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Occasional Paper

A new form of entrepreneurial capitalism based on innovation and *Research in Italy*

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With "A new form of entrepreneurial capitalism based on innovation and *Research in Italy*" the Occasional Papers of Finmeccanica, edited by the Research Department of the company, continue the publication.

The initiative is based on the consciousness of Finmeccanica that one of its institutional duties is to help in raising awareness of themes of general interest relating to the economy, technology and industry.

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"The need for the network. Internationalization as a strategy to compete in the global economy", Paolo Guerrieri, May 2008

"Impartiality is a pompous name for indifference,
which is an elegant name for ignorance"
(Gilbert K. Chesterton)

In November 2004, the deputy governor of the Central Bank of China told the Financial Times that "China would be happy to import high-tech goods from the United States, in exchange for the chance to export freely." Then he went on to say, surprisingly, that the difficulty lays in the fact that "the United States are too focused on low value-added sectors such as textiles and agriculture."

Clearly this is something of a paradox, but it is true that China is acquiring the best process technologies in all sectors and that, not by chance, in 2004 it became the top world exporter of ICT products such as cell phones, laptop computers and digital cameras, overtaking the United States by 20%. But that's not enough.

The Indian Institute of Technology now rates as one of the leading universities in the world for computer sciences, and around 10% of the engineers employed in Silicon Valley firms are Indian.

More in general, emerging countries, especially in Asia, are investing heavily in training young people. Of about 600,000 foreign students who enrol every year in US universities, nearly half come from the Far East. About a quarter of these are Indian and over 20% Chinese, another 20% come from South Korea, Taiwan, Indonesia and Thailand. In other words, Asian countries are now preparing to become competitive in the future through advanced training for their children.

What about Europe? In Lisbon, March 2000, the commitment was to become in ten years "the world's most competitive and dynamic economy, based on knowledge, able to maintain sustainable economic growth, with new and better jobs and more social cohesion." 2010 is just around the corner and it doesn't look as though this result has been achieved.

And Italy? We know only too well that *Research in Italy* is a sore point, in terms not only of funding but also of organisation and structural efficiency. However, in spite of this, Italy can boast of some fields of excellence which are recognised internationally and which ought to be more appreciated.

Research funding in Italy – both public and private – is constantly below the level of other advanced countries. Therefore this is a problem that is common to the two sectors, albeit for different reasons.

Looking at the public sector, we note that in Italy the percentage of the population with higher education is lower than the EU average; similarly, there are fewer graduates in scientific subjects and their average age is higher.

As far as the private sector is concerned, we should remember that 80% of employed people work for small/medium-size enterprises (SMEs). This pulverisation of the industrial fabric is both an advantage and a limit for the Italian economy. While the ability of small companies to innovate has contributed decisively to the success of *Made in Italy* products around the world, Italy's overall loss of competitiveness depends to a large extent on the fact that very few SMEs (less than 10%) operate in hi-tech sectors. This is due to a combination of two different aspects: on the one hand, nearly 80% of the added value of the manufacturing sector is produced by the SMEs, which however invest in R&D for less than 20%: the rest is done by large enterprises. The combination of these two factors explains why the Italian industrial structure is unbalanced towards sectors of low technological content. Something, which frustrates the efforts aimed at innovation, since innovation alone is easily imitable, while what creates a real competitive advantage is technological content.

Is it possible to transform the research sector – public and private – from a weakness into an element of competitive advantage for the whole system? In other words, can one imagine turning *Research in Italy* into a trademark of success just as *Made in Italy* has been – and still is, despite the pressures of global competition.

We believe the answer is yes.

What is necessary – and urgently required – is an in-depth deliberation followed by concrete and effective actions by all the players involved: the political powers, the institutions, the scientific community, the private sector.

We feel that the "New entrepreneurial capitalism of *Research in Italy*" can be useful for re-launching a discussion which to date has not produced significant results, despite the fact that for years it has been a constant feature of public events and conferences.

Pier Francesco Guarguaglini
Chairman and Chief Executive Officer
Finmeccanica

summary

Occasional Paper

A NEW FORM OF ENTREPRENEURIAL CAPITALISM BASED ON INNOVATION AND *RESEARCH IN ITALY*

October 2009

Introduction

Large multinational companies and new generations of innovative entrepreneurs are going to be among the protagonists of the new economic phase that is taking hold as an answer to the first true global crisis, derived from a set of contradictions and limits of capitalism of the Information Society age. The shockwave of this crisis has also rocked Italy, surprising the country in its torpid state of slow decline and progressive marginalisation compared to the most advanced economies. Italy has been affected by the crisis less than other countries but it also needs innovation to make up for a delay that has been going on for some time, more than other countries.

Italy is historically living on borrowed time with the strategic choices that determine the future. Today, faced with the enormous transformations going on in society and the structures of the economy and industry on an international scale, the inability to look towards the future and work consequently is a serious handicap.

To avoid falling further behind, the country must go beyond facing contingent problems. Because of a series of overwhelming forces, the crisis is destined to act, on one hand, as a brake to the rampant global capitalism driven by financial leverage. On the other, it will act as a generator of new Schumpeterian entrepreneurial capitalism where innovative capacity is going to play a key role. The "endless frontier of science" (V. Bush, 1945) that has sustained industrial reconstruction in the period after World War II, and the more recent extended phase of world economic growth, presumably work as a single driving force of social progress and economic development, with greater innovative potential than before.

Thanks to the leverage effect, used by the crisis, everything leads to the supposition that we will be seeing the significant development and effect of new frontiers such as green technologies, ICT, nanotechnology, life sciences, new materials and medical technologies.

The prospect of an economic recovery driven by entrepreneurial capitalism

brought about by science and technology is an opportunity that must not be ignored by a country like Italy that can attempt to hop on the new technological waves, even if not as a major player like other countries.
This is true for a number of reasons:

- first of all, thanks to the good production and absorptive capacity of new knowledge, fortunately present in some scientific and technological centres of excellence;
- secondly, Italy being able to boast the presence of a group of large and medium technology-based companies which in recent years have consolidated their position with advanced processes of internationalisation;
- thirdly, learning from the well-tested and widespread bottom-up entrepreneurship to strive for the formation of a technology based SMEs network generated by research and highly innovative entrepreneurial contexts.

Also in Italy, we must envision, as other countries are doing, a new generation of small entrepreneurs who with the aid of science and technology is able to develop new products, solutions and services, therefore, creating value by meeting the emerging new public and private needs. In order to do this, innovative finance, large industries and universities must join forces to accompany, with appropriate interventions, the process of establishing technology-based small companies and helping them grow.
At the basis of this proposal, there is the conviction that the new entrepreneurial class, aligned on the paradigms of research and know-how, can play a key role for the following:

- develop new products, solutions and services for the renewal of the production system and the support of the growth in demand;
- create technological outposts that permit large companies to get a jump on integrating new promising business lines;

- establish intelligent reference points for traditional SMEs for the purpose of absorbing and using new know-how and technologies, useful for innovation in processes and development of new business models.

By *Research in Italy* we do not mean exclusively research activity carried out in Italy, but the Italian value chain that starts from research activity, that leads to new global markets, products, services and know-how which create value and competitiveness through the application of entrepreneurial effort. In order to talk about the value chain one must necessarily look at it from a holistic perspective, that does not consider only the individual elements but the needs of the various subjects of the value chain to work together and create value.

To be players of the *Research in Italy system*, particularly, universities must be put in the condition to carry out their traditional mission of education and research but they must also know how to renew themselves from the inside in order to look beyond their traditional boundaries.

The university today must be asked to contribute to the generation of new wealth and not merely to sustain growth. Technology transfer mechanisms that no longer depend on the efforts of individual professors will be needed. These new mechanisms must be based on a new advanced policy of the institution. This means that the university must know how to structurally extend the perimeter of its stakeholders towards the world of institutions and companies, as well as taking dynamic and interactive actions with these worlds.

PUTTING ON BIFOCALS TO LOOK BEYOND THE CRISIS

The extraordinary severity of the current crisis and the exceptional weakness of the financial system has made national governments indispensable interlocutors for the defence and relaunching of the productive systems, in addition to coping with the most devastating social effects. In the absence of effective public action, crucial elements of the industrial and economic system run the risk of being irreparably weakened by the sharp decline in sales and credit and capital market restrictions, in addition to the growing weight of national distortions on international competition. However, the sheer size of the tasks assigned to national governments, which must contemporaneously restore solidity to the financial systems and support the economic and social fabric, reduces the extent of the public interventions announced. This makes establishing priorities for the use of scarce available resources even more important, working to activate the best potential of the country. The initiatives undertaken by national governments and international organizations are destined in the good and bad to influence the upturn and leave a decisive mark on the future of the society and economy.
Uncoordinated welfare-like public interventions run the risk of diverting resources towards inefficient uses and companies with distorting effects in the selection process.
They also risk, at any rate, being less effective in the medium term, with a consequent non-optimal allocation of resources and the creation of an excessive public debt burden for future generations.

The dynamics of serious, prolonged economic crises such as the current one tend to have a twofold effect:
- on one hand, they activate the disinvestment process in the production of goods and services that no longer respond to demand because the market is saturated or consumers are oriented elsewhere;
- on the other hand, they increase and accelerate investment in research in order to innovate and diversify the supply of products and services on the basis of new individual and collective needs that might emerge.

Therefore, this crisis will reward the countries capable, on one hand, of promoting and supporting complex policies to provide incentives and support the productive factors mobility

and, on the other hand, of aggregating public and private investments in order to the accomplishment of big projects aimed to exploit the new business opportunities that the crisis offers. Reacting to the crisis looking at its effects of discontinuity is imperative for the business world but above all for the public sector because it is only with their contribution that serious prospects for new growth can be assured after the crisis. Some large countries are already working in this direction bringing into play enormous resources, directing them towards strategic objectives and projects.

The United States is decidedly oriented towards cultivating the new opportunities induced by the crisis with ambitious investments in public works programs, the strengthening of the scientific-technological infrastructure and the training of human capital.

Barack Obama is the tangible sign of the discontinuity that this crisis is generating.

In a speech on April 27 to the National Academy of Sciences, he outlined his policy for looking beyond the contingent interventions imposed by the crisis and reconfirmed the role of the United States as a world leader in scientific and technological innovation, a role taken on nearly half a century ago in response to the challenge of reconstruction after the second world war. "At such a difficult moment, there are those who say we cannot afford to invest in science, that support for research is somehow a luxury at moments defined by necessities. I fundamentally disagree. Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been before" (B. Obama, 2009). On the basis of this clear strategic direction, during the same event, President Obama established the priority objective of raising R&D spending to 3% of GDP from the current level of 2.5%. The plan is to invest in basic and applied research, create new incentives for private innovation, promote breakthroughs in energy and medicine and improve math and science education.

We are looking at the most ambitious project for science and technology policy ever adopted by the United States.

China in turn has allocated $58 billion in an effort to increase renewable energy capabilities (wind and solar) and nuclear as part of its manoeuvre to stimulate growth with an overall investment of $600 billion. Within a decade, wind energy should have reached an output of 122 GW thus equal to that produced by the famous hydroelectric power plant of the Three Gorges on the Yangtze Kiang River (the largest hydroelectric power plant in the world). Chinese leaders seem oriented towards exploiting the opportunities created by

the recession to accelerate the modernisation process in the country trying to go beyond what has already been done in the advanced economies.
Therefore, taking advantage of the technological gap faced by the domestic internal combustion engine automobile industry, China has decided to leapfrog directly to the next generation of hybrid and electric vehicles. In making this choice, the enormous Asian country aims at becoming the largest electric car producer in the world and at the same time make efforts to keep the risk of environmental pollution under control[1]. To give immediate substance to this plan, the Chinese government has allocated $1.46 billion for its first packet of investments for research and innovation in the automotive sector[2].
Not all countries are equally capable of allocating enormous resources to ride the new technological wave, control the levers to determine the economic recovery after the recession and therefore generate new strong and rapidly growing business platforms. However, all countries, and therefore Italy as well, should be capable of taking advantage of the leverage effect of the crisis for renewing itself in its institutions and infrastructures at the production and business sector levels. This can be the non-negative consequence of the crisis which under certain conditions can transform itself into a positive consequence.

In Italy, the adoption of meritocratic criteria in the economic industrial policy has always been a problem. Today, in the face of a severe economic and employment crisis, it almost seems an anti-popular choice. But without the courage to make forward-looking choices, there is a concrete risk of wasting resources and sacrificing actions and investments that are essential for the renewal of the country system.
The global financial crisis and the recession have yet to open our eyes to the country's innovation deficit and the risks that we are taking if we do not prepare to take advantage of the recovery once the recessive cycle has passed. While debate has begun on the duration and effective impact of the crisis, policy makers and analysts have different opinions on the measures to be taken. The disagreement is among those who believe that the recession, no matter its origin, requires interventions in support of companies to defend positions at

[1] The environmental threat is particularly felt in the face of the sustained growth in the number of automobiles, which despite the crisis, will reach 10.2 million vehicles in 2009, up 9% from 2008.
[2] The first data confirm that China has reacted to the economic situation by sustaining growth in domestic demand. As of May 2009, in the face of the sharp drop in exports, -26.4% from last year, recorded by the Chinese Customs Authorities, the Central Statistics Office declared that domestic expenditure in China had grown by 32.9% in the same period.

risk and fight the threat of job losses and those who believe that it is necessary to push forward with the renewal process in the production structure and business system, to take into account the enormous changes that will be set into action in all countries[3].

Even if many believe that Italy will be able to "get by" better than other countries in limiting social and economic damage caused by the crisis (see figure 1), it is equally difficult to be optimistic about the future and possibility of Italian industry adapting itself to the new geography that will characterise the world economy after a severe selection and transformation process in the production apparatus and business system.

Factors in favour of Italy in the face of the crisis FIGURE 1

- √ In the last decade, Italy has grown less than the EU average but in a sustainable way
- √ Italian banks are more solid and are coping with the financial crisis better than others
- √ Italian families have less debt
- √ The manufacturing industry remains a fundamental sector of the Italian economy
- √ The leading large companies in recent years have consolidated and developed abroad
- √ In the Made in Italy milieu, a significant group of innovative mediumsized businesses has been established, projected towards the international market

Our preference for a line of interpretation that is capable of looking beyond the crisis is

[3] The difference of opinion regarding the measures to be taken is also seen elsewhere. The recent G20 in London exposed the profound differences in the point of view of the most important countries in the world. On one side, there are those who sustain that the emergency requires only measures aimed at putting out the fire and saving what is possible; on the other, there are those who insist on the necessity of being more incisive for a profound change, also in the rules of the game, in order to prevent such a situation from recurring. If instead of the G20, we look at the G2, there are also profound doubts and perplexities within China and the United States. From what Beijing has let on, there are serious reasons for worry because of the heavy exposure on US public debt and the problems in social sustainability in the face of the industrial production slowdown, since support for the regime in recent years has been based on explosive economic and employment growth. Within the new American administration, there are profound differences between those like Emanuel Rahm, President Obama's White House Chief of Staff, who sustain that this crisis represents "too great an opportunity"- that must not be missed in order to accelerate achieving Democratic party's priorities - and those more moderate areas of the party who sustain instead that this is not the time for enormous changes and therefore it is better to work towards handling the crisis.

without discussion. Considering the current extraordinary international dynamics and the structural delays that Italy has accumulated compared to the advanced economies, the most virtuos attitude is a change in perspective in terms of the economic policy debate in order to open the door to interventions and mechanisms that will pave the way for a new dynamics of competitiveness and growth.

The need to put on "bifocals" to look towards tomorrow also, beyond just today, is particularly evident for a country like Italy that risks seeing an increase in its inability to keep pace with the most advanced economies without a series of institutional reforms and crucial interventions to make up for lost time as regards modernisation and competitiveness of the country system.

Above all, investment plans must be pushed forward for large infrastructures (roads and highways, railways, ports, etc.) that stimulate significant induced activity and constitute a powerful lever for the modernisation of the country, with the creation of externalities with a general effect. Secondly, measures must be taken to increase the efficiency and productivity of the economy through the strengthening and digitalisation of the public and private service networks that work together to grow productivity and the rate of innovation in the production system.

Thirdly, putting on bifocals means having a forward-looking focus towards the nervous fabric of the industrial system, made up of both *Made in Italy* excellences and by the lesser-known entrepreneurial excellences of *Research in Italy.* These will become a powerful lever for anticipating new lines of innovative breakthroughs and in perspective stimulating the growth of the economy.

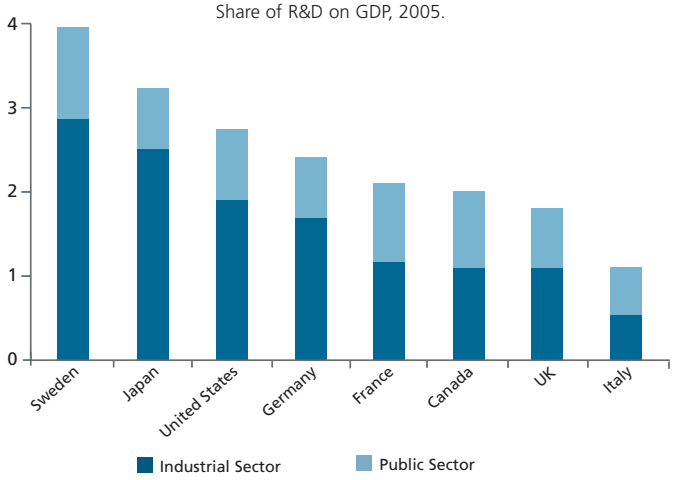
SEEKING AN INDUSTRIAL FUTURE FOR THE COUNTRY

As regards the renewal of the economic and industrial sector, with a shift in balance towards the new sectors, there is much to be done, such as the necessary step of relaunching the capacity of growth and competitiveness of the country. It is a path that goes above all through a technological renewal of processes, but especially new products and services which result from the application of science and new knowledge.

Consolidating an economic and industrial model that operates with limited use of research and qualified human capital, Italy has sacrificed the potential of its universities and young talent as the driving force behind scientific and technological progress and cultural and organisational change. By doing this we have penalised investment opportunities in new sectors (that are considered vital to sustainable growth with significant prospects of economic return) because there is a lack of capability to bring forth and put into practice new ideas and projects that derive from research and new knowledge. Innovation does not require only first-class basic research and scientific excellence. It also requires private investment and structures connecting research to markets capable of understanding, absorbing and valorising the new knowledge produced, capable of evaluating the quality of the business model proposed by the entrepreneur. This is the *Research in Italy* value chain upon which we must focus to invest in the industrial future of the country.

Public and private investment in R&D FIGURE 2

Share of R&D on GDP, 2005.



Source: OECD 2005

It is well known that Italy has a wide gap to make up in R&D spending. As seen in the graph (fig. 2), it is the private component that is well below the average of other advanced countries The combined effect of low private investment in R&D and scarce innovative strength is clearly explained by the theory of "absorptive capacity" of W. M. Cohen and D. A. Levinthal

(1990). As R&D spending declines in industry, there is a reduction in the capability of understanding and valorising the results of public research, with a weakening of the technology transfer mechanisms and innovation value chain. This weakness of the university-industry link, that supports the R&D value chain, makes the prospects for the return on investments less clear. By penalising these prospects, there are less incentives for private spending in R&D, while in the meantime the university sees its isolation from the production system growing. An economic crisis such as the current one can worsen this downward spiral because companies are forced to save money, for which there is a serious risk that cuts will be made in the already scarce investments in R&D with the subsequent further decrease in firms' capacity to absorb the knowledge produced by the public research system.

An executive, faced with the serious prospect of a balance sheet in the red, identifies R&D spending as the sacrificial victim of the crisis. This is a consolidated behaviour despite the continuous warnings from management experts and economists about the risks they are taking, especially during a phase of profound institutional, social and economic transformation such as the current one that exalts the importance and role of research and innovation as an enlightened response to the crisis. Italy, starting already from behind because of its limited private investment in R&D, risks further serious worsening of its innovation capacity.

The delays that the country has in the fields of research and innovation and the consequent incapacity of preparing for the changes induced by the crisis are a serious handicap for Italy. The reasons for this assumption are very clear, keeping in mind two considerations:

- first of all, the crisis is going to cut deep and have a powerful "creative destruction" effect as defined by J. A. Schumpeter (1943). In the future, we might have economic and financial systems, industrial structures, and entrepreneurial systems and markets greatly renewed and very different from current ones, which are the result of significant influence of finance on the trajectories and rhythm of growth, industrial investments and consumer spending to no small extent;
- secondly, Italy has a scarce capacity of creating new high-growth potential business platforms because of its chronic dearth of systematic and synergetic ties to public research and innovation. This represents a structural node that the current crisis is destined to exacerbate on the Italian economy because of the rise of new social requests, collective

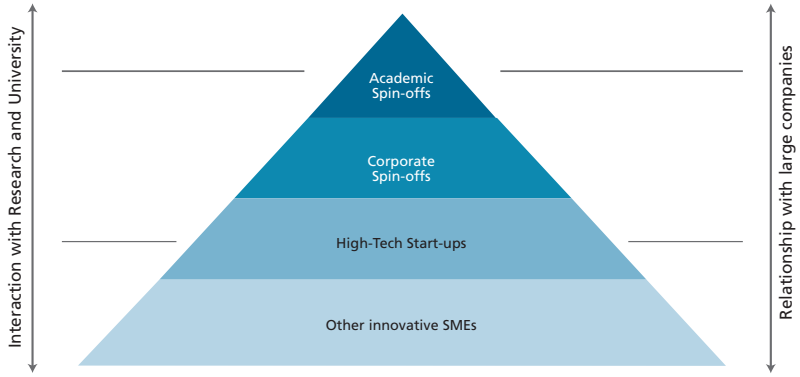
and individual needs to be satisfied through the development of new products and services with adequate and targeted R&D investment.

SUPPORTING ENTREPRENEURIAL EXCELLENCE OF RESEARCH IN ITALY AS A NEW INDUSTRIAL POLICY.

In these pages, we propose to send and substantiate a precise message, that is, next to the *well-known "Made in Italy", there is a lesser known but equally vital "Research in Italy"*, made up of the ecosystem that revolves around research and innovation that is substantiated in the new technology-based entrepreneurship; it is a system of highly innovative small companies that in one sense has a fundamental point of reference in the research laboratories and entrepreneurial contexts and in another, it finds fertile ground in the supply chain of the large and medium technology-based companies in our country (fig. 3).

The SME technology-based system

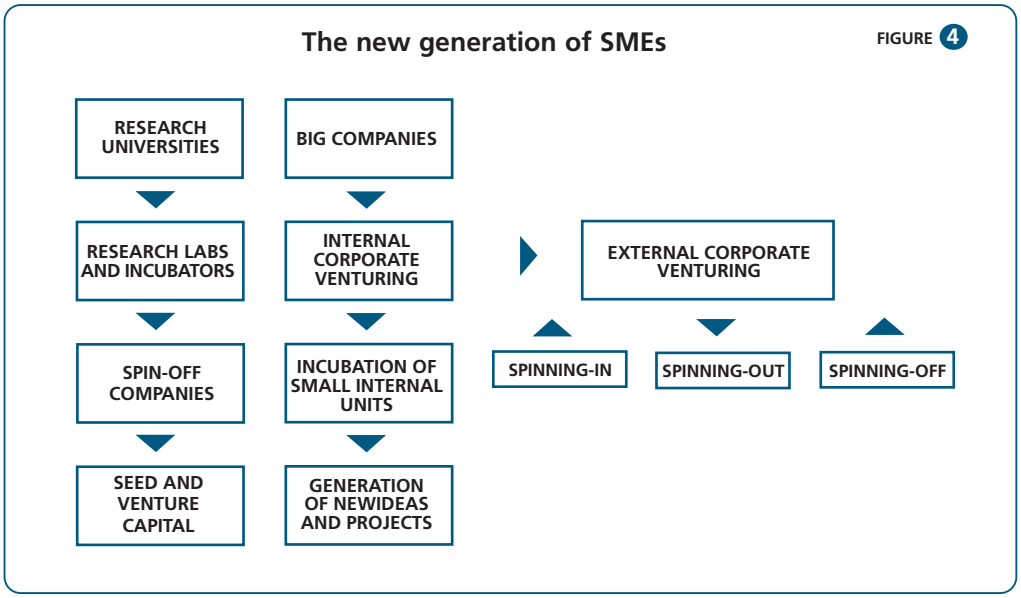
FIGURE 3



Based on OECD estimates, innovative SMEs account for 1-3% of all industrial firms.
It is therefore possible to calculate that such sector of the Italian economy accounts for 5,000-16,000 companies, and it employs something between 47,000 and 142,000 people, given that according to ISTAT in 2008 in Italy were active 521,000 industrial companies with 4.7 million employees.
As additional information on HT-based SMEs we can quote the following data.
Academic Spin-offs. According to a Netval Report, by December 2008, 762 academic spin-off companies were active in Italy, and during the period 2006-2008 approximately 150-200 firms were started each year.
Innovators within the Supply Chain. Our estimates suggest that within the Finmeccanica Group's supply chain are present more than 2,000 innovative SMEs. These firms correspond to approximately 35% of all suppliers.

The crisis justifies focusing on working towards permitting the emergence and offering space and support to this particular SME fabric. It also makes it fundamental that we do so

for the future of our economy. The process for the renewal of our production system passes through the present large and medium companies but also the very innovative new units, capable of picturing and creating new business opportunities and taking on the role of beachheads for the processes of diversification and growth of the same large businesses. This pathfinder role is the result of the natural capability of innovative SME to work on the technological frontiers, with a marked propensity for undertaking the risks inherent in basic research. In order to make a qualitative leap in innovative capability, it is fundamental to work incessantly with a focused industrial policy, on promotion and support of starting and growing a new generation of small technology-based firms (spin-offs and start-ups). This must find fertile ground in an innovation ecosystem capable of turning scientific and technological acquisitions into new businesses. The crisis can facilitate this type of evolution because it will lead to the rediscovery of the importance of pioneering research that is useful in creating technological and innovative discontinuity. The starting point down this path is basic research where universities and advanced training centres play a key role in creating the knowledge and competences necessary for advanced technology-based innovative processes. The same research environment gives rise to the new generation of technologists and entrepreneurs capable of interpreting and putting into practice a new entrepreneurial function. These are young people, with fundamentally solid education backgrounds that have done advanced training in applied research, capable of turning scientific knowledge into new innovative processes, products and services, creating high-tech spin-off companies. Possible candidates for the role of incubators for this new innovative entrepreneurship are essentially the scientific-technological research laboratories of excellence, capable of competing in pioneering fields and training young valid researchers and technologists with the right attitudes and motivations for becoming entrepreneurs. The new innovative businesses, in addition to being incubated in university laboratories, can be technological startups that spring up from the more advanced entrepreneurial fabric or spinoffs and spin-outs created by large and medium companies working in advanced sectors (see figure 4).
Thus, industrial policies must look beyond the crisis. They must put into practice interventions and actions that identify the scientific-technological production centres of excellence. Then, they must methodically support and accompany the spill-over processes and new entrepreneurial drives to activate and substantiate the value chain that winds from research and development towards industrialisation and the market.



EVOLUTION OF THE INNOVATION SYSTEM

In the face of the complex world economic crisis, the most forward-looking public intervention plans see research and innovation in the perspective of relaunching the economy after the crisis. It is a shared feeling that this crisis is going to produce important changes in society, infrastructure systems, lifestyles and consumption, inducing strong drives toward innovation. These changes will most benefit those countries and companies capable of adapting to the changing scenario, therefore, giving impetus to the renewal of the supply system of goods and services based on the new orientation and needs at the market and demand levels.

All this leads to the hypothesis that the innovative potential constituted by patents, technologies, know-how and human capital of excellence will lead to a competitive advantage upon which the most virtuous countries can build upon to make their production and entrepreneurial structure better prepared to understand and satisfy the new needs of essentiality, price, effectiveness, safety and sustainability that will emerge from the market and society.

In 1945, Vannevar Bush, the founder of the National Science Foundation, predicted that

the "endless frontier of science" would have represented the premise for the economic development for decades to come and that the real challenge for advanced countries was that of continuing to explore these frontiers with faith and ambition (V. Bush, 1945). Today in the midst of the worst crisis since World War II, it is possible to see just how relevant this old premise is today. The scenario that we have in front of us is that of a new economic miracle modeled and driven by research and technology.

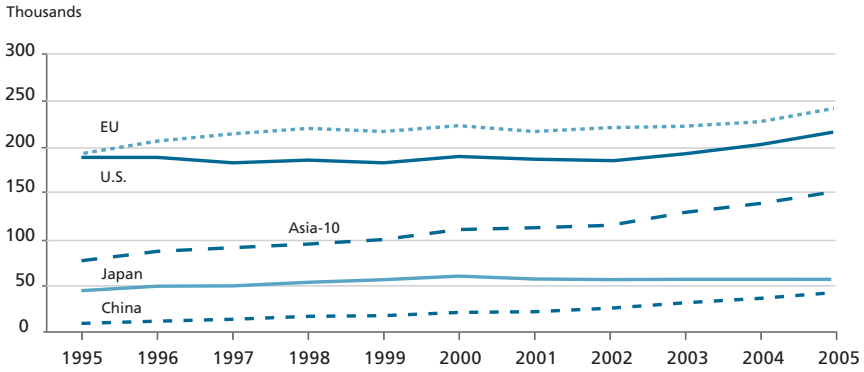
If in these years the capitalistic system has suffered a deep setback, we must not forget that we are coming out of the longest uninterrupted phase of expansion of the world economy. This phase, in the past 20 years, was driven by economic systems capable on one hand, of investing on a big scale in scientific and technological progress (G. Dosi, P. Llerena & M. Sylos Labini, 2006) and on the other hand, of valorising this progress better than others, facilitating its transfer to the market thanks to systemic collaboration between industry, universities and innovative finance (M. Kenney & R. Florida, 2004).

This is not the place to go into further details on the dynamics that have led certain regions to better exploit the lasting convergence and integration of these "three pillars". It suffices to remember two essential elements. First of all, in the USA where scholars have been for a long time debated on entrepreneurship policy (D. Hart, 2003), the excellence of basic research has indeed been a precondition but not a sufficient element for bringing to bear innovative potential for the creation of new opportunities. In Europe, instead, where it has often been highlighted how interactions between research and industry are too weak, some observers have been talking of the "European paradox" that sees the maintenance (and increase) of the share of scientific publications (figure 5), accompanied by a progressive decline of the European share of patents, technological products and exports and licensing revenue (figures 6 and 7).

A second paradox, this one all Italian, concerns technological districts. According to this scheme, an attempt was made to reproduce by top down design, for science/tech-based production, the architecture of the traditional industrial districts which during the 1990s (P. Cooke & K. Morgan, 1998; B. Harrison, 1992; A. R. Markusen, 1996; M. Storper, 1997) came to the attention of international regional literature. It was Porter himself who supported in a certain sense this possibility stating that, once activated, external and learning economies targeted towards the creation of a local competitive advantage: "No production can be con-

Scientific articles published in scientific journals by geographic area: 1995-2005

FIGURE 5

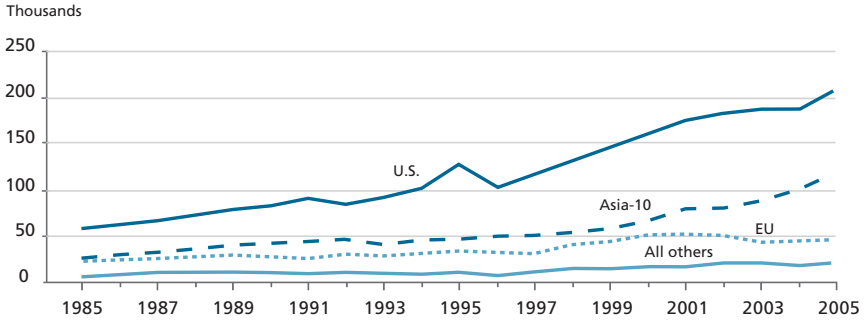


NOTES: Asia-10 includes China, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Thailand. China includes Hong Kong.

Source: National Science Board, Science and Engineering Indicators 2008

Patent applications to the USPTO: 1985-2005

FIGURE 6



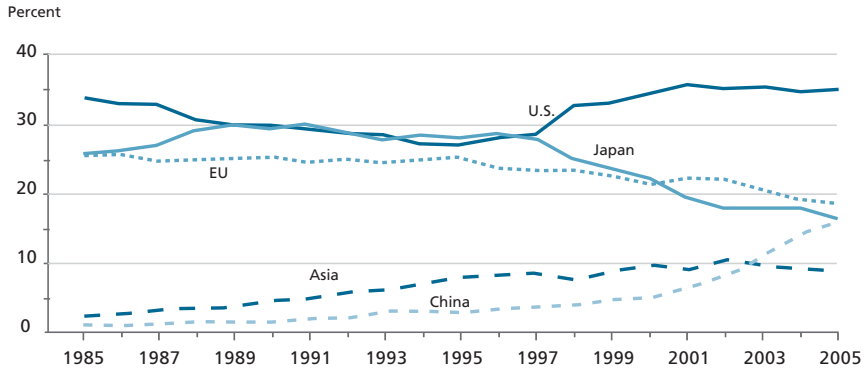
EU = Europeand Union; USPTO = U.S. Patent and Trademark Office

NOTES: Country of origin based on residence of first-named inventor.
Asia-10 includes China, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, and Thailand. China includes Hong Kong.

Source: National Science Board, Science and Engineering Indicators 2008

Distribution of high-tech production by geographic area: 1985-2005

FIGURE 7



NOTES: Asia includes India, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan and Thailand. China includes Hong Kong.

Source: National Science Board, Science and Engineering Indicators 2008

sidered low-tech: everything is potentially high-tech" (M. Porter, 1998). This vision has led to not taking into consideration the complex structural and functional diversities that exist between the product chain of the science/tech-based sectors and the *Made in Italy* districts (A. Di Minin, M. Lazzeroni, & A. Piccaluga, 2003). As one can see, taking it to an extreme, even if the social capital, external economies and networks are a similar yeast in Silicon Valley and in the more traditional Italian district, the basic ingredients (the companies) are quite different, with the result that what comes out of the "district oven" in terms of business models, management capability and competitive strength is an intrinsically different product. While the traditional industrial districts are structurally based on a dense network of only small and very small local units, closely intertwined and conditioned by each other, the technological districts are experienced purely as an opportunity of putting together a cluster of companies of different sizes and origins, with a strong propensity towards innovation supported by research. Therefore, it is wishful thinking on the part of certain Italian political and academic environments to think they can make up for the lack of large technology-based companies and systematic relationships between universities and compa-

nies through local aggregation of a number of companies and other public and private entities in consortium-like structures with the primary purpose of gaining access to public financing allocated to "technological districts", proposing research projects hardly capable of creating sustainable and lasting value.

This bureaucratic-welfare way of thinking must give way to new mechanisms of creating value through research with a central role of highly innovative companies, interested in supporting state-of-the-art research projects to be carried out in tune with and in collaboration with qualified public-system research centres.

In the current phase of the profound changes in the scientific-technological panorama, the crisis can also act as a detonator of the scientific potential already acquired in various pioneering fields and thus accelerate the efforts to apply it. This is a connection that must

Italy's return to the nuclear power: how to create value FIGURE 8

- √ The return to the nuclear power is an important decision for balancing and diversifying country's energy sources and for rebuilding the scientific, technological and industrial chain. This return would generate also important linked activities since the nuclear power is a strongly interdisciplinary technological sector.
- √ To have significant industrial spin-offs from Italy's return to the nuclear power production, actions must be taken immediately and the government must provide guidelines that permit allocation of the necessary investment and restart with the universities for the supply of engineers and knowledge.
- √ This return must be exploited in order to allow Italy to create value from it by playing a role in the most technologicaly important parts of the product chain.
- √ Today the construction of a nuclear power plant can be divided into four "lots":
  - nuclear reactor core-steam generator
  - the so called "nuclear island";
  - the turbine building;
  - the balance of plant, in other words, the rest of the accessory works.
- √ Our country must not be content with being involved in the last two tranches but also in the first two levels because that is where the technological core heart of the power station is. For this reason, Italy must choose carefully its technological options between the French ones (Edf) and the North American ones (Westinghouse). It is also important to stipulate strategic alliances with foreign partners. These partnership should maximize positive spill-overs on industry and university.

not be missed by a country like Italy in its attempt to latch onto the new technological wave, on one hand thanks to the excellent absorptive and creation capacity of new knowledge that exists in the scientific and technological environments of excellence and on the other hand, bearing in mind the innovative capacity which Italy retails at the level of some large companies and the technology-based and more innovative SME fabric. In this latter context, creative and entrepreneurial capacity especially present in research laboratories of excellence must be given space and supported. These laboratories, rendered vital by the presence of young talents, must be part of that process aimed at renewing the production fabric from the bottom up with the contribution of a new class of entrepreneurs, sons of the age of knowledge. If one looks at the sectors of activity of the academic spin-offs, born

Fields of Specialisation of spinoffs FIGURE 9

SECTORS	SHARE (%)
ICT	36.1
Life Sciences	15.0
Energy & Environment	13.4
Electronics	12.1
Innovation Services	8.0
Biomedical	7.6
Industrial Automation	5.2
Nanotechnology	1.9
Aerospace	0.7

Source: Netval www.netval.it

in these contexts, it is easy to understand that we are looking at small companies working in state-of-the-art technological sectors from which we expect an important push for the renewal of the economic system (fig. 9).

Italy's position in the new global configuration of the value chain of research and innovation is influenced and conditioned by two main factors:

- the globalisation process going on at the level of knowledge, highly qualified human

capital and research carried out by the advanced economies, and the new large emerging countries like China and India which have established ambitious programs in the fields of training and R&D;
- the advancement of the open innovation model as a response to the speed of development, contamination and cross-linking of knowledge and technology and the diversification of the supply sources for scientific knowledge that leads companies to use universities as preferred knowledge hubs more and more effectively than before.

THE GLOBALISATION PROCESS OF INNOVATION AND RESEARCH AND DEVELOPMENT: ITALY'S POSITION

Half a century ago it would have been difficult to foresee the emerging countries catching up with the more advanced ones, becoming, in the space of a few years, major manufacturers and also important players in the "Endless Frontier" of Science. Today globalisation has lost its unidirectional connotation, having become a circular phenomenon, where it is no longer easy to identify and predict the direction where it is going and where the stimuli for its development come from and go. Increasingly more often, multinationals from emerging countries participate in the planetary economy in new ways (R. Varaldo, 2002), while the foreign subsidiaries of Western countries take on autonomy and develop their capacity of influencing the innovative impetus of the parent company (H. Dunning & S. M. Lundan, 2009). Specialised literature has for some time recognised the "circular nature of globalisation", pointing out how multinationals have played an extremely central role (R. Doz, F. Santos, & P. Williamson, 2001; H. Dunning, 1994) and emerging countries have benefited from infrastructures and organisation models of the advanced economies, once they become participants in the global supply chain for products, services and knowledge (P. Dicken, 1998). Globalisation has given emerging countries the following opportunities:
- *access global networks* of research and innovation through the growing mobility and circularity of knowledge at the scientific industrial level, activated through individual researchers, scientific organisations, conventions and meetings, specialist journals and the press;

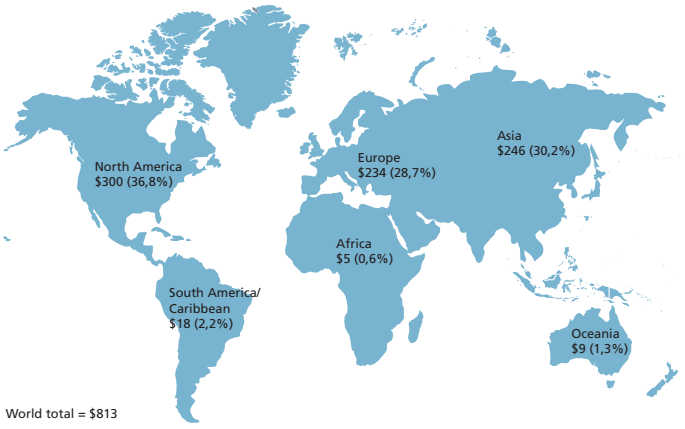
- *acquire state-of-the-art technology* (or almost) from advanced countries interested in making production investments in new countries, as typical instruments of internationalisation of large and medium companies; new countries have shown themselves to be willing to open their markets but often in exchange for access to Western technologies; innovation hubs at the global level have been opened thus allowing countries, that were once on the outside, to acquire their own capacity in applying knowledge and technology in new processes, products and services;
- *grow and improve their absorptive capacity* of the knowledge and technology from advanced countries; initially, providing scholarships and grants for young talents to train in the best foreign research universities, especially in the United States, and now instituting policies for the re-entry of intellectual talents in the framework of a forward-looking strategy of strengthening and qualification of research and training in the scientific field, well-endowed, selectively targeted at high-performing universities of excellence. The new incoming countries, therefore, did not receive only the leftovers of the international "scientific dinner table" because they assured themselves the competencies and capacity of playing a role in scientific and technological advancement through the insertion of new generations of researchers and technologists in the best education and training circuits.

While the OECD countries are still the most active investors in R&D and the best performers in terms of inventions, globalisation has lowered the entry barriers and created many opportunities for the new players to insert themselves into the global networks, with the prospects of contributing to scientific progress but especially to being able to drain off knowledge at zero or almost zero cost. Despite the fact that there are no short-term win-win situations, the traditional innovation hubs have learned to involve emerging countries in their networks, especially those countries active in training and research with extensive multiyear investment programs.

The diffusion of communication technology and data transfer and the development of the world transport and logistics system have facilitated the globalisation process making it possible an *innovative division of labour on a worldwide scale* that in many ways has become necessary due to the extreme complexity and transversal contamination of know-how.

With the globalisation process of research and innovation, in a climate of open markets

Distribution of R&D spending in 2002 FIGURE 10



NOTES: R&S estimates from 91 countries in billions of purchasing power parity dollars. Percentages may not add to 100 because of rounding.

Source: National Science Board, Science and Engineering Indicators 2008

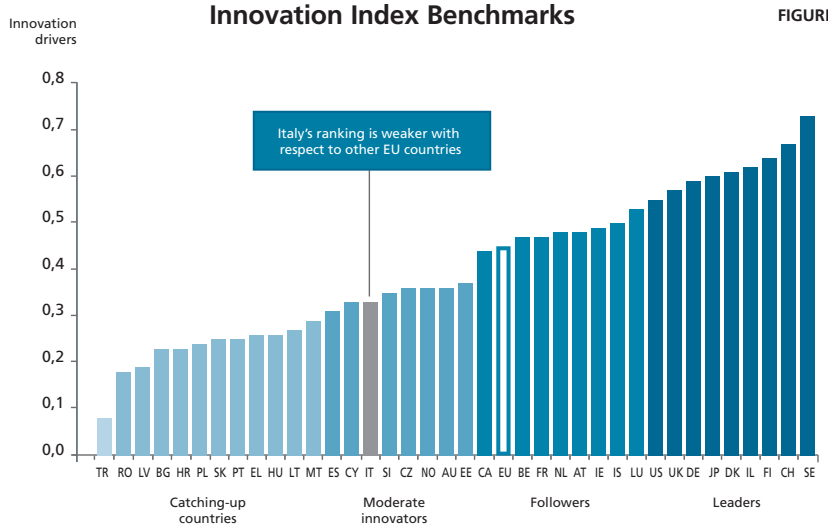
and liberalisation of international trade, opportunities of offshoring[4] R&D in the new knowledge hubs constituted by China, India and the Eastern European countries have increased considerably. The new wave of globalisation extends practically to every activity and function of the value chain. "Services, innovation and development, and basic research, in which the West currently holds a dominant position, could follow industrial production and be transferred to Asia" (C. V. Prestowitz, 2005). In fact, along with China, that is becoming the great global manufacturing platform, India is preparing itself as a pre-eminent area for the production and export of services and softwares, offered at absolutely competitive prices (R. Dossani & M. Kenney, 2009).

R&D is becoming increasingly more internationalised (fig. 10). In the first five-year period of the new century (2000-2005), R&D spending has grown worldwide at an average rate of 4.2%, in China and India by 17% and in countries like South Korea and Taiwan much more (E. Jaruzelski, K. J. Dehoff, & R. Bordia, 2006). The consequence is that many large companies are taking considerable interest in the new emerging countries for the offshoring

[4] Offshoring is the practice of transferring abroad activity that was once carried out in the country of origin, both through outsourcing on an international scale and foreign direct investments.

of R&D which till now has been carried out in the country of origin.
Only one third of the laboratories of the large multinational companies are still located in the countries where the companies are headquartered compared to 55% in 1975. On the other hand, more than 75% of the new R&D centres that the large multinationals plan to open in the next two years will be located in China and India. These enterprises are attracted both by the possibility of achieving significant cost savings but also by the wide availability of qualified human capital, assured by universities that in many cases have reached international levels of excellence. The emergence and networking of global players like China and India (as well as smaller countries like South Korea, Taiwan and Israel) has increased

Innovation Index Benchmarks FIGURE 11



Source: EU Commission, Febr. 2008.

interest regarding offshoring of R&D and the related high-skilled human capital favoured by the existing infrastructure and R&D capability of developed nations.
The risks of this type of evolution for Italy are clear. We have already pointed out how the gap is widening while new geographic considerations align the interests of the leading countries, directing them increasingly further from our know-how and from localisation advantages that Italy can offer. In the face of the colossal investments made by the new emerging countries in

order to reinforce their research and training structures, Italy is seeing its own delay getting worse, both as regards investments in tangible research infrastructures (laboratories) and intangible (human capital) and as regards all the other innovation indicators[5]. Furthermore, it is very difficult to profitably exploit and utilise the existing university research network of excellence, not knowing how to create a bridge between private and public, company and university, for which the economic returns on investment accumulated in the public system are very low.

The emergence of global players increases competition for R&D related to foreign direct investments (FDI) and research talents, making the catching up and relaunching process more complex and costly. It is no longer possible to conceive of isolated and autonomous national innovation systems, like at the times of Vannevar Bush. Today we are dealing with interconnected research and innovation networks, global product chains with which every country (through their research institutes of excellence, technology and talent) must interface.

Multinationals have been at the centre of this phenomenon and have coupled the development and assembly of more innovative products with the decentralising of the supply of standard production and components in emerging countries. In doing so, they have almost made the predictions of the majority of American think tanks in the 1980s come true, where they warned the postindustrial world that "what you stop producing today, you will not know how to innovate tomorrow" (S. S. Cohen & J. Zysman, 1987).

The growth of foreign investments, greater protection for intellectual property and circulation of talents have given rise to a new way of innovating on a planetary scale. This does not mean that local competitive specificities are being leveled: anything but. As Richard Florida (2005) affirms, responding to the provocation of "The World Is Flat" by Thomas Friedman (2005), the irrelevance of barriers and distance brings with it new and reinforced local specificities, where the centrality of places that have known how to adapt to new markets better than others has been reinforced. Recent studies (S.S. Cohen, A. Di Minin,Y. Motoyama, & C. Palmberg, 2009; J. T. Macher & D. C. Mowery, 2008) resize the R&D offshoring phenomenon undertaken by multinationals.

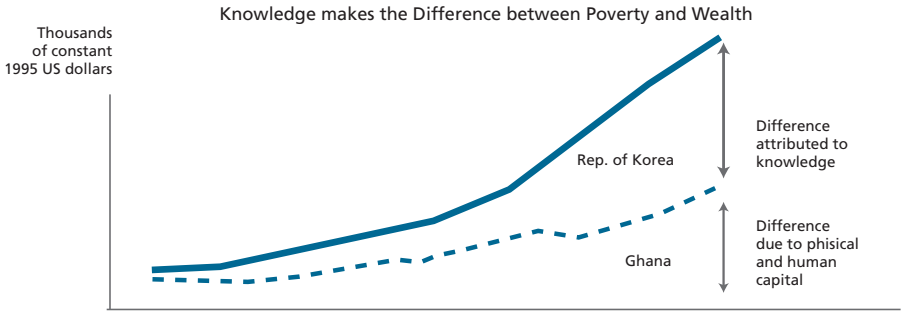
[5] Italy's standing in the international classification (22nd in Europe) places it among the "moderate innovators", therefore behind the innovation leaders (USA, Japan, UK, Germany, Scandinavian countries) and the catching up innovators (other EU countries fig. 11).

These and other works confirmed that the traditional global centres of innovation have not lost their centrality but instead they have learned to exploit the ties with other markets and production centres to reach a higher level of specialisation and a more fluid relationship with rapidly expanding markets (M. Robyn, 2007; A. Saxenian, 2006).

At the same time, some emerging countries have successfully exploited the innovation wave coming from far away to increase their development rates to high levels. According to the World Bank (fig. 12), what has distinguished emerging countries from those playing catch-up has been precisely their participation in the first banquets of the knowledge economy (World Bank, 2008)[6].

Comparison of per capita GDP between South Korea and Ghana

FIGURE 12



Source: World Bank 2008

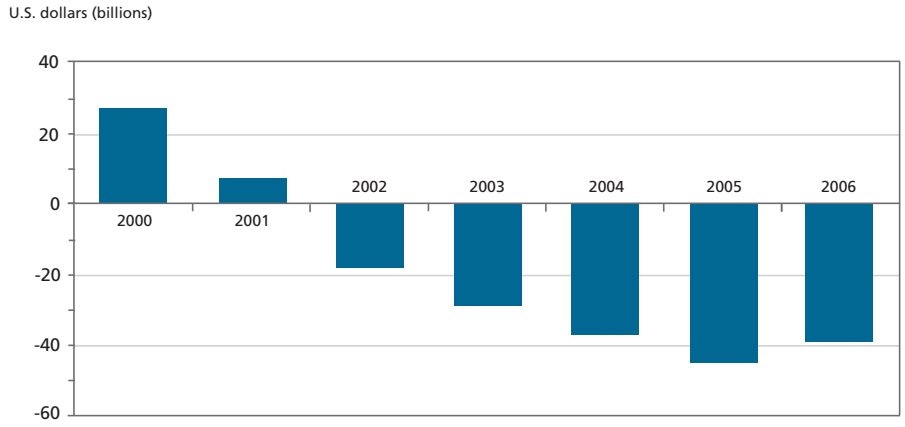
Even the circulation of talents (A. Saxenian, 2006) is proof of the renewed centrality of traditional centres of innovation. Analysing the flow, we discover furthermore that young Asians are in pole position for exploiting the development of the global superclass that D. Rothkopf (2008) talks about, crossing physical and virtual barriers.

[6] The World Bank, in its Growth Report, highlights how the results are particularly visible in the developing countries. In fact, if we take into consideration the 13 emerging economies with the highest growth rates from 1950 to 2004, we discover that these countries have been at the centre of intense flows of qualified human resources, know-how and technology.

The globalisation of research and knowledge has increased interest towards the protection of intellectual property and licensing contracts. American multinationals have shown that they know how to play this game shrewdly, as shown by the two graphs presented here (figures 13 and 14).

During recent years, the United States has amassed an enormous balance of payment deficit regarding high-tech products but at the same time has amassed an enormous surplus towards the rest of the world as regards copyright and technology licensing.

US trade balance for high-tech products: 2000-06 FIGURE 13

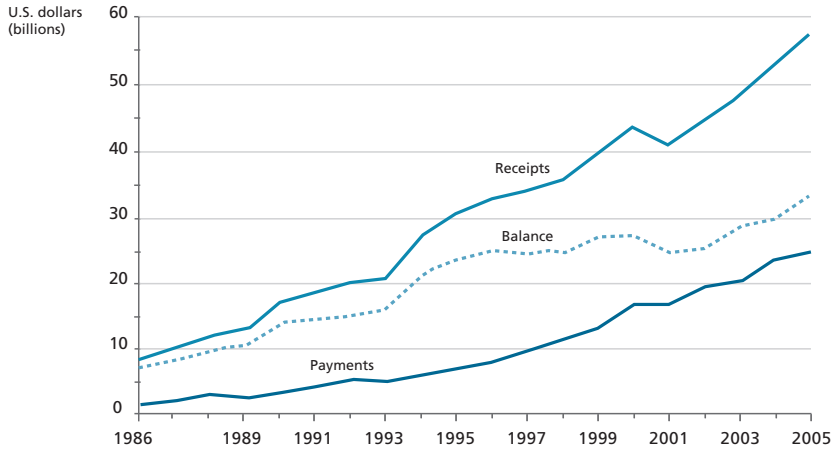


Source: National Science Board, Science and Engineering Indicators 2008

In this scenario of collaboration and development, Italy runs the risk of falling further behind in its competitive capability precisely because it has not latched onto the ongoing process of globalisation of research and innovation, where universities as well as large multinationals play a determining role.

This causes severe damage to the competitiveness and international strength of our industry. As we have pointed out in other places (R. Varaldo, 2008; R. Varaldo & L. Lamberti, 2009), the reasons for Italy's delay are ascribable also to our manufacturing traditions, rooted in a context of small and medium businesses. Italy is lacking possible global players capable

US revenue, payments and surplus deriving from royalties on intellectual property rights: 1986-2005 FIGURE 14



Source: National Science Board, Science and Engineering Indicators 2008

of "projecting themselves into the countries and seats of activation and control of large global flows of new capital, technology and talent". A recent Mediobanca study on R&D (2008) highlights this delay. Out of the population of 342 TNC, Italy has just 17 companies, on the average smaller and less internationalised, with a foreign investment capacity much lower than our foreign competitors. The weight of these large companies for Italy is especially low compared to other European economies[7].

This structural element is a serious handicap for Italy's participation in the global supply chain, heavily centred around foreign direct investment. It is sufficient to consider that in 2006 Italy had affiliates in China while France had 331 and Germany 281.

In partial dissent regarding the role of large multinational companies, some analysts have

[7] The Mediobanca study takes into consideration 342 companies worldwide with sales greater than €3 billion, equal to at least 1% of GDP of the industrial sector of the country of origin, which in addition has made at least 10% of its sales abroad. These companies work essentially in global oligopolistic sectors such as energy, automobiles, chemistry, mechanics and telecommunications. The weight of Italian TNC in this group was consolidated in 2006 at 6.7%, compared to 23.4% for German companies, 22.7% for English companies, 16.6% for French companies and 11% for Scandinavian companies. Compared to the GDP of the country of origin, the Italian TNC contributed in 2006 for a share equal to 13.9% of the total compared to 36.3% in Great Britain, 34.9% in Scandinavia, 30.5% in Germany and 20.3% in France.

commented optimistically on the advent of a fourth capitalism in Italy (F. Coltorti, 2004), represented by a nucleus of 4000 medium-sized companies concentrated mainly in the *Made in Italy* sectors. Here we can only partially share this enthusiasm, since with globalisation, the internationalisation model is changing considerably, having changed from a unidirectional process centred on exports to a relational multipolar process based on a strong, intense circulation of capital and intangible resources where size matters. Therefore, only large companies are capable to reinforce and qualify their operating systems and organisational structures, providing them with intellectual capital and qualified human resources in order to adapt better to the ongoing changes in globalisation (R. Varaldo, 2008).

Nevertheless, there is the possibility that the crisis will raise doubts about the globalisation process without limits nor rules (G. Tremonti, 2008). The spectre of new protectionism (also technological) is contradictory to the globalisation process. The little available data regarding the dimension of the crisis today indicate a sharp drop in foreign direct investments while cuts in resources invested in the research system, as well as employment difficulties, certainly do not promote talents mobility. The question that we have to ask ourselves is whether the slowing down of a train that we risked having already missed could turn out to be an opportunity for our country.

OPEN INNOVATION: THE NEW ROLE OF UNIVERSITIES AND PUBLIC RESEARCH

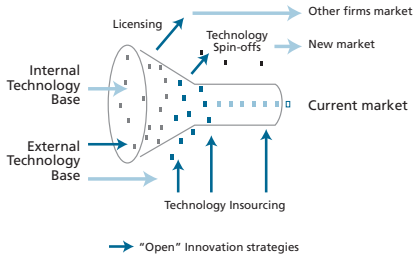
The prospects for Italy's recovery in the fields of research and innovation - with all the possible waterfall effects in terms of institutional reforms and changes in the production structures and qualified job market - goes mainly through the reorganization of industrial innovation processes based on open innovation business models. "The adoption of the open innovation model finds its foundation in the progressive levelling out of the playground where the industrial innovation is developed. This is due on one hand to the reduction of economies of scale in R&D, on the other hand to the increasing worldwide dispersion of knowledge amongst companies in despite of dimension" (H. Chesbrough, 2008, p. 26) (see box 1).

OPEN INNOVATION PRACTICES IN ITALY

Henry Chesbrough (2003) explained to company executives the importance of carrying out detailed analyses in order to collect good ideas directly from the market, on the basis of the supposition that probably "the most competent person does not work for me!" As Chesbrough points out, the marketing of new technology does not occur only through its application to products and services of the same company who made the necessary investment in R&D for the development of this technology. Marketing also takes place through indirect forms (such as licensing contracts and the establishment of spinoff companies), that often provide significant and immediate returns for the financial well-being of the internal research centres.

The business model is a fundamental element of open innovation (Chesbrough, 2006), because it gives emphasis to an often ignored aspect: the projection of the entire company and its resources towards the objective of innovation.

Open Innovation Funnel



The open innovation paradigm is at the centre of an international debate. While researchers ask themselves if it is new or original (Dahlander & Gann, 2007), the OCSE recently published a compendium on the international practices of open innovation (OCSE, 2008).
A recent study (Chesbrough, 2008) analyses 23 Italian cases through the open innovation paradigm. In the face of scant available resources for industrial R&D, in Italy, some open innovation precursors emerged that had overcome the Not Invented Here syndrome without knowing the specific characteristics of the open innovation. The executives of these companies examined the market and introduced new technologies already developed by others into their laboratories and, in the end, developed new paths for the marketing of more advanced projects. In this way, they contributed to the financial well-being of the parent company in times of budget restraints.
In the Italian situation, the innovation impetus came from a change in the environmental conditions. For example, European guidelines forced the adoption of a more innovative approach in sectors like transport and banking. In other cases, a significant transformation of a company created the opportunity for innovating business practices. For some companies, technological integration and the creation of new product lines has been made possible thanks to the close interaction with its customers, especially with those willing to share the risks of innovative efforts. An approach open to the interpretation of the development of one's own market permitted some already established companies to anticipate their customers' needs. Some small and medium businesses then saw the change process of their own business model as an opportunity to stand out and compete with larger companies in different industrial sectors.
An important question on the table, in an open business model, is often the use and exploitation of intellectual property rights and the goods derived from them. In Italy, some companies and institutions have integrated a careful management of their patent portfolio, technological development and protection from the infringement of intellectual property, a fundamental point for the various industrial sectors of *Made in Italy*: from high fashion to high technology.
Although they do not constitute a classic model of open innovation, the Italian cases are nevertheless the result of courageous choices (and often just plain luck at the industrial level) made in markets in which competition is fierce and the competitive advantage margin for Italian companies is low. These are examples which could provide some indications following the current recession also for the champions of innovation who are facing budget constraints for the first time.

This means that companies, even the large ones, have become more dependent than before on the contribution of external research and knowledge in their innovation processes. The open innovation model is typically compared to the so-called traditional closed model, in which companies mainly refer to their own R&D departments. These structures - well-equipped with means and personnel, modeled according to a dominant technological vision Bell-Labs style - in the past have fueled the "innovation machine" of the large companies (W. Baumol, 2004) that wanted to have almost monopolistic power using R&D and extreme product innovation.

The changes that have taken place in the governing of universities and public research over the past decade -in particular the movement towards greater autonomy, the emergence of an entrepreneurial spirit, the acquisition of competitive funding capability and the use of temporary research personnel- have shown that research universities can play an active, central role in the open innovation process. The perspective for these universities is to become "knowledge hubs" for companies, large and small, capable of providing knowledge and also collaboration in the development of new knowledge.

The growing importance of the "knowledge sourcing role" of universities has led to the following:

- the development of international innovation networks (globalisation of innovation) in the wake of the globalisation of production networks; the globalisation of innovation in fact accompanies and drives the globalisation of research, where the universities of excellence cover a central institutional role with their capacity of linking and collaboration on scientific field;
- the fact that following increased competitive pressure, innovation becomes increasingly risky and costly for which companies are reducing their commitment to long-term and basic research. This fact increases the importance of public research, independently from whether the results are directly channeled into spinoffs in the value chain as in biotechnology and other fields or whether they become public domain through scientific journals;
- the fact that the growing recourse to open innovation is driven by the growing convergence of technologies (nanotechnology, biotechnology, ICT) which by generating new research and innovation fields interfacing with existing fields, require cross-functional and multi-discipline approaches to R&D.

For a long time, the links between universities (as well as public research institutes) and companies have been based on an unidirectional "technology – push" model of knowledge transfer. Now, with the open innovation model, the public research sector must know how to equip itself to develop knowledge together with companies through stable collaboration and possibly the establishment of joint research laboratories. With this evolution, universities are stimulated to become partners with industry to create joint knowledge development, in this way overcoming the traditional model of technology transfer, where the return on public investments was less exposed to the risk of privatisation (D. C. Mowery, R. R. Nelson, B. N. Sampat, & A.A. Ziedonis, 2004), but also less effective.

Italy presents itself somewhat unprepared to fully exploit the new opportunities of open innovation. Even if the debate is still open and there are signs of dynamism (Netval, 2009)[8], our country is too conditioned by structural, cultural, institutional and regulatory constraints that have blocked the evolution in the relationship between universities and the production world, in line with other advanced countries. Today, these constraints are delaying and slowing down the renewal of the university system.

If it is wise to be worried by the limitation of funds invested in research, it is even wiser to be more worried by the low productivity of the investments and the fragmentation of institutional responsibilities and spending. Low productivity means a low return and therefore a disincentive for private entities to invest in research and innovation, with the penalisation in terms of image but also financing of basic research and therefore that of universities and public scientific institutions.

In Italy, public research of excellence is not lacking, but without the awareness of which scientific-technological product chains should be promoted, from the national system of innovation point of view, they do not know how to direct the activity of researchers towards objectives, or activate the resources for extending the range of the results produced. Under certain conditions and with the appropriate initiatives, that driving force which we are lacking and which keeps us drifting farther away from the most advanced economies may spring forth. However, in the country, there is no proper awareness of the potential and value of these strategic resources that most certainly exists in other countries.

[8] For a report on and analysis of the activity of technological transfer centres, see the annual report of Netval, the Association of University research valorization centres.
www.netval.it.

Paradoxically, as we have already pointed out, the world of science and technology being increasingly globalised, we are witnessing a phenomenon in which Italy, with its excellences however sacrificed by limited resources, does contribute to the progress of know-how but not to their development and use, for which investors and industries of other countries benefit having the competences and means to absorb, channel and exploit new scientific and technological knowledge up to industrialisation. The consequence is the alarming absence of Italy in the competition to be the first to bring to market innovations that are destined to be technological breakthroughs.

Given that Italian research lacks an innovation ecosystem capable of making it a generator of value, it is inevitable that a vicious circle is created which, on one hand, pushes industry away from investing in research and on the other, pushes the world of Italian research to find recognition, outlets and development for its "products" abroad, where excellences are appreciated and valorised in a scientific sense but also in an economic sense. The result is further penalisation that affects our capability of obtaining return on investments because we only take part upstream and not in the heart or valley of the value chain of research and innovation. While in one way we offer contributions "free of charge" to the "knowledge factory" through our research centres of excellence, in another way, we do not know how to participate with equal capacity in the "innovation factory" (M. Lazzeroni, 2004).

For this reason we find ourselves spending money in R&D that does not correspond to adequate economic returns. Therefore, the R&D balance sheet, at the country system level, is destined to be structurally in the red.

A fundamental change in course must be made in Italy regarding the too limited and traditional way in which the political and economic community is led to perceive and interpret the role of university institutions. Here we propose to consider them part of the *Research in Italy* value chain, taking into consideration first of all those universities that have already demonstrated the ability to collaborate in a systemic way with industry and valorise their own patrimony of innovative and technological ideas registering patents and supporting the creation of spinoffs.

In an economy increasingly based on knowledge, these universities constitute a bulwark of innovative potential of a country and its capacity for progress in the educational, scientific and technological fields. Other countries have already understood this. Besides the United

States and other advanced European countries, there are the new large emerging countries from China to India to South Korea where continuously growing investments in research and universities have been established as absolute priorities in the modernisation and growth strategies of the country. The paradox that we might face in Italy is that by reducing investment in R&D and training and continuing to leave the universities in isolation, we might further reduce the capability of public research to work alongside and support renewal efforts in the country. This would create a vacuum in the supply of scientific and technological knowledge and people trained for the jobs of the future. Italy's destiny seems to be that of a country - closer to the developing world rather than that of the advanced economies - that participates in the industry of innovations more on the demand side as an outlet market for products developed elsewhere rather than the supply side.
Only the countries prepared for the "after-crisis challenge", activating now the appropriate policies for relaunching research and advanced training, will be able to take advantage of the new opportunities that will spring forth. The fear is that Italy will be shut out from this context and will see its technology-based innovation capacity further reduced. This will be because it did not know how to fully understand the changes brought about by the crisis in order to use them as an opportunity to relaunch the economy and recover competitiveness, consequently establishing appropriate policies and actions.

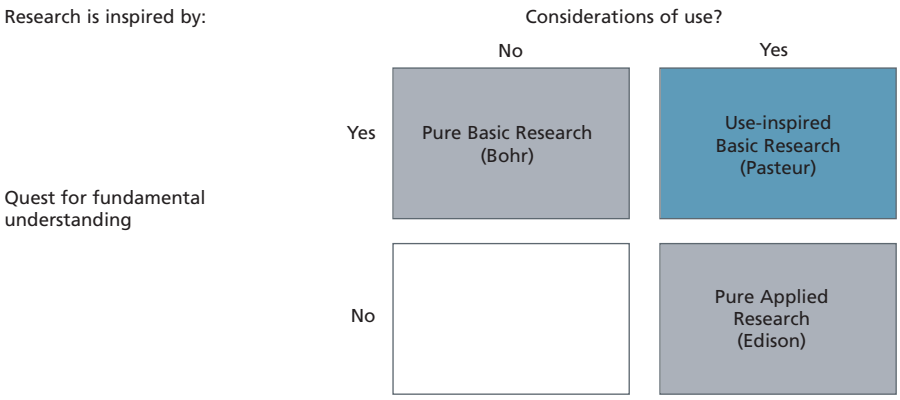
THE PROBLEM OF USE-INSPIRED RESEARCH

In recent years in Italy, there have been many initiatives taken to promote innovation (often with the emphasis on public and private technology transfer) though without method and without any stable critical reflection on the experiences, thus omitting activating a learning process for the continuous improvement of policies and actions.
Consequently, the results have been modest and the dispersion of resources alarming, confirming the impression of a country incapable of making its innovation policy initiatives systematic and effective.
We must reach the point of sharing, at least among the more aware and interested players, a more advanced *capability of governing research and innovation.* This is rendered essential by the current crisis that threatens both the more strategic investments (think of re-

search and innovation) and the future of the traditional manufacturing sectors and the possibility of latching onto the new emerging sectors. In this framework, the recovery of a more active role of research universities is central to the open innovation processes. It becomes a strategic priority for the future of our economy and the same requirements of competitiveness and growth of our industrial vanguard. In an elegant representation by Donald Stokes (1997), scientific research is categorised according to three contexts, depending on what motivates the researcher (fig. 15).

There are two variables to be cross-linked: on one hand, whether there is the drive to look for new fundamental knowledge and on the other, the importance attributed by the

Quadrant Model of Scientific Research FIGURE 15



Source: Donald Stokes (1997)

researcher to the use of knowledge.

Compared to the three quadrants represented in the figure, Italy is positioned in a differentiated way. On the average, Italian research populates to the upper left quadrant where it also has points of excellence in many of the different knowledge branches.

This quadrant represents the so-called curiosity driven research preferred by N. Henrik David Bohr[9], where from such research new scientific acquisitions, even important ones, can spring forth. Italy also comfortably makes itself at home in the lower right quadrant,

identified with Thomas A. Edison[10], which includes the traditional individual inventors with entrepreneurial vocation, driven to find innovative solutions for practical problems, frequently exploiting genial traits coupled with solid know-how.

Instead, our country is traditionally lacking in the upper right quadrant that regards basic research, with the purpose of finding new knowledge thinking about its relative use (use-inspired basic research) according to the approach of Louis Pasteur[11].

The lack of a system governance as regards research and innovation is particularly felt in Italy for this third quadrant that we would like to consider in its holistic complexity. The incentives currently present along the path of the entire Research and Innovation (R&I) value chain, correspond to a self-interested way of thinking, to sectorial interests and not product chain interests.

However, generating value from R&D, putting new knowledge incorporated into new products and services into the marketplace, requires acting according to a vision that rewards the final result. At the end, it is the market that activates and creates value from R&D.

According to the sectorial/corporative viewpoint, a university researcher is evaluated on the basis of his/her scientific production (publications) using strictly internal university system parameters, while his/her attitude towards the external implications and importance of the work are either ignored or even frowned upon[12]. Entrepreneurs and executives are themselves rewarded on the basis of economic results, often short-term ones, and not certainly for the scientific technological advancement of the company's products.

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[9] *Niels Henrik David Bohr* (Copenhagen, 7 October 1885 - Copenhagen 18 November 1962). Physicist and mathematician, Nobel Prize winner in 1922, he provided essential contributions in the understanding of atomic structure and quantum mechanics. His institute served as a focal point for theoretical physicist in the 1920s and 1930s.

[10] *Thomas Alva Edison* (Milan, 11 February 1847 - West Orange 18 October 1931), American inventor and entrepreneur, who was the first to apply mass production principles to the invention process. He was one of the most prolific inventors of his time, having obtained a record of 1093 patents in his name, but in most cases they were the result of collaboration with others. Edison demonstrated particular ability in beating his competitors to the market with marketable inventions. The invention of the phonograph in 1877 was the first to bring him fame. In 1879, he managed to achieve the mass production of long-lasting light bulbs and create a system for the generation and distribution of electricity.

[11] *Louis Pasteur* (Dole, 27 December 1822 – Marnes-la-Coquette, 28 September 1895), French chemist and biologist, he is universally considered the founder of modern microbiology. Alumni of the ecole Normale Supériore in Paris, he was professor of chemistry at the University of Strasbourg. All the important discoveries of the French scientist were made in the fight against the most serious problems, in the mid-19th century, in agriculture, agricultural industry and breeding farms. Pasteur, thanks to the results of his research, has a pre-eminent role among the founders of the modern industries of food transformation and livestock breeding.

[12] In the case of quite a number of professors and researchers in Italian universities, it may be appropriate to use the "fourth quadrant"- the one in the lower left - considering that their contributions, both scientifically and practically modest, cannot be placed in the other quadrants.

On the other hand, the national and regional public entities that grant financing end incentives for R&I, often end their task with the allocation of the funds, frequently without there having been a serious meritocratic selection process and almost never activating effective post-evaluation procedures of the results obtained.

From this lack of systematic administration of R&D policy and criteria for granting financing and the evaluation of results, the country system is heavily penalised both at the basic research level and at the level of the other links in the innovation value chain, with distorting effects and dispersion of actions and means. Companies also pay for this stalemate in the administration of R&D policy, starting from those most exposed to global competition and more active in the innovation field. To achieve the virtuous dynamics of the third quadrant, it is necessary to create a system with the activation of a true value chain, made up of different players (public research laboratories, industrial laboratories, market experts, product managers, innovative financing, etc.).

They must be capable of collaborating among themselves sharing the output and input of the various links in this chain, according to an interactive logic. From the acquisition of a systemic capability of administering the R&I value chain, we are convinced that important prospects for our country can sprout, taking inspiration from the Open Innovation model to promote and organise stable collaboration among the different players involved.

David Teece (1997) teaches us that what is important in a company is not its current competitive advantage but its capacity to maintain and renew the sources of this advantage over time, in other words its dynamic capability. Never like today has Teece's call been so topical in the face of the $50 trillion in capitalisation that has gone up in smoke worldwide in the space of a few months, in the face of the collapse of the financial system- in the face of a radical and perhaps perennial change in needs and preferences, with effects on the structure of consumer and investor demand.

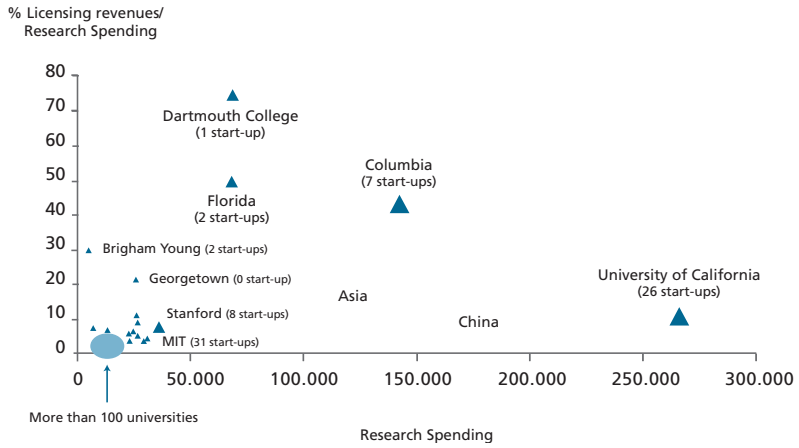
The answers and resources for the renewal of companies' dynamic capability and therefore the country system come from the governing of the R&I value chain, the third quadrant.

ACCOMPANING THE NEW ENTREPRENEURSHIP WITH AN EFFICIENT AND DYNAMIC INNOVATION ECOSYSTEM

In order to draw up "a third quadrant policy", we should take those actions that in one sense do not disrupt the delicate mechanisms of equity and scientific value that stimulates upstream progress of the *Research in Italy* product chain. In another sense, they must sustain the push of the "destructive creator" characteristic of dynamic and innovative entrepreneurs, that decides the winners and losers downstream in the market challenge.
Up to now, we have seen too many failed attempts in Italy, and an extremely alarming dispersion of resources on the various fronts of technological transfer. There has been no leadership! There has been no national policy for research and innovation that had the creation of an innovation ecosystem as its point of reference.
There are three priorities of an open innovation policy that promotes and sustains the entrepreneurial product chain of *Research in Italy*:
1. *Identify the Research Universities of excellence.* Even though for 20 years, other advanced countries, have been experimenting a new role of universities as a factory of knowledge and driver of the innovation value chain, there are only a few research universities of excellence in Italy that could live up to the task. Although the race towards patenting has been a generalised phenomenon and technological transfer offices have been established in almost every university, most of the results, in terms of spin-offs and licenses, is concentrated in a few excellent universities, such that 50% of our spin-offs companies come from just 10 universities (Netval, 2008).
This phenomenon of concentrating the highest research valorisation capacity levels in few universities is a fact that Italy shares with other countries, including the United States (fig. 16).
There is a phenomenon in the American experience that must be pointed out: the universities that are the most active in the field of patenting, licensing and spinoffs are also the most active and play an important role in basic research driven by intellectual curiosity. This should eliminate the reservations and objections so eradicated in the Italian academic world towards those colleagues that know how to talk and collaborate with companies and in general the external world.

Licensing Revenue and Research Spending of U.S. Universities

FIGURE 16



In 2001, average licensing revenue for the universities more active on technology transfer initiatives, were less than 10% of total research budget. Source AUTM

2. *Understand what our technological excellences are.* The starting point is to accept the rating of success and insuccess. It is not possible to intervene with method and effectiveness in the research-innovation value chain if we do not admit that Italy has an advantage in some scientific and technological areas while in others it must play catch-up and in others it has no hope. From a product chain point of view, given that our objective is to create value recognised by the global market, we must concentrate first of all on our excellences. Up till now, we have limited ourselves to considering certain products *Made in Italy* as excellence. However, we must update our analysis of our industry's position with a perspective vision on the dynamic capability of *Research in Italy*.

3. *Intensify the entrepreneurial push.* The researcher - potential inventor - is not normally an entrepreneur. Moreover, he is generally not driven by the anxiety of economic interests, even if at times it can be used as a starting point in the chain that leads to creating value from and with research.

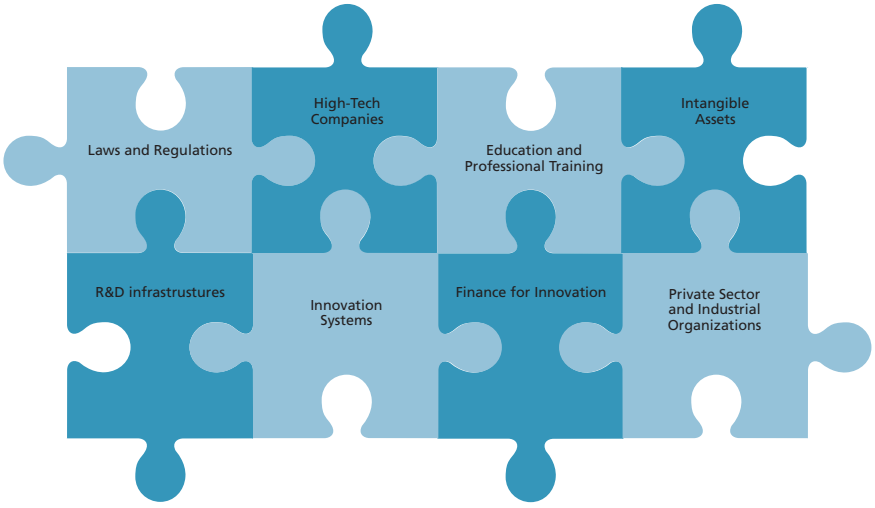
Therefore, it is necessary that the researcher has the possibility not only of having access to the resources necessary for developing and finishing his scientific work, but also to be appropriately oriented.

In the closed innovation model, large companies could count on R&D laboratories where the basic research was located in an organisational and human context that facilitated the assimilation of reality sensing by researchers. Groups of people could be also used in long-term projects, thinking about a 10-15 year timeframe. But these people were embedded in a company organisation which in turn was embedded in the market, for which they were naturally oriented towards reality sensing. In one aspect, industrial researchers with their work in scientific companies, often with policy responsibilities, could play an active role in the transfer of scientific messages to the entire community useful for avoiding unproductive dispersions of efforts and means. With the migration of basic research from industry to universities, the traditional mechanisms of reality sensing were disrupted, while equally ready and effective replacements are taking time to take off.
There is a strong need to draw benefits from scientific research carried out in universities, to act in a way that promising research does not fall into a black hole as well as avoid that "research that will never get off the ground spends years trying to fly" (E.A. Fitzgerald, 2009). Any attempt to make basic research more targeted must not however push researchers too strongly towards short-term thinking and the desire to contribute with incremental advances. In the best research universities, stimulated by an entrepreneurial-type social and organisational climate, a dynamic equilibrium between the diverse needs has been reached, for which professors manage to be excellent basic researchers but also avoid the risk of *"non-reality sensing"*. This is achieved through the following:

- the creation of entrepreneurial and competitive research environments where researchers can effectively carry out their role but also take advantage of frequent and systematic contacts and one-to-one interactions with technologists from the production world that help them to think in terms of *"pratical value creation"*;
- a university policy that on one hand encourages contacts and collaborations with the outside and on the other, eliminates the traditional bureaucratic barriers that weigh down the decisional and management processes.

The open innovation paradigm has overwhelmingly affirmed itself and spread in countries characterised by an innovation ecosystem that revolves around work joined with various components: networks of research and training infrastructures, innovative financing and a rich fabric of large companies and SME, etc. (fig. 17).

The innovation ecosystem FIGURE 17



The technology-based innovative companies are the ones who most need this type of ecosystem. These companies which spring forth from research, or at any rate are strongly connected with research, must exist and operate in dynamic and proactive institutional and entrepreneurial contexts in order to express their potential and follow paths of sustainable growth. These are companies that can consolidate themselves and grow only if they are allowed to project themselves towards the global market passing through progressive injections of entrepreneurship and risk capital (business angel, venture capital) and relations with the world of more involved large and medium companies.

In this innovation ecosystem, language is not codified. Institutions and infrastructures that promote its fertility must work together synergetically. There must be a public administration capable of providing adequate incentives and services effectively, simply and quickly.

CONCLUSIONS: THE NEW ENTREPRENEURIAL CLASS OF RESEARCH IN ITALY

The current economic phase is destined to create drive and opportunities for a renewal of the entrepreneurial class. This renewal will be accompanied and stimulated by the presence of open innovators capable of successfully creating new products, new solutions, new business models and new forms of cooperation.

As we highlighted, Italy has accumulated a serious delay in most advanced technological industries and this is a fundamental problem.

In his recent travel to Asia, President Napolitano invited us to consider South Korea as an example of a "remarkable story of success". The story of a country that has been able to act with "far-sigthedness" and to shape its development by "investing in education and research". Even in the recent anti-recession plan, Seoul's government "focused (…) on investments in environmental technologies and renewable energy sources. This choice looks beyond the contingency of the economic cycle, straight to the future of the country and the welfare of next generations" (G. Napolitano, 2009).

The limited number of Italian multinationals operating in high-tech industries prevents us from filling our delay. As we stated in this paper, large companies should be supported by high-tech SMEs which could act as outposts in leading industries, vital for economic and technological development.

Space is also being created, even in Italy, for a new generation of researchers-entrepreneurs, protagonist of that Third Quadrant that we have described while technological start-ups are rising and establishing themselves in new advanced industries.

Yesterday's entrepreneur controlled the competences of a craft or industrial product chain, or its parts. The relationship between the strengths and weaknesses within this product chain was the sources of revenue and the competitive advantage of the company. The new knowledge-era entrepreneur model must know how to successfully position itself in a different value chain -precisely that which springs forth from research and arises from a scientific and technological push- to project itself into the international markets and therefore be part of the clan of the new global managerial class.

A heretofore little-known reality is that of the technology-based SME system, represented by spin-offs, start-ups and other innovative companies. It is a reality with promising growth

opportunities in the world of industry and science. Therefore we face an effervescent and dynamic entrepreneurial phenomenon, that can drive the Italian production system towards change. The protagonists are young entrepreneurs.

They convey innovation to their territory, while their proximity to the world of research and markets brings new entrepreneurial vigor due to the young people provided with knowledge, capability and motivation more in line with the paradigms of a global society based on knowledge.

Innovative entrepreneurs provided with a firm scientific and technological education and strong creativity, are players that compete in the marketplace and therefore, in the final analysis, they accept its verdict. If they know how to create value, they attract resources and produce wealth. If, instead, their business project is ill-conceived, they fail and the energy is used in other forms.

The wish is that the crisis can be the opportunity of creating also in Italy a structurally valid bridge between research and industry, between public and private, to draw value from the innovative assets available in university centres of excellence and the technology-based entrepreneurial fabric. To accompany this process, a national interest project must be created with the involvement of a set of public and private national, regional and local players, at different levels of commitment and participation, that are interested in this type of "mission".

Anyway there are new opportunities for attracting the attention and interests of foreign investors to the excellences of *Research in Italy*, that attention and interest which today is turned towards horizons far from our country. In this phase of disorientation and the search for new reference points, Italy could have an opportunity for regaining positions in the European context and beyond. By putting its creative forces into a network and valorising them for the benefit of the enormous effort of innovation that must be made at the global level, the country would begin its journey towards growth aiming at a more sustainable and more responsible capitalism (G. Tremonti, 2008).

Bibliography

Baumol W. 2004. *La macchina dell'Innovazione*, Milano, Università Bocconi Editore

Bush, V. 1945. Science The Endless Frontier. Washington, D.C.: Office of Scientific Research and Development.

Chesbrough, H. 2003. *Open Innovation.* Cambridge, MA: HBS Press.

Chesbrough, H. 2006. *Open Business Models*. Cambridge, MA: Harvard Business School.

Chesbrough, H. 2008. *Open: Modelli di business per l'innovazione.* Milano: Egea.

Cohen, S.S., Di Minin, A., Motoyama, Y., & Palmberg, C. 2009. The Persistence of homebias for important R&D in Wireless Telecom and Automobiles. *Review of Policy Research*, 27 (March).

Cohen, S. S., & Zysman, J. 1987. *Manufacturing Matters: the Myth of the Post-Industrial Economy.* New York: Basic Books.

Cohen W. M. and Levinthal D. A. 1990 Absorptive capacity: a new perspective on learning and innovation. Administrative Sciences Quarterly

Coltorti, F. 2004. Le medie imprese industriali italiane: nuovi aspetti economici e finanziari. *Economia e Politica Industriale,* 121.

Cooke, P., & Morgan, K. 1998. *The Associational Economy. Firms, Regions, and Innovation.* London: Oxford University Press.

Dahlander, L., & Gann, D. 2007. *How open is innovation?* Paper presented at the DRUID Summer Conference 2007, Copenhagen, Denmark.

Di Minin, A., Lazzeroni, M., & Piccaluga, A. 2003. *HTSFs in peripheral, knowledge intensive areas: an in-depth analysis in Pisa.* Paper presented at the The Eleventh Annual High Technology Small Firms Conference, Manchester.

G. Dosi, P. Llerena and M. Sylos Labini. 2006 The relationships between science, technologies and their industrial exploitation: An illustration through the myths and realities of the socalled 'European Paradox'. *Research Policy,* 35, 1450-1464.

Dicken, P. 1998. Global Shift : *Transforming the World Economy.* New York: Guilford Press.

Dossani, R., & Kenney, M. 2009. Service Provision for the Global Economy: The Evolving Indian Experience. *Review of Policy Research,* 26(1-2): 77-104.

Doz, Y., Santos, J., & Williamson, P. 2001. *From Global to Metanational. Boston, MA:* Harvard Business School.

Dunning, J. H. 1994. Multinational enterprises and the globalization of innovatory capacity. *Research Policy,* 23: 67-89.

Dunning, J. H., & Lundan, S. M. 2009. The internationalization of corporate R&D: A review of the evidence and some policy implications for home countries. *Review of Policy Research*, 26(1-2): 13-33.

Fitzgerald E.A. 2009. *How a Dose of Reality Can Make Science More Visionary,* in Kauffman Foundation Thoughbook

Florida, R. 2005. The world is spiky. *Atlantic Monthly* (October): 48-51.

Friedman, T. L. 2005. *The World is Flat. A Brief History of the 21st Century.* New York: Farrar, Straus and Giroux.

Harrison, B. 1992. Industrial districts: old wine in new bottles? *Regional Studies,* 26(5).

Hart, D. M., ed. 2003. The Emergence of Entrepreneurship Policy: Governance, Start-Ups, and Growth in the US Knowledge Economy. Cambridge, MA: Cambridge University Press.

Jaruzelski, B., Dehoff, K., & Bordia, R. 2006. Smart spenders: The Booz Allen Hamilton Global Innovation 1000. *Strategy+Business.*

Kenney, M., & Florida, R. (Eds.). 2004. *Locating Global Advantage.* Stanford, CA: Stanford University Press.

Lazzeroni, M. 2004. *Geografia della conoscenza e dell'innovazione tecnologica.* Milano: Franco Angeli.
Macher, J. T., & Mowery, D. C. (Eds.). 2008. *Innovation in Global Industries: U.S. Firms Competing in a New World.* Washington D.C.: Board on Science, Technology, and Economic Policy, the National Academies Press.
Markusen, A. R. 1996. Sticky places in slippery space: a typology of industrial districts. *Economic Geography,* 72(3): 293-313.
Mowery, D. C., Nelson, R. R., Sampat, B. N., & Ziedonis, A. A. 2004. *Ivory Tower and Industrial Innovation: University-Industry Technology Transfer before and after the Bayh-Dole Act.* Stanford, CA: Stanford University Press.
Napolitano, G. 2009. *Brindisi del Presidente Napolitano in occasione del Pranzo di Stato offerto dal Presidente della Repubblica di Corea*. Seoul, 14 settembre, 2009.
Netval. 2008. Rapporto Annuale: Netval.
Obama, B. 2009. *Remarks of President Barak Obama.* Washington, April 27, 2009: National Academy of Sciences.
OECD. 2008. Open Innovation in Global Networks.
Porter, M. 1998. Clusters and the new economics of competition. *Harvard Business Review* (Nov/Dec): 77-90.
Prestowitz, C. V. 2005. *Three billion new capitalists: The great shift of wealth and power to the East.* New York: Basic Books.
R&S Mediobanca. 2008. *Multinationals: Financial Aggreagates (342 Companies) 1997-2007.* Milano: Mediobanca.
Robyn, M. 2007. *The elephant and the dragon: the rise of India and China and what it means for all of us.* New York: W.W. Norton & Company.
Rothkopf, D. 2008. *Superclass. The Global Power Elite and the World they are Making.* Brown: Little.
Saxenian, A. 2006. *The New Argonauts : Regional Advantage in a Global Economy.* Cambridge Massachusetts: Harvard University Press.
Schumpeter, J. A. 1943. *Capitalism, Socialism and Democracy.* New York, London: Allen & Unwin.
Seib, G. F. 2008. In Crisis, Opportunity for Obama. *The Wall Street Journal* (Nov. 21st): A2.
Stokes, D. 1997. *Pasteur's Quadrant*. Washington, D.C.: The Brookings Institution Press.
Storper, M. 1997. *The Regional World. Territorial Development in a Global Economy.* New York and London: Guilford Press.
Teece, D. J., Pisano, G., & Shuen, A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal,* 18(7): 509-533.
Tremonti G. 2008. La Pausa e la Speranza, Milano , Mondadori
Varaldo, R. 2002. Imprese transnazionali e Paesi emergenti: le diverse vie alla globalizzazione. *Economia e Politica Industriale* (113).
Varaldo, R. 2008. Le nuove dimensioni della globalizzazione: attualità del pensiero di Sergio Vaccà. *Economia e Politica Industriale,* 2008(3):
Varaldo, R., & Lamberti, L. 2009. La grande crisi globale: una sfida per la politica industriale e per le imprese. *Economia e Politica Industriale*, 34(1):
G. Zampini: *"Questa è l'occasione per rilanciare l'industria e la tecnologia italiana del settore"*, Il Messaggero, 15 maggio 2009
World Bank. 2008. *The Growth Report.* Washington D.C.

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