresight study technology is used as an instrument for predicting and planning the prospects of regional development. Regional foresight is a method of long-term prediction of the scientific, technological, and social development,

RESUMEN:

El documento presenta los resultados de las investigaciones realizadas para predecir el desarrollo científico, tecnológico y económico de una antigua región industrial de la República de Kazajstán, como la región de Pavlodar, sobre la base de estudios prospectivos regionales. La región de Pavlodar entra en la categoría de antiguas regiones industriales de la República de Kazajstán y requiere la modernización tecnológica de las grandes y medianas empresas, lo que aumentará la relación de los fabricantes, centrada en el procesamiento avanzado de materias primas y la fabricación de productos de alto valor añadido. El documento presenta una evaluación de la estructura establecida de la economía de la región, lo que confirma el predominio de la orientación de las materias primas y un porcentaje insignificante de sectores que producen productos finales. La mejora de la eficiencia de funcionamiento y la competitividad de las regiones a largo plazo, dicta la necesidad de organizar una visión coherente del futuro tecnológico. En la práctica mundial, la tecnología de estudio de prospectiva se utiliza como un instrumento para predecir y planificar las

based on the polling of experts in the areas of socioeconomic and innovative development of the region. The authors describe the results of the conducted regional foresight study, the focus whereof was the regional priorities of innovative development, with the use of the critical technology method in combination with SWOT analysis, polling of experts, and work with focus groups. Based on the determined priorities of scientific, technological, and social development, the paper presents the scenario of development of the Pavlodar region.
Keywords: old industrial region, consequence prediction assessment, scientific and technological development, regional foresight.

perspectivas de desarrollo regional. La prospectiva regional es un método de predicción a largo plazo del desarrollo científico, tecnológico y social, basado en el sondeo de expertos en las áreas de desarrollo socioeconómico e innovador de la región. Los autores describen los resultados del estudio de prospectiva regional llevado a cabo, cuyo foco fueron las prioridades regionales de desarrollo innovador, con el uso del método de tecnología crítica en combinación con el análisis FODA, la encuesta de expertos y el trabajo con grupos focales. Basado en las prioridades determinadas de desarrollo científico, tecnológico y social, se presenta el escenario de desarrollo de la región de Pavlodar.
Palabras clave: antigua región industrial, evaluación de la predicción de las consecuencias, desarrollo científico y tecnológico, prospectiva regional.

1. Introduction

Increasing the functioning efficiency and competitiveness of old industrial regions is relevant for many regions of the world. For such regions, it is important to develop a regional socioeconomic policy as the basis for the innovative transformation system (Matveev et al., 2016).

Old industrial regions under economic modernization can use the experience of developed countries for managing old industrial territories (European regions. Economic consolidation, n.d.; The Ruhr region of Germany, 2008; Kydyrova et al., 2016), which are objects of the national economic policy, and take different measures for improving and modernizing their economy.

According to specialists, an old industrial region is a territory with a dominating industrial sector, including large and medium enterprises with excessive production capacities and outdated technologies and equipment (Tatarkin, 2013; Turgel, 2013; Makogon, 2013). Under modern conditions, the problem of rehabilitation and subsequent development of old industrial regions is crucial for the country’s economic modernization.

Studies, devoted to the functioning and modernization of old industrial territories, regions, and cities, were and continue to be conducted in may developed countries, Russia, Ukraine, and are described in economic literature (Tatarkin, 2013; Turgel, 2013; Makogon, 2013). Based on the analysis of method, used to determine the prospects and future development of territories, the authors concluded that using foresight studies was expedient for determining the modernization areas of an old industrial region’s economy (Reger, 2001; Meissner,2009; Godet et al., 2006).

Scientific literature gives many definitions of foresight. In particular, according to J.F. Coates (Coates, 1985), foresight is a process by which one comes to a fuller understanding of the forces shaping the long-term future, which should be taken into account in policy formulation, planning and decision making... Foresight includes qualitative and quantitative means for monitoring clues and indicators of evolving trends and developments.

Foresight is an effective instrument that ensures the accomplishment of such goals. Foresight studies have been used for several decades. They were first conducted in the USA and Japan in the 1960s and 1970s (United Nations Industrial Development Organisation, 2005).

Foresights were conducted in several countries at various organization levels, including supranational, national, sectoral, regional, and corporate. Their results are used by both governmental and private organizations (Cagnin et al., 2008). In Japan and South Africa, foresight projects ended with their practical implementation in the making of the national and regional policies in the field of innovations and scientific and technological development (Calof, & Smith, 2012), and in the launch of new national and regional research programs, for example, in Great Britain, the Czech Republic, and Poland (Klusacek, 2003; Mazurkiewicz et al., 2012; Czaplicka-Kolarz, 2011). The results of foresight studies affected the existing mechanism of project funding, for example, in Germany and France (Giesecke, 2007; Cadiou, 2003;

Hoffmann, & Rader, 2003).

At present, foresight studies are considered an assessment instrument for scientific achievements and innovative policy, carried out at the national and regional level.

Research purpose – to reveal the essence of prediction of an old industrial region's future, based on the application of the results of regional foresight studies with regard to the economy of Kazakhstan

In order to achieve this purpose the following tasks were completed:

- to generalize the advanced experience in the field of prediction of modernization and fundamental transformations of old industrial territories and regions;
- to generalize foreign experience of conducting foresight studies and to determine the possibilities of its practical application in Kazakhstan;
- to present the results of future prediction of an old industrial region in Kazakhstan, based on the conducted regional foresight.

2. Methods

The theoretical and methodological basis of research is constituted from provisions of the theory of regulation and sustainable development of industrial production in a variety of forms of economic management and integration processes of the development of industrial regions, and works of leading domestic and foreign experts in the field of industrial development. The validity of the research was achieved by the usage of general scientific methods of analysis. Conclusions were developed as a result of generalization of scientific material on the problem of research, as well as the usage of abstract-logical, analytical, concrete-historical, economic and statistical methods, in particular, the method of economic groupings, comparative analysis and expert analysis.

3. Data, Analysis and Results

The transition of Kazakhstan's economy to the innovative path of development under globalization and the increasingly deep integration of the country into global economic relations, and the growth of economic transparency is imperative to the maintenance of sustainable economic growth rate in the mid-term and long-term prospect. In the age of world economy globalization, the basis for the successful positioning of a country, region, or sector consists in constant innovative updating, aimed at achieving maximum productivity, competitiveness, and development of human capital assets. According to existing assessments, from 50% to 90% of gross domestic product (GDP) growth in developed countries is determined by innovations and technological progress. Innovations become an obligatory condition and the main "engine" of development for all sectors of industry and services.

The conceptual Programs of long-term socioeconomic development of Kazakhstan set ambitious tasks – to bring the income of Kazakh citizens closer to its level in developed countries, many-fold increase of labor productivity, winning new positions in world markets, achievement of technological leadership in selected areas, etc. These programs can only be implemented by radical improvement of Kazakhstan's economic competitiveness, based on constant technological updating and qualitative improvement of technological development of its key sectors.

Despite significant investments in education, science, and innovation during recent years, Kazakhstan, unfortunately, continues to lag behind world leaders in the main indicators that determine the level of scientific and technological development. The share of Kazakhstan's high-tech products in export is virtually non-existent; in Russia, it does not exceed 4-5%, while in China, this indicator is 22.4%, in South Korea – 38.4%, in Hungary – 25.2% (Report on the trends in the development, 2011).

The task of creating science-intensive manufactures, the products whereof will be in demand in foreign markets, is relevant. For this purpose, it is necessary to increase the funding research and development (R&D); in Kazakhstan, expenses on science should reach 3% of the GDP by 2030. This step will allow Kazakhstan to reduce the gap between it and the leading countries and to reinforce the fundament of competitiveness (Nazarbayev, 2012).

The Pavlodar region is one of the key industrial regions of Kazakhstan, which has a historically established territorial industrial complex.

The regional economy is characterized by a progressive structure. Industry and agriculture have the greatest ratio in the production of the gross regional product (GRP) – 42.2% and 4.5%, respectively.

The region's share in the country's manufacturing is 11.8% (second place after the Karaganda region – 25.1%).

At the same time, despite a high diversification of the region's economic structure, the leading role in the industry is played by raw material sectors, which produce intermediate products, the ratio whereof in the national output of such products is:

- alumina – 100%;

- ferroalloys – 75.9%;

- motor fuel (gas, including avgas) – 44.9%, kerosene – 38.6%, diesel fuel – 33.3%, fuel oil – 23.3%;

- electric power generation and distribution – 44.2%, heat power – 16.8% (Committee on Statistics of the Republic of Kazakhstan.., 2017).

The established specialization of the regional industrial production indicates the preservation of raw material domination in its structure. The ratio of sectors that produce end products (agricultural product processing, chemical industry) remains insignificant. There is a negative tendency of decrease in the ratio of oil refining and, more importantly, manufacturing of machines and equipment. While the problems of the oil and chemical industry are either solved or being solved, no such changes are observed in mechanical engineering, which is essentially capable of ensuring sustainable dynamic development of the entire region in the long term.

In order to change the existing situation and ensuring the competitiveness of regions and the national economy overall in the long term, it is necessary to organize a consistent vision of the technological future of Kazakhstan in all participants of this process – the government, business, science, and civil society – and try to accomplish set objectives by joint effort. The key role in the organization of this process is played by the government – both as its initiator, and as the guarantor of the execution of reached agreements.

The technology of foresight studies is used in the world as an instrument of prediction and planning of the prospects of regional development. At present, this technology of long-term prediction and planning began to be implemented in active researches between international associations and corporations, with the involvement of the leading experts of countries that significantly affect the development of a respective industry (Lyasnikov, & Dudin, 2013).

Foresight studies pursue greater aims than the examination of trends in certain fields of science and technologies. They are often conducted at the regional and national levels, with a view to determining the economic potential of the scientific and technological areas that are planned to receive investments, in order to support the existing and to develop new production industries.

Ultimately, such projects are intended to examine the future, which is a complicated process of interaction of various interested parties, which accounts for their opinions, expectations, and experience.

Foresight study stages include:

- precise determination of the study purpose;

- involvement of various interested parties in the development of study objectives;
- determination of the executors' areas of responsibility and authority;
- focus on the practical implementation of study results;
- development of a plan for the practical implementation of study results at its early stages;
- effective distribution of information regarding the study progress and objectives, and stimulation of the implementation of obtained recommendations.

The objective of selecting innovative priorities of the region by foresight was accomplished in Kazakhstan for the first time. Therefore, a methodology of their selection was developed at the initial stage, which developed and concretized general approaches and principles of regional foresight.

Regional foresight, which is an adaptation of the strategic prediction methodology to regional problems, is widely used in developed countries. Foresight helps select strategic alternatives of regional development, with account for available possibilities.

Continuity of methodological decisions, used during the selection of priorities of scientific and technological development at the national level, was ensured during the development of the methodology for selecting regional innovative priorities.

In this project, regional innovative priorities were understood as scientific results with a wide range of practical applications, which correspond to the best standards of world and Kazakh researches; promising technologies with the greatest innovative potential; new high-tech products and services with competitive advantages in developing and emerging markets, in which the region's scientific and technological potential can be utilized effectively.

The development of an innovative growth strategy, which assumes a limited choice of regional priorities, is a crucial condition of transition to innovative product manufacturing and reduction of the raw material ratio in export. The active support of said priorities will stimulate the development of the most promising areas, while ensuring the diversification of the economy and its sustainable innovative growth on a qualitatively new basis.

In Kazakhstan, Pavlodar region included, certain aspects of fundamental and applied science are developed under a number of government-funded programs. At the same time, the taken measures are insufficient. It is necessary to admit that the "intermediate" status of many technological solutions and products is Kazakhstan's chance to enter the international system of generation of new knowledge and technologies.

It is important to note that the scale and rate of necessary changes are determined not by the readiness of the Kazakh economy, but by the speed at which these changes occur in the world.

Thus, it is necessary to make decisions regarding a wide range of issues in very short terms.

The authors' analysis and view of the situation are based on the understanding of the fact that the economy, society, and environment will constantly face such trials as:

- the need for sustainable management and use of renewable resources;
- the need for sustainable energy sources;
- climate change;
- constant change of consumer expectations.

Natural resource competition, tension (in volumes and prices) regarding resource reserves can reduce the profitability of traditional industrial sectors and transform the structure of the industry. The forcing of chemical synthesis out of the production cycle and its replacement by biological synthesis is a strategic trend (this process concerns the agricultural and food sector, the production of medicine and various types of energy, etc.).

In foresight studies, experts distinguish the following main trends of scientific and economic development:

- intensification of technological convergence;
- intensification of diffusion of modern advanced technologies into medium-tech sectors of the manufacturing industry;

- growing importance of the multidisciplinarity of scientific researches;
- intensification of the effect of new technologies on management and organization forms of business, which stimulate the development of flexible network structures.

The development of these trends allows developing new materials, suggesting new technological solutions at the intersection of related fields of science and industry. This results in the improvement of existing production processes and personnel competence, and the implementation of resource-saving approaches (Hoffmann, & Rader, 2003).

When determining the areas of scientific and technological development, it is necessary to consider the effect of three dominating trends:

- completion of globalization, integration, and specialization of the world institutional space, its new formation – the knowledge-based economy;
- the developing countries' gaining competitive advantages in the socioeconomic field, in connection with global technological parity;
- acceptance of innovations as a competitiveness factor at all levels of the economy, focus of investments on the advanced technology sector.

The effect of these trends gives ground for optimism regarding the possibility of forming and utilizing the potential of the national high-tech sector as a strategic driving force for the reforming of Kazakhstan's economy and its gaining competitiveness under global integrative development.

Kazakhstan chose to move from the raw material to the high-tech model of development, and to a knowledge-based economy. This strategic maneuver demands joint effort of the government, science, business, and the society in the formation of the national and regional innovative systems and a timely discovery of new fields of knowledge. The analysis of long-term trends in scientific and technological development and timely correction of scientific priorities, based on this analysis, should become crucial elements of management, a mechanism of governmental policy-making in the scientific and technological field, and a guideline for the business strategy of the business sector (The Concept of innovative development, 2013).

From September 1 to November 30, 2014, the first regional science and technology foresight for the determination of possible variants of developing the regional scientific and technological potential was conducted in the Pavlodar region. The objective of the foresight project was not only to obtain prediction materials, but also to form a consistent view of the innovative development prospects in the "key players" that determine the scientific and technological, innovative, and socioeconomic policy of the region. The solution of this task was facilitated by the participation during all stages of the project of executive state body, large industrial enterprises, business, science, and education representatives.

Under the science and technology foresight, a polling titled "Vision of the scientific and technological development of the Pavlodar region up to 2030" was conducted in the region. 80 regional enterprises participated in the polling. The polling objective was to determine the vision of the development of the Pavlodar region up to 2030.

Enterprise managers and specialists acted as experts. The poll suggested assessing the purposes and objectives of the Pavlodar region scientific and technological policy up to 2030, as well as the mega-trends that affect the development of science and technology in Kazakhstan and the Pavlodar region, in terms of their:

- priority;
- implementation period;
- level of effect on economic and social indicators.

Respondents were offered to choose one of the suggested answers that was the closest to their assessment, or to give their own answer.

The expert group determined the priority of various economic sectors for the development of

the Pavlodar region. According to the experts' assessment, the following economic sectors were distinguished as top-priority ones in the Pavlodar region (Figure 1): energy development – 17; mining and metallurgy – 15; chemistry and pharmacy – 13; agro-industry – 10; mechanical engineering – 9.

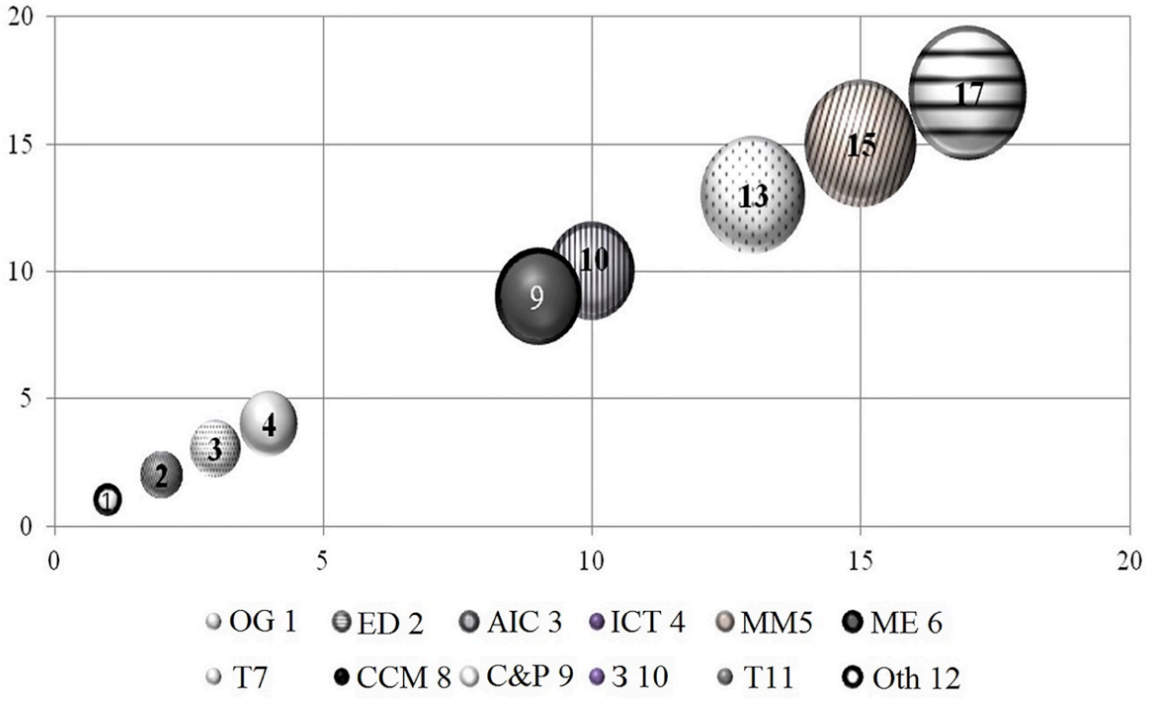

Figure 1. Expert assessment of promising economic sectors of the Pavlodar region
Note: OG1 – oil and gas industry, ED2 – energy development, AIC3 – agro-industrial complex, ICT4 – information and communication technologies, MM5 – mining and metallurgy, ME6 – mechanical engineering, T7 – transport, CCM8 – construction and construction materials, C&P9 – chemistry and pharmacy, T11 – tourism, Oth12 – other
Source: original calculation

During the polling, experts analyzed the conditions of development of various sectors of the national economy and the quality of conditions in the region (Table 1).

Table 1. Expert assessment of the attractiveness and condition quality in the region

Sector	Industry attractiveness	Conditions quality in the region
Energy development	1	3
Oil processing	1	3
Petroleum chemistry	1	2
Agricultural chemistry	2	3
Production of paint and varnish	2	3
Household chemistry	2	2
Coal chemistry	1	3
Ferrous metallurgy	1	3
Non-ferrous metallurgy	1	3

Railroad equipment production	1	3
Agricultural equipment production	2	2
Road and construction equipment production	3	1
Electric appliances production	3	2
Crop growing	3	2
Animal husbandry	3	3
Food production	1	3
Beverage production	2	3
Pharmaceutical production	1	1
Clothing production	3	2
Furniture production	2	2
Construction material production	2	3
Tourism	1	3
Logistics	1	3
Coal and lignin mining	1	3
Non-ferrous metal ore mining	1	2

Source: original calculation

The attractiveness of an industrial sector can depend on the development rate and demand for its products. The assessment of future growth of an industrial sector in the Pavlodar region was ranked from 1 to 3, where:

3 – the industrial sector will have high growth rates, over 5% per annum;

2 – the industrial sector will have average growth rates, 3-5% per annum;

1 – the industrial sector will have low growth rates, under 5% per annum.

According to experts, the promising industrial sectors of the economy in the Pavlodar region are energy development, oil processing, oil chemistry, coal chemistry, ferrous metallurgy, railroad equipment production, food production, pharmaceutical production, tourism, logistics, coal and lignin mining, and non-ferrous metal ore mining.

The favorable conditions for the development of an industrial sector include natural resources, skilled personnel, infrastructure, supplier system, access to the market, etc. The assessment of the Pavlodar region attractiveness was ranked from 1 to 3, where:

3 – all necessary conditions for the development of the industrial sector are available;

2 – certain conditions for the development of the industrial sector are available;

1 – conditions for the development of the industrial sector are virtually unavailable.

4. Discussion

According to experts, the following economic sectors have favorable development conditions in the Pavlodar region (Makogon, 2013): energy development, oil processing, oil chemistry, production of paint and varnish, household chemistry, ferrous metallurgy, non-ferrous metallurgy, railroad equipment production, food production, beverage production, pharmaceutical production, tourism, logistics, coal and lignin mining, and non-ferrous metal ore mining.

Thus, the following areas of the industrial sector are crucial for the scientific and technological development of the Pavlodar region:

- railroad equipment production;
- household chemistry, oil chemistry, and oil processing;
- energy development;
- logistics (inclusion of the Pavlodar region in the food export hub of Siberia and the markets of the Customs Union);
- tourism;
- pharmaceutical production;
- food production.

With a view to developing these areas, the region created a special economic zone (SEZ) of Pavlodar city (46 registered members, total amount of funds required for the creation of the "Pavlodar" SEZ infrastructure is 29 billion tenge). Plans include the creation of an industrial zone, which will allow increasing the availability and quality of the industrial infrastructure for the development of new economic sectors. Governmental programs provide funding for the modernization of existing manufactures, their diversification, and the creation of new enterprises in the promising sectors of the national economy.

The solution of the problem of improving the functioning effectiveness and competitiveness of old industrial regions dictates the need for developing a regional socioeconomic policy.

During the development of a modernization strategy for an old industrial region, it is important to form regional innovative priorities, which are scientific results with a wide range of practical applications, which correspond to the best standards of world and Kazakh researches; promising technologies with the greatest innovative potential; new high-tech products and services with competitive advantages in developing and emerging markets.

The objectives of the foresight project was not only to obtain prediction materials, but also to form a consistent view of the innovative development prospects in the all members of this process (government, business, science, civil society) that determine the scientific and technological, innovative, and socioeconomic policy of the region.

The assessment of purposes and objectives of the Pavlodar region scientific and technological policy up to 2030, the determination of mega-trends that affect the development of science and technology in Kazakhstan and the Pavlodar region, was conducted in terms of their:

- priority;
- implementation period;
- level of effect on economic and social indicators.

5. Conclusion

The conducted research discovered that the key sectors for the scientific and industrial development of the Pavlodar region are as follows:

- railroad equipment production;

- household chemistry, oil chemistry, and oil processing;
- energy development;
- logistics (inclusion of the Pavlodar region in the food export hub of Siberia and the markets of the Customs Union);
- tourism;
- pharmaceutical production;
- food production.

A special economic zone (SEZ) "Pavlodar" was created in order to develop these sectors (46 registered participants, the total amount of funds required to build the infrastructure of SEZ "Pavlodar" is 29 bn. tenge). Creation of an industrial zone is planned, which would increase the availability and quality of industrial infrastructure for the development of new sectors of the economy. A state program is financing the modernization of existing production facilities, their diversification, and creation of new enterprises in promising sectors of the economy.

The results can be the basis for making evidence-based decisions in the field of modernization and management of Pavlodar region, and other regions, which have similar industry structure, the Northeastern region of Kazakhstan as a whole. In addition, the results may be useful in conducting a comparative analysis of the situation in regions of different countries with similar characteristics.

Acknowledgement

The article was written with the support of the grant of the RK Ministry of Education and Science, Project 3931 / GF4.

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Revista ESPACIOS. ISSN 0798 1015
Vol. 38 (Nº 43) Año 2017
Indexada en Scopus, Google Schollar

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