The innovation potential and the innovation impact in Romanian firms

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Abstract

This paper presents some results regarding the innovation impact estimation in innovation potential at the firm level. The source data is represented by a dedicated Survey applied in firms in 2005, representatively at national level. The aggregate Index of the innovation potential is estimated through a specific methodology served to deter the innovation impact into the innovative firms relatively to non-innovative firms. Among the main results we mention the tendencies registered at firm's level to add in the same time to product and process innovation objectives the organisational and marketing innovation objectives.

Key words: innovation process, innovation impact, management of innovation.

JEL Classification: O, O31, O32, O33

1 Introduction

Romania is a country "with innovation performance well below the EU average"[1], is presented in the EIS 2009 Report, under the revised methodology as **catching up country** that have been improving their performance the fastest in its group.

In this paper we make reference at the innovation performance of Romania, described in terms draw by the previous methodologies, our reference year is 2005. In that context, the innovation performance of Romania was at the base level: a) EIS[2] - European Innovation Scoreboard 2005, where Romania had the 33 rank from 34; b) EXIS - Exploratory Approach to Innovation Scoreboards 2005, where Romania had the 22 rank in the picture of the structure of innovation capabilities (using indicators that differentiate between styles or *modes* of innovation). Regarding the important difference between inputs of innovation and the innovation performance of the Romanian firms there was the origin of the research idea: where into the innovation process could be identified the problem that could explain the weak ability of firms to translate innovation inputs into innovation outputs.

Starting with the guidelines and concepts definition stated in **Oslo III 2005** [3] we built a method for innovation potential measurement in the Romanian enterprises. Oslo Manual points in the Annex: §487, §489, §492, § 493 paragraphs factors and conditions for the innovation surveys in developing countries concluded in some specific needs. The innovation potential at firm's level represents a priority for the improvement of innovation strategies development in Romania in perspective of enhancing the innovation performance.
Our contribution is represented by innovation potential estimation based on the Aggregate Index of the Innovation Potential at firm level AIIPF, with theoretical maximum value and estimated values. The AIIPF was calculated through a specific methodology through a specific methodology with the source data the indicators developed into a dedicated Survey applied in firms in 2005, representatively at national level.
We present as the main research results – expressed into national average values for Romania in 2005:

a) the observed impact of innovation into the innovation potential at firm level
b) the degree of realisation of the average innovation potential.

2 Innovation Potential at firm level

2.1. Why to study the innovation potential at firm's level?

New demands induced by the new significant factors as technical and scientific progress and globalisation affects also the firm. In this picture the importance of innovation becomes crucial. The evolution of work could be regarded as a history of innovation. Under the innovation theory could be re–evaluated some events. So, since the dawn of industrialisation era there was also manifested the innovations in work organization (studies initiated by **Frederick Winslow Taylor** and **Frank Bunker Gilbreth, Sr**). Almost in the same time with the increased complexity of mass production process development there was crystallised the scientific management, technology management, system integration and automatisation. In the industrialised era the **„quest was for the control of the movement and time"**. After the transition to the post industrial era the **"quest turn out to be for the control of the new"** and this becomes the centre of the preoccupation. This evolution bring in the light of interest the strategic innovation, knowledge management, creativity and innovation management. Innovation and innovation potential is a problem of the innovation management. If the innovation performance is the result of the innovation potential degree of realization, then the way to understand the innovation process could be important some questions like: the correlation between innovation potential and innovation performance, solution to increase the innovation potential and the maximization of the its degree of realization. The innovation management or the management of innovation include also planning, scheduling, and coordination **methods, standards, and the organization of process innovation in view to develop innovation process inside and outside of the organisation. „**The focus of innovation management is to allow the organization to response to external or internal opportunity, and use its creative efforts to introduce new ideas, processes or products".[4]
The innovation potential at national and regional level represents a priority for the improvement of innovation strategies development in Romania in perspective of enhancing the general innovation performance. Through assuming this strategic objective means also to develop innovative policies packages adequate with the specific Romanian background and with the actual stage of its socio-economical development. In the view of improving the low innovation performance is a must to adequate the strategies with the accurate instruments.
The scope of this research is represented by creating a general view / radiography of the Romanian firm's innovation potential, equally for innovative and non innovative ones regarding the upstream of innovative process flow– with or without achieving innovation

results mainly using as the starting point the paragraph: §505. A particular subject of interest in developing countries is the "potentially innovative firm". Innovation-active firms are those "that have had innovation activities during the period under review, including those with ongoing and abandoned activities". [3] Potentially innovative firms are a subset of these, those that have made innovation efforts (i.e. conducted innovation activities) but have not achieved results (innovations) during the period of analysis.

2.2. Aspects that characterise the "Methodology of statistical survey organisation developed for measurement of the innovation potential in firm in Romania 2005 - INOFVOR"

In view to reach the mentioned scope of portrayal the actual situation of the innovation capacity and innovation potential, we develop and apply in the firm a survey at the national level. We used a Simple random sampling (SRS) without replacement (in the hypothesis that the variable observed are independently and identically distributed (iid) random variables) with stratification (see Annex 1 coverage).

a. Coverage (see Table 1)

The target population of statistical survey on innovation potential was the total population of enterprises in industries and services, Market Services, Non-market services (L + M + N)

The enterprises were selected according to size-classes (by number of employees), unit (percentage and absolute value), classification of economic activities (in accordance with NACE Rev.1) and innovation indicators (performance innovation indicator turnover/employee).

b. Registration methods: The information was registered in the statistical survey using the questionnaires in only face to face interview.

Data collection and processing was made by CURS Centre for Urban and Regional Sociology during the observation period: 26 October -17 November 2006. Results have been released in December 2006.

c. Reference period

2003-2005 is the period for which the data are registered in the statistical survey questionnaire.

2005 was used as a reference year for an important part of the questions.

d. Sample of statistical survey

The statistical survey on innovation potential is carried out on a sample of 2000 enterprises (out of total 45382 number of active commercial societies in 2005, enterprises having over 10 employees), with a response rate of 44,72%.

d.1. ***Sample extraction***

The sample extraction was made by INS in the specialised department, out of statistical business register - REGIS- active enterprises with legal entity, having 10 employees and over which carry out their activity in industry and services (both in market and non market services), according to the coverage of the statistical survey mentioned at point a.

The nomenclature of enterprises is created form an exhaustive zone (enterprises having over 1000 employees) and a selective zone (enterprise having 10-100 employees).

We point out that for the non-market services, L, MA, NA sectors there almost exhaustive inclusion of the units (enterprises having over 10 employees).

Enterprise size is evaluates by average number of employees in the reference period.

Number of employees/ size of enterprise: *10-49 small enterprises; 50-249 medium enterprises; 250 -1000 large I enterprises; 1000 and above large II enterprises.*

So, the sample was built in strata using as stratification variables: a) NACE sub-divisions; b) enterprise size (10-49, 50-249, 250 -1000, 1000 and more employees) according the number of employees (at the end of 2005); c) it was included also the regional aspect.

e. Main characteristics of the innovation potential questionnaire

In our research we designed a **questionnaire for "Potentially innovative firm evaluation in Romania** (breakdown by sector and industries)" with the conceptual structure presented in the Figure 1:

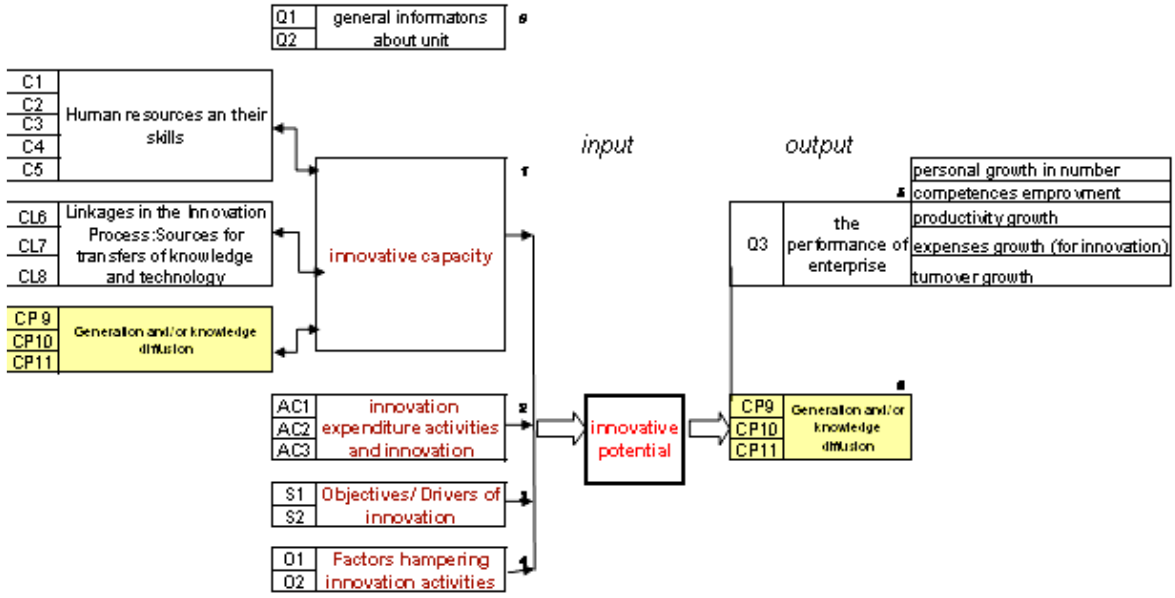


Figure 1 The conceptual structure of the questionnaire shaped in view to measure the innovation potential in firm

Main characteristics of the innovation potential questionnaire

e1. concepts stated in CIS 4 (CIS3);

e2. based on the Oslo Manual III, 2005 and Oslo Manual II, 1997;

e3. 18 questions structured in 4 blocks:

The blocks I to IV represents synthetic the innovation potential:

I. ***innovative capacity***

I.a. ***Human resources*** *and their skills;*

I.b. Linkages in the innovation process (sources for transfers of knowledge and technology);

I.c. Linkages in the innovation process (generation and/or knowledge dissemination);

II. ***innovation activities development,***

III. ***innovative objectives and the strategic perspective of the enterprise face to face the innovation target;***

IV. ***factors hampering innovation activities (****Factors hampering the transition of the enterprise from the non-innovative stage into the innovative one, the evidence of the adequate stimulus/ incentives for the innovation processes acceleration at microeconomic level;*

f. The survey for innovation potential measurement in Romania (for the year 2005) includes some n**ew issues** like:

f1. the measurement of the innovation with principal items for innovation process (including all 4 types of innovation: process, product, organisational and marketing)

f2. the measurement of the innovation in new coverage domains: **both in market and non market services (L + M + N)**

Difficulties:

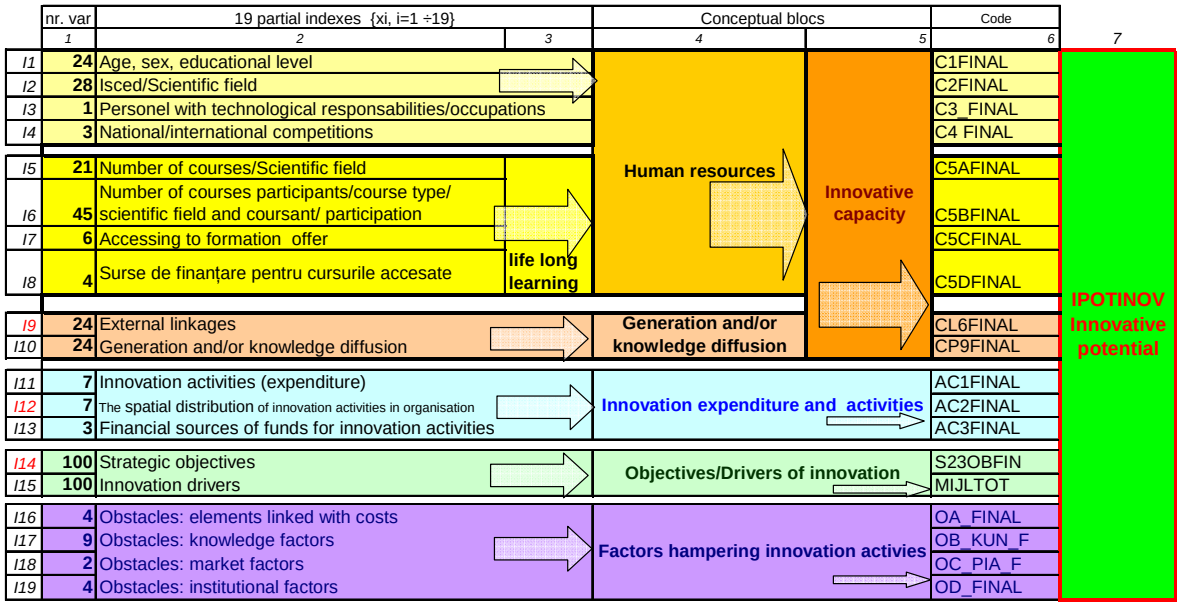
- *data for turnover are affected by a large scale of non responses*
- *concept validation and crystallisation*

⏭ *developing adequate instruments for including non-market services in the innovation process;*

f3. measurement of the innovation including the enterprise strategy and also means of implement it through innovation activities;

2.3. Some aspects Methodology of the Innovation Potential Index

The detailed aspects regarding the measurement and the constructing the **Innovation Potential Index was published** CIUCĂ V., LINCARU, C., ATANASIU D., ALEXEVICI N., OLARU P., PREDONU M in 2007*[5]*. Based on "*HANDBOOK ON CONSTRUCTING COMPOSITE INDICATORS: METHODOLOGY AND USER GUIDE" we build the Innovation Potential Index.[6* The constructing composite of the **Innovation Potential Index was based on** Weighting and aggregation method. We opted to apply the simple linear aggregation and for this purpose we identified the independent variables (with a low level of correlation) base on the fact that „…When using a linear additive aggregation technique, a necessary and sufficient condition for the existence of a proper composite indicator is *preference independence*", (Debreu, 1960; Keeney and Raiffa, 1976; Krantz …1971 [5]). At this step was resulted 19 partial indexes {xi, i=1 ÷19} (see figure2)



416

Figure 2 Blocurile conceptuale şi caracteristicile principale ale variabilelor care participă în construirea indicilor parțiali şi indexului potențialului de inovare

The methodology includes also some theoretical hypothesis of the concepts and definitions used in this research, harmonised with the international practice:

a) „A firm is innovative if it conducts at least one innovation activity**"** reformulated from "An innovative firm is one that has implemented an innovation during the period under review." OSLO II §152

b) The Index of the Innovation Potential in firms does not contain indicators that characterise the innovation results.

Based on these assumptions, in our methodology the identification of an innovation activity is validated by the innovation input method of measurement and not by the innovation output alternative method. The innovation input method considers that an innovation activity is conducted if the firm allocate expenditures in view to conduct the respective innovation

activity (expenditure for innovation activities comprises current and capital expenditure incurred for the innovation activities OSLO II §351,).
The innovation activities measured (OSLO II §351, excluded the activities **Acquisition of other external knowledge, Market preparations for product innovations**) in our study are:

Innovation activity 1. AC_1: Intramural R&D;
Innovation activity 2. AC_2: Acquisition of extramural R&D;
Innovation activity 3. AC_3: Acquisition of machinery, equipment and other capital goods;
Innovation activity 4. AC_4: Other preparations for product and process innovations;
Innovation activity 5. AC_5: Training;
Innovation activity 6. AC_6: Preparations for marketing innovations;
Innovation activity 7. AC_7: Preparations for organisational innovations.

After the innovation activities typology (the 7 innovation activities presented above), based on Table 2 and Table 3 we built a firm typology with 9 types of firms:

Innvoation firm type 1. „**any innovation activity**" –firms that conduct at least one innovation activity (at least one innovation activity from our list with 7 items;
Innvoation firm type 2. **MAXINOV** – firms that conduct maximum of innovation: or/and the 4 types of innovation activities (using the OECD definition) product and process innovation, or marketing innovation or organisational innovation**;**
Innvoation firm type 3. **AC1_467:** firms that conduct "**and/in the same time**" product and process innovation, "**and/in the same time**" marketing innovation "**and/in the same time**" organisational innovation;
Innvoation firm type 4. **AC1_46 :** firms that conduct product and process innovation "**and/in the same time**" marketing innovation;
Innvoation firm type 5. **AC1_47 :** firms that conduct product and process innovation "**and/in the same time**" organisational innovation;
Innvoation firm type 6. **AC1_67 :** firms that conduct inovare de marketing "**and/in the same time**" inovare organizațională;
Innvoation firm type 7. **AC_4 :** firms that conduct **only** product and process innovation;
Innvoation firm type 8. **AC_6 :** firms that conduct **only** marketing innovation;
Innvoation firm type 9. **AC_7 :** firms that conduct **only** organisational innovation;

3. Research results. The observed impact of innovation into the innovation potential

3.1. The innovation potential Index

The level of innovation potential is expressed through the Innovation potential Index calculated through a specific methodology [a dimensional] with average national values calculated with the values of the indicators resulted from survey application and also with maximum theoretical value resulted through the methodology construction of the Innovation Potential Index. IPOTINOV(see table 4)
The IPOTINOV theoretical maximum value is 16173 (points, a-dimensional) and represent the potential that could be obtained if all the units/firms should realize the maximum theoretical individual performance (18.09). The IPOTINOV realized maximum evaluated and the unit level is 16.52 and the minimum value is 0.02.

In the Figure 3 is presented the distribution by the typology of the innovative activity realised by the firms: The IPOTINOV realised at firm level as national average for the innovative firm compared with the non-innovative firm and also the maximum theoretical value.

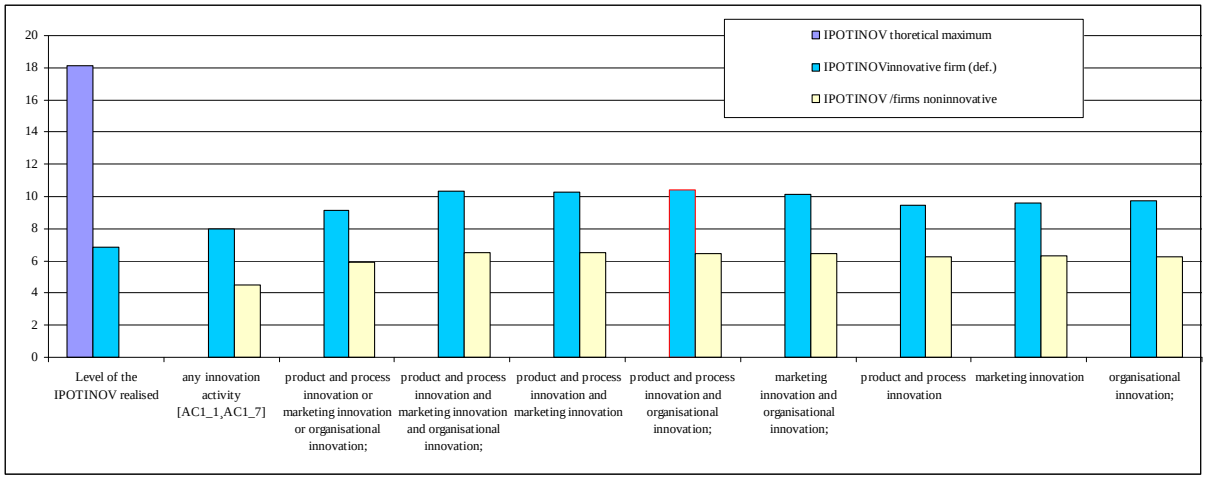


Figure 3 The IPOTINOV realised at firm level as national average for the innovative firm compared with the non-innovative firm and also the maximum theoretical value

3.2. The observed impact of innovation into the innovation potential

The observed impact of innovation into the innovation potential is expressed as difference between the level of the innovation potential index of the innovative firms and level of the innovation potential index of the non innovative firms, by the typology of the innovation activities. (Figure 4, Table 4)

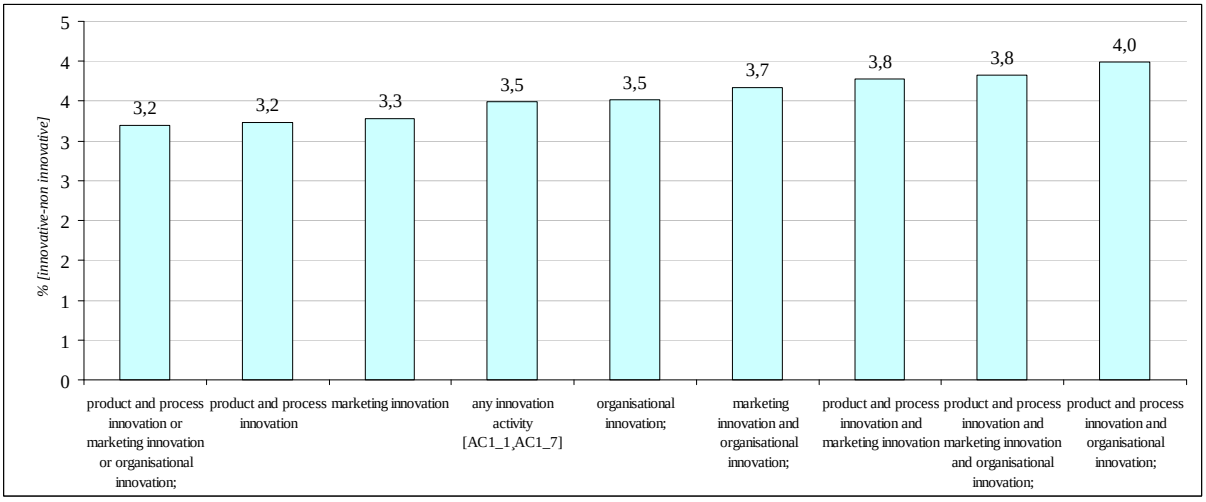


Figure 4 The observed impact of innovation into the innovation potential

3.3. The degree of realisation of the average innovation potential at national level

The degree of realisation of the average innovation potential at national level, calculated as the difference between: degree of realisation of the innovation potential at innovative firm level relatively to the maximum calculate value of the Innovation potential Index (theoretical

value) and the degree of realisation of the innovation potential at non-innovative firm level relatively to the same reference value (the maximum calculated value of the Innovation potential Index) by the typology of the innovation activities. (Figure 5, Table 4)

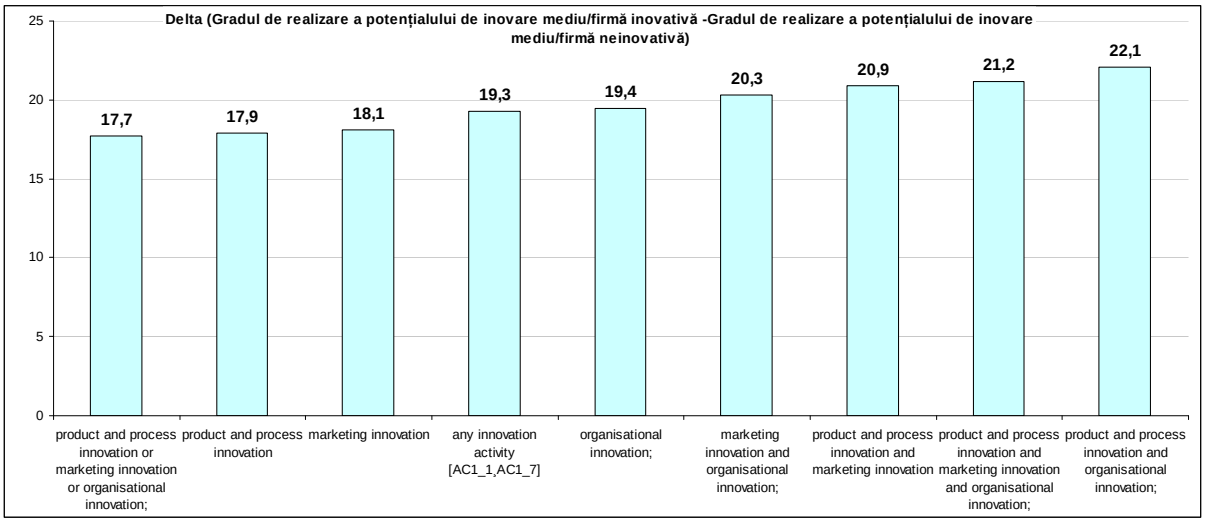


Figure 5 The degree of realisation of the average innovation potential at national level

4 Conclusions

4.1. The best performance in terms of IPOTINOV realised at firm level as national average (with the value 10.4) is realised by the firms that conduct in the same time:

a) firms that conduct "**and/in the same time**" product and process innovation, "**and/in the same time**" marketing innovation "**and/in the same time**" organisational innovation;

b) firms that conduct product and process innovation "**and/in the same time**" organisational innovation.

Between the types of innovators the minimum level of IPOTINOV is realised into the firms that**:** firms that conduct **only** product and process innovation; firms that conduct **only** marketing innovation; firms that conduct **only** organisational innovation.

4.2. Our results indicate also that the innovation management couldn't be ignored any more in perspective of developing a durable competitiveness of the firm. The strategic standpoint development of the firm must consider the inclusion of the entire typology of innovation, in a blended manner in concordance with the own objectives. The maximum degree of realisation of the average innovation potential is realised for the optimal using of product and process innovation, marketing innovation and organisational innovation, all the same time. The strong demand for an innovation management is expressed by the presence almost ubiquitous of the organisational innovation.

4.3. The real utility of the Innovation Potential Index results would be better understand, as a **preferential description of the input for the innovation process,** when its coordinate in the theory of innovation should be better fixed. Using the innovation potential measurement represents a contribution to the innovation performance measurement. Through assuming this strategic objective means also to develop innovative policies packages adequate with the specific Romanian background and with the actual stage of its socio-economical development.

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Annex 1

Table 1

Sectoral desegregation

Sector Heading	ESA95 Sections	Innovation in Industry and Services during 202-2004 (INS)	Potentital Innovation Survey (INCSMPS)
Agriculture, hunting, forestry and fishing	A + B		
Industry	C + D + E		
Energy and Manufacturing	C+D		
Manufacturing	D		
Mining and quarrying	C	NACE 10-14	
Extraction of energetic products	CA		
Extraction of nonenergetic products	CB		
Manufacturing	*D*	*NACE 15-37*	
Manufacture of food products, beverages and tobacco	DA		
Manufacture of textiles and textile products	DB		
Manufacture of leather and leather products	DC		
Manufacture of wood and wood products	DD		
Manufacture of pulp, paper and paper products; publishing and printing	DE		
Manufacture of coke, refined petroleum products and nuclear fuel	DF		NO
Manufacture of chemicals, chemical products and man-made fibres	DG		
Manufacture of rubber and plastic products	DH		
Manufacture of basic metals and fabricated metal products	DI		
Manufacture of machinery and equipment n.e.c	DJ		
Manufacturing n.e.c.	DK		
Manufacture of electrical and optical equipment	DL		
Manufacture of transport equipment	DM		
Manufacture of other non-metallic mineral products	DN		
Electricity, gas and water supply	EA	NACE 40-41	
Construction	**FA**		NEW
Services			
Market Services	**G + H + I + J + K**		
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	GA	NACE 51	
Hotels and restaurants	HA		NEW
Transport, storage and communication	IA	NACE 60-64	
Financial intermediation	JA	NACE 65-67	
Real estate, renting and business activities	KA	NACE 72, 73, 74.2,74.3	NO
Non-market services	**L + M + N + O + P**		
Public administration and defence; compulsory social security	L		NEW
Education	MA		NEW
Health and social work	NA		NEW
Other activities	OA	NO	NO

OBS: NACE 73 R&D

Table 2

					def. OSLO			
					produs și proces		*marketing*	*organizațională*
Code variable		AC_1	AC_2	AC_3	AC_4	AC_5	AC_6	AC_7
	any innovation activity							
	MAXINOV							
AC1_467	product and process innovation, marketing innovation and organisational innovation;							
AC1_46	innovation							
AC1_47	product and process innovation, and organisational innovation;							
AC1_67	innovation;							
AC_4	**only** product and process innovation							
AC_6	**only** marketing innovation							
AC_7	**only** organisational innovation							

Code variable	*Nr. Crt*	innovation activities typology
AC_1	***1***	Intramural R&D
AC_2	***2***	Acquisition of extramural R&D
AC_3	***3***	Acquisition of machinery, equipment and other capital goods
AC_4	***4***	Other preparations for product and process innovations
AC_5	***5***	Training
AC_6	***6***	Preparations for marketing innovations
AC_7	***7***	Preparations for organisational innovations

	or/and
	and/in the same time
	only

Table 3

YES	Total firms	NO
	any innovation activity	Non innovative relatively -any innovation activity	
	MAXINOV	Non innovative relatively MAXINOV	
AC1_467	product and process innovation, marketing innovation and organisational innovation;	Non innovative relatively to product and process innovation, marketing innovation and organisational innovation;	AC1_467
AC1_46	product and process innovation, marketing innovation	Non innovative relatively to product and process innovation, marketing innovation	AC1_46
AC1_47	product and process innovation, and organisational innovation;	Non innovative relatively to product and process innovation, and organisational innovation;	AC1_47
AC1_67	marketing innovation and organisational innovation;	Non innovative relatively to marketing innovation and organisational innovation;	AC1_67
AC_4	only product and process innovation	Non innovative relatively to only product and process innovation	AC_4
AC_6	only marketing innovation	Non innovative relatively to only marketing innovation	AC_6
AC_7	only organisational innovation	Non innovative relatively to only organisational innovation	AC_7

Table 4

		Firms with innovation expenditures relised in the year 2005 for conducting innovation activities:								
		oricare AC1	MAXINOV	AC1_467	AC1_46	AC1_47	AC1_67	AC_4	AC_6	AC_7
	Level of the IPOTINOV realised	any innovation activity [AC1_1,AC1_7]	product and process innovation or marketing innovation or organisational innovation;	product and process innovation and marketing innovation and organisational innovation;	product and process innovation and marketing innovation	product and process innovation and organisational innovation;	marketing innovation and organisational innovation;	product and process innovation	marketing innovation	organisational innovation;
IPOTINOV thoretical maximum	18,09									
IPOTINOV realised	6139	**4876**	**2441**	**798**	**914**	**1031**	**1071**	1604	1448	1606
Number of innovative firms	894	**612**	**268**	**77**	**89**	**99**	**106**	**169**	**151**	**165**
IPOTINOVinnovative firm (def.)	6,9	8,0	9,1	10,4	10,3	10,4	10,1	9,5	9,6	9,7
Sum IPOTINOV firme non-innovative firms		1263	3698	5341	5225	5108	5068	4535	4690	4533
Number of non-innovative firms		282	626	817	805	795	788	725	743	729
IPOTINOV /firms noninnovative		4,5	5,9	6,5	6,5	6,4	6,4	6,3	6,3	6,2
innovationimpact into innovation potential		***3,5***	***3,2***	***3,8***	***3,8***	***4,0***	***3,7***	***3,2***	***3,3***	***3,5***
The degree of realisation of the average innovation potential at national level for the innovative firm relative to the maximum theoretical value	**38,0**	**44,0**	**50,3**	**57,3**	**56,8**	**57,6**	**55,8**	**52,5**	**53,0**	**53,8**
The degree of realisation of the average innovation potential at national level for the non-innovative firm relative to the maximum theoretical value		**24,8**	**32,7**	**36,1**	**35,9**	**35,5**	**35,6**	**34,6**	**34,9**	**34,4**
delta (The degree of realisation of the average innovation potential at national level for the innovative firm - The degree of realisation of the		19,3	17,7	21,2	20,9	**22,1**	20,3	17,9	18,1	19,4