

Assessing national policies to support software in Europe

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Abstract

Purpose – *Software and software-based services (SSBS) are a major domain of the European ICT industry and are recognised as a key element in developing the information society. This article aims to shed light on the various strategies, policies and activities pursued by the EU and its member states.*

Design/methodology/approach – *The article is based on a survey of national programmes that are aimed specifically or in substantial part at the software sector. This analysis and assessment usually faces two challenges: unlike other technologies that have the same significance and/or the same attractiveness, the SSBS industry is a very dynamic one, due to several specific characteristics; and there are increasing inter-dependencies between the European and national levels as well as between supply-side and demand-side policies, which require a more detailed analysis of the different national policies for the EU member states. Therefore a comparative analytical framework is used that takes account of the different composition and structure of the SSBS industries in EU member states.*

Findings – *The analysis shows that there are still great differences among the EU member states, but in general there is relatively little activity in European member state governments targeted specifically at fostering SSBS producers. However, as a result of the EU activities virtually all member states have implemented policies to foster the development towards an information society.*

Originality/value – *The paper highlights that normally these overall policies address and integrate both the supply side as well as the demand side. This is at least an improvement compared to recent years, when adaption, diffusion and application were taken for granted.*

Keywords *Public policy, Innovation, Communications technologies, Computer software, European Union*

Paper type *General review*

The European software and software-based services (SSBS) industry is a major part of the European ICT industry that ranks alongside such traditional pillars of the European economy as the pharmaceutical and automotive industries. In 2006, the sector employed round about 2.75 million people and created a value added of €180bn. Its significance will rise in the coming years. Though these are impressive numbers, the SSBS industry is less developed in Europe than it is in the USA (Reding, 2007). This situation has a clear impact not only on the industry itself but also on the competitiveness and strength of the whole European economy. Several studies showed that Europe is lagging behind in terms of productivity growth due to the low adoption of ICTs in enterprises (van Ark *et al.*, 2003). Recent research, however, shows that software is the key driver to enable all ICT-based productivity growth (Eicher and Strobel, 2009). Therefore strengthening the European SSBS industry is an important part to improve this situation.

1. The software and software based services industry (SSBS)

Traditionally, the software industry is understood as “software products” and “IT services”. This is also reflected in the NACE classification v1.4, where Sector 72, Computer and

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Related Services, covers this segment (Eurostat, 2008). In the recent years, however, the market has undergone a major change.

Although software as an intangible asset has always suffered from the tension of being both product- as well as service-oriented, the convergence of internet and classical software products and IT services as well as new technologies like service-oriented architecture (SOA) led to a new dynamic, which is, among others, reflected in the development of product portfolios and revenue models (see Figure 1). On the one hand, there are at least four basic revenue models. On the other hand, the product portfolio keeps changing due to technological developments. The resulting matrix of relations offers a first overview of a possible structure of the market and industry based on simple business models. A comparison of existing business models, however, shows that they are combinations of different fields. The reason lies in the overlaps resulting from the interaction with distribution and implementation models as in the case of cloud computing as well as with the value added systems arising from the interdependencies of the four aforementioned factors (revenue, distribution and implementation models as well as product portfolio) (Rajala *et al.*, 2003). Although the recently adopted NACE Rev. 2 classification now subsumes most of these economic activities in the new Section J, Information and Communication (Eurostat, 2008), it is not clear if this adjustment is adequate to cover all changes caused by developments like the internet of services or the internet of things.

2. Policies in support of the SSBS Sector

One of the major concerns for policy makers in the European Union has always been the persistent wide variation among member states with respect both to the production of SSBS goods and services and to the distribution of SSBS application capabilities. Several European countries are situated at the forefront of SSBS developments and applications, but most have much less prominent positions and some are lagging significantly behind the European average. This situation is even more complex because of the fact that in most of the member states there is no clear differentiation in terms of policies held between the ICT industry in general and the SSBS industry in particular.

Figure 1 Revenue-product matrix

Revenue model Product portfolio Examples	License/ maintenance	IT services	Paid web base	Advertisement
Systems infrastructure software PC or server operating systems; network management; etc.	✓	✓	✓	✓
Tools DBMS; middleware; SE tools; etc.	✓	✓	✓	✓
Application software Office software; enterprise software; individual software; etc.	✓	✓	✓	✓
Games Video games (consoles); web- based games; etc.	✓	✗	✓	✓
IT infrastructure related	✗	✓	✓	✓

Source: Giron *et al.* (2009)

Although wrapped in the discourse of open markets, European policy historically (and somewhat curiously) has regarded ICTs in general 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). Within this development, the support of the SSBS sector has been a neglected field for a long time. In the 1970s and 1980s the support focused mostly on the ICT hardware sector and in a wider sense on the ICT systems sector. Software and software-based services have gained in importance only step-by-step since the mid-1980s (Coppey, 2004). Boosted by the dotcom boom of the 1990s, the SSBS finally became a more separated part within the ICT industry. In the European case, however, the “merit” element has more to do with capability building and with the distribution of benefits than necessarily with a failure of the market to provide ICT goods (David *et al.*, 1995). Similar perspectives are shared by most member states, thus setting up a potential “subsidiarity” dilemma as to which policy actions might best be pursued and at which administrative level (European Commission, 2002). Especially with the recent accession of 12 new member states, the goal of encouraging reasonable parity in ICTs and especially in SSBS production and use amidst such social and economic diversity presents arguably a much more significant problem for European policy makers than it does elsewhere.

Indeed, in earlier times there was a limited amount that could be accomplished at the European level with regard to ICT industrial policy. Beyond the EU Research Frameworks, most of the scope for applied policy initiatives to stimulate industry competitiveness remained 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[1]. This situation has changed again in recent years with the re-emergence of industrial policy at the EU level, which is marked by the 2002 Communication on *Industrial Policy in an Enlarged Europe* (European Commission, 2002) and the following implementation of a new industrial policy framework (European Commission, 2005b), which includes ICTs and therefore SSBS as one field of action. This is accompanied by an ongoing review of the state aid rules (European Commission, 2004).

This presence of an industrial policy at a European level complicates the national policy environment significantly. For example (subsidiary 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 or will be transferred to the European level. Amidst this uncertainty, it is an open question whether national policies have evolved in a coherent common direction and/or whether they had any notable success. A clear sign for these complex interdependencies is the fact that most EU member states now pursue a national Information Society (IS) policy. These policies derive from, or at least refer to, the i2010 strategy of the EU, but still depend on the industrial as well as political structure of each member state’s individual shape and foci. Normally, these overall policies address and integrate both the supply side (i.e. ICT or SSBS R&D or industry programmes) as well as the demand side (i.e. e-skills for users, broadband availability).

While these considerations only reflect the historical and organizational problems of policies in support of the SSBS sector in Europe, there is also a set of problems that software itself presents to every policy maker. On the one hand, software and software-based services seem to be a relatively low-investment industry with high growth rates and therefore an interesting field of development for many countries. On the other hand, SSBS has become a crucial, and beyond that, a critical element for businesses and administrations worldwide, i.e. software (production, usage, and maintenance) has become a major factor of cost for administrations as well as for businesses all along the value chain from development, production and distribution to maintenance for all goods and services. Unlike other technologies with a similar significance, the SSBS industry is a very dynamic one due to the following specific social, economic and technological characteristics (Tessler *et al.*, 2003):

- The differentiation of the industry into various segments (as described in our definition), each of them with own sub-markets, actors, but also with fluid borders among them.

- The fact that new software technologies and applications are often built on top of existing software “infrastructures”. Therefore there is a need for interoperability, which is often insufficiently implemented.
- The skills required in each segment and layer have a very broad scope and vary extremely, so that it is difficult to address the needs of them all.
- The absence of cost-intensive production processes and at the same time low development costs, which can rapidly increase in later stages. This creates a very fluid structure in the beginning, but as soon as the structures are stabilised it is hard to change.
- Most of the successful countries are only specialised in one segment, for example Japan in games, India in outsourcing services, Israel in exporting technologies and Germany in embedded systems.

This list is not exhaustive and can be easily extended, though it is misleading to conclude a uniqueness of the SSBS sector. The peculiarity, not the uniqueness of the SSBS industry, is in the number of these characteristics and especially in their dynamic interaction. Together with the aforementioned tension between product or service, this situation resulted into a different business and work culture as in other more classical industries like mechanical engineering. The resulting volatile structure of the sector brings policy makers in face with a number of problems. In countries that already have a specialisation in a segment there is a tension between supporting this specialisation and simultaneously addressing emerging developments, which potentially can harm them, whereas in other countries the tension is between building up general infrastructure and specialising on promising fields. Furthermore, all countries are faced with the problem that software as described above gained significantly in importance for all other industries. This creates a situation where these industries become more and more influenced by the dynamic developments of the SSBS sector (Eicher and Strobel, 2009). As a result, policies in support of SSBS and ICT sectors have to serve various, often contradictory aims in a volatile, risky and highly dynamic environment. This may also explain the absence of theory-based approaches in contrast to other fields of technology policy.

The analysis that follows in this paper has three main objectives. First, we will shortly discuss the problem of making a multi-country assessment of industries whose characteristics vary widely from location to location and make an outline to the research framework. Second, we will present a synthesis of characteristics of EU member state policies in support of the SSBS sector. Third, we will present analyses of policies from selected EU member states in these areas. The empirical basis for our analysis was documents on national policy initiatives and support measures collected and presented by ERAWATCH[2] and INNO-Policy TrendChart[3]. This information was complemented and updated by a survey among the ERAWATCH/PolicyTrend country correspondents and government officials.

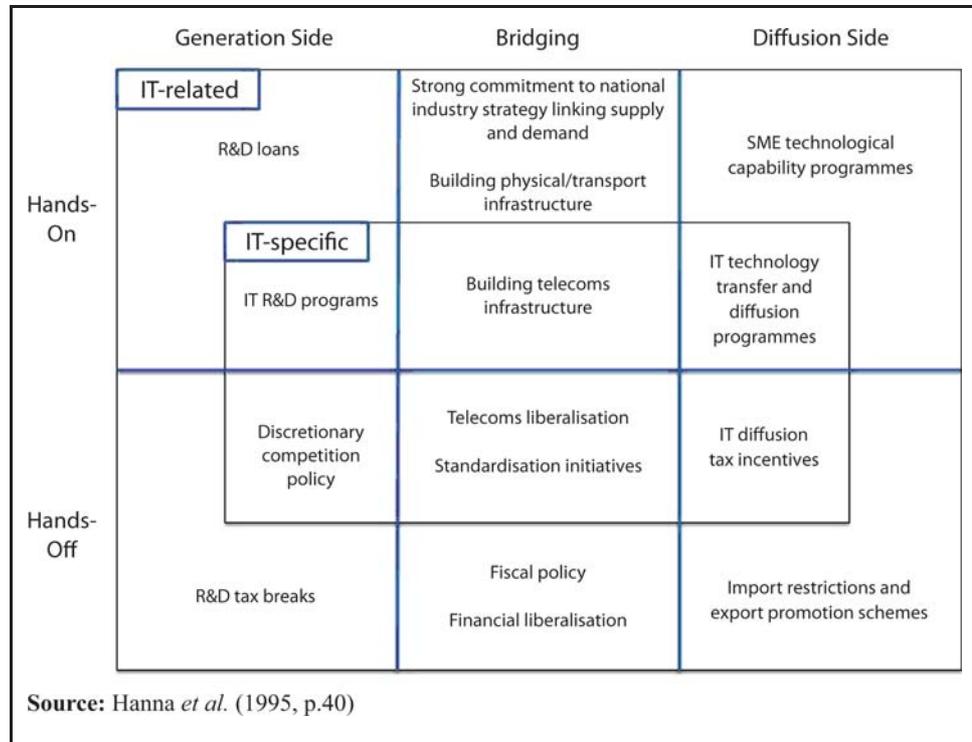
3. Overview of the policy areas covered

The first and most obvious result of our analysis was that while all EU member states have developed their own information society (IS) strategy in response to the EU i2010 initiative, no EU member state has a dedicated strategy for the SSBS sector. Instead, one finds a broad range of integrated IS programmes including various measures and instruments aiming at supporting the supply side as well as the demand side.

In principle, the ICT industries can be supported through a wide range of policies. The best-known and most embracing overview on these policies is provided by the information technology matrix shown in Figure 2.

On the one hand, Hanna *et al.* (1995) differentiate in their taxonomy policies that support the IT production (generation side policies), enhance the IT use (diffusion side policies) or link producers with users (bridging policies). On the other hand, they distinguish hands-on and hands-off policies, depending on the degree of governmental direction. Hands-on policies encourage firms to follow paths in accordance with the government’s strategic priorities, while hands-off policies do not set specific goals. Finally, they also differentiate between

Figure 2 Information Technology Policy Matrix

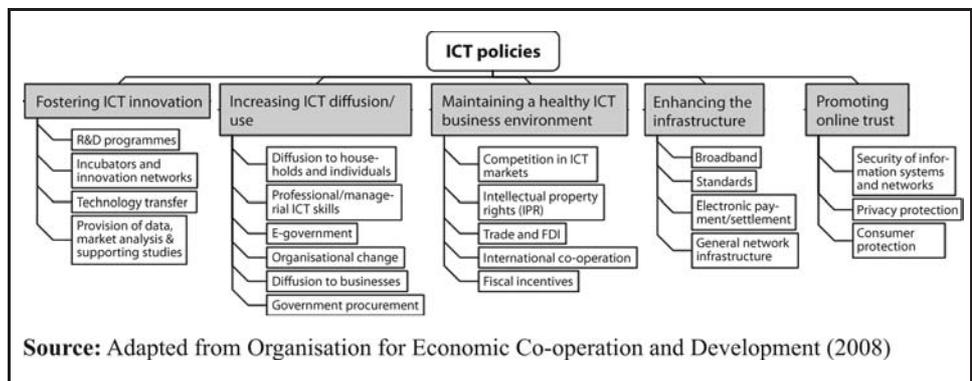


instruments that are specifically directed towards the IT sector (IT-specific) and those that are not aimed at the IT sector alone but nonetheless influence the IT production and use (IT-related).

A more generic, but for the purposes of this study more reasonable approach, is the *OECD ICT Policy Framework*, which is an outcome of the OECD's *Information Technology Outlook* policy development research (Organisation for Economic Co-operation and Development, 2008) (see Figure 3).

Recent research (e.g. Hassanlou *et al.*, 2009), as well as our own background research, indicates that the most common policy instruments aim at fostering innovation, increasing diffusion and maintaining a healthy business environment (basically inward investment policies). By far, most of the policies identified are innovation (R&D) policies.

Figure 3 Taxonomy of ICT policies



4. Classification of countries

In general, wide discrepancies between EU countries regarding ICT and SSBS production and application make comparisons notoriously difficult. Some EU countries have very high levels of domestic and industrial ICT, and especially SSBS penetration, but are not otherwise significant as producers of ICT and software products and services. 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 the different levels and types of engagement as well as the different structural relationships within the SSBS industry. Therefore, we took several indicators into account. Apart from the statistical indicators, like share of NACE 72 on GDP or employment, we also used indicators from:

- the i2010 interim review, such as internet usage, e-business and e-government deployment;
- economic indicators, like the ICT sector growth (European Commission, 2008) from the Europe INNOVA ICT Sectoral Innovation System report;
- indicators for innovation performance (Wintjens and Dunnewijk, 2008); and
- indicators for R&D spending from a report on R&D investments in ICTs (Lindmark *et al.*, 2008).

Moreover, the classification also blends in more qualitative criteria such as the significance of national SSBS producers in the SSBS industry globally and the degree to which SSBS production is concentrated in domestic firms (as opposed to inward investing foreign firms). To account for the resulting contextual differences, the EU member states were classified into different groups. The value of this classification, which was adapted from earlier research (Friedewald *et al.*, 2005), is that it can be used to construct hypotheses about how policy can interact in different national circumstances. The three groups are:

1. *Independents* – States with a significant and established domestic ICT and SSBS producer segment that is capable of developing and/or providing most product and service requirements and that is a major supplier in both domestic and export markets. Countries in this group have domestic firms that are significant players in a range of global markets. The SSBS/ICT sector has a significant R&D intensity and a high innovation performance. High coverage with broadband infrastructure exists and internet usage within society, government and business is widespread.
2. *Intermediates* – States that are mainly importers of ICT and SSBS products and services (particularly goods), but that are otherwise substantial recipients of inward investment involving high levels of domestic value-added. Countries in this group have significant independent production and export capabilities in selected ICT and SSBS product/service areas. The SSBS/ICT sector has a significant R&D intensity and/or a high innovation performance. Coverage with broadband infrastructure exists and internet and ICT usage within society, government and business is widespread.
3. *Dependents* – States that are mainly importers of ICT and SSBS products and services (particularly goods) and that receive mainly lower value-added ICT inward investment (manufacture rather than design). Countries in this group have limited or no significant independent ICT and SSBS production and export capabilities. The states have, in general, lower broadband coverage and also usage of internet and ICT within society, government and business differs strongly.

Using these definitions and synthesising the known market characteristics, the EU member states can be allocated roughly according to the scheme shown in Table I.

5. The European SBSS policy landscape

5.1 A shift in European Policy – the i2010 initiative

An important ICT policy initiative at the European level was the adoption of the i2010 strategy in late 2005, which combined the experiences made in the earlier “eEurope 2005”

Table 1 Classification of EU member states

<i>Independents</i>	<i>Intermediates</i>	<i>Dependents</i>
Finland	Austria	Bulgaria
France	Belgium	Cyprus
Germany	Denmark	Czech Republic
Italy	Ireland	Estonia
The Netherlands	Spain	Greece
Sweden		Hungary
UK		Latvia
		Lithuania
		Luxemburg
		Malta
		Poland
		Portugal
		Romania
		Slovak Republic
		Slovenia

programme with the goals of the Lisbon agenda. Due to the economic relevance of ICT and SSBS in particular, the i2010 strategy has become a key element of the Lisbon strategy itself. As a result, it has had three major aims (European Commission, 2005a):

1. to create a Single European Information Space, which promotes an open and competitive internal market for information society and media services;
2. to strengthen investment and innovation in ICT research; and
3. to support inclusion, better public services and quality of life through the use of ICT.

The Directorate General for Information Society and Media (DG INFSO) and the Directorate General for Enterprises and Industry (DG ENTR) have initiated numerous activities to achieve these goals, including regulation, research funding, pilot projects, promotion activities and partnerships with stakeholders. Important examples are the promotion of the “internet of things” and the “future internet”, including the deployment of the Internet Protocol Version 6 (IPv6). The strongest focus, however, is on ICT research and development with instruments such as the European Technology Platforms, the Joint Technology Initiatives and especially the Seventh Framework Programme for Research and Technological Development.

5.2 Analysis of national ICT/SSBS policy approaches

Following the European example, nearly all member states introduced information society programmes, which address mainly the demand side, i.e. promote the development of computer literacy, the deployment of various electronic services like e-business or e-government. To a lesser extent they also support the supply side, i.e. the producers by R&D funding. The focus of the national programmes varies between the different member states. One reason is the different structure and economic strength of the ICT sector in the member states. Another reason is the existence of earlier policies for ICT in different areas like innovation, ICT usage or ICT business climate and the general approach in innovation policy. All this led to a broad variety of national programmes. Another difficulty in researching policies in this area is the tendency to more coordinated and integrated policy approaches. Therefore the results of an initial analysis are not surprising. First of all, no EU member state has a stand-alone policy specifically for the SSBS sector. Second, the two countries – the UK and Ireland – that pursued exclusively horizontal policies for a long time have now also introduced IS programmes. Both countries demonstrate interesting polarities in the emerging dynamics of national ICT sector policy.

The Irish policy of the late 1990s and early 2000s has attracted much foreign investment, especially in the software sector, and in only a few years has transformed Ireland into one of the leading software exporters in the world. The policy was part of a more national economic

development and employment strategy that was open to any sector. It turned out that almost all foreign investment went into the ICT industry, which effectively transformed the development policy into an ICT policy (Sands, 2005). This implicit tendency becomes now explicit in the “Best Connected” strategy, which is a software strategy within the National Development Plan and the new Action Plan for a Knowledge Society (Enterprise Ireland, 2009). The UK has a rather different approach, reflecting more a particular philosophy of industry support. UK programmes are normally completely horizontal and concentrate much more on supporting overall industry competitiveness than on supporting any particular sector. Following the rationale of the i2010 strategy, the UK decided to change this policy approach with the adoption of the “Digital Britain” strategy in June 2009 (Department for Culture, Media and Sport and Department for Business, Innovation and Skills, 2009).

All other member states have a policy agenda that refers directly to the i2010 strategy in form of a coordinated IS strategy or at least policies with a comparable scope. Therefore, classification within this field is quite problematic, since these national policies often combine multiple programmes. They can address or have an impact in many ways. Referring to the taxonomy presented before, it can be said that only the Independents among the EU member states have IS policies with dedicated SSBS programmes. Examples are the VERSO programme in Finland or the THESEUS programme in Germany, which aim at R&D for the internet of services. These countries also often have additional programmes with strong SSBS-related parts (e.g. IT security or embedded systems). On the other hand, it is obvious that most of the countries classified as dependents pursue IS policies without specific SSBS focus. They mostly aim at improving demand-side factors like the availability of broadband or the development of ICT skills. In some cases there are also programmes for improving e-government, e-procurement for public authorities or increasing e-business/-commerce in the private sector, but this has only indirect effects as long as there are no specifications for addressing or at least including local SSBS producers.

Between these two sides there is the group of those countries that pursues IS policies with SSBS-related programmes, but the borderlines on both sides are fuzzy. One example is the Czech Republic, which has established an ICT and Strategic Services programme. Though being open to all industries, it aims at attracting primarily SSBS companies. In general, this group covers most of the intermediates and some independents as well as some dependents. Of particular interest are the cases of the intermediaries that are mostly located in this group, because the reasons to classify them in this way vary strongly. There are cases like Spain with its Ingenio 2010 programme, which includes several sub-programmes with a horizontal character, but a strong emphasis on companies in the ICT and SSBS sectors as a result of the government strategy towards SSBS. Another case is Denmark, which is rated as one of the leading countries in ICT use, but which has no big local ICT and SSBS sector. Therefore, most of the Danish policies are non-sector-specific, horizontal activities, but in well defined niches, where the country has a competitive advantage and selected single initiatives are carried out.

In general, one can observe that in the last years the number of policies directed specifically at ICT or even SSBS producers has increased. Because of the character of SSBS as a basic technology most of the initiatives aim not exclusively at them, but rather at all industries with a high ICT and SSBS intensity. Therefore, it is difficult to classify policies and programmes unambiguously. Indeed, the major focus of most ICT policies in the member states is to stimulate and/or aggregate the demand for ICT and SSBS and not to support the competitiveness of ICT (or even SSBS) producers directly.

Maintaining a strict producer orientation leads directly to the difficulty that many initiatives, which were significant to domestic ICT/Software producers were not directed only at one industry. Indeed, we could identify four main policy modalities that were all relevant to ICT and SSBS producer sector initiatives:

1. vertical initiatives which have exclusive orientation to the ICT sector including programmes specially orientated to the SSBS industry (S);
2. vertical initiatives which have an exclusive orientation to the ICT industry (V);

3. quasi-horizontal initiatives oriented to the SSBS/ICT industry as part of a cross-industry innovation framework (Q); and
4. horizontal initiatives available to any industry on the same terms (H).

Therefore, in a second step we analysed a selected set of representative EU member states out of the three country groups. The aim of this analysis was to identify relevant policies in support of ICT/SSBS corresponding to the taxonomy of the OECD and classify them along the four main policy modalities.

Nearly all of the “dependents” introduced an information society strategy in recent years, albeit with a strong focus on strengthening the demand side. Most notably are measures to increase (broadband) internet access and measures aiming at the improvement of ICT skills in wide sections of the population. Most of these activities were initiated and co-funded by EU structural funds (e.g. in Slovakia) or by international institutions like the World Bank (e.g. in Romania). In general, policies to upgrade the ICT infrastructure are relevant for all industries, not only the ICT or SSBS sector. Moreover, most of the countries have implemented programmes to increase ICT use in businesses. These programmes have a considerable range: on the one hand, there are countries like Slovakia and Greece that aim at modernising existing industries like mechanical engineering by the means of an increased adoption of modern, ICT-based tools in administration and production. Other countries, such as the Czech Republic, put an emphasis on ICT and SSBS producers either by addressing topics related to the SSBS industry or by implementing programmes that are mainly directed towards ICT and SSBS producers. This is also often the case in R&D funding schemes, which include measures that are mainly directed towards producers of ICTs and related fields, but there are no programmes that address SSBS as such in particular. All other initiatives and programmes that are aimed at maintaining a healthy ICT/SSBS business environment, like attracting FDI or providing tax incentives, are horizontal, i.e. they do not address one sector alone. This is surprising given the fact that some countries, like Romania for example, mention the software industry as a possibility to create economic growth because of its low initial investments. Malta is an exception in Europe as the country has already implemented its second national ICT strategy with the clear aim of attracting foreign companies. Similar but often less advanced programmes to improve infrastructure can also be found, as already mentioned, in other countries. However, it is not fully clear if measures to improve the business environment in particular are exclusively directed at the ICT/SSBS sector or they are open to other sectors like the financial services or other high-tech sectors.

It can be summarised that nearly all policies in the dependents group can be characterised as horizontal (H). Only a few countries have within the policy fields of fostering ICT innovations (most notably R&D funding and supporting incubators or networks) and increasing the ICT diffusion, quasi-horizontal programmes. Some of them have such quasi-horizontal policies in the field of maintaining healthy ICT business environment (Malta, for example).

The situation of the intermediate countries is more complex. One characteristic of the countries in this group is that they all have an ICT and partly SSBS sector of considerable size, but the sector is often fragmented. Most of the bigger companies are subsidiaries of multinationals companies that operate not only sales and support services, but also development facilities. Therefore, most of the countries are highly dependent on FDI. The other part of the sector consists of small local, often very innovative companies that are primarily active in the SSBS sector. One thing they all have in common is their strong support of the diffusion of ICTs in all areas by different measures like e-government programmes, delivering e-skills to the work force or the diffusion of ICTs in business, although the level of diffusion is already high in these country as it is stated by the e-readiness ranking (e.g. DK 5, AT 10) (Economist Intelligence Unit, 2009). One example is the use of electronic identification schemes (e-IDs), where many of the Intermediate countries are forerunners in the EU. Another element of their policies is to maintain a general healthy business climate that helps attracting foreign direct investments across all industries, though the implementation/focus differs significantly from country to country. Ireland, for example,

officially follows a strict horizontal policy to attract FDI, but the programmes nearly exclusively attract investments in ICTs and especially in SSBS production by default. Other countries, like Denmark and Austria, have set clear preferences for attracting FDI in high technology sectors, such as biotechnology, medical technology and nanotechnology but also in ICTs with a focus on SSBS. The range of possibilities is even wider when it comes to policies for fostering innovations. On the one hand, Austria and Spain have R&D funding programmes that clearly address high-tech industries. The sub-programmes where each is directed towards a specific sector including ICT/SSBS, are at the borderline between quasi-horizontal and vertical programmes. On the other hand, Ireland and Denmark's R&D support programmes are officially not limited to specific sectors. However, both countries have a clear bias towards ICTs and software.

In general, the group of intermediary countries have an overall focus on horizontal initiatives. As in the dependent countries there is a strong focus on demand side initiatives (such as the upgrade and extension of the ICT infrastructures), but more forcefully than the dependents. In the field of maintaining a healthy business environment, many countries have adopted quasi-horizontal measures, often focusing on ICT/SSBS businesses. There is, however, also a tendency towards more focused policy instruments in the field of fostering innovations by implementing quasi-horizontal programmes, but with nearly vertical character.

The independent countries also pursue a wide range of policies that are difficult to generalise. One main reason is the total size of their economies and especially their ICT and SSBS sectors. As a consequence, there are a lot of initiatives that support these sectors in different ways. In general, there is a wide variety of demand-side oriented horizontal programmes to support the diffusion of ICTs in all sectors (private, business, administration). In some of the countries there are tendencies to enforce the use of open source software (OSS) in the public sector, but these often take place at a regional or local level. In order to provide a healthy business environment, the independent countries clearly pursue horizontal programmes (in contrast to the dependent and intermediate countries). We assume that this can be traced back to the fact that most countries have strong ICT/SSBS (and other high-technology) sectors with a major local actor such as SAP or Nokia. Therefore, it seems that they do not find it necessary to implement quasi-horizontal or even vertical programmes. Within the field of fostering ICT innovations we can also observe a development towards more SSBS focused programmes, coinciding with the development in the other groups and also with developments at the European level. In practice, this is the field with the broadest diversity among the Independent countries. Finland and Germany in particular, have increased the number of SSBS specific R&D funding, while The Netherlands has less of such specialised funding but rather tries to cover the sector as a whole. Each country seems to favour areas where its major national players are active. Most of the other policy sub-types, like technology transfer or Incubators and clusters, are of horizontal nature. Only programmes for providing market data and further analyses are quasi-horizontal since they focus on data about specific high-tech sectors, typically including ICTs. A step further is Finland, which runs an annual report on its software industry, which also allows to identify developments and to set up clear goals as it is done in the VERSO program.

Whether by design or default, the primary modes of policy intervention at the national level are still horizontal and foremost demand oriented activities (see Table II).

Most of the policy initiatives were of the horizontal and quasi-horizontal type and were spanning sector boundaries. Many were aiming at integrating ICT/SSBS goods and services into various social and industrial contexts. This is perhaps not surprising given the intermediate goods characteristic of ICTs. We hasten to add that this observation does not necessarily imply a reduced overall spending on software-related activities at the national level, but 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. In most countries, ICTs and software are now important elements of broader industrial policies and programmes. In some cases (such as Germany or Finland, or even the UK), however, software related issues constitute the central element of these activities.

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

Policy types	Country groups		
	Independents	Intermediates	Dependents
<i>Foster ICT innovation</i>			
R&D funding	S/V	V/Q	H
Technology transfer	H	H	Q
Incubators and innovation clusters	H	Q	Q
Provision of data, market analysis and supporting studies	Q/V	Q	H
<i>Increase ICT diffusion/use</i>			
Professional/managerial ICT skills	H	Q	Q
Diffusion to businesses, households and individuals	H	Q	Q
E-government	H	H	H
<i>Maintaining a healthy ICT business environment</i>			
Fiscal incentives (e.g. tax credits, VC schemes, deferrals)	H	H	H
Trade and FDI	H	Q	Q
<i>Enhancing the infrastructure</i>			
General network infrastructure	H	H	H
Broadband	H	H	H

Notes: S, sector specific; H, horizontal; Q, quasi-horizontal; V, vertical) **Source:** Authors' own research

However, because of the i2010 strategy of the European Commission, we expected changes within national policies. Therefore the rise of vertical programmes in the group of independent countries was no surprise, but the wide lack of vertical initiatives in support of ICTs (V) or the SSBS (S) sector in particular within the intermediate and dependent country groups was unexpected. At least there are some signs within the group of the intermediary countries that this situation is in flux. The focus of ICT/SSBS sectoral policies on R&D funding and other initiatives for fostering innovations seems to mirror developments at the EU level, where a significant amount of resources have been spent on this kind of activities. Nevertheless, most of the initiatives we identified that were oriented towards the building up of the ICT or in particular of the SSBS industry, i.e. in areas like skills, technology transfer, incubators and business/entrepreneurial support, were found to be targeted more specifically at ICT or SSBS producers when they were implemented by 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 many 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 within the intermediary and dependent groups. The clear exception is Ireland, whose industrial policy portfolio is structured largely around inward investment. Even including Ireland, however, no inward investment programmes that targeted specifically ICTs were found in any of the countries. They all were horizontal or, in some exceptions, quasi-horizontal initiatives.

6. The challenge: policies for the future SSBS industry in Europe

Based on the observation that the software sector undergoes major changes (e.g. Sharpe, 2009; Organisation for Economic Co-operation and Development, 2009), the challenge is to develop a future-oriented innovation-driven industrial policy that enables the European SSBS industry to foster innovation, new businesses and markets. Given the current structure and the expected future development of the SSBS industry, the rise of the software-based internet services (SBIS) segment is the most significant development (Giron *et al.*, 2009). It

offers an opportunity to change the structure of the existing SSBS industry that is mainly dominated by American companies as well as to improve the competitiveness of the overall EU economy through a fast adaption of these technologies.

Although most of the relevant issues of software-based internet services (SBIS) and the internet of services are addressed in the Seventh Framework Programme, we were expecting that the EU member states would pick up these developments and start their own policy initiatives and programmes. In real terms, only a few countries have done this yet. There are, however, some notable examples of such programmes, such as the Finnish "Verso" programme, the Austrian "Research, Innovation, Technology – Information Technology" programme with its focus on semantic systems and services, and the German "THESEUS Research Program", with a focus on technologies for the internet of services. Smaller activities include the Danish enforcement of OSS use by state procurement programmes or similar activities like the use of open standards in e-government.

What all activities at the national level of the member states as well as at the EU level have in common is that they are directed at R&D funding, i.e. the development of basic technologies in this field. So far, there are no programmes in excess of this that address the corresponding changes in business like trainings for managers in the SSBS sector, stimulation of investments (seed capital) or similar. In principle, this does not imply a general problem, because most of the initiatives that aim at increasing ICT diffusion like procurement policies, fostering innovations like incubators or maintaining a healthy business environment like fiscal incentives can also be used to speed up the development of emerging technologies. Therefore, only the aims, not the policies themselves, have to be adjusted. However, a problem in this context is that in most EU member states these policies have a low performance for existing technologies. Because of this, it seems unreasonable to believe this will be different in the case of emerging technologies. Another problem is that some of the measures or policies that are necessary to enforce business development have to be implemented at the EU level or even above that, like data protection or the alignment of regulations on services.

Finally, we have to state that only a small number of independents or intermediates that already have a strong SSBS sector or even single SSBS producers launched broader activities in the form of policies or programmes. In contrast to this, it is obvious that most of the dependents did not do so, though many of them count on the SSBS sector as an important area of growth due to its low investment requirements (Tessler *et al.* 2003). It is also not clear to what extent these member states can profit from the ongoing EU programmes. Furthermore, it is clear that recently the programmes have focused on the technological side of the ongoing major changes, while the business side has been neglected. As a result, there is the risk of European firms being at the forefront of technological developments but being unable to commercialise them, a problem inherently associated with the European innovation system. One possibility to change this situation would be the use of demand-side oriented policies like pre-commercial public procurement, such as in the SBIR program in the USA (Wessner, 2004).

Another challenge for developing new policies in support of the development of the SBIS market and industry is the aforementioned re-emergence of industrial policy that came along with the shift towards an innovation-based approach. The most significant change within the framework already mentioned for an industrial policy of the Commission is a matrix-like approach, which combines horizontal policies with sector-specific vertical policies (European Commission, 2005b). This development resulted from the experience of the 1990s, i.e. that pure horizontal policies aiming at the creation of a favourable competition environment varied strongly in their impact among different industries. Therefore, the new integrated approach clusters manufacturing industries into four groups with similar challenges and combines them with seven cross-sector policy initiatives. Furthermore, a set of industry-specific actions like lead markets was identified (Zourek, 2005; European Commission, 2005b). Additionally, the systems of innovation approach, which argued that not the market but system failures are the main reason for a low rate of innovation, gained importance in policy making (Woolthuis *et al.*, 2005). In this understanding, innovation policy

includes all political measures that influence innovation processes, for example the development of new products and process innovations (Chaminade and Edquist, 2009). The consequence is that the development of existing and emerging technologies and industries, which should drive growth and employment, cannot be based on a single industrial policy alone, but needs to be complemented by a broader look at the consistency with other domains of policy (Soete, 2007). This more systemic view, which was incorporated in the Lisbon Strategy, is explicitly formulated and implemented by the policy frameworks of the EU as they are expressed, for instance, in the *Communication on a Broad-based Innovation Strategy* (European Commission, 2006).

Both developments are of particular relevance to the support of the SSBS industry in Europe. This is clearly marked by the report of the ICT Task Force (EU ICT Task Force, 2006). The latter was established as one sector-specific measure of the new industrial policy at the EU level. In this report and in its follow-up, the Commission refers to the Lisbon Strategy as well as to the broad-based innovation strategy, having in mind its systemic nature. The Task Force, which was initiated in the summer of 2006 and consisted of stakeholders from the ICT industry and civil society, published a report in November 2006. The report identifies the major barriers for the competitiveness of the European ICT industry and gives recommendations to improve it. In total, the Task Force identified seven areas, each encompassing several sub-topics. The European Commission took up this document and responded with a follow-up report in 2007 (European Commission, 2007). Referring to the recommendations of the ICT Task Force, the *Staff Working Follow-up Report* documents what activities and initiatives are already ongoing or planned by the services of the European Commission in the different fields. Therefore, the follow up report with its overview on all horizontal and ICT-specific vertical policy actions spans a concrete framework for developing specific measures for the SSBS and especially SBIS industry in Europe.

7. Conclusions

We conclude from our findings that relatively little policy activity in European Member State governments is being directed specifically at fostering SSBS producers, although the number of policies that aim in general at the development of an information society increased since the beginning of the 2000s. It seems that this is also a consequence of the i2010 strategy implemented by European Commission. On the surface this is at least an improvement compared to earlier times, when adoption, diffusion and application of ICTs was taken for granted, although there was always a strong merit goods association for ICT products in national economic strategies. However, this state of affairs is likely to reflect evolving boundary issues, both between national and EU levels of administration and among producers and user sectors.

Nevertheless, the analysis has shown that there are still great differences between the EU member states related to policies in support of the ICT/SSBS sector. While the dependent countries in general focus on horizontal policies, especially on the increase of ICT diffusion and infrastructure programmes as a consequence of the implemented IS programmes, there are different tendencies in the intermediary and independent countries. In these groups of countries the number of vertical initiatives that address the ICT or in particular the SSBS sector has increased. Most interesting is that within the group of intermediaries there is the tendency to implement vertical policies for the ICT and the SSBS sector, in particular, or at least to support existing quasi-horizontal policies aiming at high technology sectors, including ICTs. This is done by implementing single measures in support of single areas of the SSBS sector. The independent countries that have significant software sectors or strong players in these sectors also raised the number of vertical programmes in support of the ICT sector. Recently, there are also some programmes within the ICT policies that directly address the SSBS. At large, this variety of developments coincides with those taking place in Japan and the USA. Large differences exist in comparison to other countries with established or emerging SSBS sectors. Partly, countries like India or Israel pursue horizontal initiatives, which aim at maintaining healthy business environments that are comparable to the ones in the European intermediary countries. In other countries like South Korea,

governments pursue overall information society/economy programmes. Within these different types there are often specific elements like the venture capital in Israel or the focus on specific SSBS sector directed policies in South Korea that are comparable to the variety one sees in Europe.

In the European member states most initiatives that exist in support of the ICT and the SSBS sector in particular mainly focus, with only a few significant exceptions, on the development and the early-stage commercialisation of technology, rather than on the support of underlying factors such as the skills or the creation of the appropriate fiscal and investment climate, which is also considered as critical to competitiveness. Moreover, the technology focus dominates irrespective of the relative historical strength or weakness of various countries in ICTs and particular in SSBS markets. Therefore, it is not a surprise that the few recent initiatives dealing with the major changes in the SSBS sector towards SBIS also only focus on the technological aspects like basic R&D funding. Initiatives that aim at more than early-stage commercialisation, such as those supporting managerial education for people employed in the SSBS sector or pre-commercial procurement, are still missing. Moreover, often possibilities to recognize such changes and their impacts are lacking, because there are no permanent monitoring systems established. Within such a system the assessment of existing policies is only a first step of an overall system analysis. Together with a review of other studies and an analysis of existing systemic failures through stakeholder interviews, this empirical analysis can serve as a basis for further decision making on measures in support of the SBIS market and industry. Additionally, persistent assessment of policies allows the identification of best-practice measures, which could be used for further actions.

However, the implementation of such measures raises a new question regarding the coherence of the new industrial policy framework of the EU. Due to the fact that the ICT sector is one of the sectors under coverage, documents related to it clearly show the limits for actions in support of the SSBS. Therefore, policies in support of SSBS, and especially of the emerging segment of SBIS, have to be very specific, i.e. they have complement or supplement existing horizontal policies or policies in support of the overall ICT sector, or else they have to target areas not yet covered.

Notes

1. The rules covering State Aid are laid out in Articles 107-109 of the Treaty (TFEU).
2. See <http://cordis.europa.eu/erawatch/>
3. See www.proinno-europe.eu/

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