

Department of Business Studies

THESISBOOK

To the Ph.D. Dissertation of

Measurement of Innovation Activity at Hungarian Companies

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1. Preliminaries of the research and reasons of the topic

I started my economist career in the research and development department of a great socialist company. Here I had the possibility for eight years to look how results of applied research were born and how they did *not* become products in the market. My experiences augmented later at other company and in a bank what financed development projects. In focus of my economic research activity is the company behaviour and industrial development. In the last ten years I usually faced the issue when companies continuously complied with changing conditions – they survived turns in the markets and in the structure of owners – they continuously regenerates, grew, and at the same time the cut back earlier industrial research institutions, departments and they do not make demands on the skills of the recent workshops. Therefore the Hungarian companies are not considered as innovative ones. The GKI Economic Research Co. carries out pretty much empirical collection of data, the mentioned contradiction frequently appears in these investigations. I increasingly felt necessary to review and to reconsider opinions about company innovation and the collected experiences. This internal pretension overlapped with the appreciation of role of innovation in growth following the millennium in the mainstream of theoretical and business economics.

The suspicion inevitably arises: one reason of contradiction could be that the different players do not understand the same under expression “innovation”. Such episodes indicated me to this thought as the remark of a relatively small brickyard’s director. I conducted an interview with him in the topic of environmental protection when he mentioned that they did not research and innovate but they tried to mix of remnants of certain agricultural plants into the clay. During the burnout those would burn as well, the losing heat could spare on the gas consumption and would not count into the CO₂ quota of the company. When I called his attention that this activity was innovation and can be proud of it. He answered, they would have kept it secret, or else they should fill a lot of papers. A researcher colleague turned my interest into broader context reporting about her American study trip where she was taken to visit a successful small enterprise innovation support project in a remote town. The innovation was that the local screen printer changed the former design of T-shirts for teenagers to portrait of Britney Spears. In the first instance I was amazed, but after a time I recognised that this activity had all the characteristics of innovation: the knowledge was (the copyright of the photo) bought, the method of printing onto the T-shirt elaborated, the printer sample and the

colours framed and the result was a renewed product what is suitable to the demand of the consumers.

Due to such impacts I began go deeply into the special literature and innovation policy papers and it turned out that there were truly a lot of discussion, disagreement about notion of innovation. In works of economy historians, macro and business economists emerged that the explanation and the treatment of innovation; moreover innovation achievements were strongly embedded into the social environment. So the mentioned case with the T-shirt was amazing because of the difference between the American more praxis oriented and the European science respected way of thinking. The brickyard case mirrored the discrepancy between the theoretical and company view points. Due to my background and research field for me the interesting questions are the impacts of company behaviour to the macro economy it was obvious that I have to go further into this direction with the investigation.

I am in the fortunate situation that my workplace, the GKI Economic Research Co. carries out regularly inquiries on company behaviour and attitude, so I enjoyed and used a rich background support during my work. The ongoing non-company innovation researches widened my knowledge about the topic as well.

2. Methods

Recognitions mentioned in the introduction needed revisiting literature related to the notion of innovation. Among the huge amount of documents the only solution was to keep the principle: I search the contribution of company innovations to the growth, so I avoided science policy questions, I focused on these segments of macro theories which are connected with fulfilling and non fulfilling innovations in business sector. The full list of refernces consist anyway 141 items. Inevitably I had to think in national economies, however probably all non-professional knew that there was no thing what could more easily and quickly spring over geographical and political borders as novelty. Decision of definition problems were quite easy, according to *Schumpeter* [1911] I agreed with the most widely accepted definition of the OECD in Europe:

An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. (OECD [2005], p 46.)

This decision revealed one possible reason of the contradiction mentioned in the introduction: notion of innovation often mixes with the research and development. This has very practical reason: the last one seems to be well measurable at macroeconomic level, it is suitable to build in econometrical models, so many people tend to use it as innovation indicator, moreover economy politicians like it, and this leads to not really effective solutions in innovation incentives. In my thesis under research and development I mean *production* of new knowledge and under innovation I mean their *application*.

There were several experiments for measuring innovations; most of them used the method of business surveys. So I had the possibility to carry out secondary analysis on former – among them my colleagues' and my own - investigations European and Hungarian researchers. It turned out that results of innovation measurement are very sensitive to the way of execution of the surveys, to the choice of answers and statistical data to build into the composite indicators. Surveys of researchers commonly result greater innovativity than statistical offices, samples of the formers are mostly non representative. Statistical data commonly measure research, mostly input of it.

Many people investigated impacts of social environment; more types of substances were emphasized and tied to scope their relation to the innovation. My starting point was my basic conviction that even the last events (IT revolution, global crisis) did not make throwaway old textbooks according to them the welfare of nations depend on the success of their companies, moreover success achieved in markets, in competition.

From the countless plausible connexions I chose the impacts of corruption, state support and competition environment on innovations.

As the corruption became an important topic in the last years following its consequences destroying not only the Hungarian public life but the economic growth; I sought and found macro level relationship between corruption and innovation, as modest contribution to mapping of the multiple connections of social environment and company behaviour. It was

again secondary analysis on survey results. Beside this I revisited role of state subsidies and relationship of competition relations and company innovations.

I planned test my statements relating from searching of literature and secondary analysis by empirical research, by a survey composed directly for this purpose. But at this point I felt into a special situation. I investigated empirically the relationship of innovation and economic growth in a period – in spring of 2009 – when the greatest economic crisis achieved its bottom, and it is not clear it was absolute or local bottom. So I surveyed the companies' innovativity in a recession environment.

Such an external shock can provoke different reactions in the companies. The first is naturally cost cutting, strengthening of liquidity management. Anyway the most of respondents answered these in the business cycle survey of GKI in December 2008. But in that time we got signals of certain groups of companies (mainly in the manufacturing industry) planned forward escaping and wanted to get out by innovation from the situation. I investigated this phenomenon by a new survey. As earlier became obvious that the company innovativity was motivated by achievable benefits of investments in innovation, it became interesting that in circumstances of crisis, when markets overturn, old network of connection burst, companies go through painful changes, firms consider innovation activity as redundant risk or as instrument of recovery. The result of research can be a small contribution to the chapter of crisis management what needs obviously refreshment. This situation made possible to frame a new, non planned thesis. Beside this, the former conjectures, conclusions were tested.

The survey was carried out in May 2009 by a questionnaire switched to the monthly business cycle survey of GKI.

Table 1.**Main data of respondents, May 2009**

Number of companies

Industry	Number of questionnaires	Number of responses		Number of innovation responses		
	Pieces	Pieces	Percent	Pieces	Percent in questionnaires	In respondents
Manufacturing	1400	266	19,0	124	8,9	46,6
Construction	1400	208	14,9	80	5,7	38,5
Services	1300	222	17,1	66	5,1	29,7
Together	4100	696	17,0	285	7,0	40,9
Non classified				15	0,4	2,2

Source: GKI survey

I found only few close, significant relations in the course of processing responses by cross tabulation. The great number of responses made it possible to construct a binary logistic regression model and investigate with it what impacts the innovativity of Hungarian companies. I composed 41 variables from the responses. Most of them were simple binary variable; few were ordinal and one scale variable. The dependent variable was naturally whether fulfilled the company innovation or did not. To the calculations I used the SPSS statistical program. I did not order any constant to the model. I got the better fitting model including the variables with the method Enter.

My researches aimed the verification of the following statements:

- T1: The European – among them the Hungarian – innovation policy often focus to improve research and development indicators while companies are interested in benefits of innovations.
- T2: Innovation is the tool of competition for the companies. Innovativity of companies depends less on numbers of competitors then on nature of competition.
- T3: State support of company innovation should point not subsidy of innovation but galvanisation of competition connecting to innovation.
- T4: The crisis in the world economy indeed holds in company innovations but a good many of companies see the way of outburst in increasing of their innovations.

The structure of the thesis is the following: in the second chapter I review – by literary sources - the role of innovations in growth and competitiveness. Here comes it to the

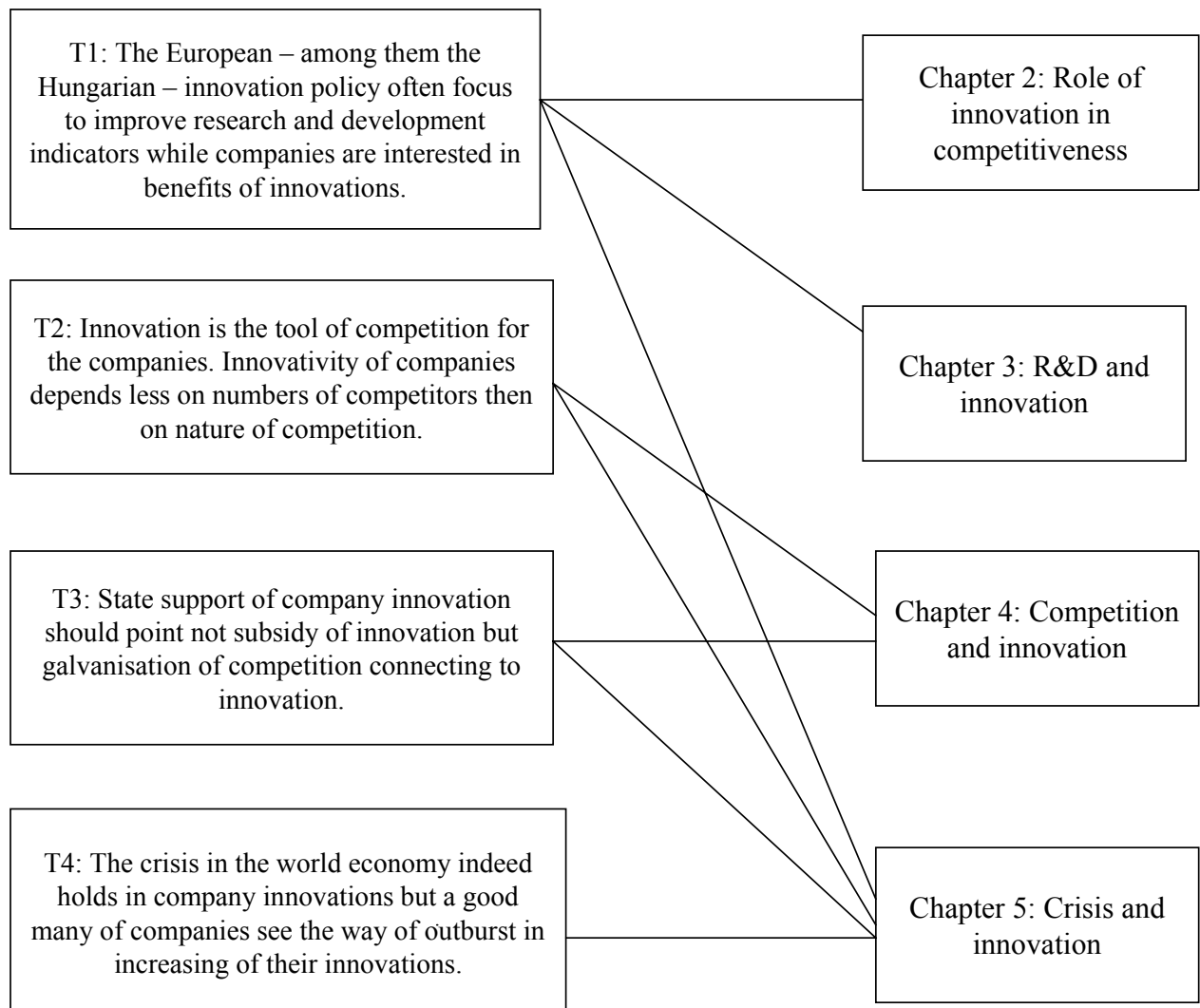
definition of notion and types of innovation. The third chapter deals with measurement of innovation performance and with the biased choice of indicators. Here I use beside the literature results of international and domestic empirical researches. The fourth chapter reviews how relate innovativity to the performance of companies, to keeping position in the competition. The fifth chapter shows the results of an empirical investigation, where by a survey among Hungarian companies I look for answers to the question, what drives and what hinders company innovations and what impact has the global crisis to the innovation efforts of domestic companies. I summarize the most important drivers in a logistic model.

In the summary I review which thesis was approved and which not.

The structure does not prove linearly the thesis. However there is unambiguous coincidence between main message of each chapters and each thesis, each chapter produces arguments strengthening or weakening other thesis. The fifth chapter implicitly tries to support all theses empirically.

Graph 1.

Connection of these and chapters



3. Results of dissertation

3.1. R&D indicators and company innovations

The first thesis is substantiated in the second chapter, where literary sources prove that innovativity is basic instrument of economic growth; companies can improve their competitiveness through their innovations. That statement that European focuses too strongly to the R&D indicators is verified by basic union documents, most familiar of them is the Lisbon Strategy. Its only numerical innovation target is: “*overall spending on R&D and*

innovation in the Union should be increased with the aim of approaching 3% of GDP by 2010.” (EC [2002] Point 47.)

In the third chapter I approve again by literary sources and economic policy documents that European and connecting with it Hungarian governments chose not too fortunately as instrument of innovation stimulation the R&D intensity indicator (proportion of R&D expenditures on GDP). (E.g. *Barysh et al [2008]*) Remarkable part of company innovations materializes not fulfilling research and development, moreover not buying such results (for inst. Patents, licences, know-hows, etc.). The analysis of European Innovation Scorecard 2007 brought our attention that more than half of innovative companies carries out innovations without any (own and purchased) research and development, for instance organisational or marketing innovations. (*EIS [2007]* p. 6.)

In the world – mainly in the USA considered as most important competitor of the EU – on the other hand non research and development based company innovations gain great attention. But there is no stable system of their measurement evolved. (See e.g. *Andrew et al [2009]*) My empirical investigation strengthened that Hungarian companies carried out varied kind of innovations primarily for improving their competitiveness and only little part of applied knowledge originated directly from the research sector.

Table 2

Source of applied knowledge

Percent of responses

	Product innovator	Process innovator	Marketing innovator	Organisational innovator	Sum
Employees	57,4	62,1	67,9	69,6	58,5
Professional forums	30,4	33,7	32,1	31,9	32,3
Costumers	25,2	23,2	24,5	24,6	22,0
Cooperation with academic sector	14,8	18,9	18,9	11,6	17,7
Competitors	15,7	21,1	20,8	20,3	17,1
Cooperation with compnies	17,4	15,8	24,5	21,7	15,2
Bridging institutions	0,0	1,1	1,9	1,4	0,6
N	115	95	53	69	164

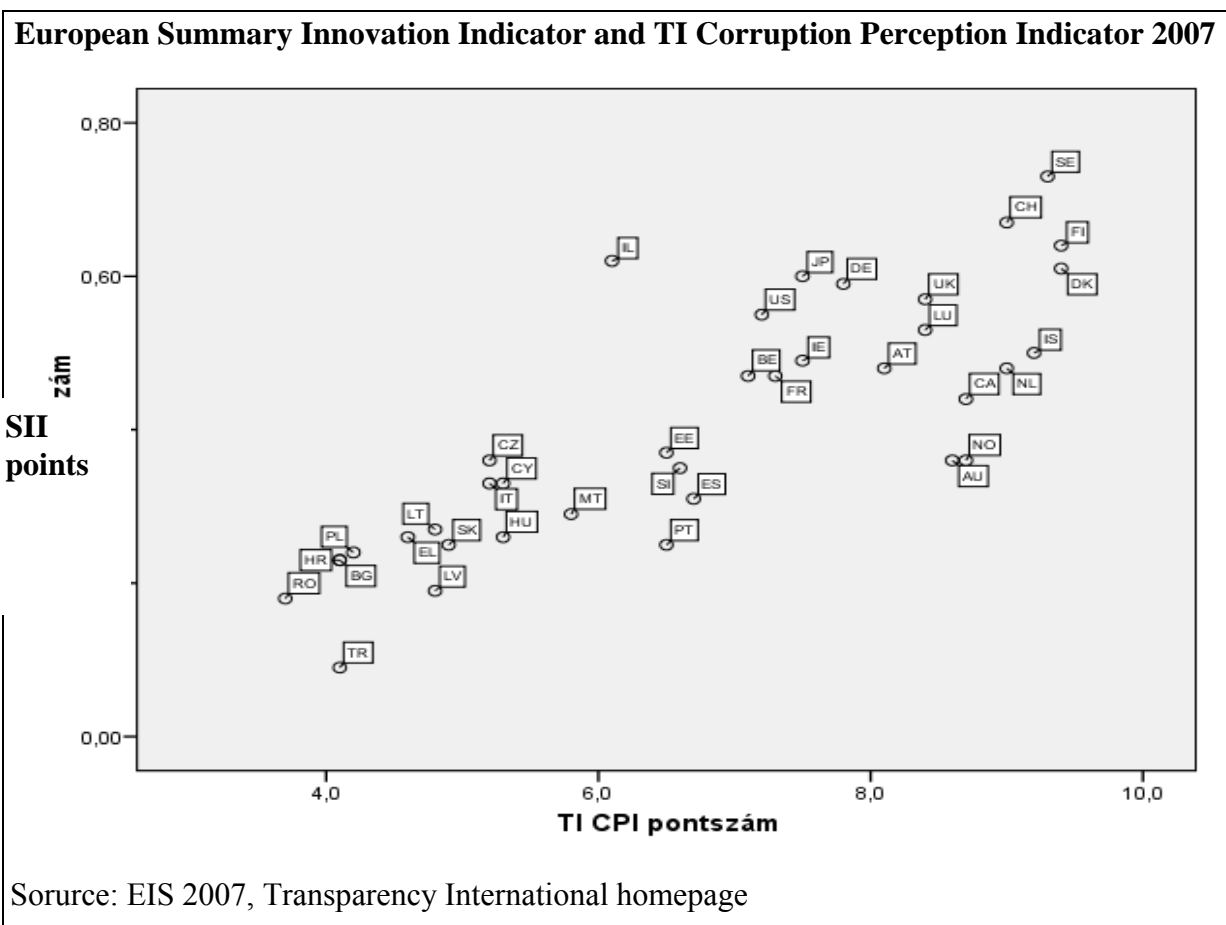
Source: GKI survey

On one hand this statement can give inspiration for researchers of company behaviour not to restrict their investigation to the companies' R&D data, but to strive to pay attention to the innovative efforts in the firms. On the other hand I could maybe provide useful arguments for them, according whom it was not expedient pushing financing problems of scientific research institutions onto the companies, for from more R&D expenditure there would not be more innovation fostering economic growth.

3.2. Competition and innovation

The second thesis follows from the first one. Both the special literature and secondary data analyses revealed that conditions of competition essentially influenced innovation activity of companies. I contributed to better understanding of impacts of social environment by unfolding relations between corruption and company investments.

Graph 2



TI CPI points

While I found unambiguous correspondence (with 82% correlation coefficient) at macro level between innovativity and freedom from corruption of countries, the picture in the business survey became more differentiated. Fifth of companies indicated that in their markets corrupt methods occurred in the competition, in the same proportion innovator and non innovator respondents. I do not consider this as refutation of the macro level connection. We can not leave out of attention that perception of corruption can have serious retentiveness for the firms however the experienced corruption is lower than the picture in minds about its measure. Maybe they principally do not want step in those market segments they presume being corruption infected, maybe they do not want rise to view from their competitors, for fear of being forced to give bribery. All these keep them back from innovation, in familiar markets, in common size they can survive with very few of innovation. It is indicated that under pressure of crisis companies competing in corrupt markets give up in bigger proportion innovations than others.

3.3. State support and innovation

The third thesis is outgrowth of the former ones. If innovation is tool of competition for the companies, it seemed to be a logical consequence that the main task of the state was not providing subsidies but animating the competition. The low efficiency of state subsidies was supported by secondary analyses in the fourth chapter principally. The business survey showed as well that companies drew very little on direct financial innovation subsidies in depth of the crisis in spite of financial troubles. Who did it they relied more on EU-sources than domestic. (Here a converse impact could appear: who gained sources from the Union, they fulfilled the innovation and such sources were more available.) Where state subsidy appeared there was a great importance for the company.

The second part of the thesis was not fully proved. However it was not questioned that the state's important task to ensure the competition, in the literature turned out that there was more to do.

Table 3

Characteristics of the four policy instruments from a firm’s perspective

Instrument	Public procurement	Regulation	Research institutions & universities	Public R&D subsidies
Character				
Input	money	none	knowledge	money
Primary participation incentive for firms	sales	mandatory	access to knowledge	cost/risk sharing
Selection by	state	none	firm	state
Effect on success	market risk reduction	market risk reduction	Technological opportunity	cost reduction
Inherent risk	Idiosyncratic demand	“egalitarianism”	idiosyncratic knowledge	crowding out of private R&D investments

Source: Aschoff and Sofka [2008] p. 6.

An innovation constraint can be created by the state according to demand influencing regulation, by public procurement it can step on with demand for innovation activity. This last one is exceptionally capable in my view to help promising solutions go over the barrier of economies of scale before their penetration.

For instance the “Green car” or renewable energy programmes of the European Union could be boosted best way through purchasing electric office cars or implementing CO₂ free heating systems in office buildings.

The state can play even so active role in stimulating company innovations, but this can not be simple money distribution, but a certain activity of integrator, market- and relationship organizer. The importance of last one was emphasized by lack of common interest fields of academic and business sectors, what appeared both in the special literature and in the business survey.

3.4. Crisis and innovation

The fourth thesis did not arise at setting up the research plan but it was born by life. When I achieved phase of empirical research it turned out the world was surviving a global crisis what was seen a great while ago, and this impacts the innovation behaviour of companies. So

testing of the first three theses happened in circumstances of crisis, my fourth statement could not get literal supporting, secondary analysis was moreover impossible to be carried out. Empirical analysis however approved that in spite of risen financing troubles remarkable part of Hungarian companies – more than half of them – reacted with increased innovation efforts to the crisis, seeing the way of recovery in it.

I measured the innovation activity of companies in first instance with the four types of innovation activity in the Oslo Manual. More than half of respondents – 57 percent of them – answered, that they have fulfilled some kind of innovation in the last three years, so I got higher innovation activity rate than the last Hungarian CIS survey showed. But one can suppose that the companies who sent back only the business cycle survey but did not the innovation survey they did it hence they did not fulfil innovation in the last three years. So the rate of positive responses was only 23,6%, this was near to the CIS2006 survey results.

I investigated whether did fulfil the firms other activities serving renewal. I considered as such the training of employees and – in trace of Schumpeter – inclusion of new supply sources. Studying the extended list of activities 72% of respondents carried out some kind of innovation between 2006 and 2009. 9% of them reported five, 4% all six types of activities. Considering employee training and supply renewal as innovation indicator 30% of respondents of the survey of GKI in May 2009 proved to be innovative. In the further examination I considered only those companies as innovators who fulfilled innovations according to the Oslo manual and I tested the theses accordingly.

Table 4**Impacts of crisis to the innovations**

percent

	Non innovators	Innovators	Successful innovators*
Restrictive	43,8	44,5	48,5
Facilitates, as we can stay in competition ...			
... with new products, with change of profile	4,1	17,7	20,9
... by implementing new technologies	0,8	13,4	14,9
... selling our products in new markets/ to new customers/ with new methods	6,6	20,1	23,1
... by renewal of functioning of the company	7,4	17,1	20,1
Facilitating together	56,2	55,5	51,5
N	121	164	134

*= successful innovator was called the company who labelled their innovation as successful

Source: GKI survey

Between the separate questions and company innovativity I rarely could show statistically significant connection – and it was weak, at best average – I was curious about the whole existence of what factors made it likely that the company fulfilled innovations. Constructing a binary logistic model offered as convenient tool. According to results the probability that the company will carry out innovation is risen 15 times by gaining the implemented knowledge from cooperation with academic sector, 10 times by getting European Union subsidy, 5 times by starting innovation aimed extending production and services. In small proportion, but contrary effects the number of competitors, so in markets with many players is less likely that the company begins innovation. Analysis of each factors emphasised that beside of most frequent characteristics companies fulfil innovations from many different reason and with implementation of many different resources.

4. Summary

The study aimed the verification of the following statements:

T1: The European – among them the Hungarian – innovation policy often focus to improve research and development indicators while companies are interested in benefits of innovations.

T2: Innovation is the tool of competition for the companies. Innovativity of companies depends less on numbers of competitors then on nature of competition.

T3: State support of company innovation should point not subsidy of innovation but galvanisation of competition connecting to innovation.

T4: The crisis in the world economy indeed holds in company innovations but a good many of companies see the way of outburst in increasing of their innovations.

The first and the second theses were proven by the literature, by the secondary analyses and by the empirical research. The Lisbon strategy of the EU, the Hungarian laws about the innovations and about the innovation fund, respectively their criticisms have shown excessive accentuation of R&D intensity and its fault, innovator respondents of the business survey relied only in low proportion on knowledge from cooperation with academic sector. Again the literature – mainly *Schumpeter* [1986], *Arrow* [1962] and *Aghion - Howitt* [1992] – showed that the number of players in competition itself does not improved and not deteriorated innovativity of companies. Contrarily the characteristic had very important impact, this was affirmed by secondary analyses.

The third thesis could be only partly proven. However both the literature (e.g. *Czarnitzky-Hussinger* [2004 and *Czarnitzky-Licht* [2004], furthermore *Hujer-Radic* [2005]) both secondary analyses revealed low innovation incentive of state subsidies, the necessary role of the state was laid down broader than in the thesis.

The fourth thesis was verified by the business survey: more than half of respondents – even among the non-innovators in the last three years – considered, that they had to boost their innovation efforts.

The study answered a few questions and raised new ones.

However in Europe innovation survey is carried out according to the recommendations of the OECD, it would be very useful to find “hard” statistical data, they are in better relation with innovations than the R&D indicators. These data should be suitable to international comparison, construction of models and they should be producible regularly with relatively low efforts. In the American literature there are more indicators of such kind, as take-off their adaptability can be investigated, but usage of other data can be analysed.

Further researches are needed in topic of the relationship of corruption and innovation. Unfortunately corruption became recently a “hot topic”. We can trust that in a few years it will lose a bit of importance, but the phenomenon will not disappear in short term. Better understanding its effects, its way of operation could strengthen the instruments of persistent struggle against it.

It would be worthy to further investigate the phenomenon that companies make such low demand on knowledge from the academic sector. This question was researched mainly from viewpoint of academic institutions, the opinion of the company sector is less well known.

It turned out again from the study that globalisation makes frontiers permeable for the new knowledge; already the company networks mellowed them. It would be worthy to consider the theory of national innovation systems from point of role of multinational and global company realms.

Results about role of state induce research about real and potential function of public procurements and market regulations in stimulation of innovation. This could bring good many lessons both at union and domestic level.

It would be important to understand better follow-up innovations in companies. Imitations are accepted forms of innovation in the Oslo manual and historical examples show that societies implementing following innovations could become leading technology innovators, but this process cannot be considered as automatic at all. Whether does lead the high proportion of imitations to originator companies and what is to the change necessary it can be answered only having much more information.

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