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INNOVATION AND TECHNOLOGICAL CATCH UP: WHAT SHOULD WE LEARN EMERGING ECONOMIES FROM THE EUROPEAN EXPERIENCE?

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Abstract

The last ten years European Union experienced an uneven technological catch up process, which enabled latecomers to use advanced technologies and innovations without incurring high research development spending, and with large disparities in their innovation performance. Developing countries have already followed this movement, as the Eastern Asian experience proved. This evolution could be accelerated by the implementation of user innovation, which will bend it to the needs of the developing countries population. But it requires the development of technological and social capabilities, and the reinforcement of national innovation systems that will allow these countries to upgrade their innovation performance.

I. Introduction

At first studied in a macroeconomic framework, the analysis of economic convergence and technological catch up had experienced recent advances, from a theoretical and an empirical point of view. It followed the tradition of historical works initiated by Gerschenkron (1962) and Abramovitz (1986), from the study of the XIXth century European experience to the contemporary experience of Asian emerging countries (Shin (1996), Chang (2002)). These studies prove that the macroeconomic convergence needs a complete set of institutional factors, summing up in the term of "social capabilities" and "technological capabilities", while recent works in the field of the economics of innovation proves that the intensification of growth in knowledge leads to an acceleration of technological diffusion towards emerging countries (Keller, 2004). This acceleration brings about a sharp rise in the rate of total factor productivity growth in these countries, far more important than the effect of the rise in capital intensity can explain. From this point of view it is worthwhile to point out that both the World Bank and UNIDO focus recent reports on this issue, namely in the World Bank report on technological diffusion (World Bank, 2008) and on the UNIDO report on the industrialization strategy towards the "bottom billion" (UNIDO, 2009).

From this point of view, the European Union has been an exceptional experimentation field: it has recently known an uneven technological catch up process, with its progressive enlargement to the countries of Southern, then Central and Oriental Europe. One of the main advantages of this experience is that it benefits from a complete statistical Survey, with the European Innovation Survey (CIS1 to 4) and the European Innovation Scoreboard (2010). The aim of this paper is to present and discuss some recent results obtained in this field in Europe, and to discuss the question of the catch up process in the developing countries.

This paper will also refer to two main new trends in the economics of innovation. Firstly, as the process of technological diffusion is becoming more complex, it concerns not only its producers, but also its users (Von Hippel, 2005). That means innovation process needs to promote innovation users, who have the ability to modify an existing product or process, or to create a new use for it. This kind of innovation has been encouraged by the development of the Information and communication technologies, as the experience of FOSSS proved. While this kind of innovation appeared for a first time in the more advanced countries, it is a challenge that the emerging countries will have to cope with. It is an important way to appropriate new technologies that emerging countries should promote, in order to adapt technologies to their needs and even adopt a leapfrogging innovation strategy.

The second recent evolution, which matches the first, concerns the acceleration of knowledge spillover, which concerns firms and countries. In the advanced countries, a significant part of innovative firms doesn't run any RD activities, while developing countries experience a rise in their total factor productivity with a low, even null, level of R&D spending. This evolution concerns, not only industry and services, but also traditional sectors like fishing or agriculture, which benefits of a kind of "digital provide" using ICT. All these facts are linked to the existence of technological spillovers but as in the Gerschenkron approach they require some technological capabilities. In the Kaplinski and alii words (Kaplinski and alii, 2009), innovation in the developing countries should become "below the radar", and be devoted to the satisfaction of their needs rather than adapting or copying the way of life of advanced countries.

In order to take into account of this new development in the technological diffusion and innovation process, we will at first detail some facts and results about the European experience using the CIS and European Innovation Scoreboard We will thereafter discuss some open questions asked by the technological catch up of developing countries, regarding their ability to improve their technological and social capabilities, to build up their own national innovation systems, and to promote their own innovation users.

II. The Dynamics of Innovation and Technological Catch Up: Some Results of the European Experience

II.1. A Fast Convergence Process, with Large Disparities in Innovation Performance

Over the past thirty years the European Union experienced an exceptional historical convergence process which concerned at first the Southern European countries, and after the Central and Oriental European countries. From this point of view the Lisboa Strategy aiming a ratio of 3% of the GDP devoted to R&D by 2010 was doomed to fail since the first millennium decade saw the integration of low RD level countries, lower than 0.5% of their GDP, which exert a negative effect on the aggregated data.

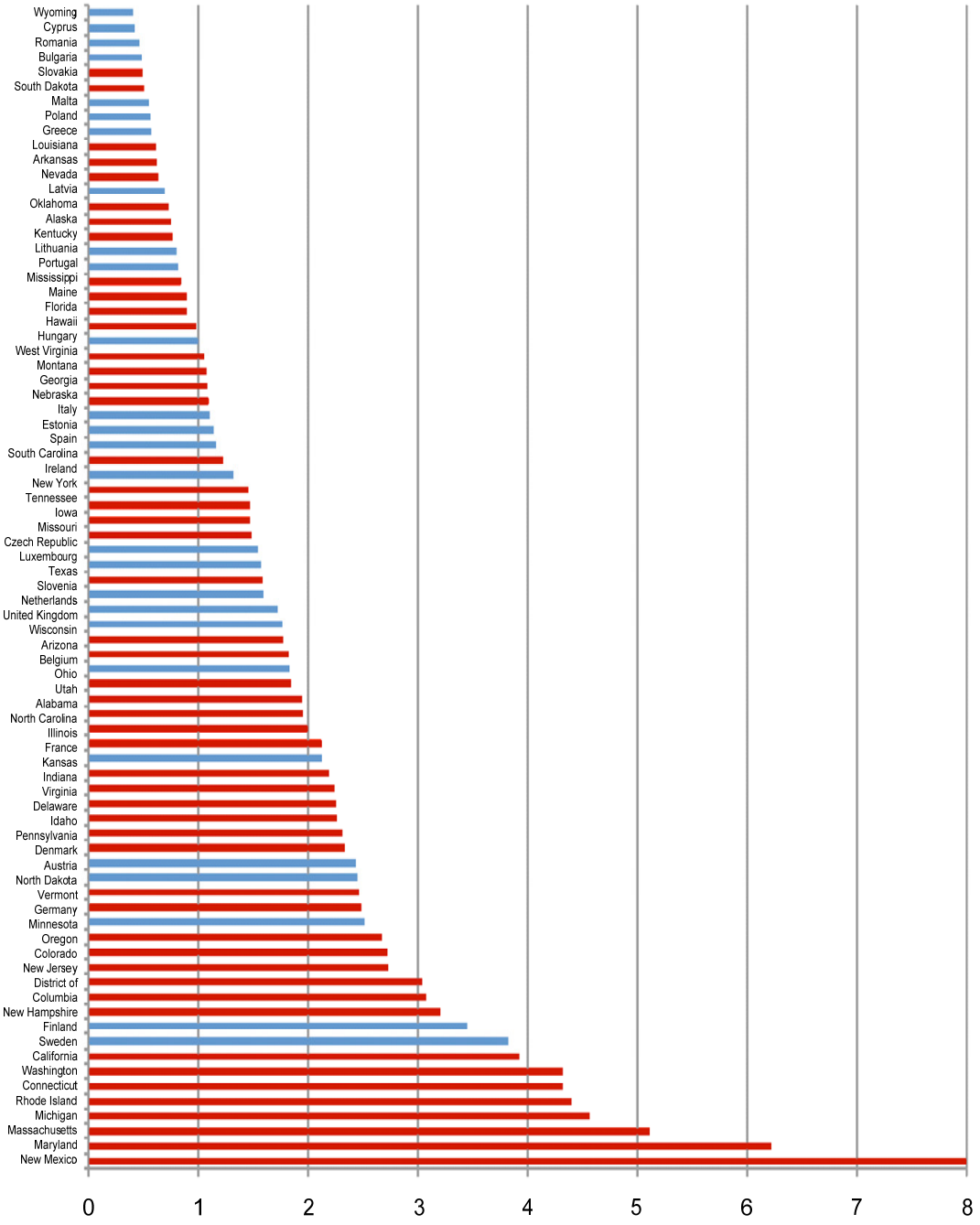
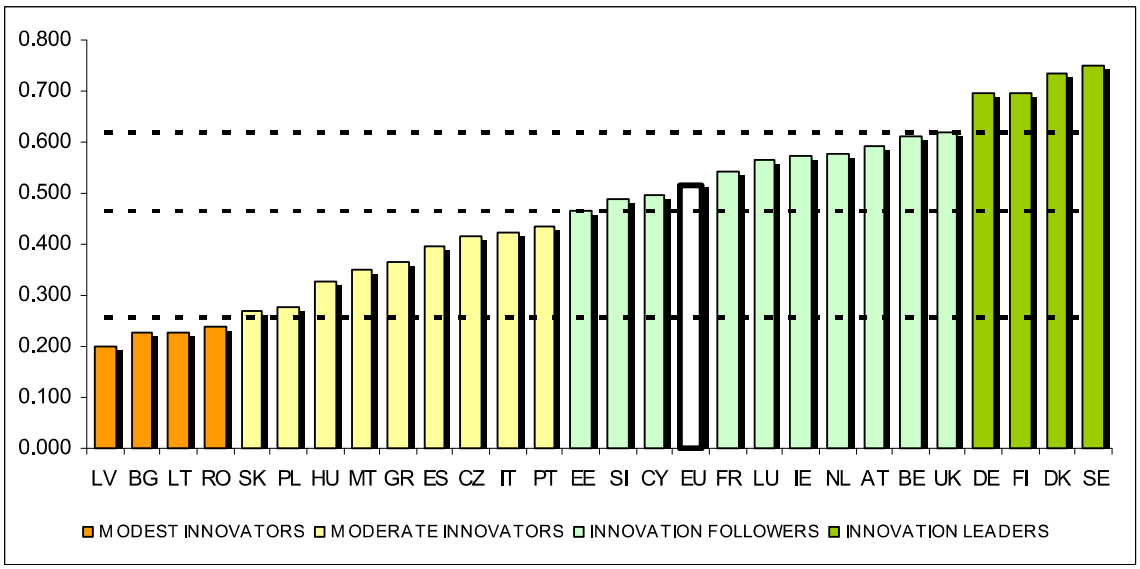


Figure 1. R&D intensity of US Federal States (2004) and EU Members states (2006)

Source: Van Pottelsberghe, 2008

Comparing Europe to more homogeneous countries like Japan or USA is, from this point of view, nonsensical. The alleged R&D gap is decreasing when the European States performance in this field is detailed. It has been done by Van Pottelsberghe, who compared the R&D performance between the European and the American Federal states: if some "high tech" American federal states obtained far better result than the European ones, the ranking between the two geographical areas is quite mixed, for example the Scandinavian countries appear in the top group of this ranking. (Van Pottelsberghe, 2008). On the contrary, latecomers in the European Union, which shows very low level of R&D spending, are close in this field to some rural area.



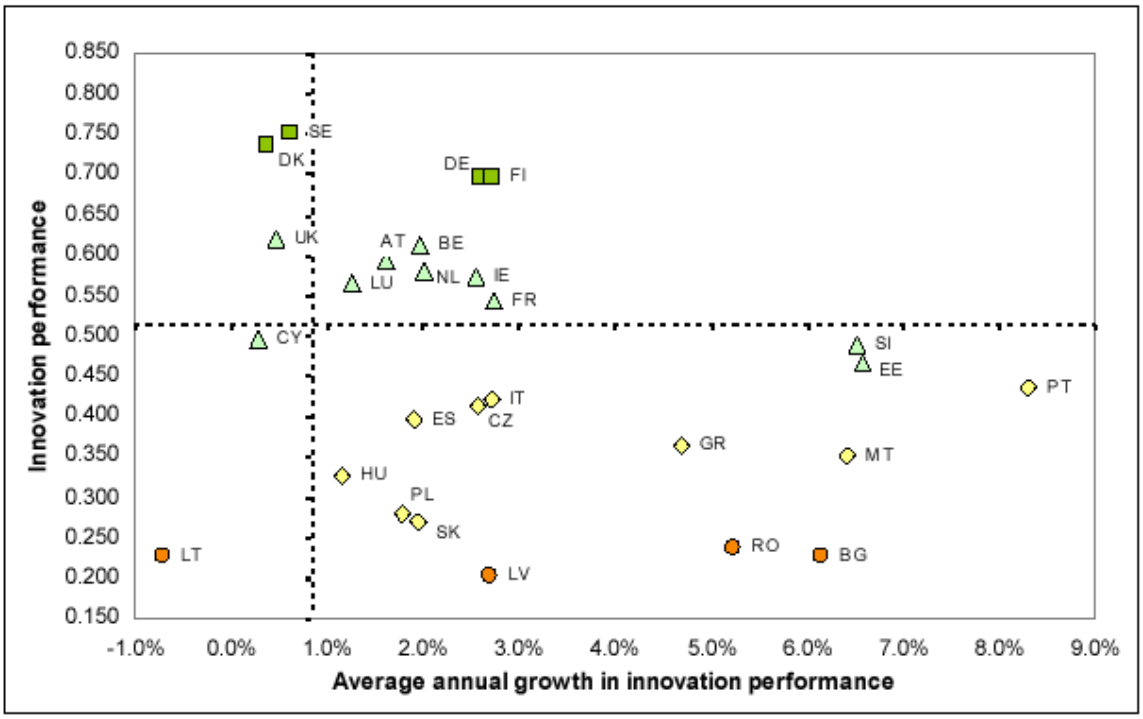
Note: Average performance is measured using a composite indicator building on data for 24 indicators going from a lowest possible performance of 0 to a maximum possible performance of 1. Average performance in 2010 reflects in 2008/2009 due to a lag in data availability.
The performance of Innovation leaders is 20% or more above that of the EU27; of Innovation followers it is les than 20% above but more than 10% below that of the EU27; of Moderate innovators it is less than 10% below but more than 50% below that of the EU27; and for Modest innovators it is below 50% that of the EU27.

Figure 2. EU Member States Innovation Performance

The large disparities between European countries innovation performance are confirmed by the four CIS studies over the last ten years, and the European Innovation Scoreboard, now Innovation Union Scoreboard (IUS, Innometrics, 2011). This Scoreboard ranks the European countries according to an index of Innovation Performance, build up from 29 indicators, in four main categories: innovation enablers, firm activities and innovation output, lead to a clustering in four groups, namely the innovation leaders, (dark green), the innovation followers (light green), the moderate innovators (yellow) and the modest innovators (previously catch up countries, orange). As it could be guess, this ranking is close,

but not similar to that of R&D intensity. For example, Germany, with a R&D intensity close to that of France, belongs to the group of Innovation leaders, while France appears in a lower position in the innovation follower group. On the bottom of the innovation performance index it can be seen that some newcomers in the Europe Union are ranked in a better position that their R&D intensity let guess.

As one can check on the following figure, which plots the growth rate and level of each country innovation performance, a convergence process is in progress: level and growth rate are inversely related, with important divergences between countries in each group. For each category we can find countries with slow, moderate or fast growth. It is worthwhile to note that the largest disparities appear on the modest (round, orange) and moderate innovator (diamond shaped, light yellow) countries, which means that the performances of each national innovation systems are quite different. For example Hungary and Romania, which have close innovation performance level, show an important gap in their growth, in favour of the latter.



Note: Colour coding matches the groups of countries identified in Section 3.1. Average annual growth rates as calculated over a five-year period. The doted lines show EU27 performance and growth.

Figure 3. Convergence in Innovation performance

Table 1

Innovation growth leaders

Group	Growth rate	Growth leaders	Moderate growers	Slow growers
Innovation leaders	1.6%	Finland (FI), Germany (DE)		Denmark (DK), Sweden (SE)
Innovation followers	2.6%	Estonia (EE), Slovenia (SI)	Austria (AT), Belgium (BE), France (FR), Ireland (IE), Luxembourg (LU), Netherlands (NL)	Cyprus (CY), United Kingdom (UK)
Moderate innovators	3.5%	Malta (MT), Portugal (PT)	Czech Republic (CZ), Greece (GR), Hungary (HU), Italy (IT), Poland (PL), Slovakia (SK), Spain (ES)	
Modest innovators	3.3%	Bulgaria (BG), Romania (RO)	Latvia (LV)	Lithuania (LT)

Note: Average annual growth rates as calculated over a five-year period.

Source: Innovation Union Scoreboard 2010, Innometrics, 2011

II.2. Innovation Performance and Catch Up Process

As we have seen, evaluating the performance of national innovation systems is not an easy thing to do. Some studies tried to evaluate the performance of the national innovation systems using CIS surveys, and their results converge with the Innovation Union Scoreboard. Edqvist and Zabala found that catch up countries perform better in process innovation rather than product innovation, and in services activities. (Edquist et Zabala (2009). Another study on the South, Central and Eastern Europe proves that the investment in the knowledge industries is weaker than in Western Europe, even when the sectoral structure of these countries is taken into account. (J. Meriküll, R. Eamets, U. Varblane, (2009).

In the field of Innovation, the situation is comparable to that of macroeconomic convergence models: the relative performance of catch up countries is higher than that of more advanced countries (Edqvist et Hommen (2008). With a low investment in knowledge activities, it is not surprising that they got a higher return than countries with higher input level in knowledge. A recent study on the efficiency of R&D spending carried out on European data confirms this point (Harfi et Mathieu (2009). The authors rank the countries according to an efficiency index calculated according to a technical efficiency model that links the RD input to their innovation capacity. This capacity is measured by their ability to create new products for the market (product innovation), or for the enterprise (imitation): we can check that the performance ranking of countries doesn't fit their level of R&D investment. For example, Romania which invests less than 0.5% of its GDP in R&D is 5th in Innovation and 7th in imitation (on 17 countries) in technical efficiency term, as Poland and Estonia whose results are far better than their R&D investment let us guess.

Table 2

Measure de l'efficiece tecnique par pays

Pays	Effort de R&D en % du PIP	Imitation		Innovation		Global	
		%	Rang	%	Rang	%	Rang
Allemagne	Plus de 2%	68.91	3	67.54	4	74.30	2
France		66.40	10	67.83	3	72.06	4
Suède		69.59	1	69.48	1	74.50	1
Belgique	Cornpris entre 1.5 et 2%	64.57	13	62.33	12	70.12	12
Norvège		63.20	15	61.02	15	68.31	16
Pays-Bas		68.99	2	67.98	2	73.35	3
Espagne	Cornpris entre 1 et 1.5%	66.92	9	62.27	13	70.25	11
Italie		67.02	8	64.95	8	71.67	6
Tchéquie		67.42	6	64.79	9	71.32	7
Bulgarie	Cornpris entre 1 et 0.5%	60.46	17	61.85	14	69.64	14
Estonie		64.93	12	65.56	5	70.78	10
Hongrie		61.77	16	63.69	11	69.63	15
Lituanie		63.91	14	59.41	16	69.66	13
Pologne		68.21	4	65.38	6	71.31	8
Portugal		65.36	11	64.44	10	71.79	5
Chypre	Moins de 0.5%	67.21	7	51.39	17	64.86	17
Roumanie		67.71	5	65.08	7	71.22	9

Source: Harfi et Mathieu (2009)

Table 3

Ranking of the CEECCA Countries by Innovation Activities

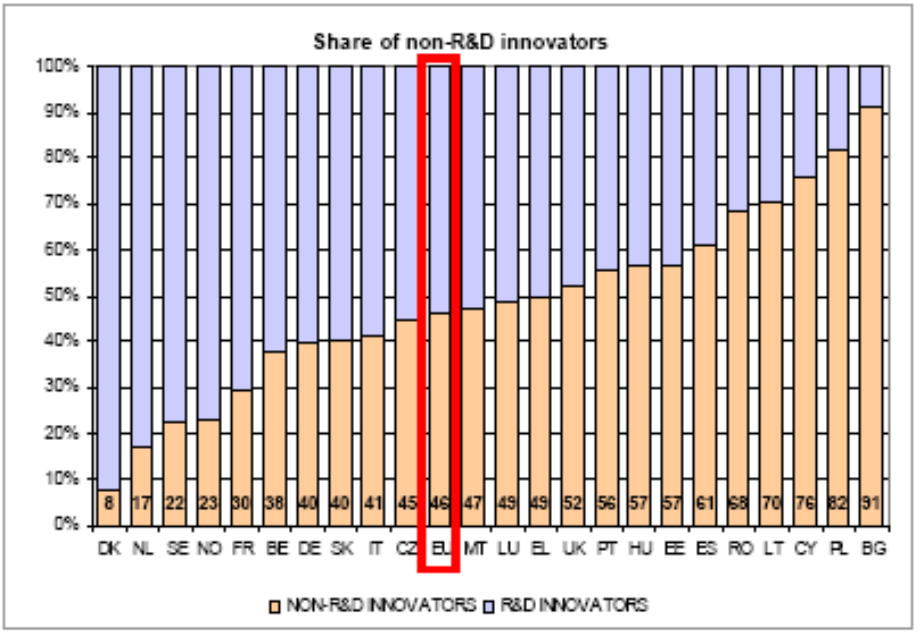
				GDPpc 2003	GDPpc 2007
Innovation Weak	11	Little BUY − No MAKE	Tajikistan, Kyrgyzstan, Serbia, Bosnia, Macedonia	20.7	21.6
	12	Some BUY − No MAKE	Azerbaijan, Mongolia, Moldova, Kazakhstan, Romania, Armenia, Bulgaria	22.7	27.4
Innovation Active	13	Mostly BUY − Little MAKE	Latvia, Poland	53.6	62.1
	14	BUY − MAKE	Slovakia, Lithuania, Hungary, Estonia, Turkey, Croatia, Ukraine, Russia	53.2	58.6
	15	BUY − MORE MAKE	Slovenia, Czech Republic	92.2	94.5

Note: GDPpc is expressed as gap relative to maximum GDPpc in the CEECCA group, i.e. Slovenia. Value are subgroup unweighted averages.

Source: R. Veugelers, Assessing the potential for knowledge-based development in transition countries, Bruegel Working Paper 2010/01

Another recent research confirms these results, since in a rather more pessimistic manner (Veugelers, 2010). Using a large panel data over 24 countries from Central and Eastern Europe, the Caucasus and Central Asia (CEECCA) countries, it tries to test their ability to develop a knowledge based growth path or to have the potential to develop in the near future. All these CEECCA Countries can be clustered according to their ability to "buy", or to "make" new technologies: it can be checked that some of modest innovators belongs rather to the first rather to the second category, while most of the newcomers in The European Union belongs to the category of Innovation active countries.

An important point is related to the existence of innovative firms without RD, or "non RD Innovators". All the Innovation surveys show that a significant proportion of firms (around one on two) belong to this category. The share of the non RD innovative firms decreases with this innovation performance, as shown on the following figure (Figure 4): while this share reaches a 80-90% value in catch up countries like Romania or Bulgaria, it falls to a level lower than 20% in Sweden, Nederland or Denmark. Improving the innovative capacity of a country needs to increase sharply its business funded spending, in order to go over the step of simple adoption/adaptation of technologies coming from external sources.



Note: Results based on CIS-4 data. R&D innovators are defined as all innovators performing in house or intramural R&D. Non-R&D innovators innovate by acquiring or by buying extramural R&D (i.e. R&D performed by other companies or research organisations), by buying advanced machinery, equipment and computer hardware or software, by buying or licensing patents and non-patented inventions, by training their personnel, or by spending resources on the design and market introduction of new goods or services.

Figure 4. Share oh innovators not performing R&D

Source: European Innovation Scoreboard 2008

III. How Does the National Innovation Systems of Developing Countries Perform?

Studies of the developing national innovation systems are still at an early stage, mainly because of the lack of data, except the case of the industrialization of East Asia, which has been widely documented, especially in the Korean case (Kim, (1980) (1997) Shin (1996). Nevertheless, recent studies have been realized, using innovation surveys with the CIS methodology.

III.1. Some Early Results on Developing Countries

A first comprehensive survey have been made by Bogliacino and others (Bogliacino et alii, 2010), which covers Latin America, Eastern Asia, Central and Oriental Europe, Russia, and Africa. Despite some comparability and measurement problems, some main features appear. When compared with European Union firms, which are used as benchmark, developing innovating firms have a slightly lower innovation capacity, as measured by the part of turnover in new products. Even when these countries results are close to the European ones (like Eastern Asia), most of these innovations concern new products to the firms. When considering the means devoted to innovation the gap within the European Union is deepening, this gap being mainly measured by the share of R&D spending in GDP. We find the same characteristics observed within the European Union: disparities are more important in means than in results of the innovation. Indeed, these disparities are diminishing sharply on recent years: countries like China, Brazil or Turkey having figures that will allow them to belong to the group of moderate innovators in the EIS terms. More detailed results have been obtained by recent studies on the mediterranean countries (Marocco, Tunisia) (Rigas et Hatem, 2008, Ayadi., Rahmouni, Yildizoglu, 2009), using innovation survey data. They prove that the main sources of innovation are external to the firms and to the countries themselves, and that the most innovative firms are working on both the domestic and foreign market, on the contrary of "purely" exporting or domestic firms which perform poorly in this field.

More aggregated results have been obtained by Fagerberg et Srholec (2008), who used 25 main indicators on technological development and governance of 115 countries between 1992 et 2004. They run a principal component analysis on these data, in order to explain the level of GDP. The idea was to find some composite common factor which will explain the variability of the whole set of data. So doing they found 4 composite factors, corresponding to the score of the countries on innovation system, on their governance, on the political system and on the openness of the economies. The explanatory power of each factor is decreasing: the fist factor, which includes several indicators, linked to the technological capabilities of the countries (patenting, publications, ICT infrastructure, ISO 9000 certification and access to finance), is the most significant and gets a correlation coefficient of 86% along a simple regression.

The second factor includes governance variables like the respect of property rights, the working of the judicial system, the presence of corruption and of a good business climate. Although still significant, the relation with economic development is weaker than that of the innovation factor, with a correlation coefficient of 52%.

On the contrary, the last two factors perform badly: the "political system" factor, that ranks countries on a scale rising with their proximity with a western representative democracy, has a weak explanatory power. It is not surprising when considering the economic success of

some authoritarian political regimes. Lastly, the fourth factor, closely linked to FDI and import, reflects the openness level of the countries and is not correlated with their level of development, even when countries sizes is controlled. It is worthwhile to underline that these results, obtained on recent data, confirms the intuition of the historical literature on convergence: the first two factors can be considered as some proxies of their "technological capabilities" and "the social capabilities".

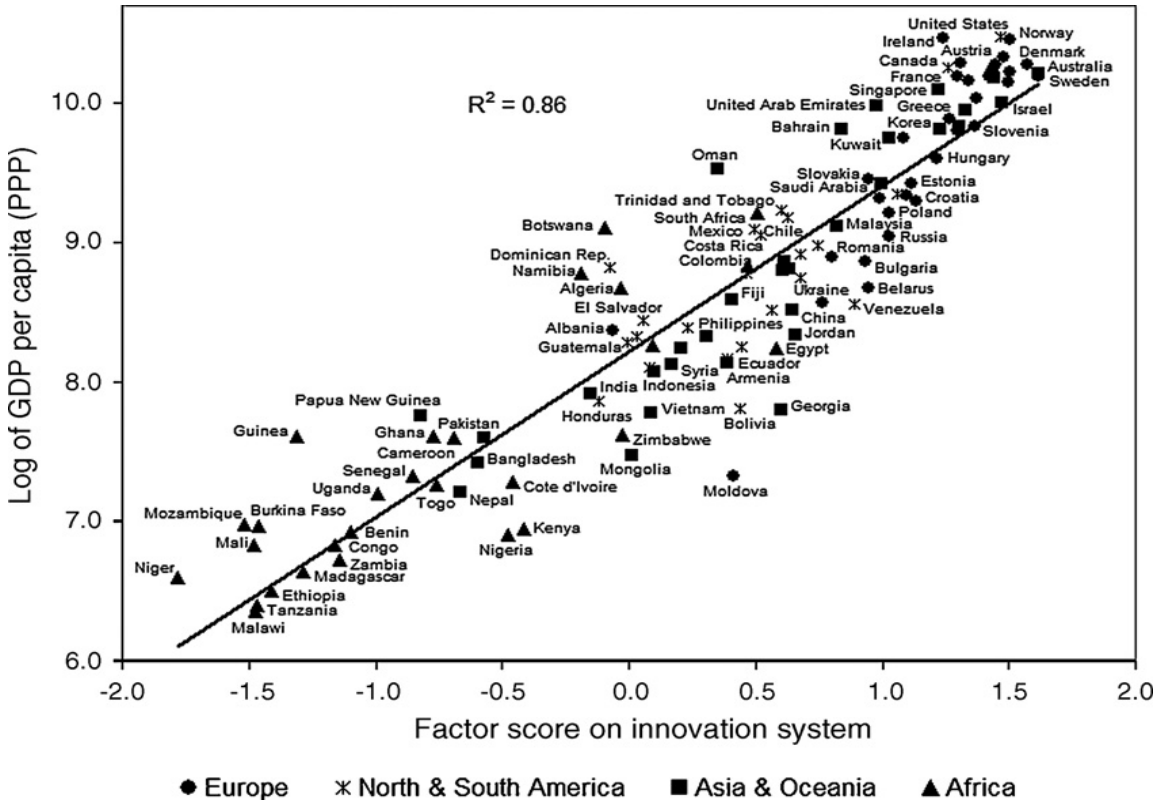


Figure 5. Factor score on innovation system and level of GDP

Source: Faberger and Shrolec, 2008

III.2. The example of South Mediterranean countries Innovation systems

If South Mediterranean Countries belong to the group of modest and even moderate innovators for some of them, they exhibit unequal performances in this field. Some recent studies have been recently realized, mainly on Marocco, Tunisia and Turkey, while some specific programs have been promoted by the European Union within the Barcelona process (ESTIME project), or by the World Bank (JE Aubert and JL Reiffers (2002)). Their results allow to characterize the national innovation systems and to help them to improve their performance. According to the AMINA network (animaweb.com), which promotes innovation

systems in Mediterranean countries, these countries devote few means to R&D, with a share of between 0.3 and 1% of their GDP, while their innovations come mainly from foreign sources. These sources are European in Turkey and Maghreb countries, and more diversified in the Middle East Countries, except Israël where the American investment is dominant.

A first study have been realized in Tunisia, using an Innovation Survey (Ayadi., Rahmouni, Yildizoglu, 2009). It proved that product innovation are motivated by the necessity to diversify products, while process innovation are more driven by quality and flexibility requirements. Two more results are worthwhile: on one hand a negative relation is obtained between the public share of capital and their innovative propensity, which could be the sign of the failing governance of public owned companies. On the other hand openness has an ambiguous role: the most innovative firms are working on both domestic and foreign markets, contrary to the purely domestic or exporting firms which perform badly.

Marocco on its side had already set up an innovation survey, following an R&D survey. It shows an increase in the proportion of Innovative firms between 1999 and 2005, from 29 to 42%, while the share of firm performing some R&D rise from 9 to 23%, a figure similar to the Tunisian one (Rigas and Hatem, 2008). Another recurring problem concerns the working of the national innovation systems, still in an infant stage: most of the firms don't know the existence of national innovation support schemes, and links between the universities and enterprises are still weak.

IV. New Channels for New National Innovation Systems?

The rise of an intensive knowledge economy leads to a double evolution: while the more advanced countries invest in high technologies in order to be on the edge of the technological frontier, catch up countries benefit from this effort in following strategies of adoption/adaptation of technologies. Succeeding in this strategy depends on their ability to adopt these technologies, to adapt them to their needs, and to promote their own national innovation system. It is clearly a key challenge for developing countries.

IV.1. Developing Countries Need Innovation Users

According to the pioneering approach of E. Von Hippel, innovation process concerns, not only its producers, but more and more its users, who are a major source of innovation product and process (Von Hippel, 1998). The development of these innovations has been boosted by the Information and Communication techniques, but it raises one question. According to Von Hippel, (Von Hippel, 2005) it will help to democratize innovation, but it is a controversial point. In fact this new innovation pattern first appeared in the more advanced countries, with an important population of high skilled "lead users", fond of new technologies and able to master and transform them. Most of the recent works on Innovation users have been done in these countries, mainly in Canada (Gault et Von Hippel, (2009)), Nederland (de Jong and Von Hippel (2008), de Jong and Von Hippel (2009)) and in Europe (Flowers, Sinozic, Patel, (2009). This last study, using the 2009 European Innovation Scoreboard is the most extensive ever. It draws a distinction between three kinds of Innovation users, named "User process Innovation", "Innovation Product Innovation", and "Involver Innovation". While the first two cover the well-known categories of innovation, the third appears when a firm decides to associate its product

users to the evolution of their product. According to this study, User innovation is more developed in large firms (more than 250 and 500 employees) than in small and medium sized firms, with a slightly prevalence in middle and high technology industries. All industries are evenly concerned by this kind of Innovation. When the comparison is done between countries, User innovation is more widespread in the innovation leaders, even if the observed disparities between countries categories are rather small. On the average, in the European Union, 30.3% of firms are User process innovators, 27% innovation product innovators, and 53.1% involver innovators, a higher proportion than observed on former studies, where it reach the average of 20% of the Innovative firms.

So the main results obtained in this field prove that the firms and countries that have the highest capability to produce innovation are the most able to use it. It shouldn't be surprising: it means that innovation production and use are more complementary than substitute. Flowers go so far as calling the innovation users as "super innovators", which have to be promoted by innovation policies [1](Flowers and alii, op. cit., 2009).

IV.2. How to Improve the "Below the Radar Innovation" (Kaplinsky et alii, 2010)?

For the developing countries, promoting innovation users is a key challenge. It is important to point out that if this issue has not been well studied in these countries, it does not mean it doesn't appear. In fact, the development of ITC in the traditional sectors like agriculture and fishing (Galiègue, 2009, Jensen, 2008) can be considered as an innovation User strategy, as in a broader sense most of the strategy of technological adoption/adaptation. Others facts and arguments can be used to support this idea. As Kaplinski and alii argue, innovation should be bend to meet the needs of developing countries, and become, according to their term, " below the radar" (Kaplinski and alii, 2010). Firstly it is important to point out that the R&D expenditures of developing countries have reached significant levels: from 2% in 1990, they reached more than 20% in 2000 of the total world spending, if we count all the spending outside the Triad (Japan, USA, and Europe). So developing countries have already the technology capabilities and innovation capacity to change its pattern. A second important point is related to the change of localization of production: most of the world industrial production is now realized in developing countries, and their demand for adapted products and technology is rising. As the innovation capacity of developing countries has been created in major exporters of manufactured goods (China) or services (India), they need to follow the demand of the most growing demand potential, which is in other developing countries. As Kaplinski and others claim that developing countries should accompany and accelerate this evolution, by promoting their own innovation systems. In another words, it is necessary to promote the production and use of innovation in these countries, in making their producers and consumers new lead users. Some recent examples of this evolution, mainly in ITC, Health care and Pharmacy are given by Kaplinski. But it is important to point out that innovation policy, as the action of NGO, should be the key drivers of such a "pro poor" innovation strategy.

[1] Let's point out that the first Free Open Source Software (FOSS) appeared in the community of computer "geeks" coming from University or computing company of the more advanced countries. Even the Ubuntu software, although born in Africa (South Africa), owes his success to its adoption in advanced countries.

IV. Conclusion

In this survey we state that, if a catch up process is well under way in a growing number of developing countries, it is basically because these countries have been able to develop their own technological and social capabilities, which allow them to adopt external technology at a low cost. But if these countries want to go further in the process of technological appropriation, they need to build up their own innovation system. As seen on the case of south Mediterranean countries, these national innovation systems are still in an infant stage and should tighten the links between Universities, public policy and institutions, and enterprises. They should also promote innovation users, who will have the ability to find use of products adapted to the needs of their enterprises and population. It is one vital condition to upgrade their innovation performance, and turn the innovations to the satisfaction of their own needs.

References

1. Abramovitz M. (1986), "Catching up, forging ahead and falling behind", *Journal of Economic History*, No. 46, pp. 386-406.
2. Arvanitis R. et Hatem M., Innovation Policies in the context of North-Africa: new trends in Morroco and Tunisia, MPRA Paper n°17939, Decembre 2008, *http://mpra.ub.juni-muenchen.de/17939Aubert* JE et Reiffers JL (2002), Le développement des économies fondées sur la connaissance dans la région Moyen Orient et Afrique du Nord: facteurs clés, Banque Mondiale, Marseille, Banque Mondiale.
3. Ayadi M., Rahmouni M., Yildizoglu M. (2009)) Determinants of Innovation propensity in Tunisia: the central role of External Resources Knowledge Sources, DT- GREQAM 2009-05, February 2009.
4. Bogliacino F., Perani G., Pianta M., Supino S. (2010), Innovation and development, The evidence from Innovation surveys, Working Paper BETA, 2010-13, April 2010.
5. Chang Ha-Joon (2002), *Kicking away the ladder: development strategy in historical perspective*, London, Anthem Press.Edquist et Hommen (2008): Comparing National Systems of Innovation in Asia and Europe: Theory and Comparative Framework, in Edquist et Hommen, *Small countries Innovation Systems: Globalisation, Change and Policy in Asia and Europe*, Edwar Elgar, 2008, pp. 1-8.
6. Edquist C. et Zabala JM. (2009), Outputs of Innovation systems: accounting what comes out ot the system, Circle Working paper n° 2009/14, University of Lund, 2009.
7. Fagerberg J etSrholec M. (2008), National Innovation systems, capabilities and economic development, *Research Policy*, 37, 2008, pp. 1417-1435.
8. Flowers S., Sinozic T., Patel P., (2009), Prevalence of user innovation in the EU, INNOMETRICS Report, *http//www.proinno-euroope.eu/metrics*.
9. Gerschenkron A. (1962), *Economic Backwardness in Historical Perspective*, Cambridge, Belknap Press.
10. Gault F. et Von Hippel E. (2009), "The prevalence of user innovation and free innovation transfers: implications for statistical indicators and innovation Policy", MIT Sloan School WP 4722-09.
11. Huang C., Arrundel A. et Hollanders (2010) H., How firms innovate: RD, non RD and technology adoption, UNU-MERIT Working paper, 2010-27.
12. De Jong J. et Von Hippel, E. (2008), User Innovations in SMEs: Incidence and transfer to producers, Scales Research Reports H2008 14, EIM Business and Policy Research.
13. De Jong J. et Von Hippel, E. (2009), Free transfer for User Developed process Innovations for producers: A typical behavior among Dutch High Tech SMEs.
14. Flowers S., Sinozic T., Patel P., (2009), Prevalence of user innovation in the EU, Rapport, INNOMETRICS Report, *http//www.proinno-euroope.eu/metrics*.

15. Galiègue X (2009), Economie de la Connaissance et diffusion des technologies dans les pays en développement: quelques résultats récents, *Economies et Sociétés*, Série dynamique technologique et organisation, W, No.°11, 6/2009, pp 969-992.
16. Harfi M. et Mathieu C (2009), Innovation en Europe et Efficacité technique, ERUDITE, Avril 2009.
17. INNOMETRICS, Innovation Union Scoreboard 2010, Innometrics, February 2011, *http://www.proinno-europe.eu/inno-metrics/newsroom/innovation-union-scoreboard-2010*.
18. Jensen R. (2007), The digital provide: information (technology), market performance and welfare in South Indian Fisheries Sector, *Quartely Journal of Economics*, August 2007, pp. 879-924.
19. Kaplinsky R., Chataway J., Clark N., Hanlin R. Kale D., Muraguri L., Papaioannou T., Robbins P. et Wamae W (2010). Below the radar: what does innovation in emerging économies have to offer to other low income Economies, UNU Merit Working Paper, No.°2010-020.
20. Keller W. (2004), International Technology Diffusion, *Journal of Economic Litterature*, Vol. XLII, September, pp. 752-782.
21. Kim L. (1980), Stages of development of industrial technology in developing countries: a model, *Research Policy,* 9, p. 254-277.
22. Kim L. (1997), From *Imitation to Innovation: The dynamics of Korea's Learning*, Harvard Business School Press, Harvard.
23. J. Meriküll, R. Eamets, U. Varblane (2009), Sectoral system of Innovation: the Central and Eastern European Perspective, UNU Merit Working Paper, 2009.
24. Shin, Jang-Sup (1996), *The economics of the latecomers Catching-up, Technology Transfer and Institutions in Germany, Japan and South Korea*, London, Routledge.
25. UNIDO (2009), "Breaking in and moving up: New industrial challenges for the bottom billion and the middle-income countries", Industrial Development report, 2009.
26. Van Pottelsberghe (2008), Europe RD: a missing target?, Brueghel Policy brief, 2008 (3).
27. R. Veugelers, Assessing the potential for knowledge-based development in transition countries, Bruegel Working Paper 2010/01 *http://www.bruegel.org/publications/ show/category/working-papers*.
28. Von Hippel E. (1998), *The Sources of Innovation*, Oxford University Press, 2005.
29. Von Hippel E. (2005), *Democratizing Innovation*, MIT Press.
30. World Bank, (2008) *World Economic Perspectives 2008*, January 2008.