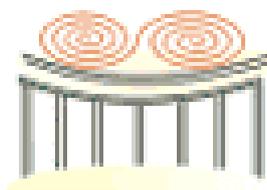# THE EUROPEAN RESEARCH AREA AND THE EXTERNAL CONTEXT

by Keith Smith

Supporting Science & Technology policies

FINAL REPORT OF THE STRATA CONSOLIDATING WORKSHOP

SESSION 1: GLOBALISATION - STRATEGIES OF MULTINATIONAL CORPORATIONS, INTERNATIONAL RESEARCH CO-OPERATION AND IMPLICATIONS FOR S&T POLICIES IN EUROPE

Brussels, 22&23 April 2002

1.1. Introduction

The STRATA programme consists of about 25 research networks focusing on research, technology and innovation policies in Europe. This paper discusses the work of four of these networks. They formed the core of a thematic workshop on 'Globalisation: Strategies of MNCs, international research co-operation and implications for S&T policies in Europe', as part of a wider STRATA conference on 'Science and Technology Policies in Europe: new challenges, new responses'. This was held in Brussels on April 22-23 2002. This overall activity is probably best seen in the context of wider discussions and debates on the shape of European RTDI, and it is to that context we turn first.

In two recent Heads of Government meetings, in Lisbon and Barcelona, the EU adopted an ambitious strategic economic target, namely that the EU should become the world's most competitive knowledge-based economy by 2010. Towards achieving this, the European Commission has for some time been developing a far-reaching move in research and innovation policy. Public R&D in Europe remains largely the province of the Member States, and this leads to replication and a lack of coherence at the European level. The new EU policy, known as the 'European Research Area' proposes a major change in the organisation of public R&D in Europe, seeking greater strategic coherence through a more integrated European approach.[1]

The ERA involves a number of elements. These include new approaches to networking and to large-scale targeted research at the European level, a more focused approach to large-scale facilities and infrastructure, better cohesion between member states, and greater attention to human resources and training issues at the European level. Considerable emphasis is placed on linking research to social needs, on sustainability, and on social and ethical issues.
This is a bold policy, which follows logically from the trends in the various FRAMEWORK programmes of the 1990s. Both the rationales for the policy shift, as well as its content, have been well thought through. Of course the details of agreement between the member states, and of policy content and implementation, will probably take some time to work out. Certainly there are many difficult issues to resolve – the allocation of large research facilities between member states and regions, for example, is likely to involve tough

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[1] *See the following three major documents:* **Towards a European Research Area** *(Brussels, COM (2000) 6 final),* **Making a Reality of the European Research Area: Guidelines for EU Research Activities (2002-2006)** *(Brussels (2000) COM 612 final), and* **Innovation in a Knowledge-Driven Economy** *(Brussels, 2000*

processes of analysis and negotiation. But if the policy is successful, or even only partially successful, then it will have a powerful impact on the trajectories of scientific and technological advance in Europe, and through that on the long-term growth process.

But not all aspects of the policy are in place. This paper is essentially about something that is missing from the ERA, namely a fully worked-out international dimension. The ERA is rightly focussed primarily on the internal structure and operations of European RTDI policy. However external issues are referred to at several points and there is a recognition that the international context is going to be an important element in shaping the outcomes of the policy. But the international dimensions are arguably more complex and more urgent than the framers of the ERA have acknowledged. The purpose of this paper is to look at what some recent research and networking activities in Europe can contribute to understanding the external challenges that face European policy makers.

1.2. Some key external issues

The ERA policy documents refer to international developments in two broad ways. On the one hand, there is brief reference to globalisation, but this is primarily in the context of Triadic competition.[2] On the other hand, there is reference to the idea of 'brain gain' – of making Europe an attractive destination for researchers from other parts of the world, or an attractive destination for currently expatriate European researchers.[3]

However the issues for Europe in fact go far beyond these phenomena. Broadly, we can distinguish two dimensions of problems, economic and social.

On the one hand there is the economics of global interdependence, which is certainly in large part a process of 'Triadization' – that is, of large and rapidly growing flows of trade and foreign direct investment (FDI) between Europe, the USA and Japan. But such flows are also increasing globally. FDI has been growing much faster than either trade or GDP around the world. In Europe FDI flows have had significant effects: in most EU economies about a quarter of manufacturing output is now produced by affiliates of foreign firms. In some countries (such as Ireland) such production is around 70% of manufacturing output. At the same time, there is *outward* investment:

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[2] *Innovation...(p.12)*
[3] *Towards...(p.19).*

European multinational corporations (MNCs) are investing heavily abroad, and their strategic investment decisions and location choices have important implications for European R&D and employment. A somewhat neglected issue is the flow of portfolio investment as an element of globalisation. This will be discussed further below, but it is an element of the situation that may have unrecognised impacts on R&D and technology performance of European large firms.

On the other hand, there are social dimensions of the international situation, specifically movement of people. Here the issues are to do with the conditions of the developing world. Poverty, health crises, political instability and war are driving forces behind migration and asylum seeking, and although levels of international movement are not high in any absolute sense, they are enough to create political consequences in Europe. How the political consequences of immigration and asylum issues work out in Europe is an immediate concern, but it is important to look beyond the current situation. Ultimately, European security and growth rest not only on Europe's internal efforts but also on a stable international environment, particularly in the developing world. So Europe has a direct interest in promoting growth processes in developing countries, since successful development strategies will play a major role in alleviating the current crises of migration and movement. Such growth processes will in turn depend on technological development in partner countries. For this reason, the ERA should if possible contain an element of development strategy, relating European policy initiatives to potential development partners. Such initiatives might include policies relating to external foreign direct investment, North-South research partnerships, education and training, and participation in European research programmes. If successful, externally oriented RTDI initiatives would not only alleviate social and population problems in developing countries. The would also generate a possibly substantial economic pay-off, since economic growth is not a zero-sum game, and the trading and investment partners of growing economies tend to share in the benefits.

1.3. Conceptual foundations of the ERA

In the context of this paper a point about the conceptual background of the ERA should be mentioned. The ERA documents cited above refer frequently to "systems" theories of innovation. These approaches to innovation performance stress the operations of firms as creators of technological change, but seek to situate firms within a wider context of governance, policy frameworks, regulation and knowledge creation. There is quite substantial

evidence, from historical case study and statistical research, that firm performance is strongly affected by these contextual factors. So innovation outcomes depend on the operations of what we can call the innovation system as a whole, not simply on the behaviour of the elements of the system. This has directed the attention of policy makers to the policy implications of the systems approach, and especially to those parts of the system that are publicly funded or supported. These include universities, research programmes and other elements of the knowledge infrastructure.

The systems approach is closely relevant to the ERA policy. But this should not obscure the fact that the systems concept needs further development. One element of this might be in the area of the rationale, scope and foundation of policy. A second concerns boundaries: how should we think about system boundaries, and how important are the links between a system and the external world? In other words, how are international links organised, and how do they affect outcomes?

These issues are important to the functioning of the ERA. The networks discussed here have addressed both. These issues will be returned to below.

1.4. Strata Networks and Papers

These kinds of issues have been addressed in various forums sponsored by the European Commission. We turn now to one of them, namely the STRATA workshop on 'Science and Technology Policies in Europe: new challenges, new responses' held in Brussels on April 22-23 2002. As noted above, one of the themes of the workshop was 'Globalisation: Strategies of MNCs, International Research Co-operation and Implications for S&T Policies in Europe'. This later theme consisted of four work elements. Firstly, there were four invited papers, on modes of globalisation and their implications for national policymakers, on S&T issues in India, South East Asia and China by Ron Johnston, Pikay Richardson, Sanjaya Lall and Jon Sigurdson respectively. Finally there were reports on the work of four Strata networks. These were:

MESIAS – The relationship between technological strategies of multinational companies (MNCs) and national systems of innovation and the consequences for national and European S&T policies)
KNOGG - Knowledge, Growth and Globalisation – Science and Technology Policy as a Growth Factor in Smaller Economies
GLOSPERA – Global Systems and Policy Design for the European Research Area

SEGERA – Second Generation Research Agenda on the European System of Innovation

In what follows we discuss the work and results from each of the networks, then the issues raised by the invited papers, then some of the resolved and unresolved problems in this area.

1.4.1.MESIAS

This network deals with an important issue, namely the implications of multinational business for systems approaches to innovation policy. Most systems approaches incorporate the idea of regional or national borders as important boundaries for the operation of particular institutions or practices that characterise innovation systems. Such boundaries are of course porous, with global trade, financial and investment flows occurring across them. Systems approaches have not been particularly successful in assessing the significance of such flows for the operation of national or regional systems, or in assessing how and to what extent globalisation should affect policy formation and implementation. This is likely to be an important issue within the ERA, a topic that is taken up by MESIAS.

1.4.1.1. Significance of the Issue

An initial question concerns the wider significance of the issues addressed by MESIAS, and this rests to a great extent on the scale of MNC operations and FDI. There are data problems here, and one suggestion might be that both the data problems and the general dimensions of the issue could have been dealt with more directly in MESIAS. Historically, the main data has been on capital stocks and flows reported as part of the balance of payments accounts. It is only recently that OECD-country statistical agencies have collected data on the organisation of such investment, by collecting data on output contributions of foreign affiliates. It is even more recently that statisticians have started to move on such questions as outward investment by MNCs and service sector activities (an increasingly important part of MNS activity). The new data available on performance of foreign affiliates is enough o show that this is a very significant contribution to output in Europe. In most European countries foreign affiliates generate between 25 and 30 percent of manufacturing output, although in some countries (such as Ireland) the share is much higher (around 70%). There seem to be some quite strong variations in the character of such investment – in Ireland, France and the UK, MNC investment seems focused on high-tech sectors (as conventionally defined). In other countries, however, there are quite substantial investments

in medium or low-tech sectors such as vehicles, non-electrical machinery and food. The statistical issues will be returned to below, but from the available indicators we know that on analytical and policy levels MESIAS is certainly taking up a key issue for Europe.

1.4.1.2. Questions Addressed by MESIAS

The MESIAS network meeting essentially addressed three issues:

- The relation between MNC strategies and innovation systems
- The role of basic science and university-industry links (especially as location determinants)
- Absorptive capacities with respect to MNC technologies

In what follows we offer some comments on each of these issues.

1.4.1.3. The relation between MNC strategies and innovation systems

There is no single way to conceptualise either the strategy of an MNC or the innovation system within which it is operating. A strong point about the MESIAS project is the recognition of diversity among European economies, and in the kinds of behaviour adopted by MNCs: 'European heterogeneity allows us to expect the existence of country differences in Europe when the behaviour of MNEs is handled in close connection with the national systems' (Molero and Alvarez 2002:6).

One important source of diversity/heterogeneity derives from sectors. As one point of departure in looking at diversity, countries have different sectoral structures. While it was rightly recognised that distinctions such as, for example, 'mature' and 'modern' sectors are not necessarily helpful, nevertheless there are important technological differences among sectors. - 'Typically, food and beverage companies usually had their technological activities more decentralised, while the opposite was true for aerospace or electronic firms' (Molero and Alvarez 2002:9). This is an important insight, because it potentially makes a link between external sources of knowledge (and hence the roles of knowledge infrastructures within specific innovation systems) and firm strategies.

However it is not clear in MESIAS how these sectoral differences relate to differences in MNC strategies. In MESIAS the distinction was established between *Home Base Exploiting* Strategies, which sought to exploit the technological advantage a firm has from its domestic activity, and *Home Base Augmenting*, in which the bulk of the activity is oriented to increasing the

technological basis with the incorporation of other created assets available in advanced countries (Molero and Alvarez 2002:9).

Presumably Home Base Exploiting strategies are those of the more centralised sectoral structures, while Home Base Augmenting strategies are typical of decentralised technological activities. But it is difficult to connect the sectoral issues with the strategic ones, particularly when we come to another important MESIAS point, namely differences between European and non-European MNCs. European MNCs appear to be very active in locating technological activity outside Europe, while Europe appears to be less dynamic in terms of hosting non-European R&D. But do these outcomes result from factors intrinsic to company strategies (perhaps deriving from sectoral characteristics), or should they be explained by the characteristics of European innovation systems? Obviously it would be unreasonable to ask network participants to resolve such issues. At the same time, it would be very interesting to hear the views of participants on how such issues, however speculative the views might be.

The general issue about system/strategy links could be pushed a bit further. Sectoral structure is an important aspect of any innovation system, but it is only one dimension. Others, highly relevant to MNC operations, include corporate governance systems, regulatory frameworks, labour market operations and industrial relations (including non- explicit habits, practices and procedures in work organisation), financial market structures and operations, and the whole array of public policies (from macroeconomic policies down to more detailed levels). There seem to be many areas where our understanding of the links between innovation systems and MNC activity is at best incomplete. It would be completely unreasonable to ask for such issues to be resolved by a network. At the same time, a more speculative and wide-ranging survey of the issues, mapping out potential lines of future research, would be very useful.

1.4.1.4. The role of basic science and university-industry links

MESIAS strongly emphasised the role of external sources of knowledge to MNCs (Molero and Alvarez 2002:15; Narula 2001). This is an area of strength in this network, with participants having developed robust conclusions out of previous research. For example, there is reference to interesting work from Portugal indicating that locational choices by foreign firms respond to existing local capabilities. There is a range of other literature emphasising this point.

There are two closely related issues here. The first concerns knowledge: the role of basic science in the development of modern technologies appears to be increasingly important. The second, following from this, concerns location: proximity between companies and universities seems to be essential in shaping, accessing and using such knowledge. These insights are very important both from an analytical perspective, but also in terms of how we understand innovation systems, and what the role of policies like ERA might be.

The issue here is the role and operations of knowledge infrastructures in innovation systems. In thinking about location decisions, as well as about the competitiveness of European firms, we need to know more about how these infrastructures relate to firms in specific sectors. This takes us back to the strategy distinctions made earlier. In what sectors do firms require close access to knowledge infrastructures, and in what sectors are other incentives appropriate? Some major recipients of FDI, such as Ireland, do not appear to rest their locational attractiveness on infrastructures, and this is presumably linked to the nature of knowledge creation in the major sectors of FDI in that country. On the other hand, a sector like pharmaceuticals is closely linked to the existence of university research facilities in such fields as molecular biology.

What MESIAS points up is the need for some kind of systematic taxonomic work, which can link our understanding of firm knowledge bases, sectoral knowledge bases, and knowledge infrastructural facilities. The kinds of specialisation issues addressed by Archibugi and Pianta a decade ago really need to be revisited. Such links between infrastructural specialisation and location are essential for the intelligent design of infrastructure policies, both at national and European levels. The policy issues are important because the very existence of knowledge infrastructures tends either to rely on public funding, or to be based on public procurement and regulation of private activity. The ERA in particular is in large part an infrastructure policy, and the work of MESIAS is closely relevant. Once again, a somewhat bolder and more speculative approach by participants would be interesting to read.

1.4.1.5. Absorptive capacities with respect to MNC technologies

MESIAS presents an interesting approach to the issue of absorptive capacities, with potential policy implications. Previous approaches have emphasised the role of skills, human resources, etc. In MESIAS the argument is that a key element of MNC operations is participation in international

networks. The suggestion is that such networks are 'a way of accessing international knowledge sources for less developed regions' (Palaskas and Tsampra, 2002). The idea develops into a discussion of the accession countries. The question here is the extent to which FDI is 'enclosed', or on the contrary transforms the innovation system in some wider way? There is clearly no general answer to this question, and much depends on the specific incentives that attract FDI in the first place. Once again, there are policy issues that could be explored more deeply here.

1.4.1.6. Data Issues

One element of MESIAS deserves further consideration, namely questions concerning data. At several points there emerge questions about available data sources, and about the interpretation of data. Given the quantitative importance of FDI and foreign-affiliate production in Europe, some wider assessment of the adequacy of available data might be useful here.

1.4.1.7. Policy conclusions of MESIAS

MESIAS offers eight points of policy conclusions. These are all interesting and important, though not all of them relate to the specific role of MNCs. Some of them deserve a lot more attention than they are getting, particularly in the context of ERA. These include:

- The way that European innovation policies tend to be characterised by uniformity, while the EU is characterised at the economic level by great diversity among countries and regions.
- The possibilities for upgrading low-technology niches in Mediterranean and accession countries into knowledge-based activities that might not only generate growth but also FDI
- The role of large-scale science infrastructures for MNC location decisions and the distribution of this across sectors.

1.4.2. KNOGG – Knowledge, Growth and Globalisation – Science and Technology Policy as a Growth Factor in Smaller Economies

One simple element of diversity in Europe is simply the size distribution of the European economies – a small number of relatively large economies, down to some economies that are very small indeed. These size differences are closely associated with important differences in economic structure. We often find diversity in industrial specialisations, patterns of innovation inputs, trade patterns (in both specialisations and partners), technological specialisation,

institutional set-ups and in infrastructures (in levels of provision and modes of operation). Many of the smaller European economies have in fact performed very well since the mid-1990s. In Table 1 for example, we find a number of EU or accession economies, plus Switzerland, all of which have experienced higher rtes of productivity growth than the USA over the relevant period.

Table 1: Output per person hour 1995-98 (Annual rate of change, %)	
AUSTRIA	6.2
SWITZERLAND	2.3
FINLAND	3.6
GREECE	2.5
HUNGARY	2.8
ICELAND	3.7
IRELAND	3.6
POLAND	5.7
PORTUGAL	3.9

Source: OECD, **A New Economy? The Changing role of Information Technology in Growth** (OECD, Paris), 2000, table 1, P.21

Looking at this group of countries, we would almost certainly not seek to explain their good performance by reference to one model of growth, and certainly not a model of growth that is shared with larger economies. Ireland is growing for different reasons than Greece, and Poland for quite different reasons again. Yet when technological aspects of growth are discussed, however, these aspects of diversity often drop away, and we are left with policy frameworks that are very general and indeed abstract in character, as though one set of policy recipes is relevant for all.

The KNOGG project seeks to evade these conceptual restrictions by looking at the growth experience and problems of smaller European economies, focusing on Finland, Hungary, Netherlands, Ireland, Slovenia and Greece. The project comprises work on

- The role of science and technology policy in the growth process in small open economies
- Knowledge bases, and EU programmes across countries
- Roles and location decisions of TNCs
- Policy options in S&T for small economies

This work is still in an early phase, and one major piece has been completed on 'The Role of Science and Technology Policy in Small Economies'.[4] This paper is a framework for the project as a whole, and is in fact an extremely detailed overview of a wide range of growth issues: theories, modelling, econometric work, policy approaches and instruments in the various countries studied by the project.

This paper focuses essentially on four aspects of growth theory:
- the neo-classical approach,
- growth accounting and convergence models
- 'technology-gap' models of growth
- the 'new growth theory'

In the first and oldest of these approaches, technological change is seen as external (or 'exogenous') to the economy. In the last three, it is seen as something produced within the economy; for this reason modern theory is often referred to, in a general way, as 'endogenous growth theory'. How do these theories approach innovation and technological change?

The past fifteen years have seen major developments in a number of areas of economic theory, which are relevant for industrial and economic policy. Growth theory, international trade theory, industrial organisation theory, studies of the firm, and the economics of technological change have all produced new ideas and analyses. Do these changes in these fields have anything in common? At a general level the answer is yes. If there is a connecting thread between these developments, it is the concept of 'endogenous innovation': the idea that new technological and organisational patterns are produced by investment decisions within the economic system, rather than by technological parameters deriving ultimately from outside the economic sphere. However this idea of endogenous change is also closely associated with other ideas - in particular the role of imperfect competition and increasing returns to scale - which are in sharp contrast to the usual models on which most industrial policy approaches are based.

These types of approach are obviously very different from the neo-classical general equilibrium theories, which have dominated the analysis of industrial policy in most OECD economies. In particular, public policy cannot be based on clearly defined market failures, since in the new approaches some of the 'failures' are actually seen as sources of growth. In the general equilibrium

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[4] *'The Role of Science and Technology Policy in Small Economies', WP1 15.03.2002 (No authors indicated)*

approach, investment decisions and technological choices are responses to market signals in which absence of information is not generally a problem. In the newer approaches, investment and innovation occur in highly uncertain environments, and often represent strategic initiatives that are not in any simple way responses to market signals.

What is really missing from KNOGG at the moment is the recent work that has sought to integrate innovation studies into the theory of growth. These newer, rather unorthodox areas - in evolutionary theory, regional economics or institutional economics - seem to be central for the KNOGG project, but are referred to only in passing.[5] At the same time, there is no real account of what has happened in the economic and social study of innovation where there is a large body of empirical evidence on the character of innovation. The empirical results suggest that technological change is not a marginal area in terms of its economic and social significance. On the contrary, it is central to the processes of output growth, productivity growth, and international trade on which the prosperity of advanced economies is based. Because of the link between technological change and the growth of income, technological change also has important implications for the evolution of the tax base, and hence for the financial position of the public sector and the ability of the government to finance welfare and other social policies. The technological performance of the economy is thus a legitimate matter of government concern. But this can involve many different types of activities, and can occur both at national and regional levels. The growth literature on convergence-divergence suggests an important policy problem concerning the tension between the need to support and maintain existing technology/industrial bases, and the need to adapt to change of various types.

The perspectives sketched above are important for the public policy dimensions of KNOGG. In particular the existence of diversity and variation, at both industry and firm levels, means that 'neutral' policies for support are not always appropriate. This has two dimensions. First, when firms differ sharply, then a neutral policy will not affect all firms equally, but will in effect be a form of selective policy. For example, tax credits for R&D may appear neutral, but in fact they selectively favour firms in R&D-intensive industries, or firms using research-based innovation strategies. Secondly, it is necessary to be selective when adaptation is necessary. For example, when a new and important generic technology - such as IT - emerges, it is extremely important to focus on that technology, and to selectively develop it. Of course there are major decision problems involved in how to do this; but the

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[5] *Ibid. pp14-15*

economic history of growth rather clearly suggests that specialised adaptation of such technologies is central to long-run growth.

These general issues are important because we may have to move towards a more systematic theoretical context. At the moment we have quite disparate bodies of theory and analysis being brought together, and it is not clear how well they really fit together – KNOGG is an example of this. The first KNOGG paper is a brave attempt to put together a lot of growth theory, a lot of empirical results, and an innovation-based approach to growth in small economies. But it is still not a particularly unified approach, and there remains a problem concerning the treatment of variety/diversity, and at what levels that is handled So the problem of developing innovation-based theories of growth that are relevant for the specific structures of small economies, and relevant across different sectoral structures, remains. In the workshop discussion, there was general agreement that innovation and globalisation issues look different across sectors. This implies variation in problems for countries, according to the sectoral structure of the economy. This is addressed in KNOGG, but at this stage KNOGG probably remains too close to mainstream growth theory, so the real small-economy issues are not sufficiently integrated. But this is an early-stage assessment, and there is much still to do in this project. What has been done so far is an impressive point of departure.

1.4.3. GLOSPERA – Global Systems and Policy Design for the European Research Area

GLOSPERA deals with issues in scientific co-operation. The network involves experts on science policy (from 12 countries), and the core of the work is a series of case studies of major international co-operation projects. The main objectives of the GLOSPERA project are:

- to identify best practices in organising international S&T co-operation in global-scale multilateral research programmes and intra-European research co-operation programmes;

- to analyse the implications of globalisation for policy design

- to develop new approaches to integrate scientific and technological expertise into the design of external relations policies of the European Union

- to improve mutual understanding and co-operation between international S&T policymakers and policy researchers around the world.

This study is essentially focused on the experiences of four cases:

- the Human Frontier Science Programme
- Intelligent Manufacturing Systems
- Human Genome Project
- Intergovernmental Panel on Climate Change

The characteristic feature of these cases is that they are all global issues involving large-scale externalities (that is, they may be problems because they involve large detrimental externalities, or the solution of the problem may involve large beneficial externalities). It is the externality dimension that makes them global, but what makes them relevant to the EU is that they all require high-level scientific and technological expertise, not only to seek solutions, but even to consider fruitful lines of research. GLOSPERA is in a relatively early stage, but it seems clear that some interesting early conclusions are already emerging. These include general problems of compartmentalisation of relevant knowledge by country and field of expertise. At the same time there is a need for expertise for careful policy design: the network emphasises the unique circumstances of each co-operation case, and the consequent need for case-by-case policy design. This places major demands on policy capabilities, but it is also clear from this project that these problems are even more severe when we consider participation by small countries. A network member writing on Portugal remarks that:

In the case of the IPCC it has also been considered that there is a lack of co-ordination between the policy-makers and the scientists/experts at the national level. In this sense the international advisory committees act as *de facto* national committees. And while some researchers have been funded for research on climate change, this has happened in a detached way from the Portuguese participation in the IPCC discussions and without explicit terms of reference from the Portuguese agencies for the Portuguese research. Accordingly the contributions to the IPCC have been few and more on an institutional basis than on a scientific one. Furthermore, information regarding Portuguese participation in the IPCC suggests that there is weak co-ordination between the scientific and the policy-making national participation due to the responsibility of the different tasks being divided through different Ministries (Environment and Science and Technology). Although there is an Interministerial Commission on Climate Change this is more focused on the policy implications of the results produced by the IPCC. In fact, the scientific contributions towards the IPCC studies have been strongly dominated by a

few countries, which has often raised questions about its applicability in other contexts.[6]

These problems are serious enough, but we ought to recognise that they can go further. GLOSPERA is in fact dealing with high-level scientific co-operation in fields where there is a rather wide consensus (regardless of the vagaries of US policy) on the significance of the issue. If we are to have what the Commission has called 'a European Research Area open to the world' then the issues of bilateral and multilateral co-operation must extend into new fields of North-South co-operation. To some extent the issues here are being explored with respect to the accession countries, and actions are underway. But if we are to have a genuinely 'non-fortress' ERA then we will need to extend the analysis of projects like this one into new fields related to far less glamorous scientific problems, and into more mundane fields of production and technology. This will presumably involve a major extension of current work on building scientific and technological capabilities in developing regions, and a careful analysis of how current North-South co-operation can be revised and strengthened.

1.4.4. SEGERA – Second Generation Research Agenda on the European System of Innovation

It is probably too soon to comment seriously on this project, since it has only very recently got underway. However this is an important project that goes into issues at the core of ERA design, since it deals with the future of the innovation system concept. The notion of the innovation system as the right framework for policy is central to the ERA, but we should face the fact that although this concept is a very helpful and illuminating one, it still contains many aspects that need more work.

SEGERA identifies six areas of work, towards an objective of a "second generation research" agenda to address the governance of the European system of innovation.

These are:

- Systems of innovation theory in relation to EU developments
- Risk society and the governance of science at EU level
- Global co-operation and research at the EU level
- Disparities and divergence in enlargement
- IPR regimes in the EU and the European innovation system
- Private financing of innovation in the EU.

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[6] *Tiago Santos Pereira, 'Coordination and Collaboration? Notes from a small country perspective', Paper presented to Glospera Workshop University of East London, 24-27 October 2001*

These are important issues. We can note that several of them intersect with other STRATA projects – the work on diversity and divergence intersects with KNOGG, while the work on research co-operation intersects with GLOSPERA. It is appropriate that these themes are taken up in the context of the systems framework that is so integral to ERA.

However the themes listed above are all relatively applied: they apply systems theory to a set of rather urgent areas of practical problems. The danger here is that we may assume that systems theories are somehow complete on the theoretical level. But this is not so. There are a number of quite basic unresolved issues in systems theories that deserve attention if the theory is to become widely applicable. These unresolved issues include:

- Concepts of system boundaries, and of the interactions between systems and their external environments. There is as yet no really good analysis of how systems articulate with each other, and of what factors shape effective borders or boundaries to a system. This is an important issue in thinking about the arenas of policy application, and the domains of cross-system policy collaboration.
- Policy concepts appropriate to the systems framework. Most innovation policy is still conducted in a rather orthodox "market failure" framework. Some progress has been made towards systems frameworks for policy, but much remains to be done.

The final work programming of SEGERA (WP4) will look toward such unresolved issues, and this is likely to be a major contributor of this project.

1.5. Background Papers

The international issues addressed by this workshop require an assessment of the current state of the international context, and the workshop heard four papers on this. One paper dealt generally with modes of globalisation, particularly with respect to R&D, while three had a particular focus on regions or countries.

Johnston addressed current issues in globalisation, focusing on three broad aspects, all of which were to some degree also addressed in the STRATA programme. These issues were firstly the nature of the multinational or metanational firms, and the powerful role played by its strategic decisions in shaping the location and impacts of knowledge creation. Secondly, he

addressed international institutions shaping knowledge creation and dissemination, focussing in particular on WIPO and TRIPS. The wide scope of the TRIPS agreement was emphasised, and Johnston discussed the implications for international scientific co-operation (a neglected topic generally). The major questions here concern how intellectual property rights are assigned when research projects are collaborative and transnational, and what the implications of IPR protection are for the establishment of complex collaborative projects generally. When research projects take the form of network organisations crossing national boundaries, claims on IPRs become both contentious and an essential point in bargaining over the returns to an innovation. Finally, there is the emergence of new patterns of international scientific collaboration, where Johnston drew attention to the wider significance of some of the projects studied by GLOSPERA. The policy implications concerned knowledge management systems (which will have to face the increasing global complexity of knowledge inputs), the role of 'knowledge magnets' (virtual platforms for the creation of new knowledge bases), ownership of publicly funded research (in the new IPR context), appropriate commercialisation models, and new institutions and key infrastructures.

The three country/region papers (Lall 2002; Sigurdson, 2002; Richardson 2002) were all (to different degrees) optimistic about the regions studied; that is, each of them emphasised growth successes, often of quite different kinds, and hence they stressed the increasing roles of these countries/regions in the world economy. All are already, or are likely to become, major trading partners for the EU in years ahead. But all are making major efforts in knowledge intensive industries and in terms of R&D and knowledge creation are both potential partners and competitors with the EU. Choices will have to be made about the sectors and locations of collaboration, and this is going to involve an assessment of Europe's strengths and weaknesses in relation to these regions and countries. Nothing is set in stone in terms of development paths or of appropriate policy frameworks: Lall emphasised the fact that even where policies are shaped by market failure considerations, these failures only exist against the background of 'visions' concerning the desirable development path. Such development visions are needed for policymakers in Europe also, and will play a role in shaping not only the policy paths that are chosen, but the potential collaboration partners in the developing world.

1.6. Discussion: STRATA and the International Dimension of the ERA

In this final section we outline some of the unresolved issues raised by these STRATA networks. A first issue concerns the status of the national innovation system concept as a framework for policy analysis: This was the core of the SEGERA project. But what kinds of issues are involved in developing this concept?

A key point for the ERA is firstly the extent to which key components of the NIS are affected by changes in the global environment. On the one hand many of the core aspects of an innovation system are not obviously affected by globalisation – these include education, infrastructure provision, public R&D, and the income distribution. Institutions such as corporate law might be included here. Obviously there are budget constraints, and this has something to do with globalisation because of the internationalised nature of bond markets, but otherwise governments have quite a wide discretion to make decisions. So policymakers at both national and European levels have a wide range of possible action arenas within the innovation systems framework. At the same time, analysts have given relatively little attention to at least three key issues:

First, how local in knowledge, and how does this affect the stability of the innovation system? What fields of knowledge creation, relevant to what sectors of the economy, are capable of creating locational assets for Europe? How is this situation affected by globalisation, FDI, TNC location decisions, transnational agreements on trade etc?

Second, closely related to this, there is the problem of conceptualising sectors and hence growth strategies – which sectors are really capable of sustaining high and preferably growing levels of economic activity in Europe? How can we understand growth trajectories in the context of specific country or regional characteristics? It is often claimed that Europe" greatest strength is its diversity, but several of these networks (and the ERA documents incidentally) have pointed out that Member-State RTDI policy is in fact characterised by uniformity. In analysing the issues here we need to question some accepted underlying assumptions – for example, that there is a European innovation problem characterised by high scientific output and low innovation rates. Similarly, that product cycles are speeding up, that innovation pressures are increasing, that global competition is intensifying. Is R&D location more flexible? Is the productivity of R&D falling? These questions are often treated

as answers, but they really are not facts, they are unresolved hypotheses, and more work is needed on them if intelligent policies are to be formulated.

Third, the international environment involves a complex set of relations with the developing world. These countries are likely to play a far more important part in Europe's future than is currently recognised. This follows in part from the political issues concerning migration and asylum-seeking that are currently affecting European electoral politics, and that are to some degree shaped by deep problems of political and economic instability in developing countries. But this international environment of developing countries also offers a major opportunity. Incorporating a development strategy component into ERA might have important impacts on the future growth trajectory of Europe.

These framework issues are important because we may have to move towards a more systematic theoretical context. At the moment we have quite disparate bodies of theory and analysis being brought together, and its not clear how well they really fit together – KNOGG is an example of this. It's a really brave attempt to put together a lot of growth theory, a lot of empirical results, and an innovation-based approach to growth in small economies.

Beyond these issues there are globalisation questions that could have a sharper focus, both for ERA and in future STRATA networks. These include the status and impacts of transnational agreements such as TRIPS, TRIMS, MAI and especially GATS. TRIPS is an agreement of very broad scope – far wider than the patenting issue. It includes agreements on copyright, trade marks, industrial designs, geographical indications and integrated circuit design. If fully implemented it would dramatically extend the scope of appropriability. So this is an issue both for developing countries and for the EU. Related to this is a far more contentious problem, namely GATS. This would effectively privatise public services globally, and in fact constitutes a point of conflict between the EU and the developing world. So it is very relevant to the STRATA projects.

Then there are the increasing flows of portfolio investment. We have a lot on FDI (covered in MESIAS and other projects). But portfolio investment has also increased dramatically, especially via mutual funds and pension funds. This has an important effect in extending Anglo-Saxon forms of corporate governance, thus transforming a key element of the institutional structure of many national innovation systems. This deserves greater attention.

We have continuing problems concerning the rationales, scope, and foundation of policy in 'open innovation systems' context. This seems mainly to do with co-ordination failure – it is definitely not a market failure. It is quite clear that if RTD externalities are to be internalised then there will have to be a new level of transnational co-operation – in part this means the ERA, but it goes far beyond that. The RTD co-operation issues become a part of global development strategies, and are tied up with inter-regional competition also. So these RTD issues ought to be seen in the context of the forward looking development 'visions' discussed in Sanjaya Lall's paper. A somewhat neglected aspect of the policy problem is coping with dynamics (mentioned by Johnston). The problems include entry/exit, labour market turbulence, product replacement, etc, as well as the broad globalisation trends.

Finally there is transnational co-operation and the 'patronage' issue. This is a matter of the content and functioning of co-operation – what do we want transnational co-operative R&D to do? Many of the real transnational issues are very long term and may involve the creation of radical technologies. This is especially the case with respect to environmental technologies. Historically most radical and large-scale innovations have emerged via the patronage system in some form. This is a main issue in managing climate change, for example, and hence for IPCC – an area in which Glospera projects are very relevant.

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