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Drivers and Impediments for Innovation in Europe

The EU 2020 strategy relies on innovation as the core driver of economic dynamics. The present Forum discusses the strategies established by the European Commission and the member states for the intensification of innovative activities. Analyses of often neglected aspects of innovation policy, such as measurement of intangible investments, service innovation and a regional innovation system complement the picture.

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Putting Innovation at the Centre of Europe – Suggestions for a European Innovation Strategy

As Europe seeks to recover from the current economic downturn, the central aim of economic policy is long-term, sustainable growth. With an ageing labour force and increased competition for limited natural resources, this growth will have to be founded upon greater productivity, which in turn will be unlocked through innovation. This article is about the ways in which national governments and European institutions can achieve the structural and cultural changes necessary to make Europe a dynamic innovation-led economy, one fully engaged with the societal challenges facing its citizens and ready to make its contribution to solving broader global challenges. It sets out a strategy based on:

- a holistic approach for an effective European innovation strategy;
- the improved distribution of responsibilities among the regional, national and European levels;
- new governance structures to solve global challenges.

At a time when the Europe 2020 Strategy[1] has highlighted the importance of innovation for economic recovery and growth and for meeting societal and sustainability challenges, the Flagship Innovation Union Initiative is setting a new direction for research and innovation policy. This paper seeks to contribute to advancing thinking in this key domain.

A Holistic Approach to a European Innovation Strategy

Advancing Research and Innovation Policy

In the past five years, a substantial reappraisal of research and innovation policy has taken place in Europe. Initially, the drive for this was the realisation that efforts to underpin the technological base, though vital, were insufficient in terms of providing the environment in which innovative firms would flourish and grow. A broader-based view of innovation has been emerging which recognises the critical importance of the research and innovation ecology, in other words the network of relationships between innovation actors and the environment which structures those relationships. The ability to source knowledge developed elsewhere or to be a knowledge supplier is captured in the term "open innovation", while the growing recognition of the role of users (both organisational and individual) has led to renewed interest in the concept of "user-driven innovation".

A series of initiatives are being undertaken. The Aho Group report, Creating an Innovative Europe, opened a new focus on Europe's need for a market-friendly approach to innovation. The EU's Broad-based Innovation Strategy made major progress in identifying ten actions as a roadmap for innovation policy and responded to the Aho group by introducing demand-side as well as supply-side dimensions to policy. Important elements of these included actions to create innovation-friendly lead

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1 Europe 2020 - A European Strategy for Smart, Sustainable and Inclusive Growth, COM (2010) 2020 Brussels 3.3.2010.

markets (embodied in the Lead Market Initiative – LMI) and the use of both pre-commercial and general public procurement oriented towards innovative solutions.

Despite progress made at the national and European levels, several key aspects remain to be addressed fully:

- the critical role of market needs and user demand in motivating firms to successfully launch their investments in innovative activities;
- how wider framework conditions (including the fiscal and competition environments), other regulations (including those for intellectual property) and infrastructure (both ICT-related and physical) affect innovation;
- the importance of what is sometimes called non-technological innovation (though a more accurate description would be non-R&D-based innovation, as technology is rarely altogether absent), especially in the service sector, and an increasing interest in innovation for public services;
- a recognition that policies for the knowledge triangle are insufficiently coordinated – for example the education and training dimension of higher education receives a relatively minor role in policies for the European Research Area.

Other key themes which were already on the agenda nonetheless need revisiting in light of changing circumstances. Critical areas include:

- access to risk finance for innovative small and medium-sized companies and a lack of coordination between financial instruments;
- improved networking between universities and other research institutions, businesses and government to ensure the effective flows of knowledge, resources and people;
- effective clusters, poles, science and technology parks and districts, and other spatial policies to create local innovative agglomerations.

These developments make new demands upon the governance of innovation policy, requiring an integrated approach and coordination across levels of government.

Improved Distribution of Responsibilities Among Regional, National and European Levels

So far, we have argued that innovation policy should be moved to centre stage, given that the whole set of other policies have various links with, effects on and implications for research and innovation. In this section, we focus on how research and innovation policy (and other innovation-related policies) should be positioned in relation to the regional, national and European levels in order to maximise the economic benefits and minimise the costs for the European Union as a whole.

The subsidiarity principle established in the Treaty of Maastricht sets the national or regional level as the default. However, some important trends suggest a need to move away from this level:

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- More extensive information and communication infrastructures and the increased cross-border mobility of individuals and organisations require a governance and support structure commensurate with these flows and spillovers.
- Europe faces more severe negative cross-border externalities and a collective need to support global public goods of the type embodied in the Grand Challenges mentioned above.
- The drive towards a European Single Market – through a comprehensive system of laws which apply in all member states ensuring the freedom of movement of people, goods, services and capital – also means a single market for innovation.
- The objective of economic and social cohesion affects not only the relative standing of member states but also their interactions. While the sectoral mix of economies and other resources makes it impractical for all to have, or even aspire to have, the same content and level of R&D, no such argument applies to innovation, which in principle is relevant for all sectors.

These four dimensions favour European-level research and innovation activity, or at least a coordinating role at the EU level (see Table 1 for an overview). The same is true of sectoral policies, especially in European industries and markets that are already highly integrated, and of generic cross-sectoral policies focusing on generic aspects like intellectual property rights regimes.

In order to react adequately to these trends, several initiatives to rebalance the distribution of responsibilities among the regional, national and European levels are needed, and a process of reshaping the framework conditions should be started.

Starting with the Lead Market Initiative (LMI), we should positively highlight the attempt to combine different sector-specific policy initiatives such as regulation and standardisation with cross-sectoral instruments such as public procurement accompanied by traditional research and innovation policies. However, the LMI was unable to provide a comprehensive approach to integrating and gaining commitment from all relevant stakeholders and institutions. It also failed to take the regional, national and European policy levels into account. For example, the national level of actors and institutions in the member states has been insufficiently involved in both the development and implementation of the LMI. In addition, pre-existing or planned lead market initiatives in some member states, like Germany, were not taken into account in the LMI concept and have not been used for a more efficient implementation of the LMI. Finally, relevant stakeholders at the horizontal level could not be sufficiently engaged, for example in the case of eHealth.

An area in which a comprehensive approach integrating both research and innovation policies as well as sectoral and even cross-sectoral policies would be of great benefit is that of biotechnology, e.g. genetically modified organisms in food. Here, a better linking and coordination between the research programmes and required regulatory initiatives to gain acceptance among critical consumers would have increased the effectiveness of public policy and the efficiency of the invested resources. In particular, the discrepancies in the acceptance of this technology between different member states represent an additional challenge which can only be tackled by a stronger coordinating role at the European level. We face a similar challenge in the area of nanotechnology, which cannot be handled solely by comprehensive research activities in the Research Framework Programmes, but requires a much more comprehensive approach.

If we take a look at sectoral policies, the future regulation of energy markets faces two challenges which have to be addressed. First, the regulation of energy networks has to take the innovation dimensions explicitly into consideration. Here, a new initiative by nine member states to build a European-wide green electricity network has to be mentioned. Second, however, the regulation of such an innovative European-wide electricity network must consider not only national infrastructures, but also those of regional electricity suppliers. A similar challenge for combining the regional, national and European levels exists in the development of infrastructures for electric cars.

Finally, among the cross-sectoral aspects, the necessary regulation of the European or even worldwide financial markets has to take into account not only the funding of research and innovation investments, but also the structure of the banking sector with regional – often publicly owned – banks, national banks and multinational financial service providers and the institutions and regulatory frameworks applying to these organisations.

The completion of the European patent system by establishing a single EU patent and a European Patent Court has already been on the agenda for a long time. Recent European Council conclusions might pave the way to achieve a major reform of the EU patent system as a comprehensive institutional framework for the aspects of intellectual property in Europe, bringing it to the same level as the conditions in the USA and Japan.

These few examples do not present a comprehensive list of activities to be initiated, but are just an illustration of priority fields of activity for a future comprehensive European innovation policy.

Table 1
Rationales of R&D&I Policies and Innovation-related Topics of Other Policies

Policies/ Level	Research and Innovation Policy	Sectoral Policies	Cross-sectoral Aspects
Regional	Reduce underinvestment in R&D&I by regional public spending with focus on SMEs Address regional innovation system failures Foster regional clusters		
National	Reduce underinvestment in R&D&I by national public spending Address rational innovation system failures Foster national clusters Foster national competitiveness Address national social and environmental challenges	Address national market failures (i.e. public goods, externalities, information asymmetries) Regulate competition policy in national markets incl. monopoly abolishment, market entry and M&A in sectors Pursue national standardisation via self-regulation Set national social objectives (e.g. affordable health care)	National consumer and worker protection Regulation of national competition, incl. entrepreneurship National labour market regulations National financial market regulations National public revenues National tax system, incl. tax credits and deductions for R&D National public spending incl. innovation-oriented public procurement National business cycle policies, incl. investment in infrastructures, green technologies, etc.
European	Establish R&D economies of scale and scope (-> specialisation is needed in order to avoid redundancies and to build critical masses = coordination) Set common incentives via the harmonised IPR Regime, which also promotes European-wide diffusion of R&D&I results Coordinate competition in research and innovation between member states Coordinate European clusters Provide for efficient allocation and mobility of researchers Foster European competitiveness Address European social and environmental challenges	Establish regulatory framework for European network industries Regulate competition in European markets, incl. cross-border M&A and MNE Create European standardisation system Pursue European economic and social cohesion	European consumer and worker protection Completion of Single Market (incl. export, FDI rules), also in services European labour market regulation European financial market regulations (incl. European venture capital) European coordination of national public revenues, especially the tax system (incl. tax credits and deductions for R&D) European coordination of national public spending, incl. innovation-oriented public procurement

A New Governance Structure for Research and Innovation Policy

As the European Union moves forward into its post-Lisbon Europe 2020 strategy, the imperatives of jobs, growth and sustainable development have never been stronger. We have reviewed the productivity and resource challenges facing Europe and set out the extended role for innovation and for the policies which foster it. We have noted the continuing or even increased importance of excellent and well-focused R&D, of securing financing for innovators and of creating the spatial and cultural conditions needed to foster an innovative Europe and the need to move forward with demand-side policies and the social dimensions of innovation. However, this requires a new recognition of the complex set of policy levers that are needed to create an innovative Europe fit to compete and cooperate with the world's best and to face the numerous and growing global challenges. This strategy paper has stressed that innovation needs to be placed at the centre of policymaking in Europe.

We have emphasised that there is an innovation dimension to nearly the full range of policies undertaken by national governments and the European Commission. Table 1 shows that there is a strong rationale for European action in almost all of these policy domains. President Barroso's call for the EU to be transformed into an innovation society gives clear evidence that the time is ripe for reform and growth.[2] To conclude our argument, we consider in practice how policy responsibility can be configured to create an effective governance system for innovation in Europe. Our comments are grouped into three categories:

- a European innovation strategy
- focussing EU institutions on innovation
- projecting coordination in Europe.

A European Innovation Strategy: The present high-level commitment to innovation and the recognition that a knowledge-driven approach is fundamental to meeting the goals of economic recovery, social development and sustainability has led to a number of promising initiatives, as enumer-

2 José Manuel Barroso: Transforming the EU into an Innovation Society, Enterprise Innovation Summit, European Parliament, Brussels, 13 October 2009.

ated at the beginning of this report. Nonetheless, there is ample evidence that Europe is not exploiting its innovation potential and that, as we have seen, significant barriers are rooted in a lack of coordination between different policy initiatives and regulatory frameworks in both vertical and horizontal dimensions. The vertical issue concerns coordination and effective subsidiarity among the European, national and regional levels, while the horizontal is concerned with bringing together the policies and institutions rooted in sectoral and regulatory domains but which are critical for innovation and the effective functioning of markets.

It is not realistic to tackle all such issues in the context of research and innovation policy, but major progress is possible if explicit strategies are agreed upon in two dimensions:

- key sectoral or technological clusters
- grand societal challenges.

These strategies should embody:

- a commitment to support R&D with excellence, relevance and the development of the next generation all catered for;

- a renewed commitment to link research with business and social partners through collaborative projects, clusters and any other instruments which foster effective working while respecting the distinct missions and competences of these partners;

- cross-governmental action to create markets friendly to innovation and with the potential to make Europe a hub for lead markets which underpin global competitiveness;

- targeted support for innovative firms, stimulating the creation and particularly the growth of new firms. While SMEs are of major importance for their job creation potential, the policies should also seek to engage the large firms which are at the centre of the innovation ecology.

To qualify as a strategy, these policy measures should contain targets, a timetable and rolling budgetary commitments. Either collectively or for individual strategies, the key stakeholders (government, business and others) can demonstrate their commitment by signing on to an innovation pact, as previously recommended by the Aho Group.

Focussing EU Institutions on Innovation: The Directorates General of the European Commission include both those with a central interest in innovation under their current mandates (e.g. DGs Research, Innovation and Enterprise and Information Society and Media) and others where innovation impinges on the competences of sectoral and cross-cutting areas. Perhaps the most obvious connections are to DG Energy and Transport, DG Environment, DG Agriculture and Rural Development and DG Health and Consumers. It is interesting to note that for most of these as well as for the structural and social funds, innovation either does not appear in their mission statements or is confined to an engagement in specific technological projects.[3]

While we recognise that the Commission services do seek to work in a coordinated and cooperative manner, the present organisational arrangements do not reflect the realities of the central role that innovation should play in policy. The following changes are needed:

- Innovation should be part of the mission of each Directorate General. This should include a mandate to promote innovation in enterprise or the public sector where this is consistent with other aspects of their missions – for example by considering innovation-based solutions when they engage in procurement. They should also be expected to seek innovative ways of fulfilling their mandates. All of the above should be reflected in the activities where they coordinate or support member state activities.

- To ensure that innovation is given sufficient attention by DGs, each one should be mandated to produce an annual Innovation Report on their own activity structured according to the above activities. This should detail progress in measures already undertaken and contain a look ahead of up to five years at how they intend to advance the innovation agenda. To support this task, a new measurement approach should be established which includes social and public innovations and which applies not only to European DGs but also to the equivalent national ministries.

- There are various options for central coordination, such as moving boundaries between DGs – this would echo the redistribution in portfolios of members of the Commission and could perhaps go further by encompassing all knowledge triangle dimensions. However, eliminating some boundaries may create new ones – for example between innovation and wider enterprise policy.

- The challenge of coordination has in part been met by the appointment for the first time of a Commissioner responsible for both research and innovation, who in turn chairs a group of the most affected Commissioners. However, it could be beneficial to add representatives of key stake-

3 K. Blind et al. : New Products and Services. Analysis of Regulations Shaping New Markets, Innovation Policy Study on behalf of DG Enterprise, Luxembourg 2004. The authors show in their study that sectoral ministries, especially in the USA, had already integrated innovation in their mission.

holders in the European research and innovation system such as businesses, scientific bodies, and higher education institutes while keeping numbers manageable. A small number of independent members could be appointed *ad personam* if particular expertise were needed. The central mission would be to provide an overview of, and give direction to, European research and innovation policy in cooperation with member states and the European Parliament.

Projecting Coordination in Europe:

- The new central role for innovation also needs to engage member states. The structure of existing advisory committees has to reflect this new emphasis and ensure that initiatives can be carried forward. The proposed extended and upgraded role for CREST (renamed the ERA Committee – ERAC) is one way forward. Complex cross-cutting initiatives such as the LMI have been inhibited by being left in the hands of policymakers who have responsibility for the much narrower domains of conventional innovation policy and are not equipped to engage the sectoral ministries and regulatory bodies, including standardisation institutes, who are key agents in demand-side innovation policy.

- The Council also needs to take responsibility for innovation in its broader conception. Innovation has recently been a regular point on the agenda of the European Council at all meetings of the Competitiveness Council (dealing with Internal Market, Industry and Research). However, some extension of the Council's mandate may be necessary to cover public service aspects of innovation.

- In the European Parliament, the responsibilities of the Industry, Research and Energy Committee again do not mention innovation explicitly and address it implicitly only in terms of the application of new technologies. A revised mandate would be beneficial.

- The new governance of innovation policy at the European level should also lead to structural changes in the member states, not simply by copying the European structure but by setting even stronger incentives for cooperation and coordination at the European level. These should reflect both the progressive integration towards a Single Market for products and services and the move towards ERA and addressing the growing global challenges. There is a strong imperative to move forward more vigorously with the agenda set out by the Aho Group for creating a market friendly to innovation in Europe.

- A further consequence is an expansion of the budgets for research and innovation at the European level on the one hand and avoiding free-rider strategies by the member states on the other hand by setting strong incentives, for example by requiring matching funds. These European funds can also be used to influence the focus of sectoral and cross-sectoral policies in the member states towards innovation.

Final Words

The central role of innovation in meeting the economic, social and sustainability challenges facing Europe calls for a response which allows its transformative potential to be harnessed to these goals. Europe and its people have strong traditions of, and enormous potential for, finding creative and entrepreneurial solutions. The task for its leaders is to provide a structure which highlights, rewards and enables innovation to pervade the policymaking and business environments. A time of crisis is also the best time for change and for building and shaping the governance of the new institutions that we need to meet future challenges.

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Boosting Innovation in Europe

The European Commission is preparing a research and innovation strategy, which will be a part of the Europe 2020 strategy, and which should be endorsed by the European Council at its October 2010 summit. The Commissioner for Research, Innovation and Science will propose:

- to refocus Europe's research and innovation policies on the "grand challenges" facing society, such as climate change and ageing populations;

- to create the conditions for a more dynamic Europe, "where excellent research improves knowledge capital and leads to innovation in successful and dynamic businesses".[1]

1 M. Geoghegan-Quinn: Preparing Europe for a new renaissance: how science can help restore sustainable prosperity, speech to the European Research Area Board (ERAB) Conference, Seville, 6 May 2010.

This paper takes as a starting point the Commission's broad aims and makes concrete suggestions for boosting European research and innovation, based on three essential principles:

- giving primacy to excellence and the merit-based selection of projects at the European level;
- the importance of the single market for research and innovation;
- removing barriers that hinder dynamic restructuring.

The principle of giving primacy to excellence should be seen in the context of two of the three priorities of the Europe 2020 strategy, namely smart growth and sustainable growth, seen as central to equipping Europe to face the challenges of global competition. Only by excelling in research and innovation at the global level – by fostering through merit-based selection the development of firms and institutions that are global leaders in their fields – will Europe be able to meet the global challenge. Emphasising excellence and merit-based competition does not have to come, however, at the expense of the remaining Europe 2020 priority: inclusive growth and its attendant concern for territorial cohesion, which aims to give member states and regions the opportunity to take part in the quest for excellence. In other words, Europe can have both world-class research and innovation as well as cohesion provided it uses two different instruments to meet the two objectives: EU-wide merit-based selection for the former and cohesion policy for the latter.

Based on the three principles spelled out above, the paper makes concrete proposals in three interrelated areas:

- basic research and in particular the role of universities;
- the creation and development of young, innovative companies;
- a patent system that underpins the growth of innovative firms.

Basic Research

It has become increasingly clear that the disappointing European growth performance of the last 30 years is closely linked to Europe's research performance. Applied research and innovation must be based on solid basic research, and the connection between university research and patenting has been empirically documented.[2] The connection between higher education and (basic) research – HER – is also obvious, and the USA, the model for other countries in terms of its successful HER system, demonstrates a very close association between higher education and research through its highly successful research universities. These excel in publications, while attracting foreign talent and developing worldwide research links, including with emerging Asian economies.[3] Meanwhile, Europe invests too little in higher education. The EU spends less than two per cent of its GDP on R&D, compared to more than 2.5 per cent in the USA. But the gap between Europe and the USA is even wider for universities than for R&D spending: total (public and private) spending on higher education in the EU accounts for less than 1.5 per cent of GDP, against more than three per cent in the USA. In terms of expenditure per student, the contrast is starker still, with annual spending more than three times higher in the USA.

Moreover, the unsatisfactory research performance of Europe's universities also results from inadequate institutions: they suffer from poor governance, are insufficiently autonomous and often offer insufficient incentives to devote time to research.

Europe started to recognise some years ago that its university system faced a problem. The 1999 Bologna Declaration was the starting point for the creation of a European Higher Education Area. The objectives were to establish a degree of comparability between higher education qualifications and to improve mobility within Europe. In 2000, the European Commission initiated the European Research Area in a drive to improve the effectiveness of research in Europe. An increasing number of EU member states have also tried to reform their university systems. But much more remains to be done. In particular, the economic and financial crisis should not be allowed to undermine basic research funding.

It has been empirically documented that for quality basic research, a mix of increased funding, stronger autonomy and more vigorous competition is required. Specifically, recent empirical evidence shows that increased university funding does lead to both higher levels of academic output (measured by publications or citations) and more patenting, and that these gains are stronger for universities that are more independent of public funding authorities and which face a more competitive funding environment.[4] The

2 See for example P. Aghion, M. Dewatripont, C. Hoxby, A. Mas-Colell, A. Sapir: The Governance and Performance of Research Universities: Evidence from Europe and the U.S., in: Economic Policy, Vol. 25, Issue 61, 2010.

3 See R. Veugelers: Towards a Multipolar Science World?, in: Scientometrics, Vol. 82, No. 2, 2010.

4 See P. Aghion, M. Dewatripont, C. Hoxby, A. Mas-Colell, A. Sapir: Higher Aspirations: An Agenda for Reforming European Universities, Bruegel Blueprint 5, 2008, and "The Governance and Performance of Research Universities: Evidence from Europe and the U.S.", op. cit.

complementarity of funding, autonomy – in terms of hiring and wage setting, for example – and competition is intuitive: (i) more money helps, and helps more when universities are allowed to allocate their resources efficiently; (ii) the discipline of competition in turn induces autonomous universities to make efficient decisions in resource allocation.

While giving universities more autonomy is the responsibility of member states, and several of them are making progress in this area, the EU could help greatly in the areas of funding and competition by:

- encouraging and monitoring – by relying on the Open Method of Coordination – a concerted effort to raise university funding in European countries, for example by one per cent of their GDPs. While the precise mechanism by which university revenue is raised could be left to the member states, it is important to make sure that it is raised. Note that higher US university funding comes partly from higher public funding but, more importantly, from much higher student fees.[5] If university funding were to come from higher student fees, it would be critical that a well-functioning system of grants or loans to help poorer students be set up;

- enhancing excellence thanks to EU-wide merit-based competition (open to anybody in the world who wants to do research in the EU) by increasing funding for the European Research Council and the European Institute of Technology.[6] The EU should also start merit-based competitions for doctoral schools, since many EU students are lured away at that stage of their careers to the USA (where more than half of the PhDs in science and engineering are foreign-born) and often settle there afterwards;

- enhancing researcher mobility through the completion of the European Research Area. Here, two important avenues for progress would be the introduction of an EU research visa and the portability of social security benefits across the EU.

Young Innovative Companies

Europe's innovation gap results from an inappropriate industrial structure in which young firms fail to play a significant role, especially in high-tech sectors. A forthcoming Bruegel Policy Contribution[7] shows that the EU has fewer young firms among its leading innovators relative to the USA. This matters for the overall private R&D deficit of the EU relative to the USA, because these companies are more R&D intensive. But this effect only accounts for about one-third of the US-EU R&D differential. The largest part of the differential is due to the fact that the EU's young leading innovators are less R&D-intensive than their US counterparts. Further unravelling why EU young leading innovators are on average less R&D-intensive than their US counterparts shows that this is almost entirely due to a different sectoral composition, with US young leading innovators more often located in highly R&D-intensive young sectors, with biotechnology and Internet services being the most obvious cases. This analysis confirms that the EU-US private R&D gap is mostly a structural issue. Overcoming this will require the EU to nurture more young firms to grow to achieve leading innovator status. This should be done in particular in young, innovation-intensive sectors. These sectors are often tightly linked to cutting edge scientific research.

There are a number of plausible reasons why Europe has fewer leading young innovators in new sectors able to achieve world leadership status. Segmented markets restrict European firms from accessing large markets and reaching an efficient scale. Less well functioning industry-science links prohibit the throughput of new scientific insights into successful innovative projects. And access to finance for risky breakthrough projects is a particular problem in Europe, with its fragmented venture capital market. The current financial and economic crisis has widened this access-to-finance gap. Young firms with breakthrough projects, but which lack collateral and reputation, are particularly threatened by the double whammy of constrained credit and higher bankruptcy risk.

A major effort should be devoted to addressing the EU's structural growth problems. EU member state recovery programmes pay most attention to large incumbent firms, ignoring the young innovators. This approach is motivated by short-term employment concerns, but it jeopardises the long-term growth that could result from breakthrough innovations. As programmes aimed at young innovative firms would be focused on small target groups, they would not require massive injections of taxpayers' money. But they would have the potential for huge returns by creating the foundations for post-crisis growth. Beyond committing resources to young innovators, it is perhaps even more important to get the policy details right, particularly in

5 The contribution of private donations and university IP revenue is also higher than in the EU but accounts for a modest share of the overall difference.

6 In the "Economic Policy" paper cited in footnote 2, it is shown that US-wide merit-based competitive basic research funding by the National Science Foundation, National Institutes for Health and National Aeronautics and Space Administration contributes significantly to the productivity of university funding (in terms of both academic output and patents).

7 See R. Veugelers, M. Cincera: Young leading innovators and the EU's R&D intensity gap, Bruegel Policy Contribution, 2010.

light of the tight budgetary position of many countries and the risk of government failure.

A fundamental principle guiding policy design is the need for a systemic approach. It is important to put in place the right framework conditions, creating a favourable environment which promotes competition and safeguards firms' access to markets, finance and skills, even if the framework is not specifically designed for young firms. But in addition, governments should redress specific barriers faced by young highly innovative firms, most notably their lack of access to finance.

- Effective intellectual property right (IPR) protection is often essential to enable young innovators to raise financing, to access new markets and to appropriate the returns from newly acquired market positions. Young highly innovative firms should be a particular target group for reducing the cost of IPR protection.

- Policies should support the development of private venture capital markets. This is also important because the efficiency of public funding improves complementarily with private venture capital.

Public funding is an obvious instrument for tackling the financial market failure faced by young highly innovative companies. Here, we offer a concrete proposal for an EU-wide programme for public funding of highly risky project proposals:

- The programme would be organised as part of the EU Framework Programme for Research and Development through the creation of an independent agency modelled after the European Research Council.

- It should be organised around the grand challenges facing the EU (such as climate change and energy, health and ageing, digitalisation and security).

- Funding would only be for the pre-commercialisation stage of the project when there are still large uncertainties and financial market failures. Funding should be phased, in view of the high risks and uncertainties involved.

- Evaluation of the projects should be on the basis of scientific and technical characteristics but also and *a fortiori* on the likelihood of commercial success. This implies a mix of expertise in the selection committee (scientific, technological, commercial, financial).

- Evaluation should be highly selective and of top quality (on the basis of the highest standards of excellence). Economies of scale in the selection procedure and competition among applicants at the EU level should allow selection of top-quality projects (once again, the European Research Council would be the model). The programme would thus act as a signal of quality (certification), which would help the selected participants to attract complementary public and private funding.

- Contrary to most other current EU-funded projects (and the Eurostars programme), there should be no obligation for collaboration, neither nationally nor internationally, since small and young innovative firms would be reluctant to apply if forced to collaborate.

- The programme should be pilot-designed, evaluated and re-adjusted or cut if not successful.

Enabling Growth by Designing the EU Patent

The EU is a market of 500 million people. A well-functioning patent system in Europe would not only stimulate innovation by existing firms; it could also help young innovative companies and entrepreneurs to improve their growth and funding prospects. At the same time, a patent that is automatically valid for such a large market would contribute to the creation and emergence of a Europe-wide market for technology that could rival the US and compete with the emerging Chinese market. The maturation of this market would be associated with greater transparency and predictability of intellectual property rights and would facilitate technology transactions at the European and world levels.

Unfortunately, the current system hinders the growth prospects of companies and holds back the crystallisation of innovation efforts into successful ventures, especially for technology-based entrepreneurs and young innovative companies. This is a consequence of several drawbacks of the current fragmented system, in which patents granted by the European Patent Office (EPO) must be managed and put in force at the national level, with the desired geographical scope for protection (i.e. in one, or several, or all of the 27 EU countries or 35 member states of the European Patent Convention).[8] The current system:

- is prohibitively expensive, due to multiple validation and yearly renewal fees, and translation costs[9];

8 B. van Pottelsberghe: Lost Property: the European patent system and why it doesn't work, Bruegel Blueprint, June 2009.

9 B. van Pottelsberghe de la Potterie, M. Mejer: The London agreement and the cost of patenting in Europe, in: European Journal of Law and Economics, Vol. 29, No. 2, 2010, pp. 211-237.

- is complex and associated with a high level of uncertainty, because parallel litigation frequently leads to conflicting outcomes in different countries;

- reduces the overall quality of the selection process, as national patent offices grant patents independently from the EPO (about 25 per cent of all patents granted by national patent offices are granted to non-domestic applicants).

The creation of the EU patent (formerly called Community patent) would drastically improve the European innovation system. The most recent proposal made by the Competitiveness Council (conclusions published on 4 December 2009) initially looked promising. It suggests the creation of an EU patent and of a European and EU Patent Court (EEUPC) which would centralise patent-related litigation in Europe. However, the proposal has serious shortcomings, which could actually result in a worse system than the current one. There is no agreement on language and translation requirements, and the proposal argues that the EU patent should be additional to current European and national patents. In addition, no provision is made to make the system more affordable for young technology-based firms, for whom intellectual property is often their main asset.

In order to be fit for its ultimate purpose of stimulating innovation, the EU patent proposal should be modified as follows:

- There should be no three-layer system in which three types of patents coexist: national, European, and EU-wide patents. The current European patent should be phased out, and national patent offices should stop granting patents, though this would not preclude them from supporting national priority applications and potentially performing search services for domestic firms and international applications following the Patent Cooperation Treaty (PCT) route.

- English-only translation for granted patents should be the norm, with machine translations into all other languages. In case of litigation, the patent owner would secure the translation into the language(s) of the main litigants.[10]

- A grace period of six months should be allowed, during which scientific or technical publication would not preclude the patentability of the published invention. This system allows academic scientists and researchers to publish and still be able to file a patent afterwards (there is a one year grace period in the USA, and the Japanese patent system has a six month grace period).

- A 50 per cent reduction in entry fees (filing, search and examination fees) should be allowed for smaller or young innovative firms to reduce early patenting costs. Later, firms could reimburse the discounted fees if the patent remains valid for, for example, more than five years.

10 It has been argued that English-only translations would be justified by four main reasons: 1) it is the most frequently used language, even for patent filings; 2) it would help sustain English as the main communication channel, especially with the current emergence of scientific research in China; 3) it would help secure Europe's firm IP right in global markets; and 4) protecting national SMEs is a wrong argument, as PCT applications can easily be extended in any country. See Bruno van Pottelsberghe: 2010. Europe should stop taxing innovation, Bruegel Policy Brief, Issue 2010/02.

Felix Roth*

Measuring Innovation – Intangible Capital Investment in the EU

The European Commission's 2020 strategy has put forward five EU targets for the year 2020 focusing on i) employment, ii) research and innovation, iii) climate change and energy, iv) education and v) poverty reduction. The following contribution focuses on the target of research and innovation and will be structured as follows. First, the EU-2020 target on Research and Development will be briefly discussed and the most recent criticism of the sole measure of R&D to capture innovativeness will be highlighted. Second, R&D investment

* The author is grateful for a grant from the European Commission under the Seventh Framework Programme for the INNODRIVE project (Intangible Capital and Innovations: Drivers of Growth and Location in the EU, contract number 214576). The final construction and merging of all intangible capital components, as well as the construction of the stock of intangible capital, were performed by the INNODRIVE project, where LUISS and CEPS contributed to the macro data. The INNODRIVE team is especially thankful for the contribution by LUISS team members Massimiliano Iommi and Cecilia Jona-Lasino in their efforts to ensure the validity of the macro data. Although the final dataset won't be released until the end of the project in March 2011 and minor changes might still be applied, any possible alteration will be slight and will not have the potential to influence the findings and conclusions of this paper.

in the EU-25[1] will be compared to the wider investments in intangible capital using a new internationally comparable dataset on intangibles for the EU-27 created within the FP7 project INNODRIVE. Third, the comparison of investments in tangible and intangible capital in eleven selected European countries will be discussed. The article will conclude by putting forward policy conclusions.

Innovation and EU 2020—Is R&D the Sole Factor to Measure Innovativeness?

When measuring innovation, most contemporary research would identify investments in Research and Development (R&D) as a percentage of GDP as one of the classical benchmark measures. In this sense, many empirical papers on the relationship between innovation and productivity growth focus on a set of R&D indicators.[2] This focus on R&D is most prominently emphasised by the European 2020 strategy[3] for smart, sustainable and inclusive growth, which proposes as one of its headline targets to foster innovation via a 3% benchmark for investment in R&D as a share of GDP. This envisaged target of investing 3% of GDP in R&D in the single member states had already been formulated in the Lisbon strategy in the year 2000 and seems to be the only benchmark criterion to be carried over from the original Lisbon strategy.[4] However, initial criticism of exclusively applying the 3% benchmark can already been heard.[5] This criticism is strongly based on the fact that R&D investment does not seem to be a valid indicator for a country's innovativeness. It is rightly claimed that R&D measures are of utmost concern for those countries with a strong manufacturing sector, e.g. Germany, but can more easily be neglected in those countries with a strong service sector, e.g. the UK.[6] This is one of the reasons why the most recent research financed within the FP7 research programme of the European Commission has developed an internationally comparable dataset to measure innovation by including a wider range of innovational dimensions, identifying these dimensions as knowledge or intangible capital.[7] Early research results suggest that an innovation indicator focusing solely on R&D might not take all dimensions of innovation into proper consideration and thus might veil important information on how to strengthen Europe's competitiveness.[8]

This view of treating innovation as general knowledge capital has been prominently developed by Corrado, Hulten and Sichel[9], who have grouped the various items which constitute a firm's knowledge into three basic categories: i) computerised information, ii) innovative property and iii) economic competencies. Their approach is currently under consideration by national statistical agencies[10] and think tanks such as the OECD[11] and several research projects financed under the European Commission's framework programme seven, as indicated above.[12]

In particular economic competencies – which include the three dimensions of brand names, work force training (or firm-specific human capital) and organisational design (or organisational capital) of a firm – seem to be crucial prerequisites for innovative processes in the manufacturing and service sectors. In the manufacturing sector, these investments should be regarded as crucial complementary

1 The cases of Bulgaria and Romania were not analysed, as the data from the INNODRIVE project does not include values for Gross Value Added at current basic prices for Bulgaria and Romania.

2 A. Bassanini, S. Scarpetta: Does human capital matter for growth in OECD countries? A pooled mean-group approach, in: Economic Letters, Vol. 74, No. 3, 2002, pp. 399-405; M. Khan, K. Luintel: Sources of Knowledge and Productivity: How Robust is the Relationship?, OECD Science, Technology and Industry Working Paper No. 2006/6; F.R. Lichtenberg: R&D Investment and International Productivity Differences, NBER Working Paper 4161, 1993; D. Coe, E. Helpma: International R&D Spillovers, NBER Working Paper 4444, 1995; W.G. Park: International R&D Spillovers and OECD Economic Growth, in: Economic Inquiry, Vol. 33, No. 4, 1995, pp. 571-591; D. Guellec, B. van Pottelsberghe: R&D and productivity growth: panel data analysis of 16 OECD countries, in: OECD Economic Studies No. 33, 2001/II; D. Coe, E. Helpman, A.W. Hoffmaister: International R&D Spillovers and Institutions, NBER Working Paper 14069, 2008.

3 European Commission: Europe 2020 – A European strategy for smart, sustainable and inclusive growth, 2010, http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf.

4 One has to note that the Europe 2020 strategy does indicate that it is necessary to develop an indicator which would reflect "R&D and innovation intensity" (p.9), thus the European Commission seems to be aware of the weaknesses of putting forward spending on R&D as the sole indicator to measure innovativeness.

5 S. Tilford, P. Whyte: The Lisbon Scorecard X The road to 2020, Centre for European Reform, London 2010.

6 S. Tilford, P. Whyte, ibid, p. 23; OECD: The OECD Innovation strategy – Getting a head start on tomorrow, OECD, Paris 2010.

7 C. Jona-Lasinio, M. Iommi, F. Roth: Report on data gathering and estimations for the INNODRIVE project – Macro approach (Deliverable No. 15, WP9), 2009; F. Roth, A.E. Thum: Does intangible capital affect economic growth?, CEPS Working Document 335, 2010, http://www.ceps.eu/book/does-intangible-capital-affect-economic-growth.

8 F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit.

9 C. Corrado, C. Hulten, D. Sichel: Measuring Capital and Technology: An expanded framework, in C. Corrado, J. Haltiwanger, D. Sichel (eds.): Measuring Capital in the New Economy, National Bureau of Economic Research, Studies in Income and Wealth, Vol. 65, Chicago 2005, University Chicago Press, pp. 11-45; C. Corrado, C. Hulten, D. Sichel: Intangible Capital and Economic Growth, NBER Working Paper 11948, 2006.

10 J. Kestenbaum: New approaches to measuring innovation, in: S. Tilford, P. Whyte, op. cit, p. 26.

11 OECD, op. cit.

12 Two projects measuring a wider set of innovation indicators have been financed under the seventh framework program of the European Commission: COINVEST and INNODRIVE. Whereas the COINVEST project has focused on a more detailed measurement for six European countries, the INNODRIVE project has developed an intangible capital dataset for the EU-27.

investments alongside classical R&D investment. In the service sector, the investments in economic competencies seem to play a key role in enhancing labour productivity.[13]

How Does R&D Investment by Businesses Compare to Investment in Intangibles in the EU?

Using newly developed internationally comparable data on intangible capital, Figure 1 shows the overall investment in intangible capital by businesses[14] when including scientific R&D and the three dimensions of economic competencies: i) brand names (advertising and market research investment), ii) firm-specific human capital and iii) organisational capital investment.[15]

Interestingly, closer analysis of intangible capital investment indicates that the 3% benchmark for total R&D spending is quite low in comparison to intangible capital investments of up to 9% by businesses in Sweden. In addition, the innovation ranking has changed significantly. When focusing solely on business R&D spending, Sweden is followed by Finland, Germany and France (see R&D share in Figure 1). Furthermore, the UK is positioned at the lower end of the distribution. However, when focusing on a wider range of innovation indicators, Sweden is followed by Belgium and the United Kingdom, which both have investment rates of approximately 8%. These two countries are then followed by the Netherlands and France. Germany and Austria are positioned in the middle of the distribution, while the two Mediterranean countries Greece and Spain are positioned at the bottom of the distribution. With an investment rate of more than 4%, Italy performs similarly compared to the analysis with a focus solely on R&D. It is the poorest performer among the four big European economies. This finding in combination with Italy's poor achievement when it comes to human capital indicate that the country seems to be very poorly equipped for future economic competition.[16] It also underlines once more the deep structural imbalances existing within the Eurozone, with Mediterranean countries lagging behind in terms of innovativeness. Figure 2 once more clarifies the significant differences between R&D investments and investment in economic competencies within an EU-15 country sample.

Figure 1
Investment in Intangible Capital by Businesses in the EU25 Compared to R&D

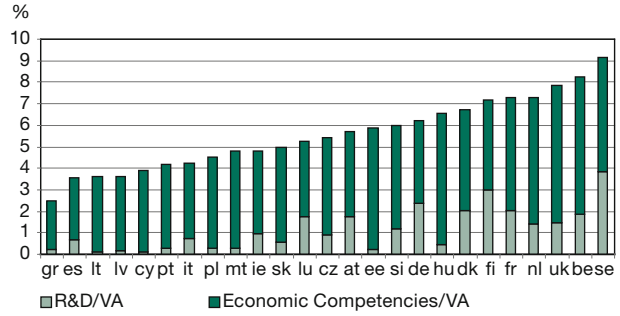
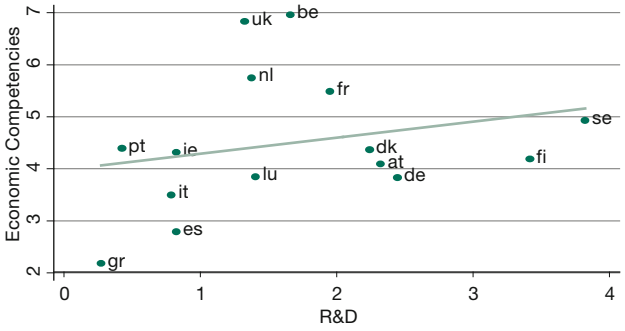


Figure 2
Relationship Between Investment in R&D and Economic Competencies



13 Currently the two FP7 projects INDICSER and SERVICEGAP try to identify, among other things, the role of intangible capital on labour productivity within the service sector.

14 As the Europe 2020 strategy identifies in particular business investment in R&D as significantly lower compared to levels in the USA and Japan, it seems crucial to focus on businesses' investments of intangible capital. Concrete reasons why the included intangible indicators should be classified as investment in Gross Fixed Capital Formation are given in C. Jona-Lasinio, M. Iommi, F. Roth, op. cit. and F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit.

15 As opposed to the original CHS framework, the author has not included software and entertainment, mineral exploration and literary or artistic originals, as those indicators have already been included in the asset boundary of national accounts (see here F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit.). Furthermore, the following intangible index will not include the indicator "development in the financial service industry", as the inclusion of this indicator creates a clear outlier in the EU-15 in the case of Luxembourg, distracting from the overall importance of the findings for policymaking. Furthermore, taking the financial crisis into consideration, the author feels that the indicator should be handled quite cautiously when measuring intangible capital in future approaches. Focusing on economic competencies in addition to R&D already highlights the inadequacy of an innovation indicator focusing solely on R&D. However, the indicator "development in the financial service industry" will be included in intangible capital measure later in this paper. In 2005, it represented around one-tenth of intangible capital in the EU-25 on average.

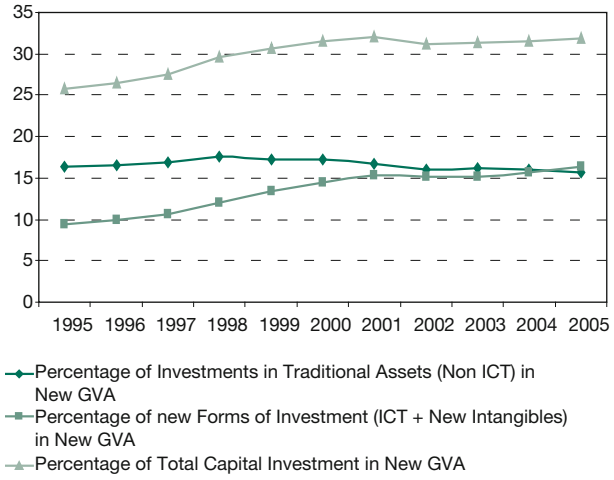
16 D. Gros, F. Roth: The Post-2010 Lisbon Process—The Key Role of Education in Employment and Competitiveness, in: Bundesministerium für Wirtschaft und Arbeit: Die Zukunft der Wirtschaftspolitik der EU—Beiträge zum Diskussionsprozess "Lissabon Post 2010", Vienna 2008, Bundesministerium für Wirtschaft und Arbeit, pp. 179-195; F. Roth, A.E. Thum: The Key Role of Education in the Europe 2020 strategy, forthcoming in: The European Dimensions of Education Policy, 2010.

Investment in R&D seems to be positively (although weakly) related to investments in economic competencies. In Sweden and Finland, high investment in R&D by businesses is associated with moderate investment in the economic competencies of their firms. The same is true for the three economies Denmark, Austria, Germany, as well as for Luxembourg, Ireland, Portugal and Italy, in which the investments in business R&D are also closely matched to their investments in economic competencies. However, the scatterplot also identifies four interesting cases in which R&D investment seems to be not so closely linked to investment in economic competencies. These countries are the Netherlands, Belgium, the United Kingdom and Greece. Whereas Greek investment in economic competencies seems to be relatively small compared to its investment in R&D, investment by the Netherlands, the UK and Belgium are particularly higher than their R&D investment. This finding implies that especially for the UK, the Netherlands and Belgium, an innovation indicator focusing solely on R&D investment poorly measures these countries' competitiveness if focusing on their innovative potential. In the UK this is due to the fact that the economic structure is more heavily dependent on the service sector as opposed to the manufacturing sector, which tends to be more important in other European member states.

Comparison Between Tangible and Intangible Capital Investment in the EU

Efforts have been made to stop the steady decline of investment in traditional tangible capital in most advanced economies. However, the efforts to increase investment in tangible capital do not seem to have taken into account the fact that the most advanced economies have simply undergone a structural reformation towards knowledge societies. But since the traditional national accounting framework has not taken these processes into consideration, the accounts were (and still are) not able to identify the actual investments made by businesses in recent decades. Figure 3 compares the levels of investment in traditional tangible capital with the new investments made in ICT and intangible capital for an EU11 country sample[17] for the time period 1995-2005. Whereas traditional tangible capital investments have remained at a 16% level, the investments in ICT and intangible capital have risen continuously and in 2005 reached a higher investment ratio than traditional tangible capital investment. Furthermore, if one accounts for both investments, the overall capital investments in the eleven EU member states was as high as approximately 32% in 2005 and has steadily risen (due to ICT investment) from 1995-2001 and beyond. Due to the burst of the dot-com bubble, the investment rate in 2005 remained at the same level as in 2001.

Figure 3
Comparison of Business Investment in Traditional Tangible Capital and New ICT and Intangible Capital in an EU11 Country Sample

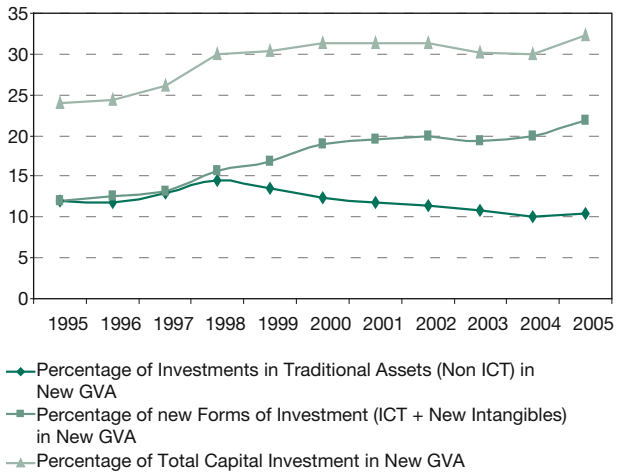


Source: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit) and EUKLEMS database (EUKLEMS: EU KLEMS Growth and Productivity Accounts, March 2008 Release, http://www.euklems.net/).

Figure 3 shows aggregated trends of eleven European countries. But to what extent do the trends differ in the individual EU member states? Figure 4 shows the three trends for the United Kingdom. Most interestingly, new investments in ICT and intangibles were already higher than investments in traditional capital investment in 1996, drawing equal in 1997 for the last time. From 1997 onwards, there has been a steady increase in investment in ICT and intangibles coupled with a steady decrease in traditional tangible capital. Whereas business investment in traditional capital, e.g. machinery, equipment, buildings, etc., reached a level as low as 10% in 2004, investments in new ICT and intangibles doubled that amount. Focusing on the total capital investment shows a steady increase in capital investment in the UK (with a minimal decline from 2002 to 2003 due to the burst of the dot-com bubble), reaching a level of approximately 32% in 2005.

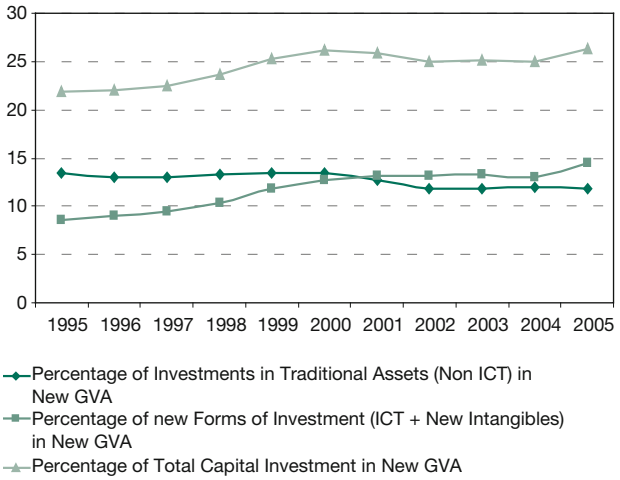
17 The following eleven countries in the EUKLEMS dataset (EUKLEMS: EU KLEMS Growth and Productivity Accounts, March 2008 Release, http://www.euklems.net/) are included in the aggregated EU-11 trend: Austria, Czech Republic, Germany, Denmark, Finland, Italy, Netherlands, Portugal, Slovenia, Sweden and United Kingdom. ICT includes computing equipment and communications equipment. New intangibles include scientific R&D, economic competencies, software and – as Luxembourg is not included in the country sample – "new development in the financial service industry". The share of investment in "new development in the financial service industry" in 2005 was, as stated above, on average one-tenth of total investment in intangible capital in the EU25 countries.

Figure 4
Comparison of Business Investment in Traditional Tangible Capital and New ICT and Intangible Capital in the UK



Source: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit) and EUKLEMS database (EUKLEMS: EU KLEMS Growth and Productivity Accounts, March 2008 Release, http://www.euklems.net/).

Figure 5
Comparison of Business Investment in Traditional Tangible Capital and New ICT and Intangible Capital in Germany



Source: INNODRIVE Project (F. Roth, A.E. Thum: Does intangible capital affect economic growth?, op. cit) and EUKLEMS database (EUKLEMS: EU KLEMS Growth and Productivity Accounts, March 2008 Release, http://www.euklems.net/).

We now turn to Europe's largest economy. Figure 5 shows the comparison of business investments in traditional capital investment and new ICT and intangible capital investment in Germany. Similarly to the UK, investments in ICT and intangible capital are diametrically related to each other. Whereas investment in traditional capital has decreased slowly but steadily, investments in ICT and intangibles have gradually grown. In 2001, investments in ICT and intangible capital were already higher than in traditional capital. Furthermore, Germany's overall capital investment in 2005 was near the 26% benchmark and increased steadily over the time period 1995-1999 and again from 2002-2005 after the burst of the dot-com bubble.

Conclusion

This article has analysed business investment using a new internationally comparable dataset comparing the rate of business investment in intangible capital in the EU27. Two main policy conclusions can be drawn.

First, the European 2020 agenda should switch its benchmark criteria from a sole focus on R&D to a focus on overall investment in intangible capital, in particular on investments in economic competencies. The R&D indicator seems to be particularly inappropriate for European economies with a stronger service sector, e.g. the United Kingdom, and seems to overestimate the innovation potential for those countries which rely heavily on manufacturing, e.g. Germany. Thus, including a wider range of intangible capital variables when measuring innovative potential would give a less skewed picture to European policymakers.

Second, today's national accounting framework seems to be ill-suited to correctly identify the ongoing transition of European economies to knowledge economies. Without identifying intangibles as an investment in Gross Fixed Capital Formation, the levels of capital investment of European economies are strongly mismeasured and far too low. Any policy conclusion based on pure analysis of the "brick and mortar" investment without accounting for intangible capital variables seems to be clearly flawed. The constant lament of falling capital investment levels in the European Union seems to be unsubstantiated once ICT and intangible investments are included. The apparent decline in traditional fixed capital formation is in fact in most European economies more than fully compensated by an increase of ICT and intangible capital formation. European policymakers should therefore find new ways of promoting investment in intangible capital and stop subsidising traditional forms of tangible capital, e.g. via the European structural funds.

Faridah Djellal and Faïz Gallouj*

Invisible Innovation and Hidden Performance in Services: a Challenge for Public Policy

Although contemporary economies are undeniably service economies, since services are now our main source of wealth and jobs, the relationship between services, on the one hand, and innovation and performance, on the other, continues to be a matter of considerable debate. Thus, in the still dominant industrialist or technologist approach to this relationship, innovation efforts and performance levels in services are underestimated. It is this approach that is responsible for the existence of two gaps: an innovation gap and a performance gap. The innovation gap indicates that our economies contain invisible or hidden innovations that are not captured by the traditional indicators of innovation, while the performance gap is reflected in an underestimation of the efforts directed towards improving performance in those economies. These gaps have their origin in certain more or less ancient myths about the fundamental nature of services and the errors of measurement associated with them. They may have harmful consequences for the validity of the public policies implemented at the national or European levels. Since they are based on imperfect or even erroneous forecasts, these policies may also prove to be inappropriate.

The Innovation Gap

The innovation gap is a measure of the difference between the reality of innovation in a service economy and innovation as it is captured and measured by the traditional indicators (particularly R&D and patents). It shows that the service economy probably innovates more than these indicators would suggest and consequently that there is hidden or invisible innovation in service economies that must, if possible, be identified and supported by appropriate public policies.

This innovation gap concerns services in particular, and it might reasonably be assumed that the larger the service sector is in a given society, the greater the gap is likely to be. In reality, however, it is also sustained by the invisibility of certain forms of innovation in other sectors of the economy. This is all the more true since contemporary economies are characterised by a certain blurring of the boundaries between goods.

Visible innovation is the innovation that is captured by the traditional indicators, such as R&D and patents. It reflects a technologist and assimilationist view that regards innovation as involving essentially the production of technical systems with a scientific basis. This concept of innovation leads to the conclusion that services are relatively less innovative than manufacturing industry, despite the progress associated with the adoption of information technology. It also indicates that innovations are much more likely to be adopted than produced by services themselves. This concept of innovation is the cause of the innovation gap under discussion here. It is able to capture only the exposed tip of the innovation iceberg. It not only causes a public policy gap but is also reinforced by it. After all, public policies intended to support innovation are primarily horizontal scientific and technological policies.[1]

Invisible or hidden innovation thus constitutes an important area of research that is still largely unexploited; it is essential to continue exploring it in order to close the innovation gap and to eliminate the gap or bias in public policy. It should be noted, firstly, that this invisible innovation is not invisible to everybody. It is undeniable that, in recent years, there have been institutional changes and efforts made by researchers to remedy this situation[2];

* This paper draws on research carried out within the ServPPIN project (European Commission, FP7). For a more developed version, see F. Djellal, F. Gallouj: The innovation gap, the performance gap and the policy gap in services, in F. Gallouj, F. Djellal (eds.): The Handbook of Innovation and Services: a multidisciplinary perspective, Edward Elgar, 2010.

1 L. Rubalcaba: Which policy for innovation in services? in: Science and Public Policy, Vol. 33, No. 10, 2006, pp. 745-756.

2 For a survey of these efforts, see in particular, among others: F. Djellal, F. Gallouj: The innovation gap, the performance gap and the policy gap in services, in F. Gallouj, F. Djellal (eds.): The Handbook of Innovation and Services: a multidisciplinary perspective, Edward Elgar, 2010; F. Gallouj, M. Savona: Innovation in services: a review of the debate and perspectives for a research agenda, in: The Journal of Evolutionary Economics, Vol. 19, No. 2, 2009, pp.149-172; J. Howells: Services and innovation: conceptual and theoretical perspectives, in J.R. Bryson, P.W. Daniels (eds.): The Handbook of Service Industries, Edward Elgar, 2007; I. Miles: Innovation in services, in J. Fagerberg, D. Mowery and R. Nelson (eds.): The Oxford Handbook of Innovation, Oxford University Press, 2005; B. Tether: Do Services Innovate (Differently)?: Insights from the European Innobarometer Survey, Industry and Innovation, No. 12, 2005, pp. 153-184; B. Preissl: Service innovation: what makes it different? Empirical evidence from Germany, in: J.S. Metcalfe, I. Miles (eds.): Innovation systems in the service economy: measurement and case study analysis, pp. 125-147, Kluwer, 1999; J. Sundbo: The organization of innovation in services, Roskilde University Press, 1998.

nevertheless, it frequently remains invisible to theoretical analysis, to the statistical indicators used by national and international institutions and to public policies. On the other hand, the issues at stake in invisible innovation do not elude the actors in organisations responsible for implementing this type of innovation. Invisible innovation is not a homogeneous category. The diverse forms it may take are often grouped together under the heading non-technological innovation. This is a convenient expression, but it conceals a wide diversity of types of innovation: social, organisational, methodological and marketing innovations; innovations involving intangible products or processes; etc.

Thus innovation in services cannot be reduced to technological innovation, as shown by the following examples: a new insurance policy, new financial instruments, a new area of legal expertise, a new restaurant or distribution concept, a new hotel or leisure concept, a new care or cleaning protocol, a new consulting methodology, etc. This does not mean that these innovations cannot be based on tangible technologies (computers or means of transport, for example), but rather that they are not consubstantial with them and that they may in certain cases dispense with them. In other words, the notion that innovation exists only when the novelty is embodied in a technical system is unjustified. Not to accept this is to seriously underestimate the capacity for innovation in services. The myopia of national and international indicators of R&D and innovation (which persists, although it is declining thanks to changes in OECD manuals) can be explained by this error.

The Performance Gap

Economic performance also poses serious problems of definition and measurement, and here too hidden forms can be identified which are also not unconnected with the service-based nature of economic activities. This performance gap reflects the difference between the reality of performance in a service economy and performance as measured by the traditional economic tools (productivity and growth). Once again, an organisation or an economy in its totality may perform better (or worse) than is suggested by the indicators of productivity or growth. In particular, this notion of hidden performance brings into play that of sustainable development, defined in both socio-economic and environmental terms, and, more generally, other worlds of performance beyond the industrial and technological worlds.

This performance gap has its roots in classical economic thought, and in particular in the work of Adam Smith, who compared the productive work involved in manufacturing with the unproductive work involved in services, which vanish at the very moment they are produced. It is curious to think that an analysis based on a definition of services confined to the work of domestic servants, servants of the state and artists continues to influence contemporary thinking. The main feature generally attributed to the service economy is that it suffers from low productivity. This characteristic provided Jean Fourastié[3] with the main criterion for the first positive definition of the service sector. It also lies at the heart of Baumol's models of unbalanced growth[4], which characterise the so-called stagnant sectors. It is reflected in contemporary discourse by the diagnosis of a new pathology, namely Solow's paradox, according to which computer technologies exist everywhere except in productivity statistics.

In reality, productivity and performance in services are not (or are no longer) by definition poor. They have undeniably increased. This increase can be explained by both the actual strategies adopted by the economic actors and the knowledge effect produced by our improved understanding of the theoretical and methodological problems posed by services.

Firstly, the economic actors concerned are not inactive. Service firms and organisations are capable of effectively implementing rationalisation strategies, which tends to give the lie to the notion that productivity in services is inevitably low.[5] It is not only in operational services that these strategies are at work. They are also deployed in knowledge-intensive services.

Secondly, the performance gap can also be filled by an improved theoretical and methodological understanding. Critical analyses of the notions of productivity and growth are frequently tackled in similar terms, since in both cases it is essentially the nature of the product that is at issue. The terms of this critical debate can be divided into two groups of arguments.

The first argument concerns measurement error. The hypothesis is that the level of productivity in services is mainly a problem of measurement, in particular of identifying the service output. Thus the unit of output for a computer manufacturer is a computer, but what is the unit of output for education, national defence (particularly in peacetime), the police or even the ministry of foreign

3 J. Fourastié: Le Grand Espoir du XXe siècle, PUF, 1949.
4 W. Baumol: Macroeconomics of unbalanced growth: the anatomy of urban crisis, in: American Economic Review, No. 3, 1967, pp. 415-26.
5 J. Gadrey: Services: la productivité en question, Desclée de Brouwer, 1996; F. Djellal, F. Gallouj: Measuring and improving productivity in services: issues, strategies and challenges, Edward Elgar, 2008.

Figure 1
The Innovation Gap and the Innovation-Performance Relationship

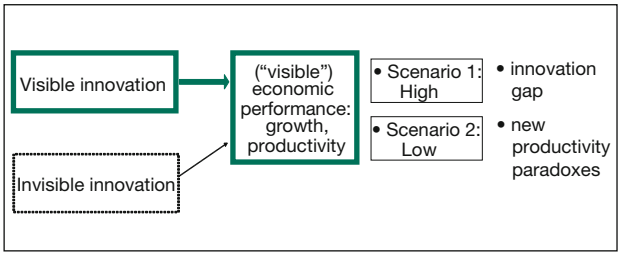
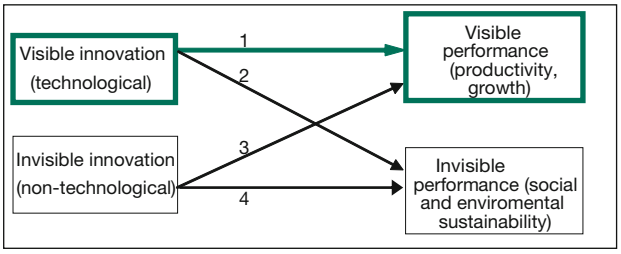


Figure 2
Innovation Gap, Performance Gap and Innovation-Performance Relationship



affairs? This first argument calls into question the results and suggests corrections of service productivity figures. In the case of public services, for example, the measurement of output in terms of input (which presupposes that productivity remains static) has been abandoned and replaced by measures of output based on the activities that comprise it.

The second argument calls into question the very notion of productivity, or at least its absolutism. The idea is that, in services to a greater extent than elsewhere, performance cannot be captured solely through the notion of productivity. Consequently, a multi-criteria form of assessment is required, one that takes account of the multiple dimensions of performance: technical performance, of course, but also commercial performance (relative to monetary and financial values), civic performance (relative to equity, equal treatment, social cohesion, respect for the environment, etc.) and relational performance (quality of interpersonal relations, empathy, trust relations, etc.)

From Innovation and Performance Gaps to Policy Gap

In a service economy, the definition and measurement of innovation as performance raises numerous difficulties. They are the cause not only of an innovation gap but also of a performance gap. We shall now compare these two gaps and examine their consequences for the fundamental relationship between innovation and performance and their implications in terms of public policies.

The fundamental hypothesis of this analysis is that innovation efforts in a post-industrial economy are always underestimated. A consensus now seems to have been established on this point, as an increasing number of theoretical and empirical works as well as, in particular, the many revisions of the OECD official manuals bear witness. The specificities of innovation in services are recognised, even if the inertia of our analytical tools and technical difficulties can prevent them from being taken into account, for example in surveys. On the other hand, a consensus on the nature, scope and challenges of the performance gap is far from being achieved. It is true that performance, considered from the viewpoint of productivity and growth, has always been at the heart of all economic theories. It is therefore subject to a major effect of cognitive irreversibility.

In view of these differences in the perceptions of gaps, it is necessary to consider several possible scenarios and to examine the consequences of these on the innovation-performance relationship. The first case (the most frequent) is based on the belief that performance is defined satisfactorily by productivity and growth. Public policies supporting innovation are based on this canonical scenario. In the second case it is assumed that the performance is badly defined (and underestimated), in other words that there is a performance gap. We will examine these two scenarios, as well as their consequences for public policy.

Performance Is (Considered to Be) Well-Defined

National and international policies supporting innovation are based on this hypothesis, according to which performance can be reduced to growth (and to productivity). The discussion and possible theoretical or operational problems therefore only concern the innovation variable. For a given innovation effort, this hypothesis allows two interesting scenarios to be considered, which differ depending on the levels of performance achieved.

The first scenario corresponds to high economic performance for a given (visible) innovation effort. This scenario may wrongly lead to the impression that a country's visible innovation effort has a high output, while in fact part of the performance is explained by invisible

innovation. In the case of UK, for example, NESTA[6] observes high economic performance in the last decade for a lower level of traditionally measured innovation than in other countries. For example, R&D per capita expenditure in the UK is two times lower than in Sweden and Finland. It is lower than in France or Germany. The number of patents per inhabitant is much higher in Germany, Japan and the United States than in the UK, however. The explanation for this paradox lies in the British innovation gap. In fact, part of the performance can be explained by the invisible innovation effort.

The second scenario corresponds to weak economic performance (growth) for a given innovation effort. In fact, the situation is then still more unfavourable than it appears, since the level of real innovation is higher than the measures considered indicate. Invisible innovation efforts combined with visible efforts are not effective. Therefore, to paraphrase the Solow paradox, we can formulate a new productivity paradox here: there is innovation and R&D everywhere (including invisible innovation and R&D) except in performance statistics.

The Performance Is Badly Defined

A number of recent studies question the dominance of productivity, GDP and growth, stating that they are neither the only nor the best indicators of the economic performance of a country. Thus, just as there is invisible innovation, so there would be invisible performance. This invisible performance mainly concerns the field of socio-economic and ecological sustainability. It expresses concerns in terms of human development, social cohesion, equality, equity and environmental protection, i.e. in outcomes rather than outputs. Here we are interested in the (theoretical) consequences of taking this new gap into account.

Thus visible innovation certainly leads to visible performance (*relationship 1*), but it can also result in invisible performance with regard to socio-civic and ecological sustainability (*relationship 2*). Technological innovation can indeed also be a source of social, civic and ecological benefits, and certain technological trajectories are more guided than others by the search for socio-economic or ecological sustainability. For example, technological innovations responding to the problems of the elderly (domestic robots, smart homes, electronic surveillance, etc.) represent a powerful innovation trajectory in ageing service societies.

Relationship 3, which links invisible innovation to visible performance, means that the non-technological forms of innovation are also a source of growth (visible performance). This is the reason (when invisible innovation efforts are significant) for the incorrect interpretation of the innovation-performance relationship (mentioned above), which identifies high growth despite a relatively weak innovation effort.

Relationship 4, finally, links invisible innovation to invisible performance. There seems to be a strong correlation between the invisible component of innovation and the invisible component of performance. Indeed proximity services, for example, are the setting for significant social innovation activity which escapes traditional indicators, whereas their role in the resolution of social problems is fundamental. More generally, if one considers performance from the viewpoint of sustainability, one notes that, although they are not dramatic, many non-technological, and particularly social, innovations play a significant role in this. Amongst others, we can mention certain forms of sustainable tourism; the many innovative initiatives in the fields of care for the elderly, social integration, childhood and in the financial field; micro-credits to respond to the problem of banking exclusion; etc.

Due to the existence of hidden performance, innovation efforts can be more effective than the measures indicate. Thus, for given innovation efforts, an apparently weak level of (traditional) performance can be enhanced from the viewpoint of alternative performance. Conversely, an apparently high level of (traditional) performance can be put into perspective, insofar as growth and productivity gains are tarnished by ecological or social damage.

The Double Gap: a Challenge for Public Policies

In view of the two gaps identified in this work, one can assume that public innovation policies are, to a certain extent, inadequate. Indeed, they rely on a partly inaccurate analysis and consequently suggest solutions that could prove to be inappropriate.

In order to carry out their diagnosis, public policies generally favour relationship 1, which links visible technological innovation to visible performance (growth, productivity). Figure 2 illustrates well all the errors in analysis and the paradoxes that can follow from such a hypothesis. We can thus identify a weak innovation effort at the same time as high (growth) performance. This is the diagnosis reached by NESTA[7] in the UK for the last dec-

6 NESTA: The innovation gap: why policy needs to reflect the reality of innovation in the UK, Report, October 2006.

7 Ibid.

ade. We can also identify an apparently higher innovation effort which does not fulfil its promises on performance. This is the case for France in the same period. To establish a satisfactory analysis, it is necessary to take into account all the other relationships between innovation and performance (relationships 2, 3 and 4), which can contribute to different interpretations of innovation efforts and levels of performance achieved.

In view of the diagnosis established on the basis of relationship 1, the solutions recommended by the public authorities naturally consist of promoting technological innovation based on scientific and technical R&D activities which can be appropriated by patents. These strategies mainly concern public research and the industrial sectors, in particular high technology. As regards training systems, policies consist of favouring scientific and technological training. As the OECD[8] emphasises, the innovation policy of member countries has mainly been considered to be an extension of R&D policies. However, in economies that are largely dominated by services, these technologist and industrialist policies have also been transposed to services. As it is with economic analysis, public policies of support for innovation in services are dominated by an assimilationist perspective.

The main lesson to be drawn from the preceding analysis in terms of public policy is that to take into account the double gap that has been identified, the public authorities should break with their technologist orientation and try to promote invisible innovations and performances.

It is thus necessary to emphasise innovation and R&D policies that are specific to services – in other words, policies that are not limited to supporting technological innovation and R&D, but which also favour non-technological forms of innovation and R&D. As the source of the gap is not confined to the service sector, it is also necessary to support innovations in services within the manufacturing and agricultural sectors. This recognition of invisible innovation in public policies should also redirect the priorities of education policy. Indeed, the development of the necessary skills in non-technological forms of innovation, whether these are skills that produce these innovations or skills which facilitate their absorption, should also be supported. The support of these skills should also not be limited to an elite, but rather disseminated to all levels of the population. This is particularly obvious with regard to social innovations that can be produced and implemented in the informal and domestic spheres (voluntary work, community organisation) as well as in the formal sphere (social entrepreneurship). All services are affected by these innovation policies. But some sectors appear to be more affected than others. This is the case with knowledge-intensive business services (KIBS), which contribute strongly to the innovation gap, both through their own internal non-technological innovation as well as by delivering services to their customers. This is also the case for the numerous proximity services, where many social innovations are implemented.

If performance in terms of sustainable development is considered, it can be noted that it is the technologist or assimilationist perspective which dominates. Most of the public policies aimed at inducing sustainable innovation fall within such a perspective, which consists of supporting sustainable technological innovations in different ways: funding, taxation (for example, by granting tax credits for clean or energy-saving technologies), public orders, the dissemination of information, etc. In order to favour invisible performance more, it is also necessary to implement demarcation policies which emphasise the specificities of sustainable innovation in services and in particular in social innovations.

Conclusion

The relationship between innovation and performance (equated with growth) is a major economic relationship which has been the subject of an extensive literature. In post-industrial economies, the two terms in the relationship raise several problems, which have been the subject of a separate branch of literature. In a highly tertiarised economy, service innovation partly escapes the tools of traditional economic analysis. An innovation gap can therefore be observed. Performance continues to be defined in terms of growth and productivity, although other forms of assessing performance have proven to be necessary. A performance gap can therefore also be observed.

Economic analysis and public policies favour the relationship between visible innovation (identified by traditional definitions, R&D and patents) and visible performance (equated with growth). They therefore emphasise technological innovation that is a source of growth. However, the double gap that has been identified reveals significantly more complex relationships, which calls into question the relevance of diagnoses and the validity of public policies supporting innovation. It therefore appears that these policies should adopt a demarcation perspective, which allows one to take account of

8 OECD: Governance of Innovation Systems, Synthesis Report, Vol. 1, Paris 2005.

and support specific forms of innovation (in particular in services) and the most dynamic and strategic sectors (for example, the KIBS), but also a certain number of economic sectors that are sources of social innovations (proximity services). These policies, whatever the form of innovation (technological or non-technological), should also favour less visible performance (sustainable performance).

Annaflavia Bianchi and Paolo Pini

The Industrial System in Emilia-Romagna, its Innovation Strategies and the Crisis Phase

This article represent a synthesis of the main results of a research project[1] conducted during 2009 and completed in the first half of 2010 on the innovation strategies and performance of manufacturing companies with 20 or more employees in the Emilia-Romagna region of Italy. The analysis of different innovation spheres – technology, information and communication technologies (ICT), organisation, training, internationalisation, environment – and the effects of each of them on economic performance at the firm level, as well as the complementarities and synergies between them and the enhanced effect of their combination on economic performance, are the central issues that were studied. Based on this research, policy recommendations for both public policymakers and firm managers can be offered.

The Facts: The Performance of the Emilia-Romagna Industrial System in the Medium Term

There are at least three components to the specific character of the innovation processes observed during the last couple of decades in the industrialised countries: the prevailing role played by knowledge embedded in both tangible and intangible capital; organisational changes associated with technology changes embedded in instrumental goods; and the pervasiveness of an innovative phenomenon focused on techno-organisational aspects in local and global contexts. Italy, although traditionally considered to be performing well in regional areas, shows difficulties in all three processes.

Recently, two theses emerged with regard to the performance of the Italian production system. On the one hand, there is the thesis of "decline", which goes hand in hand with a loss of competitiveness, low growth and income rates, and productivity stagnation. On the other hand, there is the thesis of "transformation", which outlines relevant structural and behavioural changes in Italian companies during the last decade, on the basis of the "made in Italy" success in international markets and the positive export trend, even during the strong euro phase.

The transposition of this thesis to the regional production system in Emilia-Romagna led us to identify two diverging paths at the basis of its performance: on the one hand, industrial sectors which – pulled by the foreign component of demand – reach value-added growth rates that are much higher than the national average, accompanied by good job trends; on the other hand, the tertiary sectors whose poor productivity dynamics provide a negative burden against growth and show high labour-intensive growth. We define this picture as "unbalanced growth" that emerged in the region with the new millennium.

Innovation and Performance

The competitiveness of the industrial system in Emilia-Romagna is based on two fundamental pillars: the strategic policies of the organisation of production and the strategic policies in the field of technology development. These are two competitive drivers for productivity dynamics and company profitability. Other strategic factors at the company level are the adoption of ICT, training concepts, environmental innovation strategies and internationalisation. All these strategies develop strong synergies and complementarities and are rooted in a productive, social and institutional context in which other actors such as

1 "Innovazione, produttività, sistemi locali regionali. Strategie di innovazione e risultati economici. Un'indagine sulle imprese manifatturiere dell'Emilia-Romagna" (Innovation, productivity, regional local systems. Innovation strategies and economic performance. A survey of Emilia-Romagna manufacturing companies) conducted by the Ferrara University research group composed of Davide Antonioli (University of Ferrara), Annaflavia Bianchi (Fondazione Faber and University of Ferrara), Massimiliano Mazzanti (University of Ferrara), Sandro Montresor (University of Bologna) and Paolo Pini (coordinator, University of Ferrara). Research reports available (in Italian) at http://docente.unife.it/paolo.pini/ricerca/pubblicazioni-1.

universities form a network of public bodies devoted to supporting development and technology transfer within a system oriented toward inclusion rather than toward exclusion.

All of these factors are elements of the social capital of the region. The different innovative strategies show relevant complementarities and go hand in hand with its strengths and weaknesses.

The Strengths of the Innovation Strategies

Organisational innovation. A relevant diffusion of outsourcing activities and networking with other companies and the adoption of best practices represents elements that are strategically relevant for the creation and the consolidation of competitive advantages. The best practice approaches, divided into new production and work organisation practices, are usually adopted in bundles in order to increase the effects on company performance through complementarities.

Organisational change. With relevant synergies associated with ICT and technological innovation, company strategies on employee training are quite extensive: in the observation period from 2006-2008, 90% of the companies put training activities into place. This represents an additional innovation pillar, as it is essential for building employees' skills and abilities.

Technological innovation. This issue is analysed taking into account both technology input and technology output. In the three year period under examination, 2006-2008, companies showed relevant efforts towards technological development, choosing the priority areas on which to address economic resources and the cooperation to be put in place for the research, design and development of new processes and new products. It will be outlined here that the innovation function, i.e. the link between R&D (invested resources) and networking on the one hand and between R&D and technology output on the other hand, proves to be quite robust.

ICT. In terms of ICT endowment and adoption, the regional industrial system ranks quite high in the national context.

Internationalisation. As regards inward investments (foreign share in regional companies), the region generated interest among foreign investors, notwithstanding the criticalities of the national context. As regards outward investments (foreign direct investments by regional companies), Emilia-Romagna companies are quite well integrated within global value chains.

Environmental innovation. A dichotomy emerges here between the group of companies that invests in improving the environmental friendliness of their processes and products and the large group that does not. The performance of the regional production system as a whole in terms of green innovation activities is better than the national average.

The Weaknesses of the Innovation Strategies

Best practices, which yield positive effects on company performance, especially if applied to groups of workers, are on the contrary mainly applied to individual workers, thereby losing part of their effectiveness.

Training, although quite diffused, is mainly oriented toward building technology-specific skills, ignoring the organisational-relational aspects which are critical in non-traditional organisational contexts.

On technology innovation, most of the companies (55%) define the results of their innovation activity as new only for the company itself, while a smaller group of companies consider their innovations to be new for the market or sector; only a small portion describe their innovations as fully/globally new. This can be interpreted as the adoption process of pre-existing technologies that are then adapted and integrated into the processes or products of the company.

ICT, although adopted by most companies, is limited with respect to the types of application and usage. The most common use is for the provision of and search for information, but they are rarely implemented for the management and integration of processes of production.

Concerning internationalisation strategies, a critical aspect associated with production delocalisation emerges which seems to be inspired mostly by cost-saving strategies rather than cooperation for innovation or presence in strategic markets or other propulsive strategies.

On environmental innovation, there are some weak areas of application, e.g. CO2 reduction or environmental certification, areas addressed by only 10-15% of the companies.

The Integration of Innovation Strategies: the Relevance of Complementarities

Company innovation strategies are not chosen in isolation from one another and should not be conceived of as

such. The linkages between them turned out to be fundamental in determining and consolidating competitive advantages. Thus, in the agenda of policymakers and companies we should find a policy supporting the integrated implementation of innovations and a management strategy addressing this integration. This policy should also be capable of allowing those opportunities to be linked with an organic development of the companies' innovation activities. Adequate combinations of innovation strategies seem to generate performance improvement, as shown by several analyses in the international arena as well as the results of the research detailed here.

The integration of innovation activities can generate structural innovation specificities – partly intangible and idiosyncratic, and linked with economic rents which are appropriable and defensible – as alternatives to patenting, which is a historically weak point of Italian companies. For a region like Emilia-Romagna, the patenting performance of which is higher than the Italian average, the integration of innovation strategies represents an alternative asset to be played on the markets and to be reinforced and reinvented in new and different innovation spheres.

The picture emerging from the analysis of company innovation and company economic performance conceptually completes the research path that goes from the determinants of links between innovation spheres to the connections between the different innovation spheres and a company's economic performance. The recommendation for both the company manager and the policymaker is quite clear: on the one hand, the consolidation of competitive advantages which result in higher productivity and profitability depends on an innovation strategy aware of the existence of, and based on, the complementarities and synergies between the various innovation activities; on the other hand, policies supporting and stimulating innovation – also based on public procurement measures – should take into account the synergic linkages existing between the various innovation spheres. The integrated action of public policies and industrial association policies could become crucial in order to fill the competitive gaps which might emerge when innovation strategies that are not integrated are adopted and when they neglect the organisational "capital".

Economic Policies and Strategies for the Future

The research on the production system in Emilia-Romagna shows several positive aspects as well as many weak aspects that must be faced by both company management and policymakers.

The tertiary sector was shown to be weak, with decreased industrial investments and modest domestic demand trends. There is an increasing use of atypical labour contracts, in particular for low-skilled workers and especially in the service sectors. All these factors represent signs of difficulty for the regional system to maintain or increase regional companies' market shares. In a way, they hint at a weakness and fragility of the regional economic system. The negative trend of service productivity can become a restraint on the growth of the industrial sector, as it penalises industrial companies by imposing costs higher than the ones supported by European competitors and provides little support to the start of development paths for the supply of products integrated with services and to new lines of activity based on a broader supply of services.

In order to reduce this restraint on growth and competitiveness generated by the low service sector dynamics, focused efforts have to be formulated to modernise the weaker sectors and to enhance their productivity. This might also be achieved through the more intensive use of solutions based on ICT tools and management systems, by raising the skills of service workers, and by studying methods of integration and cross-contribution of services and industrial activities and innovation activities.

The regional production system does not yet express enough innovation dynamics to face the growing national and international competition. A relevant share of primarily medium-size companies shows consistent commitment to, and tangible results from, the innovation path, but the general context conditions, the factors required to enable companies to be innovative, are still too weak compared with the endowment of some other Italian dynamic areas and especially with the average European performance. Another restraining factor for innovation is the small size of a large percentage of Italian companies, which prevents them from reaching the minimal threshold for a single firm to get involved in research and innovation activities and cooperate with external actors.

Under the current economic trend, an "exit" characterised by weak economic growth and low employment might turn out to be structurally fragile and barely sustainable.

So, could the simple survival of the regional system really be a goal in itself? Looking at the aforementioned strengths and weaknesses, this goal does not seem to be sufficient. It seems necessary to take a longer perspective, to anticipate the risks related to the critical aspects of the regional system and face them, to iden-

tify potential allies abroad with whom to strengthen the international positioning of regional companies, to start new investment paths and to transform the current sectoral specialisation. Looking at the geographic destinations of the exports of Italian regions and of Italy as a whole, it can easily be seen that the presence of Italian companies is still quite marginal in geographic areas characterised by high growth rates, especially in Asia but also in Mediterranean Africa and Latin America. To increase and reinforce the Italian presence in these growing markets, strategic alliances with complementary partners or even competitors seem to be necessary in order to aggregate the product supply and to access markets otherwise inaccessible given the small size of regional companies. As mentioned above, the small size of firms has a strong negative influence on research and innovation activity and so it requires determined support. Regional companies and the whole regional economic system should not wait for the crisis to pass; rather, they should urgently formulate individual and collective paths to reduce the identified fragilities.

How should such a transformation be pursued and what can be done? First of all, the "unbalanced growth" problem has to be faced, especially the service labour productivity trend, which is low when compared with other Italian areas. The associated low wages and high use of atypical labour contracts has to be addressed, and enhanced forms of integration with the secondary sectors have to be found.

The results emerging from the research show that firms acting in more than one innovation sphere at a time – i.e. firms which choose to pursue innovation strategies in several directions – achieve higher and more satisfactory innovative output and economic performance. Thus, it appears to be useful and necessary to help firms which are still timid in their innovation activities to make strategic choices and to guide them toward increasing and capitalising on innovation strategy complementarities. Additionally, firms, especially small ones, should be encouraged to pursue more varied innovation strategies, e.g. via policies including the aggregation of research activities and the intensification and geo-sector widening of networking.

The integration of manufacturing and services has to be developed in new ways and spheres. Looking at other industrialised countries, we see that some of them pursue health, wellness and personal care, while others prioritise the environment and the preservation of natural resources. Other small countries focus on the exchange of knowledge, on increasing its value and on its application. Italy and the Emilia-Romagna region should devote more attention to these dynamic areas of activity and to the strengthening of community identity and of services to the community, to be matched with creativity, coexistence and wealth within diversity.

In addition to the two already identified pillars represented by organisation and technology, areas of new and newly qualified specialisation and innovation trajectories – to be pursued with the support of a public policy strongly oriented toward innovation-research-knowledge-environment – have to be identified and chosen by the regional system. To guarantee an increase in employment and in the quality of jobs and workers, the region cannot just keep going with the existing specialisation model, as this will not be enough to reabsorb all the employees who were excluded during the current economic crisis. There is the risk that slow economic recovery will lead to jobless growth. New areas of potential development include the green investing society, energy efficiency in old and new buildings and renewable energy; at the sectoral level, they include health and wellness, food, private and public transport, and a pervasive commitment to creating and adopting knowledge in all economic activities.

The group of more dynamic entrepreneurs expressed a clear message: the diversification choices made in recent years have proven to be absolutely critical for the survival of the company or industrial holding. Diversification delivered an important compensation effect for the dramatic decrease in demand, and additionally it allowed for the transmission of knowledge, skills and capabilities from one sector to another and from one firm to another, thereby stimulating research and development activity and improving innovation activity.

Economists suggest that in order to formulate strategic projects and choices, a time horizon of at least ten years is required. Institutional actors have to contribute to the stabilisation of expectations, providing less ambitious but more stable perspectives. Additionally, they should act in order to orient savings to productive activities and to create investment funds that are also accessible to aggregate companies.

Finally, in order to find solutions for a system which is not growing through a widening of the production base, it is necessary to attract firms which are active in new sectors, to build a richer and more adequate endowment of skills, to extract value from invested assets and research legacies, and to improve the access to research results by small firms, which – if integrated into the system – can add their share of value.