Algerian Pharmaceutical Industry: Prospective Structural Analysis Using MICMAC Method

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Abstract:

This work aims to determine the key variables that control the development of the Algerian pharmaceutical industry in the long term using structural analysis by MICMAC method. After listing the variables, filling in the matrix of direct influences, and analyzing the indirect potential plan we select the key variables, which are Research and Development, Consumption, innovation, the level of production, production costs, and marketing / sales. We can add other regulatory variables such as human capital, partnership with foreign countries, research costs, prices and investment.

Keywords : Foresight; Pharmaceutical industry; Structural analysis; MICMAC; Algeria.

JEL classification codes : I28; I52.

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الصناعة الصيدلانية الجزائرية: دراسة استشرافية عن طريق تقنية ميكماك للتحليل الهيكلي

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الملخص:

يهدف هذا العمل إلى تحديد المتغيرات الرئيسية التي تتحكم في تطور الصناعة الصيدلانية الجزائرية على المدى الطويل باستخدام التحليل الهيكلي بطريقة MICMAC. بعد جمع ووصف المتغيرات ، وملء مصفوفة التأثيرات المباشرة ، وتحليل المخطط غير المباشر نقوم بتحديد المتغيرات الرئيسية ، وهي: البحث والتطوير ، الاستهلاك ، الابتكار ، مستوى الإنتاج ، تكاليف الإنتاج ، والتسويق / المبيعات. يمكننا إضافة متغيرات تنظيمية أخرى مثل رأس المال البشري والشراكة مع الدول الأجنبية وتكاليف البحث، الأسعار والاستثمار.

الكلمات المفتاحية: استشراف؛ صناعة صيدلانية؛ تحليل هيكلي؛ ميكماك؛ الجزائر.

رموز تصنيف JEL: I28؛ I58 .

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Introduction

The pharmaceutical industry including drug markets represents one of the most important industries in the world, not only because of the importance of drugs and medicine generally to human health, but also because of the Allocated budgets to research and development, and the resulting fantastic profits achieved.

The drug market in Algeria are relatively advanced compared to other markets, but it faces great challenges, including the status of medicine at the international level, global, regional and even national context, and last but not least, the multiplicity of importers.

The drug market in Algeria is new and is still in its early stages. The Public Pharmaceutical Corporation SAIDAL controls this field through its various production units distributed across some states.

Pharmaceutical Industry Characteristics

The pharmaceutical industry have many characteristics (Cockburn, 2004):

- The pharmaceutical industry requires huge capital, as research in this area requires a huge budget that many countries cannot afford.
- The pharmaceutical industry is one of the most regulated industries in the world, where prices and compensation are determined by legislation and laws developed by governments and health authorities.
- High productivity due to the high consumption of the drug.
- Dynamic distribution system.
- Strong specialization and high skills.
- Very competitive.

Historical development of the pharmaceutical industry in Algeria

Algeria inherited an infrastructure for the pharmaceutical industry. This structure covered the needs of the colonists and very few indigenous people.

The pharmaceutical industry has undergone three stages (Nadira & Amina, 2017):

The stage of direct management by the health administration:

This period were administrated by the Central Pharmacy and the Ministry of Health. The Algerian Central Pharmacy was established in 1969, and the aim of its establishment was ensure the state monopoly of import, manufacture and marketing of pharmaceutical products.

The stage of economic reforms:

The central pharmacy turned into four government institutions. Each institution has a specific role. The local manufacture of medicines, the import and distribution of medicines, and the importation of medical devices and supplies.

The stage of openness:

At this stage, Algeria has known the establishment of many foreign agencies in a number of economic activities. In addition, an association agreement with the European Union was signed.

Obstacles to access to the pharmaceutical industry

The drug market in Algeria is difficult to study and analyze due to the absence of accurate statistics in the field of production, distribution and consumption. Drug market in Algeria is a monopolistic market. There are many barriers to entry (Ziani, 2021):

Industrial Property Problem

The problem of industrial real estate is very difficult in Algeria, even at the political level.

The scarcity of researchers specializing in pharmacology

The Algerian University contributes only to the formation of pharmacists who are not familiar with the various sciences of pharmacology.

Banking system and loan polic

The pharmaceutical industry suffers from a lack of banking incentives and facilities in granting loans to investors in the industry.

Pricing Policy

The state determines profit margins that remain unsatisfactory for producers on the one hand, and large taxes on the other.

Previous studies

Studies and research on the pharmaceutical industry are very low because this sector is characterized by secrecy and lack of statistics. We mention some foresight studies that analyses directly or indirectly the pharmaceutical industry, health policy and drug markets.

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The first is in France, in which (BARTOLI, 2001) try to have a vision of the pharmaceutical industry and to propose scenarios of evolution of the sector to medium term at national level in France, and its consequences for organizations and unemployment reduction. The conclusion of this work consists of a series of concrete recommendations in support of changes in the health industries, unemployment reduction and skills.

The second focus on the psycho-pharmaceutical industry (Ragan, 2007). This Foresight project try to find out the views of the pharmaceutical industry on the use of psychoactive substances in the future. A questionnaire was sent to 16 pharmaceutical and biotechnology companies in order to solicit their views on the types of psychoactive substance that could be discovered within the next 20 years, and the changes to societal attitudes and business practices that would be needed to make these drugs available to patients and the public.

The third study by (de Mesa & Muñoz, 2007) try to realize a foresight exercise on biopharmaceuticals with the aim of solving or at least reducing, the failures of this Spanish sectorial system of innovation and in consequence making it stronger.

The fourth study analyze the drug prices evolution in Finland (Lintonen et al., 2014). The Drugs 2020 study aimed at explore changes in the situation of the drug market in Finland by the year 2020 using the Delphi survey. Drug experts of the EU national network in Finland are participated in the study. As a result, no consensus was reached on how drug prices will develop in the future.

The fifth study by (Foster, 2008) is a symposium organized by the Canadian Society for Pharmaceutical Sciences Satellite, 2008, Canada. The symposium brought together a group of clinicians, regulatory scientists, researchers and students to examine where clinical, pharmaceutical, and regulatory science might be in 10 to 15 years. Industry, regulatory, analytical, and clinical perspectives were presented and discussed, as well as the impact of exogenous (indirect) and endogenous (direct change drivers).

The sixth study by (Barbosa et al., 2016) aims to analyses the changes in pharmaceutical industry dynamism, and investigate the multilevel resources, capacities and institutional aspects that influence the level of exports of companies in Colombia's pharmaceutical sector.

The seventh study by (Kisa, 2006) aims to analyze the current structure of the Turkish pharmaceuticals industry to explain the latest developments and to offer some perception into the likely policy issues that this sector will face.The state determines profit margins that remain unsatisfactory for Turkish pharmaceutical firms on the one hand, and large taxes on the other.

As a conclusion to this part, the previous studies use many foresight techniques including MICMAC technique, because some studies are in advanced stages of analysis, while our study is

in the beginning, and we will continue our work to analyses behaviors of actors related to this sector in Algeria, and try to explore the several scenarios of its evolution in the future. In the other hand, the difference between the aforementioned studies is the horizon, which is in our study 15 years, and in the others between 5 and 25 years.

Method

The method used in our study is the structural analysis using MICMAC technique.

Origin and evolution of the structural analysis

The origin of the first justifications of structural analysis appeared in the works of Jay FORRESTER in 1961. In addition, the Structural analysis is based on Leontief's input-output matrices, on the theory of graphs and the simulation exercises in the USA to fulfil American army requirements (Godet, 2000).

Description of the structural analysis method

Structure analysis is carried out by a working committee consisting of experts in the field related to the subject under study. The members of foresight team does not generally exceed 15. The following phases of structural analysis are as following:

Phase 1: Listing variable: The first step consists in listing all the variables that characterize the system. The list of variables does not generally exceed 70 or 80 variables. Then, we give a precise definition for each variable (Godet, 1986).

Phase 2: **description of the relationships between variables:** The filling in the matrix allows starting a dialogue and exchange of views about the subject under study between the members team (Chine & BALOULI, 2017).

With regard to the degree of the influence between variables, there are four levels:

1. 0: no direct influence.
2. 1: low direct influence.
3. 2: medium direct influence.
4. 3: high direct influence.

P: Potential direct influence in the future.

Phase 3: Identification of the key variables with MICMAC: This phase consists in identifying the key variables that are essential to the system's development, first by using direct classification, then through indirect classification.

Results and Discussion

Many experts from high national school of statistics and applied economics (ENSSEA), National Institute of Agronomic Research of Algeria (INRAA) and Center for Research in Applied Economics for Development (CREAD) are participates in the study.

List of variables

Thirty-one variables are selected in many contexts: technological, economic, social and law. We give for each variable a precise definition: quantitative or qualitative, percentage or quantity.

Table N°1
List of variables

N°	INTITULE LONG	INTITULE COURT	THEME
1	Innovation	Innovation	Technological
2	Research and Development	R&D	Technological
3	Research costs	Res_costs	Technological
4	Investment	Investment	Technological
5	Human capital	Hum_cap	Technological
6	Production	Production	Technological
7	Production costs	Prod_costs	Technological
8	Marketing / Sales	Mark_sales	Economic
9	Logistics	Logistics	Economic
10	Distribution	Distributi	Economic
11	The consumption	Consump	Economic
12	Care offer	Care offer	Economic
13	Exports	Exports	Economic
14	Imports	Imports	Economic
15	Specialized formation	Formation	Economic
16	Chronic Diseases	Diseases	Economic
17	Competition	Competitio	Economic
18	Alternative Medicine	Alt_Medicn	Economic
19	The prices	Prices	Economic
20	Professional practices	Prof_Prac	Economic
21	Social Security	Soc_Sec	Economic
22	Partnership with foreign countries	Partnrship	Economic
23	Bank support	Bnk_suport	Economic
24	Legislation	Legislatio	Law
25	Natural resources	Nat_Res	Economic
26	Added value	AV	Economic
27	Seasonal production	Seas_Prod	Economic
28	Population growth	Pop_growth	Social
29	National Income per capita	NI_capita	Economic
30	Urbanization	Urban	Social
31	Aging of the population	Aging_Pop	Social

Source: MICMAC outputs

Filling in Potential Direct Influences Matrix

The next step is the filling in the matrix of direct influences using a dialogue between the experts participating in the analysis. Five levels are used to evaluate the influences between variables: 0, 1, 2, 3 and P.

Table N°2
Potential Direct Influences Matrix

	1 : Innovation	2 : R&D	3 : Res_costs	4 : Investment	5 : Hum_cap	6 : Production	7 : Prod_costs	8 : Mark_sales	9 : Logistics	10 : Distributi	11 : Consump	12 : Care offer	13 : Exports	14 : Imports	15 : Formation	16 : Diseases	17 : Competitio	18 : Alt_Medicn	19 : Prices	20 : Prof_Prac	21 : Soc_Sec	22 : Partnrship	23 : Bnk_suport	24 : Legislatio	25 : Nat_Res	26 : AV	27 : Seas_Prod	28 : Pop_growth	29 : NI_capita	30 : Urban	31 : Aging_Pop
1 : Innovation	0	3	3	3	2	1	0	1	0	0	0	1	2	P	1	2	3	2	3	P	3	2	0	0	2	2	0	0	0	0	0
2 : R&D	2	0	3	3	2	2	2	2	0	0	2	1	3	1	1	2	3	2	0	0	P	3	3	1	3	2	P	0	0	0	0
3 : Res_costs	2	3	0	3	2	1	2	0	0	0	0	0	2	2	1	1	0	0	2	0	1	0	2	1	0	1	0	0	0	0	0
4 : Investment	3	3	3	0	1	1	0	0	0	0	0	1	2	1	0	0	2	0	0	0	0	1	2	0	0	1	0	0	0	0	0
5 : Hum_cap	2	3	1	0	0	3	2	1	1	1	3	1	0	0	3	0	2	1	0	1	0	0	0	0	2	3	3	0	1	1	0
6 : Production	0	1	0	1	0	0	3	3	3	3	3	3	3	3	0	1	3	0	3	2	0	1	2	0	0	0	0	0	0	0	0
7 : Prod_costs	0	1	1	1	0	3	0	0	2	2	3	3	3	3	1	1	3	2	3	2	2	1	2	1	0	1	1	0	0	0	0
8 : Mark_sales	1	0	1	1	1	2	2	0	0	0	3	2	2	2	1	1	3	2	2	1	0	1	1	0	0	3	1	0	0	0	0
9 : Logistics	0	0	0	0	2	2	1	2	0	3	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
10 : Distributi	0	0	0	0	0	3	3	0	3	0	1	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 : Consump	0	0	0	0	1	3	3	1	0	0	0	2	2	2	0	2	2	1	3	1	3	0	0	0	0	0	3	0	1	0	0
12 : Care offer	0	0	0	0	3	1	1	1	1	1	2	0	0	0	1	2	1	1	1	1	1	0	0	0	0	0	0	0	0	3	0
13 : Exports	0	1	0	0	0	3	1	1	1	1	0	0	0	3	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0
14 : Imports	0	1	0	0	0	3	1	1	0	0	1	1	3	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0
15 : Formation	3	3	1	0	3	1	2	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
16 : Diseases	2	2	0	0	0	0	3	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
17 : Competitio	3	3	0	0	0	3	0	1	0	0	0	0	2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
18 : Alt_Medicn	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
19 : Prices	0	0	0	0	0	2	1	2	0	0	3	0	1	1	0	0	3	0	0	1	1	0	0	0	0	0	0	0	0	0	0
20 : Prof_Prac	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	P	1	0	0	0	0	0	0	0	0	0	0	0	0	0
21 : Soc_Sec	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	2	0	0
22 : Partnrship	3	3	2	3	0	1	1	1	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0
23 : Bnk_suport	0	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 : Legislatio	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	3	0	1	0	1	0	0	0	0	0	0	0	0
25 : Nat_Res	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
26 : AV	2	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 : Seas_Prod	0	0	0	0	0	1	1	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 : Pop_growth	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29 : NI_capita	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
30 : Urban	0	0	0	0	0	0	0	0	2	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 : Aging_Pop	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0

Source: MICMAC outputs

Characteristics of the matrix of potential direct influences

Table N°3
Potential Direct Influences Matrix characteristics

INDICATEUR	VALEUR
Taille de la matrice	31
Nombre d'itérations	3
Nombre de zéros	648
Nombre de un	151
Nombre de deux	78
Nombre de trois	79
Nombre de P	5
Total	313
Taux de remplissage	32,57024%

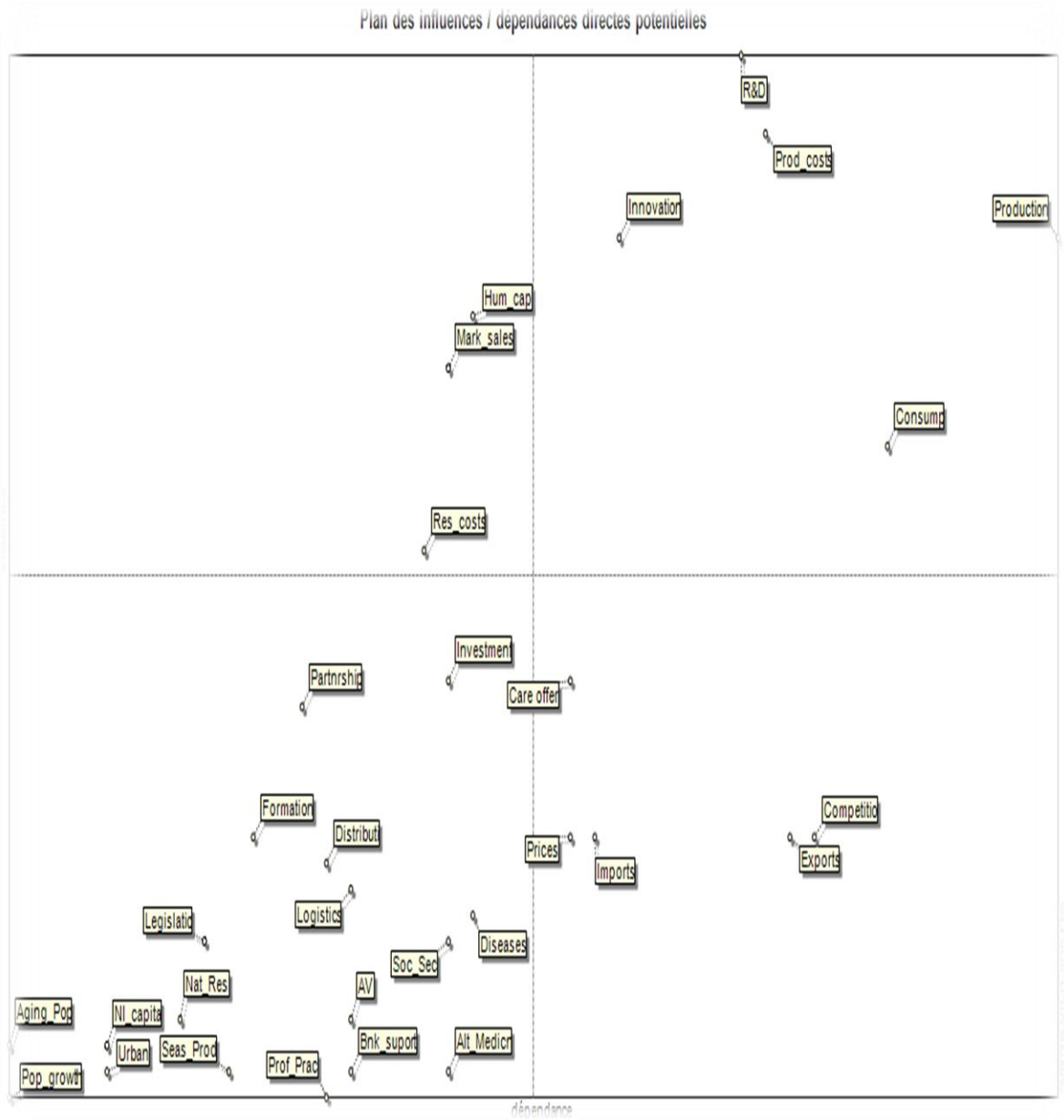
Source: MICMAC outputs

The 32, 57% fill rate reflects the direct influences between system variables. This rate is near to 30%. It is considered a good rate of filling. The rest 67, 43% represents the indirect influences between the variables of this system, of which the rest of the MICMAC method is based.

Potential Direct Plan

The potential direct plan results from the short interplay of relationships between variables. The horizon analyzed by this plan is less than five years.

Figure N° 1
Potential Direct Plan



Source: MICMAC outputs

We have four sectors of variables: **Sector B (top left)**: which regroups the variables human capital and marketing / sales. These input variables or determining variables are very influential

and less dependent on the evolution of the other variables of the system. These variables control and condition the evolution of the system.

Sector A (top right): regroups the variables innovation, research and development, production costs, the level of production and consumption. In this sector, we find the key variables or the relay variables; they are both very influential and very dependent. These are sensitive variables and should be carefully monitored for the development of scenarios and strategies.

Sector D (bottom left): regroups variables urbanization, seasonal production, national income per capita, natural resources, population growth and aging of population. These variables are excluded; they are both less influential and less dependent.

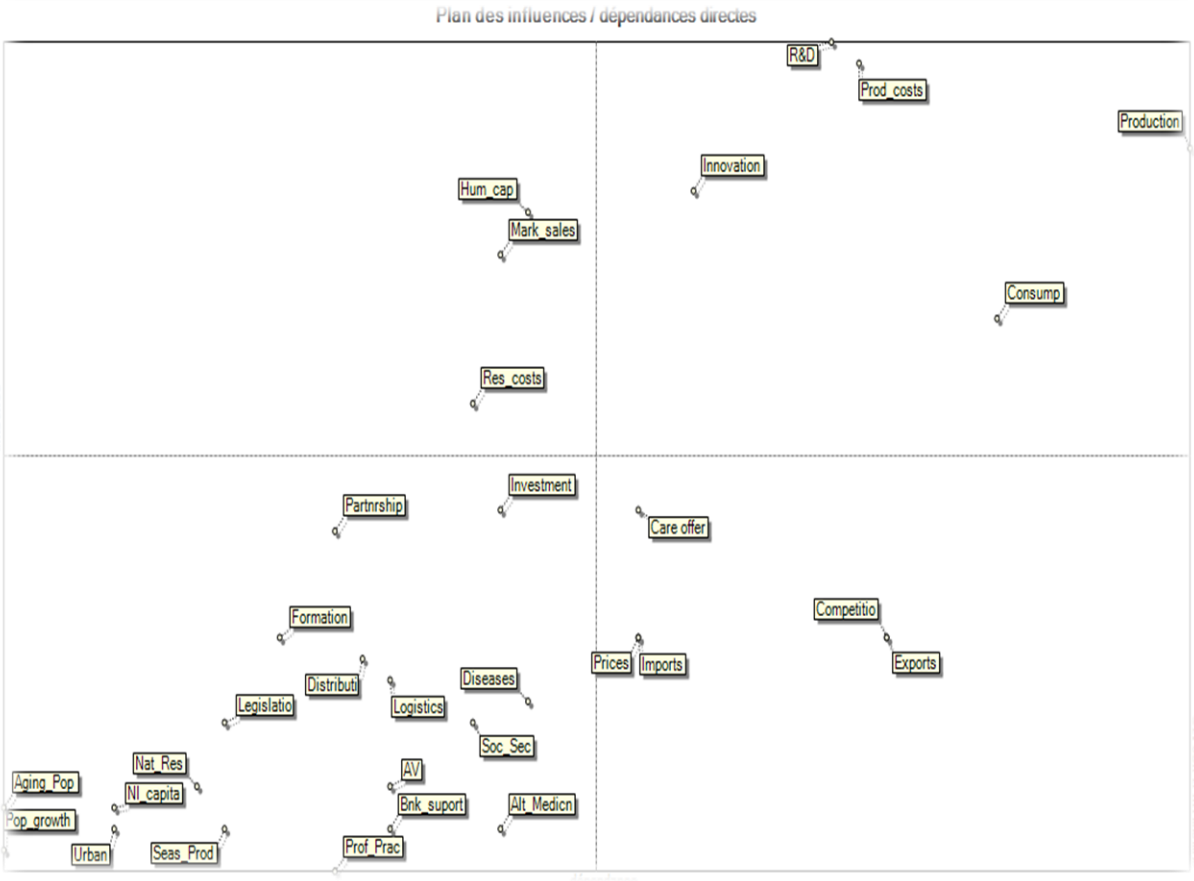
Sector C (bottom right): Middle cluster variables. These variables are averagely influential and/or dependent variables. We can say nothing about these variables in the short term. These variables are investment, partnership with foreign countries, care offer, prices, imports, exports, competition, logistics, legislation, Added Value, bank support, professional practices, distribution, alternative medicine, formation, social security and diseases.

The next step is replacing P by one.

Direct Plan

The next plan is the direct plan:

Figure N° 2
Direct Plan



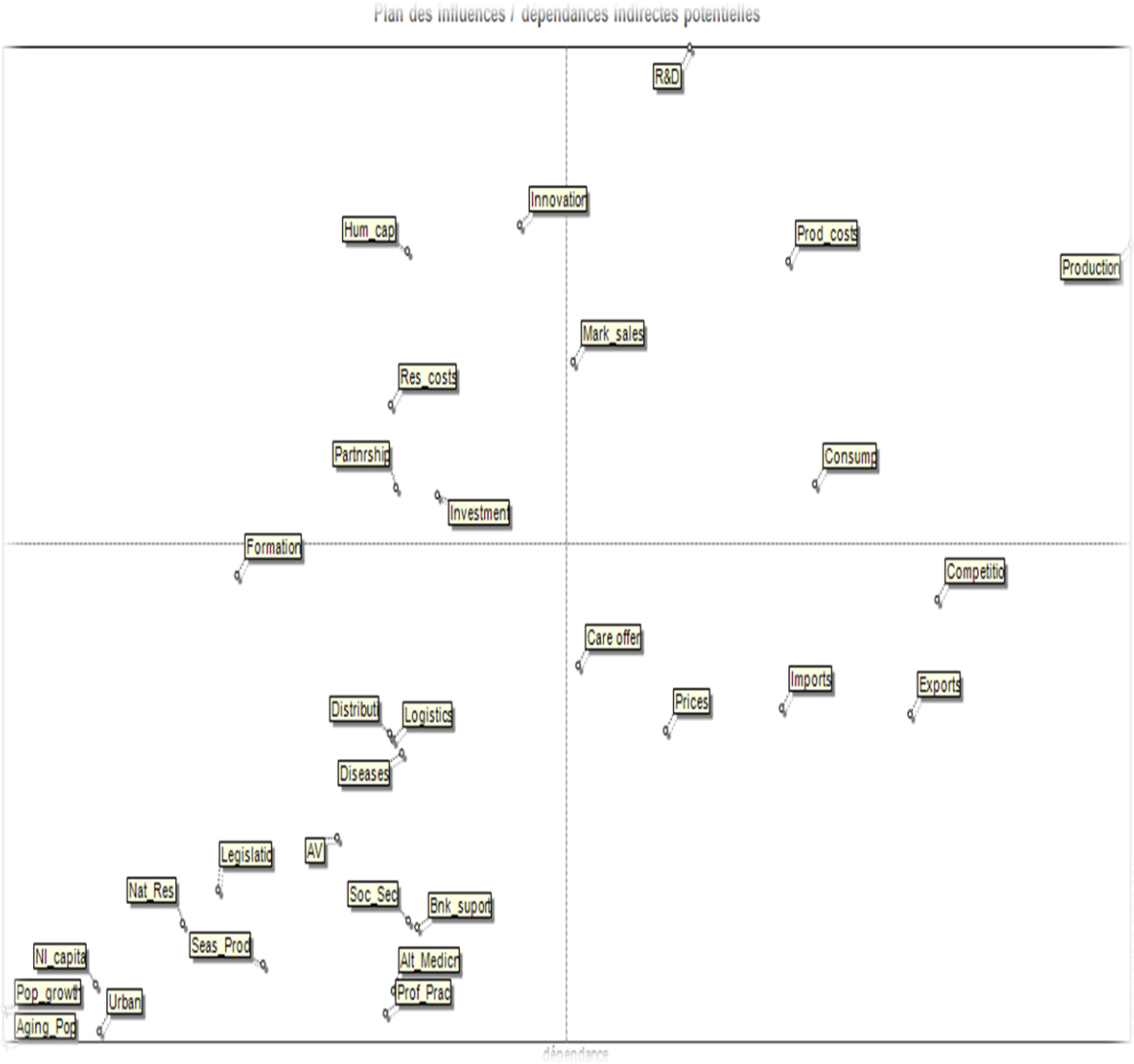
Source: MICMAC output

The direct plan results from the short to medium interplay of relationships between variables. The horizon analyzed by this plan is between five and ten years. There is no change regarding to the potential direct plan; the position of variables is the same.

Indirect Potential Plan

The most important plan is the indirect potential plan

Figure N° 3
Indirect Potential Plan



Source: MICMAC outputs

The indirect potential plan results from the long interplay of relationships between variables. The horizon analyzed by this plan is more than ten years. The interpretation is the same as before.

Conclusion

Structural analysis is a tool for structuring a collective ideas that allows us to describe a system using a matrix linking all its constituent elements (variables). The purpose of the method is to provide a comprehensive representation of the system as possible, and to reduce the complexity of the system to key variables and relationships.

Research and innovation are major levers to meet the challenges of the present, to anticipate those of tomorrow, and to develop the competitiveness necessary for the economic balance of the pharmaceutical sector in Algeria.

The development of inter-laboratory collaboration at the pre-competitive research stage would be a good way to foster creativity and build national or international partnership relationships. Indeed, it is necessary to Algeria:

- To increase the international openness of research activities.
- Encourage companies to invest in research and development.
- Encourage the transfer of knowledge.
- Develop competitiveness clusters involving companies, laboratories, universities and local authorities around research centers and equipment.

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