

Assessing European national policies to support the competitiveness of information and communication technology producers

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Abstract

Purpose – *In the context of fears that the European information and communication technology (ICT) sector may be facing a period of crisis, this paper seeks to examine the changing role of national-level policy initiatives to enhance the competitiveness of European ICT producers.*

Design/methodology/approach – *The article is based upon a study of 176 national programs that are aimed specifically or in substantial part at ICT producer goods. This supply-side focus provides a counterpoint to studies that concentrate on demand stimulation and aggregation measures, which generally make up a much larger share of national policy programs. A comparative analytical framework is used that takes account of the different composition and structure of the ICT industries in the EU member states.*

Findings – *The key findings are that technology development programs continue to dominate but that the emphasis is shifting from ICT producer goods as such to the application and coordination of ICT products and services across a wide range of industry contexts. This process takes different directions depending upon national political and administrative structures and historical national attitudes to industry policy.*

Originality/value – *The article gives evidence about sector specific strategies for supporting the competitiveness of the ICT sector and forms the basis for the identification of best practice examples.*

Keywords *Competitive strategy, European Union, Public policy*

Paper type *Research paper*

Following more than a decade of rapid and sometimes spectacular growth, by 2002 the information and communication technology (ICT) industry appeared to be facing its first significant decline. The slow-down gave rise to much discussion about whether the industry was facing a severe structural crisis or whether it was experiencing only a periodic perturbation, eventually to be followed by another growth phase.

The uncertainty has been especially intense in Europe where the perception in policy circles has long been that European ICT producers were not as competitive overall as their US and Asian counterparts. There may well be good reason for this concern. For example, an analysis of labor productivity growth in Europe concluded that productivity was strongest in sectors with a strong technological content. But although growth in these sectors has been robust in comparison with the overall European economy, on the whole it has been significantly lower than in the US (European Commission, 2004a). Another recent study shows that European performance matches that of the US only in the area of ICT services (O'Mahony and van Ark, 2003).

However, despite these discrepancies and concerns about a slowdown in the industry overall, ICT remains a very significant part of the European economy. With an annual turnover of about €200 billion, European ICT producers now represent about one-fifth of worldwide ICT production. The industry ranks with such traditional pillars of the European economy as

the pharmaceutical and automotive industries. Moreover, most current indications are that the growth trend has returned (EITO, 2004).

The state of the industry notwithstanding, one of the major concerns for policy-makers in the European Union (EU) has always been the persistent wide variation between member states with respect both to the production of ICT goods and services and to the distribution of ICT application capabilities. Several European countries are situated at the forefront of ICT development and application, but most have much less prominent positions with some lagging significantly behind the European average.

Although wrapped in the discourse of open markets, European policy historically (and somewhat curiously) has regarded ICT as having some of the characteristics of “merit goods”, i.e. goods whose socially optimal levels of production and consumption may not be met by the market alone (Stiglitz, 1988). In the European case, however, the “merit” element has more to do with capability building and with the distribution of benefits than necessarily with failure of the market to provide ICT goods (David *et al.*, 1995)[1]. Similar perspectives are shared by most member states, thus setting up a potential “subsidiarity” dilemma as to which policy actions might best be pursued at which administrative level[2]. Especially with the recent accession of ten new member states (most of them “transition” economies), the goal of encouraging reasonable parity in ICT production and use amidst such social and economic diversity presents arguably a much more significant problem for European policy makers than it does elsewhere.

One of the main objectives of the recent EU Lisbon Strategy was to stimulate levels of ICT production and adoption across the member states. But the recent report by the High Level Group chaired by Wim Kok indicates in strong terms that this goal is far from being met (Kok, 2004). The Kok group is sanguine that with greater political commitment such a goal could be met eventually. However, many of the observations that follow in this paper suggest that the scope for policy action at the European level may always have been much narrower than the High Level Group assumed.

Indeed, at present there is a limited amount that can be accomplished at the European level with regard to ICT industry policy. Beyond the EU Research Frameworks – mainly in the Information Society Technologies (IST) program – most of the scope for applied policy initiatives to stimulate industry competitiveness remains in the domain of national governments. Nevertheless, national government actions are restrained in that the EU member states are subject to State Aid rules, which restrict outright subsidy of domestic industries[3].

Moreover, the presence of a European level of industrial policy complicates the national policy environment significantly. For example (subsidiarity rules notwithstanding), it is not clear at this point to what extent policies and policy-driven applied initiatives for the ICT industries that formerly were pursued at the national level may have been transferred to the European level. Amidst this uncertainty, it is an open question whether national policies have evolved in any coherent common directions or had any notable success.

This paper is based on the findings of a study undertaken by the authors in 2004 for the European Commission[4]. The overall goal of the study was to ascertain the extent and variety of national policy initiatives in support of ICT industry competitiveness amidst the increasing complexities of a multi-layered European policy environment and concerns about the continued economic performance of the ICT producer industries. The objective was to identify aspects of these policies that appeared to be having positive effects on the competitiveness of domestic producers of ICT goods and services and that may be transferable to other member states or to the European level.

In the end, the study did not identify unequivocally any individual policy successes that could be offered up as models. Contrary to expectations, especially given the high profile of ICT in most national economic development strategies, a rather modest amount of policy aimed specifically at ICT producers was encountered. Instead of examples of good and bad policy practice, we encountered a situation in overall transition. Accordingly, we will focus

this paper upon the emerging dynamics of ICT policy-making at the level of the individual EU member state and refrain from country comparisons except for purposes of illustration.

Thus, we have four simple objectives. First, we will discuss the problem of doing multi-country assessments of industries whose characteristics vary widely from location to location and outline how we approached this problem. Second, we will synthesize and discuss the findings of the study, thus presenting an overview of the current environment for national ICT policy in Europe. Third, we will identify some common factors that on the basis of our findings seem likely to be associated with policy success or failure. Lastly, we will assess some of the implications from our study that may be relevant in planning future policies, both in Europe and elsewhere.

Description and orientation of the study

Most of the recent attention of ICT policy analysts has tended to focus on demand-side initiatives. This is largely because many of the most high profile ICT policies (e.g. broadband roll-out schemes, community access programs, e-commerce stimulation initiatives, on-line government services etc.) are oriented principally to demand creation and/or aggregation, particularly at national and regional levels. The Lisbon “eEurope” agenda blends infrastructure “push” and service “pull” elements, but most EU and national programs do not invest in infrastructure as such, except in limited “test bed” contexts which themselves are mainly aimed at stimulating service demand[5].

In order to redress this imbalance, our study focused instead on ICT producer goods. We employed the OECD definition of the ICT producer “sector” as a combination of manufacturing and services industries whose output is oriented primarily to the capture, processing, transmission and display of digital information. This includes the manufacture of computer and telecommunications equipment, industrial process equipment and consumer electronic goods, as well as the provision of computer and telecommunications services and packaged software (OECD, 2002b).

“Competitiveness” was defined broadly in terms of the ability of a firm to bring products to market, to acquire and/or increase market share and to sustain products in international markets. By the strictest definition, a product is competitive only if it achieves these goals without market distortions (like subsidies)[6]. It is obvious, however, that in many cases “competitiveness” involves various countervailing measures by governments – research and development (R&D) subsidies being a prime example. Indeed, reducing competitiveness to price and quality factors alone would admit no direct role for governments and make nonsense out of any policy initiative aimed at competitiveness. Thus, we adopted a pragmatic position which accepted that governments could play a role in competitiveness, not just in terms of creating overall favorable macroeconomic conditions, but also by intervening in more targeted ways to support key industries of structural importance to their economies.

We adopted the producer goods focus in order to orient the study towards supply-side policies whose explicit purpose is to stimulate the competitiveness of domestic ICT producers. This orientation is significant because the effects of demand-side policies on innovation and production are at best indirect and the policy objectives are not always framed in terms of the competitiveness of domestic ICT producers. While acknowledging that many demand-side policies have supply-side motivations, the net effect of many forms of ICT demand stimulation can be to attract imports rather than to stimulate domestic production. Our purpose was to explore if and how national governments in Europe had been successful in using policy to stimulate the competitiveness of domestic ICT producers.

A framework for assessing national policies

The study focused upon the so-called EU-15 countries, i.e. encompassing all of the EU member states prior to the inclusion of ten new members, which occurred in 2004[7]. The study team examined hundreds of examples of national and regional ICT-related initiatives that had been implemented in the EU-15 between 1999 and 2004. These initiatives were

identified through desk research and through direct consultations with government ministries and agencies in the EU-15 countries.

Our first goal was to select a representative range of policies in the EU-15 that had generated funded initiatives (i.e. programs, agencies, facilities etc.) specifically in order to boost the competitiveness of domestic ICT producer goods industries. This resulted in a sample of 176 initiatives from across the EU-15. In selecting the sample of initiatives for detailed study, we were careful to filter out initiatives that could not be classified primarily as industry policy. Our strategy was to eliminate initiatives that might well have an effect upon domestic ICT sectors but that were not aimed specifically at increasing the competitiveness of a sector or product group as such. Examples include R&D funding through public procurement contracts. This could have a high influence on ICT industry competitiveness, but this result is not an outcome of ICT sector policy as such, but rather of defense, education, employment or public works policies, among many others.

The core information concerning the characteristics and outcomes of these initiatives was obtained through a structured information-gathering instrument supplemented by extensive interviews with government officials and industry participants in the initiatives. In principle, the ICT industries could be supported with a wide range of policies, but our background research indicated that the most common policy instruments were oriented to innovation policy, human capital policy, fiscal and tax policy and policies to influence the investment climate (basically inward investment policies). By far most of the policies identified in the desk research phase were innovation policies.

Once the sample group was chosen, each initiative was assessed according to a common set of criteria, which explored the policy at three phases of its lifecycle: design, implementation and outcome. The scheme of criteria is summarized in Table I. Interviews with stakeholders in the policy initiatives were conducted according to this scheme. Where possible, the “outcome” phase was elaborated with information from published program evaluation data. However, as relatively few of the initiatives in our sample actually had undergone formal evaluation, the primary source of information about the impacts of the initiatives on competitiveness was gained through interviews with stakeholders. Every attempt was made to balance government views on these impacts with industry views.

The information was written up in the form of detailed case studies for each country in the EU-15. The case study information was then assessed within an analytical framework that classifies domestic policy environments in relation to the characteristics of ICT production in various EU countries.

Wide discrepancies between EU countries regarding ICT production and application make comparisons notoriously difficult. This is especially problematical in that for any given country, the index of ICT production seldom corresponds in any direct way to the overall

Table I Policy assessment criteria	
<i>Policy Phase</i>	<i>Policy assessment criteria</i>
Design	Necessary as determined in consultation with key actors and interests (including prior identification of likely direct and indirect impacts) Achievable in terms of the practicality of goal definition and instrument selection (including financial modalities)
Implementation	Manageable in that the policy can be adjusted quickly and that the costs of administering the policy and its initiatives do not outweigh the benefits Measurable such that performance indicators are built-in to the policy at the development stage Connectable such that the policy enables domestic suppliers to interact in the ICT sector globally and to exploit key markets
Outcome	Additional in terms of impacts that would not have occurred (or been unlikely to have occurred to the same extent) through other means

socio-economic indexes. Some EU countries, like Austria or Denmark, have very high levels of domestic and industrial ICT penetration, but are not otherwise significant as producers of ICT goods.

Although our study was not about making national comparisons as such, it was necessary to examine the various European national policy environments in a contextual framework that accounted for different overall levels and types of engagement with the ICT industry. The problem for comparing policies in the EU Member States is that different countries and regions can have fundamentally different structural relationships with the ICT industry. We speculated that the type of relationship could determine the choice of policy and, thus, that the criteria for assessing policy effectiveness would have to be adjusted accordingly.

To account for contextual differences, the EU15 member states were classified into three basic groups[8]:

1. *Independents*. States with a significant and established domestic ICT producer segment that is capable of developing and/or providing most ICT product requirements and that is a major supplier in both domestic and export markets. Countries in this group will have domestic ICT firms that are significant players in a range of global markets. Finland, France, Germany, Italy, The Netherlands, Sweden and the UK belong to this group.
2. *Intermediates*. States that are mainly importers of ICT goods and services (particularly goods), but that otherwise are substantial recipients of ICT inward investment involving high levels of domestic value-added. Countries in this group will have significant independent ICT production and export capabilities in selected ICT product/service areas. Austria, Belgium, Denmark, Ireland and Spain fall into this group.
3. *Dependents*. States that are mainly importers of ICT goods and services (particularly goods) and that receive mainly lower value-added ICT inward investment (manufacture rather than design). Countries in this group will have limited or no significant independent ICT production and export capabilities. Greece, Luxemburg and Portugal belong to this group.

These classifications are useful in orienting the analysis of domestic policies to national conditions and contexts. The same basic classification scheme could also be applied at the regional or local levels, e.g. amongst the German *Länder*, the English counties or the French *départements*.

But the real value of this classification is that it can be used to construct hypotheses about how policy can interact in different national circumstances. It could be argued, for example, that many of the countries in the independent group could deploy a wide variety of policy instruments with relatively even chances of success. In contrast, the generally higher proportion of imports and inward investment in the structure of the ICT industry in intermediate countries could make many policy instruments generally less effective for enhancing the competitiveness of the indigenous ICT sector because of the heightened possibility that the benefits would be captured by importers and domestic subsidiaries of off-shore companies.

Thus, we could expect that the policy tools with the highest intrinsic performance potential for dependent countries might well lie mainly in the field of innovation infrastructure and human capital development (especially entrepreneurship and technical skills). In these countries, available R&D funding is likely to be small relative to requirements to increase the international competitiveness of domestic ICT producers and the risk of benefit capture by importers is especially high. We might also expect that given the still significant merit goods perception that surrounds the ICT producer sector, we should expect to see substantial targeting of national policy initiatives specifically to improving competitiveness in this sector.

Thus, we oriented our research and analysis generally to the following hypotheses, which were based upon an assessment of probable asymmetries (like the above) in the policy goals in the different groupings, but also upon estimations of the success potential of particular policy portfolios in the different groups:

- H1. National and regional policies in support of the competitiveness of the ICT sector are shaped by industry composition in general and by the prevailing modes of political organization.
- H2. Policies in the independent group will be aimed mainly at enhancing the competitiveness of an already significant industry.
- H3. Policies in the intermediate and dependent groups are more likely to focus on building up the ICT industries.
- H4. Policy portfolios in all groups are likely to be dominated by initiatives that are targeted specifically at ICT producers.

Synthesis of findings

ICT sector policy modalities

Maintaining a strict producer goods orientation throughout the study led directly to our first obvious finding, which was that relatively few initiatives aimed specifically at ICT producers could be identified unambiguously. Indeed, the major focus of most ICT policy throughout the member states is to stimulate and/or aggregate the demand for ICT products and services and not to support the competitiveness of ICT producers directly. This was especially true at the regional level, where ICT policies typically were tied to broad regional development policies.

Furthermore, in the supply-side initiatives that could be identified, there was ambiguity as to what constituted a strictly national initiative. The obvious example concerns participation in the EUREKA program[9]. Although approved and sanctioned at a European level, participants in EUREKA projects are funded directly by national governments. It might be argued that EUREKA is composed of many R&D programs that formerly were or would have been funded as national initiatives. However, the internationally collaborative nature of EUREKA sets its projects apart from what normally would be pursued at national levels. It is clear that this program would demand a different level and method of analysis than would be appropriate for policies that have a strictly national dimension. Thus, we eliminated EUREKA projects from the scope of this study.

A more difficult problem was that many purely national initiatives that clearly were significant to domestic ICT producers were not directed only at one industry. Indeed, we could identify three main policy modalities that were all relevant to ICT producer sector initiatives:

- vertical initiatives have an exclusive orientation to the ICT industry;
- quasi-horizontal initiatives are oriented to the ICT industry as part of a cross-industry innovation framework; and
- horizontal initiatives are available to any industry on the same terms.

Virtually all of the policy initiatives in our sample were of the horizontal and quasi-horizontal type that spanned sector boundaries. Many were aimed at integrating ICT goods and services into various social and industrial contexts. This was perhaps not surprising given the intermediate goods characteristics of ICT, but the almost complete lack of vertical initiatives, especially in the intermediate and dependent country groups, was unexpected.

Table II summarizes our own qualitative assessment of the policy modalities – vertical, quasi-horizontal or horizontal – that could be identified in the national and regional policy portfolios, broken down according to our independent, intermediate and dependent groupings. Perhaps the most striking overall feature of the table is that there was unambiguous evidence of vertical policy activity only in regard to direct R&D funding in the independent country group. Moreover, even here, it is clear that this form of policy is giving way to more horizontal approaches.

Most of the policy initiatives we observed that were relevant to ICT producers were directed not at them specifically but at the competitiveness of the economy as a whole. In this context, ICT was regarded only as one of many contributors to competitiveness. On the whole,

Table II Distribution of policy modalities per country group and policy type

Policy types		Country groups		
		Independents	Intermediates	Dependents
Innovation policy	Direct R&D funding	V	Q	H
	Technology transfer, partnerships and networking	H	Q	Q
Human capital policy	Provision of data, market analysis and supporting studies	H	H	Q
	Incubators and innovation clusters	H	H	Q
	Skills and training initiatives specific to the ICT sector	H	Q	Q
	Employment policy	H		
Financial policy and investment climate	Fiscal incentives (e.g. tax credits, VC schemes, deferrals)	H	H	
	Non-fiscal inward investment support (e.g. relocation incentives, facility and infrastructure subsidies)	H	H	H
	Trade support and export market stimulation	H	H	

national governments were found to view ICT more as a general tool for economic development rather than as a sector that needs specific support measures.

Ireland and the UK demonstrate interesting polarities in the emerging horizontal dynamics of national ICT sector policy. The Irish policy that has attracted so much ICT activity (mostly software) and transformed Ireland in only a few years into one of the leading software exporters in the world, is essentially a national economic development and employment strategy that is open to any sector. Indeed, we were initially of two minds as to whether Irish policy, which is built almost exclusively on foreign direct investment, qualified as ICT sector policy at all. What orients the policy to ICT is the almost total domination of the scheme by the ICT industry. In effect, the Irish initiative is oriented to ICT producers by default.

The UK case is very different, reflecting more a particular philosophy of industry support. UK programs are completely horizontal and concentrate much more on supporting overall industry competitiveness than on supporting any particular sector. Moreover, technology development assistance is available mostly in the form of technology transfer programs that seek to link industry with basic and applied research in universities. Thus, although within such programs as LINK and the Faraday Partnerships there are many consortia specifically concerned with ICT producer goods (by the OECD definition), there are similar consortia under the same initiatives that are involved in many other technology and industry segments. Many of these involve the integration of ICT into products not associated with the ICT producer sector as such.

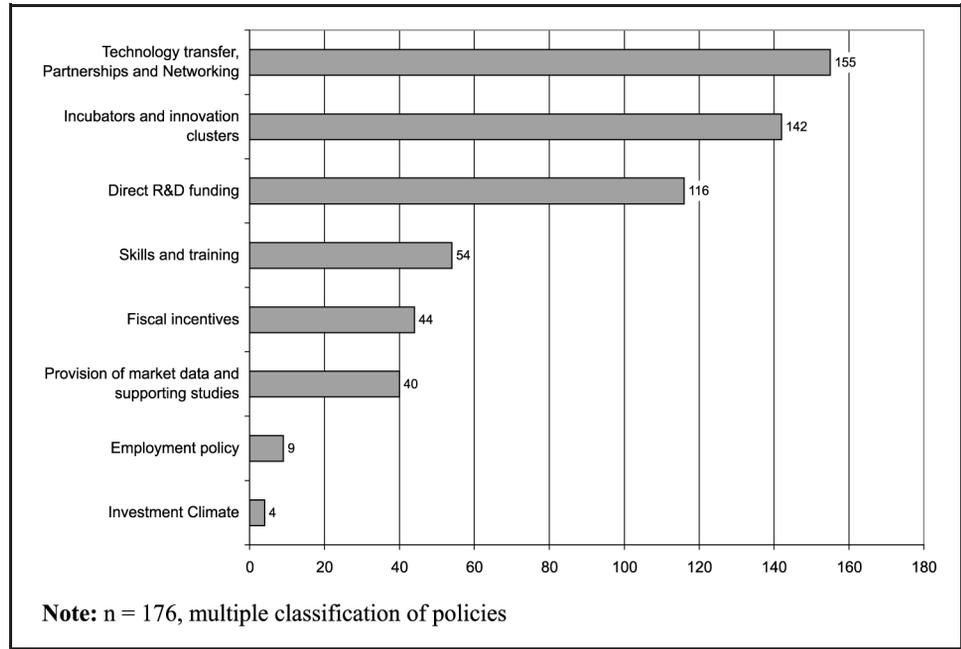
Trends in the implementation of policy types in the EU member states

Figure 1 shows the distribution of our selection of policy initiatives by type. It shows clearly that most initiatives – whether vertical or horizontal in structure – are oriented to the development (R&D), transfer and commercialization of technology. The large emphasis on incubators and clusters reflects at least in part a very substantial SME orientation for many national policies.

Programs concentrating on skills, fiscal incentives and what could be called business and entrepreneurship support follow at some distance. Moreover, some business and entrepreneurship programs often merely accompany R&D programs. Overall, there were very few examples of employment and investment climate policies that were oriented specifically to the needs of ICT producers.

As some of the funding for these initiatives is allocated on a yearly basis whereas other funding is allocated on a multi-year basis, no accurate comparison or breakdown could be

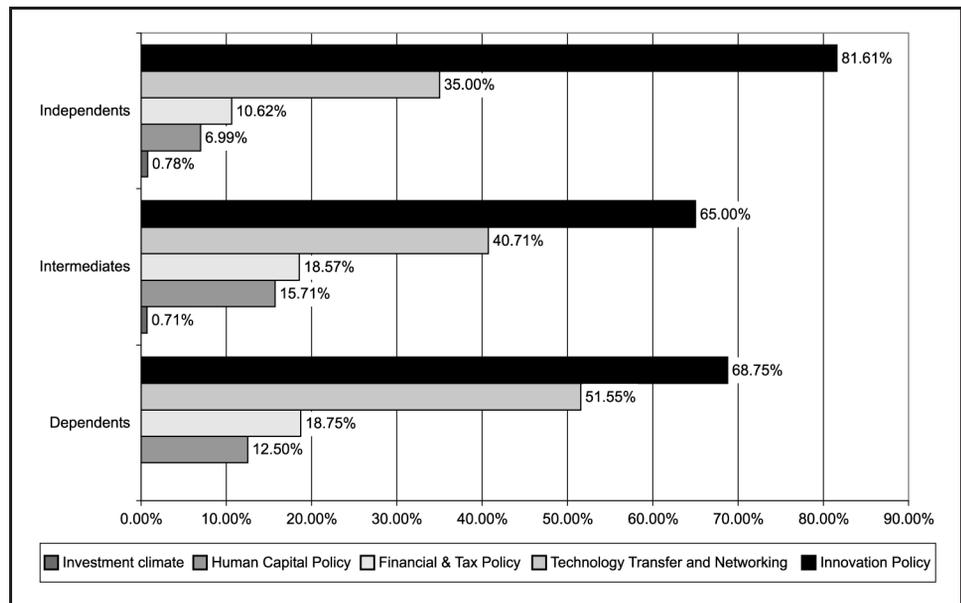
Figure 1 Initiatives by policy type



calculated regarding the distribution of resources among policy types. However, based upon what is known about relative costs for different types of activities, along with rough indications from interviewees regarding levels of funding from different governments for these activities, it is virtually certain that direct R&D funding takes up by far the greatest share of resources (taking into account co-funding).

Figure 2 shows that, in independent countries, more than 80 percent of all initiatives in our sample focused on R&D activity in some form. This proportion was less for the other groups – 65 and 69 percent of the initiatives in intermediate and dependent countries respectively.

Figure 2 Distribution of policy types by country class



But R&D initiatives were clearly dominant in all groups, notwithstanding that in the independent group these initiatives were typically much greater in scope and budget (in real as well as relative terms).

In intermediate and dependent countries, however, policy instruments for supporting technology transfer and co-operation were of greater combined importance – constituting, respectively, 41 and 52 percent of activities overall in the intermediate and dependent groups as compared to 35 percent of the activities in the independent group. This indicates a relatively greater emphasis on improving capabilities and creating partnership and networking synergies in the non-independent groups.

Proportionate to the independent group, the dependent and especially the intermediate groups invest considerably more in the development of ICT-related human resources. Initiatives in the dependent and intermediate groups focus, respectively, about 16 and 13 percent on training, as opposed to only 7 percent in the independent group. This might indicate that in countries with a strong, independent ICT sector, human resource issues become a lower policy priority, or merely that training programs relevant to the ICT industry are pursued in other policy domains (e.g. education or employment). Some of the ICT specific skill programs in the independent group were very limited in scope, e.g. directed at social groups with marginal representation in the ICT workplace.

Although few ICT-oriented employment and investment policies were noted overall, such policies formed the core of policy strategies in some countries. This is especially true for investment climate policies, which have assumed a very high profile in Ireland, but have also been applied in Germany (e.g. as the strategy for the “semiconductor region” around Dresden).

A limited regional dimension

Policy-driven programs in support of the ICT sector can be found virtually on all levels to varying extents, from large national programs, to numerous activities on regional and even local levels. However, the center of gravity for policy in support of ICT competitiveness in most European countries lies at the national level. Only in countries like Italy and Germany, which have federated political structures, were significant (i.e. substantially funded) and independent policy programs found at the regional level. At the regional level, sector-specific support policies are generally more frequently designed and implemented as part of broader economic development plans. Furthermore, with the exception of regions in federated countries, most ICT-related activities focus on demand rather than supply.

Discussion of findings

Our hypotheses regarding the relationship between national industry and political structures and policy choices (*H1*) and regarding the possibly different focus of policy in the different country groups (*H2* and *H3*) were confirmed, but by rather small margins.

The political organization of different member states was seen to have major effects on where the resource allocation authority was located; federated states were observed to yield far more control to regions in determining the scale and scope of funded programs. However, regardless of the political level at which they were pursued, most of the initiatives in all of the country groups, were oriented to innovation policies (R&D support, technology transfer and cluster/network formation).

It would appear from our sample that irrespective of the relationship of a country group to the ICT industry as a whole, most European national governments continue to allocate most of the resources in support of ICT producers to innovation-related activities. Nevertheless, most of the initiatives we identified that were oriented mainly to building up the ICT industry (i.e. in areas like skills, technology transfer, incubators and business/entrepreneurial support) were found to be targeted more specifically to ICT producers if they were implemented in the intermediate and dependent groups.

Given that most European governments put great emphasis on the importance of being able to attract inward investment, it is somewhat surprising that more countries (particularly in the

intermediate and dependent groups) did not exploit employment, inward investment, fiscal and non-fiscal policies to a greater extent. Inward investment strategies exist in all country groupings, but no overall preference for this strategy could be found in the independent and dependent group. The clear exception is Ireland, whose industry policy portfolio is structured largely around inward investment. Even including Ireland, however, no inward investment programs were found in any of the countries that were targeted specifically at ICT; all were horizontal initiatives.

We hypothesized also (*H4*) that on the whole policy portfolios would be targeted specifically at ICT producers. Instead, we found that in most policy contexts the position of ICT producers is receding as a target for specific investment by policy programs. We hasten to add that this observation does not imply necessarily a reduced overall spend on ICT-related activities at the national level, merely that policy-driven activities that once may have been mostly associated with ICT producers are now becoming integrated into a much wider scope of industrial policy initiatives.

Whether by design or default (i.e. as more of the ICT specific programs are located at the European level in IST or EUREKA), the primary modes of policy intervention at the national level are becoming more horizontal, increasingly demand oriented activities.

Assessing the performance of ICT sector policies

Assessment of the actual contribution of policy initiatives to ICT sector competitiveness was hindered in that few formal evaluations are undertaken by public authorities. Even where they exist, often evaluations either are not placed in the public domain (in many cases for obvious commercial reasons), or otherwise not designed to show impacts on competitiveness in the first place. Moreover, such success indications as we could locate from published reports or stakeholder interviews yielded no clear indications of any relationship between the extent of policy-making (i.e. the quantity or variety of policies) or the choice of policy instruments and the overall competitiveness of the ICT sector in any given country.

What was clear was that different countries use different approaches, sometimes with relatively even records of success. National approaches were found to be shaped largely by differences in political and administrative structures and by differences in factors like national industry composition as a whole. They also varied according to the composition and structure of national ICT sectors and traditions of interaction between public and private institutions, especially concerning R&D and technology transfer.

In this respect, our findings added granularity to our initial independent-intermediate-dependent classification of countries. Particularly in the independent group, different approaches could be seen to follow from the relative size and diversity of various economies within this grouping. In Finland, for example, where ICT producer goods occupy a very large share of total basic research and R&D activity, policy initiatives tended to be more vertical, focusing explicitly on gaining national competitive advantage through the export of indigenously developed ICT products and services. In countries like the UK and Germany, on the other hand, reflecting their much wider industrial scope, policies tended to be oriented towards increasing the ICT content of national industrial output across-the-board, thus offering the possibility of boosting ICT producer competitiveness by integrating their products into key markets.

Nevertheless, in the light of our findings overall, three closely related factors emerge that appear to increase the probability that policy initiatives will contribute to the competitiveness of ICT producers. These relate mainly to the changing face and role of ICT products and services in industrial contexts and to how policy initiatives do or do not reflect these changes. Because of the lack of formal evidence from evaluations, we cannot indicate the extent to which any of these factors has improved the productivity of individual policy initiatives. But we can observe that all of the positive indications we received as to where and how policy has affected competitiveness involved various configurations of these factors.

1. Firstly, we detected an overall emerging preference for horizontal approaches. It is possible that such a trend reflects a new “post-boom” awareness that the value created by ICT does not lie only in ICT products, but also in how they are applied. But we must consider also that this trend is an inevitable result of the structure of ICT industry policy in Europe, which is bifurcated between national and EU levels. Significant national top-down technology development and commercialization schemes are problematical under the EU trade rules, whereas national programs centered on basic research and technology transfer are less so. Thus, the scope for conflict between national and EU policy domains is less.
2. Secondly, linkage between policies – either in the same or in complementary administrative jurisdictions – was found often to be more important than the types of policies or policy instruments as such. Horizontal programs were seen to lend themselves better to such linkage than vertical ones. In some cases, moreover, linkage will be the key to capturing value in the longer term. For example, the Irish strategy built upon FDI could easily become hostage to fortune as Irish costs increase relative to those in some of the new EU member states or in other parts of the world. Accordingly, Irish policy links a very open FDI environment to its existing systems for basic research and support of indigenous entrepreneurs. It is significant in this context that distributed regional programs may have a harder time linking up key policy domains than nationally coordinated ones.
3. Thirdly, competitiveness is affected most directly when there is a synthesis of supply and demand-side policies. Still the most effective way to stimulate the competitiveness of domestic producers (particularly indigenous producers) is to stimulate local markets for their products, particularly commercial markets in which ICT goods and services can be embedded.

General conclusions and implications

We conclude from our findings overall that relatively little policy activity in European member state governments is being directed specifically at increasing the competitiveness of ICT producers. On the surface, this is surprising given the historically strong merit goods association for ICT products in national economic strategies. However, for countries that have significant ICT industries, this state of affairs likely reflects evolving boundary issues, both between national and EU levels of administration and between ICT producer and user sectors.

With few significant exceptions, such initiatives as do exist focus mainly on the development and commercialization of technology, rather than on support of underlying factors such as skills or the fiscal and investment climates, which are widely considered to increase competitiveness and indeed to establish the conditions in which competitive industries can develop in the first place. Moreover, the technology focus dominates irrespective of the relative historical strength or weakness of various countries in ICT product markets.

It is clear from the design and orientation of most policy initiatives that many European national governments, especially those that do not have substantial indigenous high value-added ICT producer sectors, still regard acquiring ICT producer goods capabilities as essential to growth. However, the level of resources targeted to this objective is generally small in most countries. This could indicate a problem with scoping and designing policies that would deliver the required levels of resources to the sector in order to achieve growth objectives. But it could also indicate heightened expectations that EU-level programs are now a more efficient method for pursuing many national interests in ICT industry development.

However, in countries with significant indigenous ICT producer sectors, the focus of national programs, although still also oriented mainly to technology, appears in some cases to be shifting decisively from R&D support targeted to specific sectors, to more horizontal programs aimed at overall national competitiveness. The significant exceptions to this trend

are producer countries that have very high concentrations of national scientific and R&D capabilities in the ICT domain, although a pronounced emphasis is emerging on the coordination of ICT with a wide array of application environments. Here too, however, the question looms large as to whether the national or European arena will come to dominate this coordination process.

To the question of whether national ICT sector policies are having an impact on the competitiveness of national ICT producers, the answer on the basis of our findings would have to be that the impact is at best marginal. This does not mean that government actions are not contributing to the competitiveness of these producers, only that directly targeted supply-oriented initiatives are having limited effect. We can expect that national demand generation strategies and particularly public procurement programs will continue to have the kinds of competitiveness impacts that have been observed in the past. This may imply that future supply-oriented policies would be more useful if they concentrated, as many are now beginning to do, on market and technology coordination problems rather than on merit goods objectives.

Notes

1. David *et al.* (1995) point out that, with respect to European R&D programs, only some of the expectations of policy-makers concern benefits that are conventionally economic – involving the exploitation of scale and scope economies and positive network externalities by building-up a common European R&D base. Other expectations relate to broader socio-economic goals like enhancing overall European research capabilities, increasing the profile of European research in international research networks, and contributing generally to European economic development and social cohesion. All of these goals have strong merit goods orientations.
2. The principle of “subsidiarity” in the EU context is that there should be no duplication of resources and services between the national and European levels of administration (European Commission, 1992). Specifically, European programs should not substitute for programs that could or should be funded at national levels.
3. The rules covering state aid are laid out in articles 87-89 of the treaty. These articles do not set out a legal definition of state aid; rather, they set out the principle that no national government measure can have the effect of conferring advantages on domestic enterprises over non-domestic ones. National aid schemes are legal only if approved by the European Commission.
4. See Friedewald *et al.* (2005). The study was a collaborative effort, led by Fraunhofer ISI with the participation of TNO (Delft) and Louis Lengrand & Associates (Versailles). Although the information on which this paper is based was collected for this study, this paper contains only the opinions of the authors and does not in any way reflect the official position of the European Commission on any of the issues raised.
5. The EU plan is set out in European Commission (2002). EU Structural funds may be used for all types of infrastructure investment and we may see increased use of these funds for this purpose in some of the new Member States. However, guidelines for the use of Structural Funds for ICT investments stress the services dimension and focus on bridging inequalities of access to services (European Commission, 2003).
6. The commission's own definition of “competitiveness” is “the ability of an industrial sector to defend and/or gain market share in open, international markets by relying on price and/or the quality of goods. This ability is affected by a wide range of factors, including framework conditions ranging from production costs to technological and organizational innovation, from the regulatory framework to macroeconomic conditions” (European Commission, 2004b).
7. The new member states were omitted primarily because there was no reliable basis on which to assess and compare policies with those in the EU-15. Most of the new member states have no history of policy-making in this domain, making it impossible to detect and assess trends on the same basis as the EU-15.
8. These groupings correspond roughly to the national GDP contribution if ICT producers as determined by OECD estimates (OECD, 2002a). However, the classification also blends in more qualitative criteria such as the significance of national ICT producers in the ICT industry globally and

the degree to which ICT production is concentrated in domestic firms (as opposed to inwardly investing foreign firms).

9. The main structural difference between the Information Society Technologies (IST) program and EUREKA is that IST is funded centrally by the European Commission (through the Information Society Directorate General) whereas EUREKA projects are funded directly by national governments. However, to qualify for state funding, all EUREKA projects must be approved for a EUREKA "label" according to criteria that remove state aid restrictions for internationally cooperative R&D projects.

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