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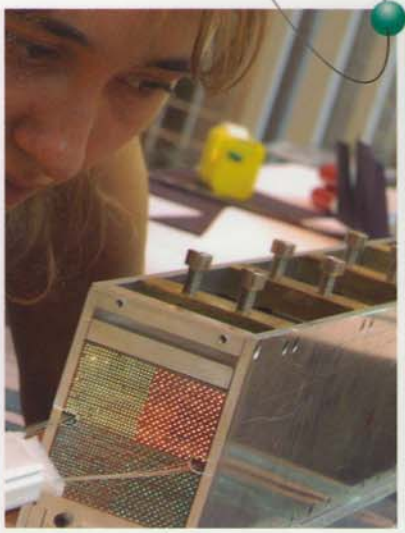

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ERA: Entrepreneurial Regional Action

Dominique Foray defines the concept of smart specialisation, how it can be managed, and reflects on how Europe is finding its own way toward the knowledge economy...

Proposals of specialisation have been a taboo subject in policy discussion in recent decades. But today, experts and policy-makers are increasingly looking for answers as to how to improve research and innovation, and enhance the European knowledge base. The question is now not 'should we specialise?' but 'how do we specialise?'

As the European Research Area (ERA) evolves, regions and countries that do not hold commanding positions in any particular scientific or technological field are looking for opportunities to address this. For many areas, there is a great necessity to increase the intensity of knowledge investments and intangible capital such as higher education, vocational training, private and public R&D, and the stimulation of other forms of innovation.

The problem is manifest where countries invest small amounts in areas such as biotechnology, ICT and nanotechnology, but fail to establish sectors that can realistically be competitive in today's world. Tough questions must be answered. Is there a better strategy than allocating valuable resources to fields where the region will always be playing catch up? How should countries and regions position themselves in the knowledge economy?

It is time to look at the case for specialisation. This is not about specialisation in a closed environment developed with a top-down grand plan industriel. Smart specialisation does not involve bureaucracy or a foresight exercise by a consulting firm. Rather, it entails an entrepreneurial process of discovery, identifying where a region can benefit from specialising in a particular area of science or technology.

To achieve this end, we need to incorporate new tools and new ideas. Governments must stand back and allow institutions to find their own way, and encourage the communication and innovation that are the pre-conditions for successful industry. The potential benefits are significant – and the strategy could lead to marked economic growth in many regions across Europe.

Crucial to achieving such aspirations is clear articulation of the specific properties of General Purpose Technologies (GPT). This will enable regions to make clear the potentialities for, and logic behind, 'smart specialisation', both in regions that have world leading scientific industries, and for areas that do not have long traditions of discovery and business success.

For areas with leading industry, this means continued investment in the invention of GPTs in areas such as biotechnology, information technology or bioinformatics. Whereas less advanced regions must develop the application of a GPT specific to one or more important components of the regional economy through the development of applied applications (co-invention) for new technologies.

By specialising in a particular technology, the realistic chance of the industry succeeding is enhanced by focusing on the development of technologies where there are just a small number of competitors.

For governments, there are two main responsibilities:

- Developing incentives for entrepreneurs and researchers to identify the best specialisation. This is important as the social value of specialisation far exceeds the benefits to individuals and organisations;
- Identifying areas where investment and funding would be complementary to specialisations, such as education and training. Here, it is important to involve the centres producing the GPT.

From the current situation to the ERA

Experts in Europe are increasingly concerned by a clear tendency for countries and regions in Europe to invest in the same science and technology endeavours, and envisage their future in a similar fashion (Doz 2005; Foray and van Ark 2008).

Every European region prides itself on having its investment plan in information technology, biotechnology and nanotechnology. Yet, in most regions, decision-makers define priorities in a very unimaginative way – there is a tendency across Europe to look to emulate what successful regions or countries do, instead of trying to find an original area for expertise.

The problem is complex and technology foresight exercises or critical technologies ordered ad hoc by administrations tend to produce the same ranking of priorities, without any consideration for the context and specific conditions of the 'client' for whom the exercise is carried out.

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Governments must stand back and allow institutions to find their own way, and encourage the communication and innovation that are the pre-conditions for successful industry, says Foray

This lack of imagination and vision produces a standardisation of the European knowledge base, and a deterioration of the originality and distinction that enable local knowledge bases to thrive. There is a danger that this lack of originality will lead to large European companies transferring innovation activities outside their native country to more favourable operating environments elsewhere (Doz 2005).

It is also largely acknowledged that the public research system in Europe remains fragmented and nationalistic, limiting agglomeration processes and hampering the formation of world class centres.

Agglomeration processes are an important engine for capacity building in a given geographical space. The engines of the knowledge economy – highly skilled people, research laboratories and services – are increasingly mobile, but where they move to is far from random.

Star scientists will move to where they can work with other scientists or with hi-tech firms. Corporate R&D will gravitate to strong universities. Innovation service providers will develop close to larger R&D companies. This agglomeration process gives rise to benefits for those who are in a position to take advantage of the pool of talents, ideas, services and infrastructures that accumulates in that particular region. This in turn acts as a powerful mechanism in attracting new capacities from other countries.

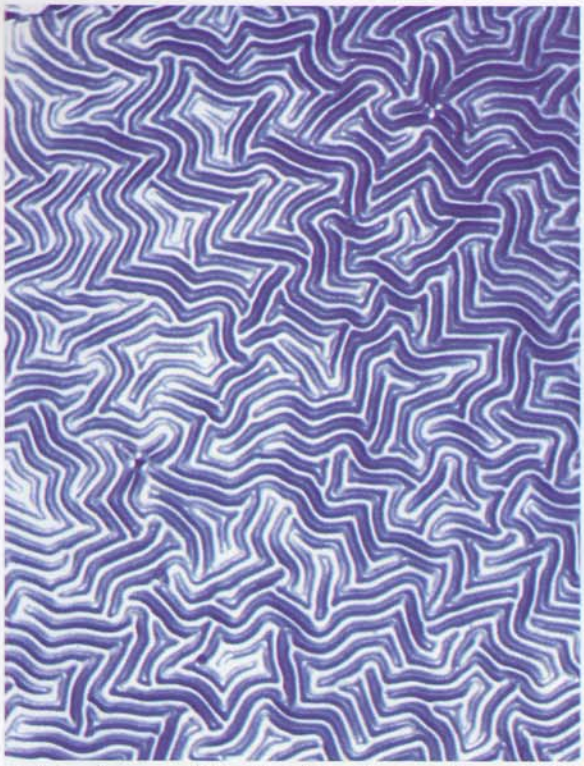
However, the fragmentation aforementioned has prevented the natural development of the hubs whose growth should be unrestrictedly nurtured by the best sources of the knowledge economy. In fact, with some rare exceptions, agglomeration processes almost exclusively operate within national systems, and this fragmentation along national lines acts as a brake on the process of creating world class centres of excellence.

To sum up, the increasing uniformity of the knowledge base, combined with the fragmentation of the European research systems between nations, leaves Europe with a collection of sub-critical systems, all doing more or less the same thing, systems that are unattractive and thus cannot compete on a global level.

How many world centres in, for example, biotechnology can Europe afford? Certainly, far fewer than 30. There is a great risk of wasting resources if all member states compete in the same area in an unco-ordinated way. Successful regions attract companies through a very rare and specific resource: the economies of agglomeration themselves. This rare resource is wasted as soon as too many sites are competing to capture the same resources.

Yet, without this fragmentation, there is huge potential for liberated agglomeration dynamics – a mechanism for finding original and new areas of expertise – and in turn, the rise of truly competitive centres that can compete on a global level.

The ERA looks to liberate agglomeration processes. Centres of excellence will be established to the advantage of some sites, while the inefficiencies currently protected by national borders will be significantly reduced. Europe will benefit from better exploitation of the main factors of research productivity – scale, scope and spillovers.



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Certain regions are well placed to build on the competitiveness in GPT, for instance, Grenoble for nano-technologies

The necessity for smart specialisation

The mechanisms at work in the ERA, it is feared, could further increase polarisation – with scientific densification for some regions, and desertification for many others. Such a result would be politically unacceptable and economically inefficient. It is therefore important not to turn the ERA into a net transfer mechanism of resources to the most advanced regions.

It therefore seems that there is only one means of reconciling unrestricted agglomeration processes aimed at developing knowledge hubs that are competitive on a worldwide scale, with a relatively balanced geographical distribution throughout Europe. The answer will come from regions and countries developing strategic vision for science and technology as to how they can develop distinctive, original, modern areas of specialisation for the future, and implement the policies necessary to make it happen.

The future could go one of two ways – a Europe that lacks imagination, where the mechanisms implemented in the ERA framework lead to a draining of knowledge from large parts of Europe unless redistributive policies are implemented, or a Europe where each region succeeds in developing an original and unique knowledge base. The latter is the notion of smart specialisation.

The right specialisations – an entrepreneurial process

Finding the solution to which knowledge base a particular region or country should build on is highly complex. It will involve not a bureaucratic logic of industrial planning, but a research process placing entrepreneurship at the centre. Until now, such an approach has received little attention from economists. This learning process involves identifying areas of research and innovation in which a region can hope to excel.

It is widely accepted that entrepreneurs are best placed to discover the right specialisations (Hausmann and Rodrick 2002). Therefore, public policies have an essential role to play in encouraging entrepreneurs who invest in this particular discovery process.

If carried out effectively, it will be possible to reveal the future strategic development areas for the region or country. If many regions achieve this, it will prevent the ERA from draining R&D from less successful regions. On the contrary, it will encourage the emergence of an equitable distribution of R&D capacities, whilst facilitating the emergence of a certain number of globally attractive and competitive knowledge hubs.

Opportunities for everyone

With smart specialisation, there are strategies for everybody, not just for Cambridge, Orsay or Louvain.

Certain regions are well placed to build on the competitiveness in GPT, for instance, Cambridge in biotechnology, Louvain in ICT, Grenoble for nano-technologies. Many other regions are in a good position to develop the applications of these GPTs in economic domains that are important for the region in question: biotechnology applied to the exploitation of maritime resources in Andalusia; nanotechnology applied to the wine quality control, fishing, cheese and olive oil industries in Braga (Portugal).

Major innovations are, of course, the result of the invention of this technology and the ensuing successive technological generations, but myriads of equally economically important innovations result from innovative developments in the new technologies.

A GPT is in fact distinguished by its characteristics of horizontal propagation throughout the economy, and that invention and application development can be mutually reinforcing (Bresnahan 2003). Such complementarities are fundamental. Application co-invention increases the size of the general technology market, and improves the economic return on invention activities relating to it.

Inventions provide opportunity for the development of applications, which in turn increases the return on subsequent inventions. When successful, a long-term dynamic develops, consisting of large-scale investments in research and innovation – with marked social and economic benefits. This provides opportunities across Europe – with some regions hosting R&D in the original inventions, and others investing in specific applications for this technology.

This goes to show that there are indeed strategies and opportunities for everyone. Some key regions will play a global role in the production of these technologies, and this role will be all the more successful if they can benefit from powerful agglomeration effects. A great many other

As part of efforts to reinvigorate the Lisbon Strategy, European Science and Research Commissioner Janez Potočnik established in 2005 a group of prominent economists in the field of 'Knowledge for Growth' (K4G). Dominique Foray has been co-chairing this group since 2006

regions could become world leaders by developing their knowledge bases focused on applied technologies for GPTs.

These regions must, however, forge strong links with regions that will have strong R&D in the core technology, so that the application co-invention processes are permanently revitalised by the generic invention dynamic. These connections are in theory facilitated by the existence of externalities between the two domains, but additional incentives are certainly also necessary.

Conclusion

At the dawn of the ERA, most European regions do not seem ready to become part of a European area that is open and competitive in the areas of research and innovation. Too many regions opt to compete in the same worldwide or European league in the field of biotechnologies or information technologies. This sheep-like behaviour inevitably leads to inefficiency and ineffectiveness, and results in an unhealthy standardisation of the European knowledge base.

The ERA represents a leap forward. In order to eliminate uncompetitiveness in the research system, the ERA is aiming to liberate agglomeration processes and facilitate the emergence of world leading centres that will be able to acquire the resources they need to succeed without obstacle or limit. This development must not, however, be synonymous with a draining of the greater part of the continent's R&D in science and technology.

Smart specialisation is the only concept that provides an answer to the problem of how to reconcile the complexities of polarisation and distribution. If correctly carried out by a large number of regions, smart specialisation will support the development of the ERA, by creating numerous critical clusters that are able to attract R&D capacities from foreign countries. But these will no longer correspond to state borders; they will be based on the existence of separate areas of specialisation, selected by these regions.

The smart specialisation process has already begun in a great many regions and territories. The few examples given here certainly do not give justice to all the efforts made at regional or country level to identify a specialisation strategy. Innovation systems associated with these knowledge bases are being developed in accordance with the technological needs of the economy in a particular region or country. They must also maintain close links with the regions where the generic technology thrives.

What still remains to be done, however, is to provide this smart specialisation process with a solid theoretical interpretation to perhaps give it even greater political impetus. Essential to achieving this is a good understanding of the entrepreneurial dimension of smart specialisation, and an appreciation of the importance of the complementarities between the invention of a generic technology and the co-invention of applications that sustain it.

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References

Bresnahan T (2003) 'Mechanisms of Information Technology's Contribution to Economic growth', in J P Touffut (ed.) 'Institutions, Innovation and Growth', Cheltenham: Edward Elgar

Doz Y (2005) 'Discussion', in P Laredo and F Sachwald (eds.) 'Le système français d'innovation dans l'économie mondiale: enjeux et priorités', IFRI et Institut de l'Entreprise, Avril 2005

Foray D and Van Ark B (2008) 'Smart specialization in a truly integrated research area is the key to attracting more R&D to Europe', in 'Knowledge for Growth, European Issues and Policy Challenges, European Research Area', European Commission, EUR 237 25 EN

Hausmann R and Rodrik D (2002) 'Economic development as self-discovery', National Bureau of Economic Research, working paper 8952

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