THE GLOBALIZATION ON TECHNOLOGY AND THE DYNAMICS OF THE INNOVATIVE PERFORMANCES di Daniele Archibugi, Andrea Filippetti

1. INTRODUCTION

The new Global Innovation Scoreboard 2008 (GIS 2008) aims at providing an overview on the main trends, results and determinants of the innovative performance of countries across the world. The results show that over the last decade there is a stable group of countries which are firmly within the top performers, which includes Sweden, Switzerland, Finland, Israel and Japan. These countries base their innovative performance mainly on the innovative activities of their business sector. However, behind the leaders, there is a large group of countries which has been remarkably narrowing the gap with respect to the leaders, and it includes emerging countries like the Republic of Korea and Singapore. At the bottom of the ranking there are emerging countries, such as three of the four BRIC countries, Brazil, China and India, which have undertaken a catching-up process by considerably increasing their innovative performances. Regarding EU countries, they perform at all the levels of performance across the GIS, i.e. there are Member States at the top and bottom of the rankings. However, although there is clearly a strong structural component to innovation performance, we do observe transitions over time. In particular several of the EU15 have moved from the 3rd to the 2nd group (UK, Austria, Belgium) and a number of lower performing EU Member States have moved from the 4th to 3rd groupings (Spain, Italy, Czech Republic, Estonia, Portugal, Greece, Lithuania, Hungary). On the other hand, some of the EU countries have shown the slowest rate of growth in the GIS index (e.g. Romania, Slovak Republic, Latvia, Bulgaria, Poland) (cf. Figure 7). Overall, the GIS 2008 findings confirm the need for policy makers to start thinking beyond the triadic division - the United States, Europe and Japan - also when they deal with technological capabilities and innovative performances. This is likely leading to a rising need

and room for innovative policy carried out at regional level.

2. GLOBAL INNOVATION SCOREBOARD: AIMS AND METHODOLOGY

2.1 Aim and objectives

The new Global Innovation Scoreboard 2008 (GIS 2008) represents a complementary tool with respect to the European Innovation Scoreboard. The GIS 2008 is focused on the mediumterm dynamics and it aims at providing an overview on the main trends, results and determinants of the innovative performance of countries across the world. The GIS 2008 explores the innovation performance of the EU27 countries and other major R&D spenders in the world: Argentina, Australia, Brazil, Canada, China, Hong Kong, India, Israel, Japan, New Zealand, Republic of Korea, Mexico, Russian Federation, Singapore, South Africa and the United States.

2.2 The methodology and the indicators

The GIS 2008 methodology includes 9 indicators of innovation and technological capabilities (see Table 1)¹. They are grouped in three main dimensions (pillars): Firm Activities and Outputs, Human Resources and Infrastructures and Absorptive Capacity (see Figure 1).

For each pillar a Dimension Composite Innovation Index is calculated as a simple average of the indicators. The GIS Index is composed of the three Dimension Composite Innovation Indexes. Since the innovation scoreboard should emphasize the innovative activities which take place in the business sector, the first pillar - Firm Activities and Outputs - accounts for 40 per cent of the total GIS Index score, while the other two pillars - Human Resources and Infrastructures and Absorptive Capacity - account for 30 per cent

¹ See the Appendix for a detailed list of the indicators.



Figure 1: the GIS construction

Pillar	Indicator	Contribution to the total GIS value
Firm Activities	Triadic patents per population (3 years average)	20%
and Outputs (40%)	Business R&D - BERD - (%GDP)	20%
Human Resources (30%)	S&T tertiary enrolment ratio	7,5%
	Labour force with tertiary education (% total labour force)	7,5%
	R&D personnel per population	7,5%
	Scientific articles per population	7,5%
Infrastructures and	ICT expenditures per population	10%
Absorptive Capacity (30%)	Broadband penetration per population	10%
	Public R&D - (HERD + GOVERD) - (%GDP)	10%

Table 1: GIS pillars, indicators and weights

each (cf. Figure 1)¹. As with the EIS (European Innovation Scoreboard) and previous GIS, the GIS Index 2008 is an indicator of intensity: all values are weighted to account for the different size of nations. Accordingly, the GIS index measures the relative performance of countries. All variables are normalized on a scale from 0 to 1, and countries are ranked on an ordinary scale. The GIS index 2008 is calculated relative to two different years – 1995 and 2005 – to explore the dynamics of national innovative performance ².

3. GLOBAL INNOVATION SCOREBOARD: MAIN FINDINGS

3.1 The GIS Index

In Table 2 the global innovation performance of countries is summarized by showing their ranks for the GIS and each of the three pillars relative to years 1995 and 2005³. Concerning 2005, the top ten countries perform differently across the three pillars. Switzerland, Japan,

¹ Accordingly, the GIS Index scores are calculates as follows: $(pillar_1 * 0.4) + (pillar_2 * 0.3) + (pillar_3 * 0.3)$.

² One of the main results of the first part of the Thematic Paper is the fact that the accumulation of technological capabilities is a structural phenomenon of the economic systems. Consequently, to address the dynamics of this process a span of ten years has been chosen. For some countries and the EU27 block the GIS is not calculated relative to 1995 due to a lack of data availability. Much of the data is not available on a comparative basis for years after 2005.

³ See Table A in the Annex for GIS index scores, pillars scores and 1995-2005 variations.

Republic of Korea and Germany show excellent relative performance in Business innovative activities. Finland, Israel and Canada are particularly strong in Human Resources. Finally, Sweden and Denmark are well-positioned regarding their Infrastructures and Absorptive Capacity. By comparing the 2005 GIS ranks to 1995 as a whole, it emerges the structural stability of innovation performance and technological capabilities: countries rank in fact fairly stably over ten years both in terms of GIS Index and single pillars ¹. However, although the structural component of the innovation performance, some remarkable transitions over time do occur as it is shown in the following. There is a stable group of countries within the top performers over the last decade: Sweden, Switzerland, Finland, Israel and Japan (while the United States drops out from the leaders in 2005). The fastest improving countries are China, which climbs eight positions (+8), Singapore (+7), Portugal (+7), Spain (+6), Cyprus (+5), Turkey (+5) and Brazil (+5). Singapore bases its increase mainly on Firm Activities and Human Resources, and

Spain and Portugal particularly on Human Resources. China shows its best performance relative to Firm Activities and Infrastructures and Absorptive Capacity, while it looses three positions on Human Resources. Brazil shows strong increases in Firm activities and Infrastructures and Absorptive Capacity and a moderate increase in Human Resources. As for the other BRIC countries, India improves one position and the Russian Federation looses two positions. Italy is at the 26th position following Spain and Slovenia.

This is due in particular to the good performance of the Infrastructures, while it is loosing ground both in terms of Firm Activities and Human Resources. The EU27 reaches the twentieth position, showing a good performance particularly on Firm Activities. The balanced innovation performance of the EU27 emerges from Figure 2 where it is worth-observing how the three pillars have the same importance. The Unites States shows a composition similar to that of the EU27, while Japan's innovation performance is more based on business activities.



Figure 2: Global Innovation Performance

¹ GIS rank correlation relatively to 1995 and 2005 is equal to 0.94, while it is around 0.90 for the three pillars.

	GIS Index		Firm Activities		Human Resources		Infrastructures and Absorptive Capacity	
Country	rank 2005	rank variation	rank 2005	rank variation	rank 2005	rank variation	rank 2005	rank variation
Sweden	1	0	4	-3	4	-2	1	1
Switzerland	2	0	2	0	5	-2	3	6
Finland	3	3	5	-1	1	3	2	12
Israel	4	1	3	4	3	-2	11	-7
Japan	5	-1	1	2	13	-3	9	-4
United States	6	-3	8	-2	6	-1	7	-6
Denmark	7	3	10	3	8	1	4	7
Korea, Rep.	8	4	7	5	7	10	14	-4
Canada	9	0	18	0	2	5	8	-1
Germany	10	-2	6	-1	17	-1	17	3
Netherlands	11	-4	9	1	20	-1	6	0
Singapore	12	7	15	6	10	11	10	2
France	12	_2	13	-4	10	-7	10	2
Austria	13	-2	10	-4	25	-7	12	8
Norway	15	+ 2	20	4	2.5	1	10	-0
United Kingdom	15	2	20 17	-5	14	4	13	9
Bolgium	10	-2	17	-3	12	2 11	10	2
Australia	17	-4	14	-3	25	-11	10	2
Australia	10	-3	19	0	9	11/a 10	19	-5
EU 07	19	n/a	11	-3	21 10	19	11/a	n/a
EU-2/	20	-3	10	-1	19	-4		-2
Hong Kong	21	n/a	32	2	n/a	n/a	15	-12
New Zealand	22	0	23	6	26	-18	20	3
Ireland	23	I	21	-1	16	10	23	1
Spain	24	6	28	0	15	10	24	4
Slovenia	25	-2	22	0	28	-4	25	-8
Italy	26	2	26	-3	32	-4	22	3
Czech Republic	27	4	24	0	29	0	28	6
Estonia	28	-2	33	4	27	0	27	-9
Russian Fed.	29	-2	27	-1	11	2	42	-3
Portugal	30	7	35	3	31	8	26	3
Greece	31	4	43	-8	24	8	35	-2
Lithuania	32	-3	41	5	30	-8	29	-3
Hungary	33	1	31	-1	38	-4	30	1
China	34	8	25	7	48	-3	31	9
Croatia	35	n/a	n/a	n/a	36	-5	43	0
Cyprus	36	5	42	2	37	0	33	5
Slovak Republic	37	-11	39	-12	34	-14	39	-12
Bulgaria	38	-5	47	-11	33	-3	37	-7
Malta	39	n/a	29	13	47	-1	n/a	n/a
Turkey	40	5	38	3	44	3	34	3
Poland	41	-3	45	-12	39	-1	36	-4
Brazil	42	5	34	11	46	2	32	10
Mexico	43	-2	40	3	35	0	44	-3
South Africa	44	n/a	30	1	45	-1	n/a	n/a
Argentina	45	-1	46	-7	40	3	41	-6
India	46	1	36	11	42	0	38	7
Latvia	47	-6	37	3	43	-7	40	-4
Romania	48	-12	44	-19	41	-8	45	-1

Table 2: GIS: ranks and ranks variations ¹ for each pillar, 1995 and 2005

¹ Rank variations are calculated using the scores for those countries for which both 1995 and 2005 data are available. Rank variations are thus not obscured by the entrance of countries in 2005 for which data were not available for 1995.

3.2 The three dimensions of innovation performance

The GIS Index is based on the three pillars described above. In this section the contribution of each of these pillars to the innovative performance and their dynamics over time is explored. Figure 3 shows the scores of the GIS Index 2005 pillars for each country. Among the first positions, in addition to the leaders, Canada is performing particularly well in Human Resources and Germany in Firm Activities,

Firm activities

while the Republic of Korea is relatively worst in Infrastructures.

The EU27 performs relatively better in Firm Activities. In the second half of the rankings there are also significant differences. The Russian Federation, Spain, Ireland and Greece show relative good performance in Human Resources, while China, Malta and South Africa perform relatively better in Firm Activities. Concerning Italy, as we mentioned it shows a good performance in terms of Infrastructures, while it signals an alarming delay in terms of Human Resources.



Figure 3: Innovation performance per pillar

Human Resources

Infrastructures and Absorptive Capacity

Infrastructures and

Firm activities

Human Resources



Figure 4: Global Innovation Scoreboard, ranking variations 1995-2005 for each pillar

Figure 4 reports the ranking variations over the period 1995-2005 for each of the tree pillars. The 1995-2005 rank variations relative to the pillar Firm Activities and Outputs reflect the major dynamism of three BRIC countries, namely Brazil, China and India – in addition to Malta concerning their business innovative performances as measured by patenting activity and business R&D expenditures. Among the top performers, some have been losing ground relative to the other countries, i.e. the United States, Sweden, Norway, United Kingdom, Germany and France. On the other hand, some top performers have been increasing their position: Singapore, Japan, Republic of Korea, Israel and Denmark. The 1995-2005 rank variations relative to the pillar Human Resources show that Luxembourg, Greece, Republic of Korea, Ireland, Singapore, Portugal and Spain are the best gainers. China looses some positions; India holds its position while Brazil and the Russian Federation moderately improve. It is worth noting that among the countries loosing positions relatively to the others there are some advanced economies, i.e. the United States, Switzerland, Sweden, Japan, Italy, France, Belgium, Germany and the EU27 as a whole. The 1995-2005 rank variations relative to the pillar Infrastructures and Absorptive Capacity show that the more dynamic countries include three BRIC countries, Brazil, China and India, in addition to the Czech Republic, Denmark, Finland, Norway, Switzerland and the United Kingdom. In Figure 5 the relative contributions of the three pillars relatively to the GIS 2005 are reported. The relative contribution of the innovative performance of the business sector - Firm Activities and Outputs - is particularly important for the first 19 countries', with the exception of Canada, Norway and Australia including Luxembourg. Interestingly, also China

shows a relative high score in innovative activities taking place in the business sector. Among the BRIC countries, Human Resources play an important role relatively to the Russian Federation and India, while Brazil and China show higher contributions concerning Infrastructures and Absorptive Capacity. The Human Resources pillar seems to play a fundamental role for the countries at the middle of the ranking, in addition to Mexico and Romania. Finally, the relative importance of the pillar Infrastructures and Absorptive Capacity is more heterogeneously distributed along the ranking. Regarding Italy, it clearly emerges the major role played by the Infrastructure pillar compared to the Firm Activities and Human Resources.



Figure 5: Global Innovation Performance, pillar composition, (total=1)

4. THE DYNAMIC OF THE INNOVATION PERFORMANCES OF COUNTRIES

4.1 The dynamic of the innovative performances

The countries are divided into groups¹ depending on their innovative performance as measure by the GIS Index both in 1995 and 2005. Based on the ranking of their GIS Index 1995 scores the countries can be divided into the following four groups of countries:

- Group 1: Sweden, Switzerland, United States, Finland, Israel and Japan;
- Group 2: Netherlands, Germany, Denmark, Republic of Korea, Canada and France;
- Group 3: Singapore, Austria, Norway, United Kingdom, Belgium, Australia, EU27, New Zealand, Ireland and Slovenia;
- Group 4: Spain, Italy, Czech Republic, Estonia, Russian Federation, Portugal, Greece, Lithuania, Hungary, China, Cyprus, Slovak Republic, Bulgaria, Turkey, Poland, Brazil, Mexico, Argentina, India, Latvia and Romania.

Based on the ranking of their GIS Index 2005 scores the countries can be divided into the following four groups of countries:

- Group 1: Sweden, Switzerland, Finland, Israel and Japan;
- Group 2: United States, Denmark, Republic of Korea, Canada, Germany, Netherlands, Singapore, France, Austria, Norway, United Kingdom, Belgium, Australia and EU27;
- Group 3: New Zealand, Ireland, Spain, Slovenia, Italy, Czech Republic, Estonia and Russian Federation, Portugal, Greece, Lithuania and Hungary;
- Group 4: China, Cyprus, Slovak Republic, Bulgaria, Turkey, Poland, Brazil, Mexico, Argentina, India, Latvia and Romania.

The country groups calculated with respect to the GIS Index in 1995 and 2005 differ significantly (cf. Figure 6). At the top level, there is always a small group of countries which outperform the other countries in terms of innovative performances. However, in 1995 the group 2 was composed of a small number of countries, while the

larger share of countries was included in the group 4. By looking at the groups calculated accordingly to the GIS Index 2005, the most striking result is that an important number of countries climbed from the third to the second group and from the fourth to the third group. The overall finding is that innovative activities are no longer a matter of two exclusive clubs including few advanced nations. On the contrary, the group 2 became the largest together with the group 3, suggesting an important process of convergence at the centre of the ranking. In addition, in 2005 three BRIC countries, namely China, India and Brazil, which are included in the group 4, are also among the countries performing better in terms of GIS Index growth rate in the ten considered years, thus confirming that the process of convergence is involving a relevant number of countries also within the group 4. Among the three big regions, Japan is still in the top performers group, the United States lost its position between the group 1, while the EU27 improved from the group 3 to the group 2.

Regarding the EU27, several of the EU15 have moved from the group 3 to the group 2 (UK, Austria, Belgium) and a number of lower performing EU Member States have moved from the 4th to 3rd groupings (Spain, Italy, Czech Republic, Estonia, Portugal, Greece, Lithuania, Hungary). On the other hand, some of the EU countries have shown the slowest rate of growth in the GIS index (e.g. Romania, Slovak Republic, Latvia, Bulgaria, Poland) (cf. Figure 7).

4.2 Convergence analysis

In Figure 7 the GIS 95 Index and the GIS index growth ² over the period 1995-2005 are plotted. Although it is not possible to observe a general process of convergence, some interesting evidence emerges. First, all the countries on the right side, which are those performing above the average relative to the GIS Index 95, perform moderately under the average growth performance, with the exception of Singapore, Republic of Korea and Finland. Concerning the group 3 there exists a process of convergence within the group. Those countries which per-

¹ In this section we exclude those countries for which we were not able to calculate the GIS index relative to 1995. The group classification is based on hierarchical cluster analysis using complete linkage between groups.

² The GIS index growth is calculated relative to the GIS index scores of countries (see also Table A in the Annex).



Figure 6: The dynamic of the groups over time GIS Index 1995 - GIS Index 2005

formed worst such as Portugal, Greece, Spain and the Czech Republic show a higher performance with respect to the other countries belonging to the same group. Finally, the group 4 have shown the strongest growth over the last decade and the largest variability. Here a marked process of divergence within this group is evident: a sub-group of countries, i.e. Brazil, India, China and Turkey, show growth rates of innovative performance well above the average.

On the contrary, another sub-group of countries, in particular Bulgaria, Romania and Slovak Republic, are increasingly loosing ground. Overall, the process of convergence does not involve all the countries. In particular, both within the group 3 and the group 4 there are countries which show very high average growth rates over



Figure 7: Convergence per groups of countries* Note: axes cross at average values * Countries are grouped according to GIS Index 2005

the decade 1995-2005 and which are reducing progressively the gap with the group 1 and group 2. On the other hand, there is a group of countries which is not involved in this catchingup process and which has seen a widening of the innovative gap with respect to the leaders.

4.3 The drivers of the innovative performances

In this section the drivers of the innovative performances of countries are analysed in terms of the three GIS Index pillars, from a cross-countries and over-time perspective. The analysis is based on the four groups calculated relative to the GIS Index 2005 scores.

Table 3 reports some economic figures and innovative performances divided per groups relative to 2005. As expected, the long-term relationship between GDP and technological capabilities is confirmed by the fact that GDP per capita declines across the four groups according to the innovative performance. However, by observing the GDP growth rates, the relationship is exactly the opposite.

Table 3 also shows the innovative performances of countries in terms of 1995-2005 growth rates relatively to the GIS Index and the three pillars (see also Table A in the Annex). The dynamic characterizing the GIS Index confirms the findings pointed out above. The group 4 are those showing a GIS Index growth rate equal on average to 4.83%, the group 3 2.15%, while the two groups of the top performers around 1%¹.

Important differences also emerge between countries at pillar level. In general, the most dynamic pillar is Firm Activities, while the most static one is Human Resources. By looking at a group level, the group 3 and the group 4 show remarkable growth rates especially for Firm Activities and Infrastructures. The Human Resources factor plays an important role mainly

¹ It must also be noted that the standard deviation of the GIS Index growth rates is progressively higher for groups 3 and 4 as compared to groups 1 and 2 (Cf. Figure 7 and the related discussion).

	Group 1	Group 2	Group 3	Group 4
Economic performance				
GDP per capita (average 2004-2006)		21,216	18,618	9,673
GDP per capita (growth 2004-2006)		1.47	2.83	4.10
GDP per capita (growth 1995 – 2006)		2.23	3.90	3.92
Innovation performance				
GIS Index (growth 1995 – 2005)		0.67	2.15	4.83
Firm Activities and Outputs (growth 1995 – 2005)		-0.21	5.30	16.7
Human Resources (growth 1995 – 2005)		0.21	2.09	4.1
Infrastructures and Absorptive Capacity (growth 1995 – 2005)		1.80	3.6	12.2

Table 3: Economic and innovation performance per group* * Groups are based on the 2005 GIS Index scores (see Figure 6)

for the low-performers countries – groups 3 and 4. Both Firm Activities and Infrastructures and Absorptive Capacity play an important role both for top performers and lagging countries. Concerning Human Resources, it is likely that there is little room for increases in the advanced countries, while there seems to be a good deal of room for improvement for group 3 and group 4 which are at a lower stage of development. However, it also emerges how between the 3 pillars Human Resources is the more "structural" relative to any stage of development.

5. THE INNOVATION PERFORMANCE OF ITALY

In this section we consider the dynamic of the innovation performance of Italy over the period 1995-2007 (see Figure 8). As expected triadic patents are the most volatile variable. However, a moderate upward trend is evident in the graph. If we compare Business R&D and Public R&D we find confirmed a long-term trend in which the former is overcoming the latter. However, in comparison with the other OECD countries, Italy shows a good balance between the two variables: Business R&D is growing in importance over time with comparison with Public R&D. The number of total researcher in the economy, both in the public and private sector, shows a substantial drop in the end of the 1990s. Researchers start growing again at the beginning of the 2000s, and by 2004 there is a

remarkable upward trend. Finally, both scientific and technical articles, labour force with tertiary education and fixed broadband subscribers show a linear upward trend over the considered period.

6. THE INNOVATIVE PERFORMANCES OF THE BRIC COUNTRIES

Over the last decades, among the emerging nations, the BRIC countries - Brazil, Russian Federation, India and China – have emerged at the centre of the economic and political stage, also for the considerable size of their economies. However, as far as the innovative performance is concerned, the GIS Index is inherently an intensity methodology and hence it is not affected by the size of the considered economic systems. Relatively to the GIS Index 2005, the Russian Federation is the only one among the BRIC countries included within the group 3, while the others are included in the group 4. This reflects the fact that all the measures are re-scaled to some indicator of dimension, mainly population and GDP. However, when the dynamics of the innovative performances are considered, the BRIC countries are among the top performers. Figure 7 clearly confirms this fact: Brazil, India and China show the higher GIS growth rates over the period 1995-2005. In terms of pillars' rankings variation (cf. Figure 4 and Figure 9), India, Brazil and China are the best performers (in addition to Malta) relative to Firm Activities.



Figure 8: the dynamic of the variables in Italy (1995-2007), selected variables

Concerning Human Resources, only the Russian Federation and Brazil gain some positions. Finally, Brazil, China and India are again among the top performers in terms of Infrastructures and Absorptive Capacity. As far as their performance structure is concerned (cf. Figure 5), China shows a relative focus on Firm Activities and Infrastructures and Absorptive Capacity, the Russian Federation is particularly strong in Human Resources. The innovative performance of Brazil is heavily based on Infrastructures and Absorptive Capacity while it lacks both Firm Activities and Human Resources. Finally, India's performance is mainly grounded on Human Resources and Infrastructures and Absorptive Capacity. To summarize, the dynamism which have characterized the BRIC countries over the last decade is also reflected in the dynamics of their innovative performance. However, significant differences emerge in their structure.

7. CONCLUSIONS: BEYOND THE TRIADIC FRAMEWORK

The innovative performance of countries and its main determinants has become a key issue of national and regional policy. The importance of this issue is based on the fact that there exists a close relationship between technological capabilities and innovative performance on the one hand, and long-term growth and competitiveness on the other hand. Additionally, the National System of Innovation stream of literature has strongly emphasized the systemic nature of the innovative activities and their crucial linkages with the environment in which they take place at national and regional level, in terms of infrastructures, institutions, knowledge and learning environment. In a period in which the process of globalization grows at a great pace, the innovative activities are increasingly based on integration, open models and division of innovative



Figure 9: The innovative performances of the BRIC countries (rankings and rankings variations)

labour. In this context, there is increasing room and need for a co-ordination of innovative policies at supra-national level. From the methodological perspective, one question needs to be pointed out. In the first part of the Thematic Paper we wrote "innovations are the direct and indirect outcomes of different activities: basic research carried out in universities, research in firms R&D labs, production. Additionally, innovations can have different nature, i.e. technological and non-technological, tangible and intangible. It is still difficult to gather quantitative information on all these aspects, and even more to get them in a comparable standard for a large number of countries".

The weight of the non-technological and non-R&D factors is gaining importance in both manufacturing and services, as well as in emerging sectors like the creative industry. Consequently, the use of composite indicators which are mainly based on technological capabilities and technological innovation raises an important question: are we underestimating a relevant part of the innovative activities and capabilities in some countries? This is something one has to bear in mind when analysing the innovative performances. The development of new indicators should take into account these new forms and modes of innovation and it is a challenge which deserves a priority effort in the research agenda in this field.

The main aim of the GIS 2008 is to explore the long-term dynamics and to provide an overview on the main trends, results and determinants of the innovative performances of countries across the world. The main findings can be summarized in the following points:

1. The exclusive club of innovative leaders. There is a stable group of countries which are firmly within the top performers, it includes: Sweden, Switzerland, Finland, Israel and Japan (while the United States drops out from the leaders and moves to the group 2 in 2005). The innovative performance of these countries is particularly based on business activities (cf. Figure 2, 3 and 5).

2. The convergence of the followers. From the comparison of the groups based on the GIS Index on 1995 and 2005 a process of convergence in the middle of the ranking emerges (cf. Figure 6). Behind the innovative leaders, the group 2 has become the larger cluster and it includes emerging countries like the Republic of Korea and Singapore. At the same time, a considerable group of countries climbed from the group 4 to the group 3 in 2005, i.e. Spain, Italy, Czech Republic, Estonia, Russian Federation, Portugal, Greece, Lithuania and Hungary.

3. The great divide of the group 4. The other main finding which emerged from the exploration of the dynamics of the innovative performances over the decade 1995-2005 is related to the bottom of the ranking. Figure 7 shows how the group 4 (based on the GIS Index 2005) are characterized by the largest variability in terms of innovative performance growth rate over the decade 1995-2005. Within this group, one sub-group performs above the average GIS growth rate while another sub-group shows the lowest performances. In particular, the three BRIC countries, Brazil, China and India, in addition to Turkey, have undertaken a catching-up process with respect to the other countries, in particular with regards to the first two groups. The fact that three of the largest emerging economies in the world are the best performers in terms of innovative performance growth deserves attention. Regarding EU countries, they perform at all the levels of performance across the GIS, i.e. there are Member States at the top and bottom of the rankings. However, although there is clearly a strong structural component to innovation performance, we do observe transitions over time. In particular several of the EU15 have moved from the group 3 to the group 2 (UK, Austria, Belgium) and a number of lower performing EU Member States have moved from the 4th to 3rd groupings (Spain, Italy, Czech Republic, Estonia, Portugal, Greece, Lithuania, Hungary). On the other hand, some of the EU countries in the group 4 (cf. Figure 7) have shown the slowest rate of growth in the GIS index (e.g. Romania, Slovak Republic, Latvia, Bulgaria, Poland). It is important to point out that the data from 2005 is unlikely to capture any effects of EU enlargement which only happened in May 2004 (and January 2007 for Bulgaria and Romania). The new Member States have significantly increased their spending on innovation support since 2004 due to the Structural Fund programmes. However the effects of this are beyond the time period included in the analysis. As far as Italy is concerned, the fact that it gained two position from 1995 to 2005 needs to be qualified. The good performance depends entirely on the Infrastructures pillar and in particular on the diffusion of the broadband. If we look to the other two pillars, there is an alarming signal coming from both Firms Activities and Human Resources. As we have seen in section 2, Italy shows encouraging performances in particular in terms of Business R&D, total researchers and labour force with tertiary education. However, innovation performance and competitiveness among countries is a game to be played in relative terms, and the main results from table 2 show that the other countries are doing much better both relative to Firm Activities and Human Resources.

From the EU perspective, there are at least three implications which can be taken in consideration regarding the dynamics of the innovative performances at global level. Firstly, innovation does not always occur in the same way. The importance of the different determinants of the innovative performance and their effects on growth can depend on the national industrial structure and on the stage of development. The study of this relationship is crucial for designing effective policies to sustain innovation and longterm growth. Secondly the GIS 2008 findings confirm the need for policy makers to start thinking beyond the triadic division – the United States, Europe and Japan - also when they deal with technological capabilities and innovative performances.

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D. Archibugi, A. Filippetti: Innovation 38