

## **Nurturing Digital Business Ecosystems - European Policy Implications and Experiences**

*Jonathan Sage, Elmar Husmann, Fanuel Dewever  
IBM Business Consulting Services  
Avenue de Woluwe 22, B 1932 Woluwe St. Stevens, Belgium*

**Abstract:** *This paper is based on experiences and concepts developed in the integrated project "Digital Business Ecosystems" funded by the European Commission under the sixth framework programme. We first outline the political case for European public institutions to fund digital business ecosystem development activities and compare that to traditional ICT research as well as structural funding. We then describe how the technology dimension, the social- and business dimension as well as the research dimension are interwoven and evolving in the context of nurturing a digital business ecosystem. This leads to an evolutionary model of engaging with European target regions, local SME communities as well as the Open Source community. We describe the initial set-up of regional catalyst organizations in 3 European pilot regions (Tampere / Finland, West Midlands / UK and Aragon / Spain) as well as the practical experiences and pitfalls from the first engagement phase. In the final section of the paper we explain the integration of new regions, the longterm sustainability perspective and formulate general policy advice for related future initiatives.*

When the European political leaders met in Lisbon in March 2000 to agree on a common strategy to make Europe „the most dynamic and competitive knowledge based economy in the world“ by 2010, their approach to policy implementation and governance held several new premises under the name of the open method of co-ordination (OMC). Among these premises three strike out when it comes to fostering innovation in Europe (Borrás and Jacobsson, 2004): *Firstly* the integration of actions at various levels of governance enabling a better regional grounding and bottom-up emergence. *Secondly* the mobilization of a wide range of actors including public as well as private sector – the later with a specific focus on small to mid-sized companies. *Thirdly* the explicit support for learning that encourages mutual co-operation, exchange of knowledge and mutual correction through peer governance.

In their specific strategy on innovation, the European Commission (2003) pointed out to the importance of information and communication technologies (ICT) in supporting the above given processes as well as the catalyzing role of ICT to enable multiple ways of innovation. Given these underlying policy premises it comes as no surprise that the concept of digital business ecosystems (DBE) resonated very well with European policy objectives and received the status of a strategic focus area in the 6th framework programme (FP6).

In this paper we take a closer look at how the ambitious EU innovation strategy translates into concrete activities at the example of the DBE action area and how the underlying new governance premises of the open method of co-ordination approach were reflected on the project level. From these experiences we derive general policy advice for the design of ICT initiatives in the next framework programme.

## Origins of the digital business ecosystem project

To jump-start the strategic area (see Nachira et al., 2002) a large integrated project under the name of „Digital Business Ecosystem“ (project DBE<sup>1</sup> - see Dini and Nicolai, 2003 and Dini et al., 2005) came to life with a consortium of 20 partners and more than ten million Euros of FP6 funds.

The project DBE has a primary focus on the European software industry – mainly on the large number of small to mid-sized enterprises (SMEs) in this sector. At the heart of the project’s technology development is an embryonic version of a publicly available European infrastructure that would extend the current functionalities of the Internet. The DBE infrastructure holds the promise to help turning a multitude of independent European software components and digital services into a sort of integrated ICT environment – a backbone for the creation of flexible business networks. That infrastructure would not only allow business partners to establish secure digital connections using common or even different software components but also support the prior steps of partner discovery, identification and contracting.

Creating a European technology infrastructure instead of e.g. direct structural funds for the ICT adoption of regional SMEs sounds like a traditional centralized technology innovation approach. However it still can correspond – with some attention - to what has been said about the open method of co-ordination and the new EU innovation strategy. From a technology point of view, the project answered to that challenge by designing the DBE infrastructure as a scaleable fully distributed peer-to-peer network. In that sense, the DBE infrastructure (see figure 1) has – like the Internet – no center and no central control. In the same way semantic information is distributed throughout the net such that no central registries are necessary to access the business service or interface descriptions of all available partners in the network.

Given these technology characteristics, the most adapted paradigm for further technology development and maintenance beyond the end of the initial project was found to be the Open Source paradigm. According to that, the source code of the DBE infrastructure would be public and development fully distributed within the user community. Thereby a thin governance layer could ensure some convergence and minimal standards but the evolution of multiple development paths would be explicitly encouraged.

The Open Source paradigm holds several advantages in the context of public innovation policy: *Firstly* it is not dependent on continued central funding and can turn into a self sustainable mode. *Secondly* it does not try to superimpose a single solution or standard but is open for multiple routes of innovation. *Thirdly* it can accommodate regional differences without giving up a common basis. *Fourthly* it is community based and motivates different actors to participate.

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<sup>1</sup> The authors of this paper are all members of the project management executive board of the Digital Business Ecosystem project – [www.digital-ecosystem.org](http://www.digital-ecosystem.org). The project has started in 2003 and will be funded until the end of 2006.

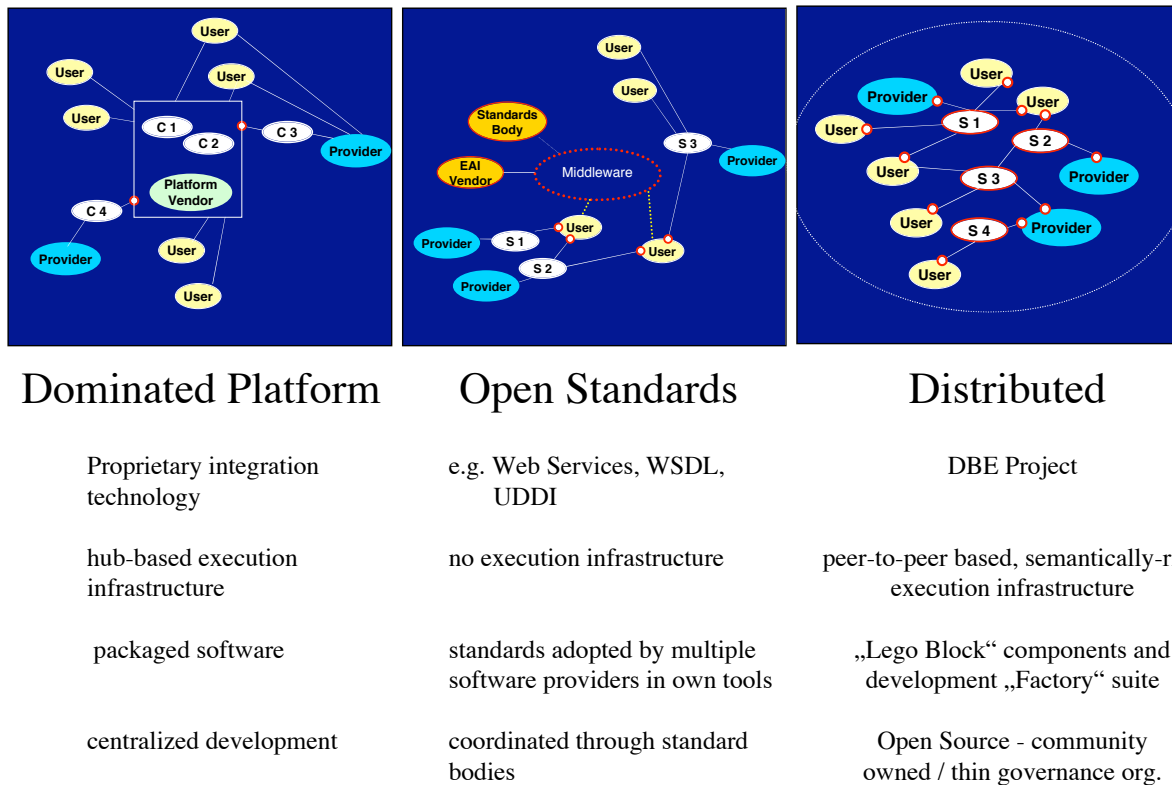


Figure 1: Competing technological paradigms for digital ecosystems infrastructures

For these reasons we claim, that the linkage of a fully distributed ICT technology paradigm with the Open Source governance paradigm is one of the most promising combinations to match the objectives of the new EU innovation strategy in the ICT area. It also addresses the general difficulty to transfer new technologies from research into practical use.

The novelty of this approach makes the DBE project a testbed for a new way of conducting European ICT innovation projects. And Open Source has turned out to be not only a technology governance paradigm for the DBE project but also a paradigm for a viable business ecosystem as such.

### Nurturing the ecosystem

In its foundation phase, the DBE project started to address the crucial question on how the digital business ecosystem would come to life in a somewhat technocratic way by developing a futuristic technology vision based on genetic algorithms and evolutionary computing. These concepts are still a central element of the technology research that is part of the project. However, even the most advanced ICT infrastructure could not come to digital life if it was not populated by software components, if no business transactions would be conducted or company networks established with its help. Given our fully distributed technology paradigm and our aim to launch it into the Open Source world, it quickly became clear that developing the technology in a closed-shop way and then launching it into public by the end of the project was no feasible option.

In addition to the research vision of an evolutionary technology - equally important impulses to nurture the ecosystem needed to come from a different domain of the project: the early engagement of European regions and their local SMEs in the programme as well as the

integration of existing Open Source communities in the project's development and prototyping activities.

Once again that resonated well with the EU Lisbon strategy objectives and the open method of co-ordination governance model. In two refined versions of the Lisbon innovation strategy in 2003 and 2005, the Commission outlined their wish to not only increase funding for ICT related projects but also to „get more out of it“. Two policy ambitions were highlighted in that context: the creation of trans-European demonstrator projects as well as the integration of SMEs into the research projects.

Another policy goal highlighted by the Commission was to address the digital divide between regions or industrial sectors with advanced ICT adoption and those with a backlog in ICT adoption and shortage of the necessary knowledge and practical skills. To that challenge the project also found a dual technology and regional engagement strategy answer. On the technology side a developers group started to focus on a toolkit that would allow a most easy creation of DBE services and linkage of existing software into the infrastructure without the need to program and fully understand the underlying technology. For that several approaches based on model driven architectures as well as natural language are currently being investigated.

On the engagement side this meant to address not only high-tech industrial sectors and leading-innovative regions but to choose a more open mix of regions and target industries.

### **The project structure**

In order to tackle the challenges outlined above, the project consortium was divided in three domains<sup>2</sup> and further on into several working areas: *Firstly* the computing domain split into the core infrastructure development, design of the distributed network topology, design of the service development toolkit, semantic meta modelling and design of basic infrastructure services as digital contracting. *Secondly* the research domain split into the natural science based work on evolutionary computing, network dynamics, service discovery and optimization algorithms and on the social science based work on understanding regulatory issues and the dynamics of DBE community formation. *Thirdly* the business domain split into the coordination of regional actions, development of training, finalization of the business vision, analysis of usage scenarios, development of a governance model, business planning for long-term sustainability and communication and dissemination.

Whereas this multitude of work areas and the different origins and cultures of the partners pose coordination problems for the project management, they also indicate how complex a project *has* to be in order to address the challenge of nurturing a digital business ecosystem. But it is not just the interdisciplinarity of different work areas that the project has to deal with. It is also the evolutionary character of the project as such.

The nurturing of a digital business ecosystem is not a task that can be planned upfront and then becomes simply implemented. The nurturing of digital business ecosystems requires the project to integrate the future actors of the ecosystem *into* the project: the software developing SMEs, their and other prospective users, stakeholders from existing Open Source communities and standard bodies as well as regional policy makers up to SME organizations.

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<sup>2</sup> The DBE project's *computing domain* is led by Sun Microsystems Iberia, the *research domain* by the London School of Economics, the *business domain* by IBM Business Consulting Belgium with *regional engagement* coordinated by the Tampere Technology Transfer Center Hermia Finland. Overall project management is provided by the T-6 consulting group from Italy and IBM Belgium.

By integration we mean that there is not a uni-directional communication towards these actors but that there is a bi-directional influence between these actors and the project. In that sense, these actors help to shape the project outcome. They do not simply receive it.

### Regional catalyzation

To take a look at this in more detail we like to concentrate on the engagement of regional SMEs with the project. Initially the project started by engaging three European regions: the region of Tampere in Finland, the region of West Midlands in the UK and the region of Aragon in Spain. In the actual state of the project three other regions are in concrete negotiations about joining and several others have signalized interest.

The project approached each region by installing a small local organization that we named „regional catalyst“. Regional catalyst members are usually either from a local technology transfer center or local technical university background. In order to fulfil their role, regional catalysts received project funds not only for their own personal costs but also funds to allow subcontracting of implementation partners as well as the conduction of events and training sessions. In addition they manage directly the funds to support a certain number of local SMEs in engaging with the project. As an overall target the project seeks to integrate more than 200 SMEs by the end of the project either as software developers or as pilot users. From that we hope to establish a core group of about 15 to 20 – *Driver* companies – that would form the core of the DBE community in the early stages and the basis for its longer sustainability.

Hence, SME funding was decided to be unequally distributed based on the level that an SME was willing to engage with the project, on the level of possible contribution – f.e. through a highly promising usage scenario as well as on the level of capabilities – f.e. through related technology expertise and existing software components.

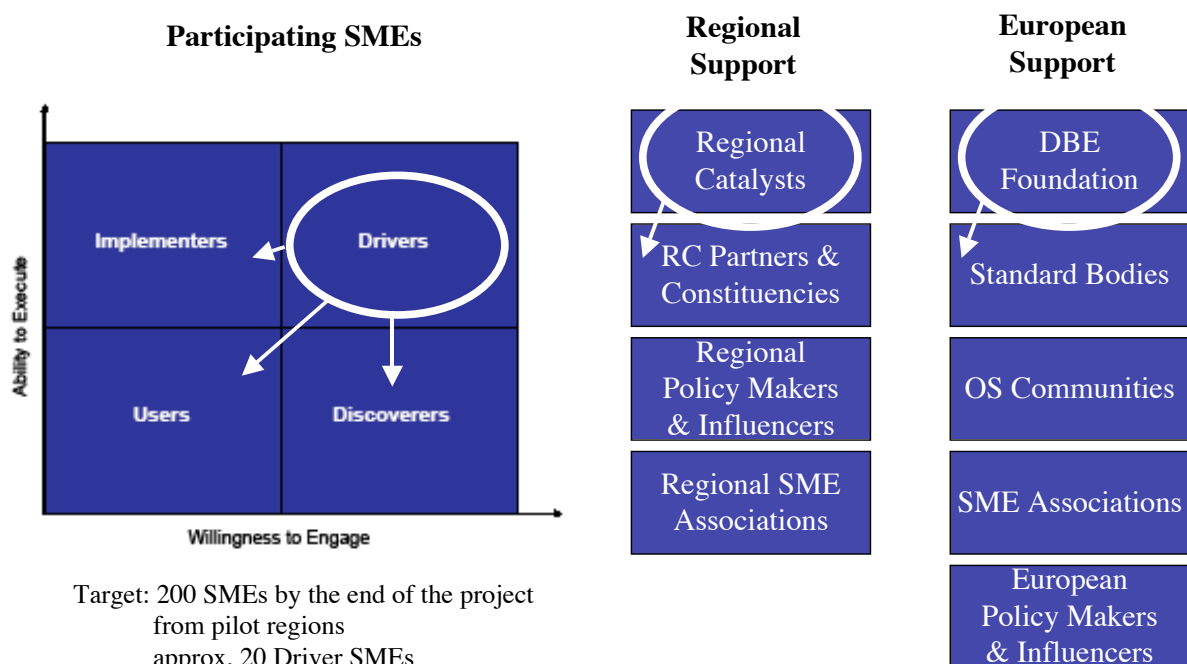


Figure 2: Target audience for the DBE community build-up

The first experiences with Driver SMEs are promising. In particular we found DBE usage scenarios<sup>3</sup> that are evolving with the active participation of Driver SMEs to be more compelling and instantly appealing than those developed in theory. In addition, SMEs started peer discussions on their usage scenarios and document their struggle with the early stage DBE technology in web-blogs and discussion forums.

However, the integration of SMEs into the project is a most difficult task. This is mainly due to the fact that – especially in the early stages – the project demands a significant engagement from an SME for little to offer in the short-term. That conflict between the short-term benefit orientation of most SMEs and the long-term benefit projection of the project can only be resolved by careful selection of SMEs.

We also found that communication towards involved SMEs has to be clear, realistic and open with regards to the current project status, backlogs and problem areas. Creating initial awareness for the project's longterm objectives is important but it cannot replace the motivation that springs from concrete involvement based on tangible results. Instead, we found that most SMEs had little interest to engage into something where they could not see immediate benefits.

Innovation theory (see f.e. Durand, 2004) has described the impact of a firm's competence base on its reaction towards technological change. In that sense, an SME is never neutral to the overall directions in technological change - with this project being just a part of one stream - but will implicitly relate each direction to its existing competence base and prior experiences. The more serious the gap between current competences of the SMEs and the competences demanded by the project is, the more difficult the engagement will be.

This phenomenon has to be seriously considered when engaging with a heterogeneous group of regional SMEs. In fact, we found that the willingness to engage with our project was highly correlated with an SME's technical as well as business experience in corresponding areas as f.e. web-services or service oriented architectures. On the contrary, SMEs with a significant competence gap towards the technological basis of our project turned out to be more reserved and difficult to engage.

One related important observation was that those SMEs that were experienced in the Open Source domain could more easily adapt to being confronted with *work-in-progress* instead of *ready-to-consume* solutions. They also tended to be more willing to co-develop application cases by bringing-in their existing OS software components – whereas developers of proprietary software were hesitating to do so claiming security and stability concerns. In addition, the less technologically up-to-date<sup>4</sup> an SMEs proprietary software products were the more difficult it turned out to engage the SME for the project.

The serious downside of that is, that the Commission's strategic ambition to help bridging the digital divide can not simply be solved by providing less-technologically developed SMEs with Open Source advanced technologies. In fact, we think that any attempt to bridge the

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<sup>3</sup> Example of a Driver company: Nemein in Finland (Tampere region) is an Open Source software developer and consulting company. They are engaged both in a larger OS community around the Midgard content management system as well as promotor of their own OS project management suite: OpenPSA. By integrating OpenPSA with the DBE infrastructure they aim to turn their stand-alone project management application into a distributed solution that would enable co-operating companies to share project information or expense reporting. <http://www.nemein.com/en/news/press/openpsa-enters-the-digital-business-ecosystem.html>

<sup>4</sup> We found f.e. that SMEs in the Spanish (Aragon) tourism sector that still maintained legacy Assembler-based applications were difficult to engage for the project – regardless of the technological possibility to integrate with the DBE. This was to some extent due to a lack of competences in Web-based technologies as Java or Web-Services but also to a „never change a working system“ attitude.

digital divide can only be successful through peer pressure arising from community dynamics. That includes the *help* and *leadership* of those SMEs that are already advanced with regard to the new technologies.

This underlines the necessity to have a phased approach where SMEs are brought-in step-wise into the project community by paying careful attention to the optimal timepoint and way of engagement. The prior selection and estimation of an SME's readiness to engage with the project was based on the contact network of the regional catalysts and previous experiences with the firms as well as on a series of general information workshops and discussion sessions in the regions.

### **The engagement strategy**

We subdivided the engagement planning into five distinct but - with regard to time - overlapping phases. As of June 2005 the project has started the first engagement phase in the three pilot regions and is preparing the upcoming phases. New regions that are joining the project will start later but will probably – due to the progress of the pilot regions – be able to undergo the early steps faster.

The *first phase* was named „initiate local sub communities“. In this initial phase the project is in a pushing role, actively selecting, encouraging and enabling SMEs and other actors to join the DBE on a regional level. The previously discussed engagement experiences relate mostly to this phase.

The *second phase* has the aim to „encourage self-dynamic in initial sub-communities“. In this phase, the project changes from a strong push-approach to a facilitator role. Here, independent interactions between the parties are actively encouraged and rewarded by the project, with the aim to strengthen the initial sub-communities. Mostly this is done through workshops but also by providing the communities with tools for electronic interaction and knowledge exchange.

The *third phase* aims to „extend beyond initial sub-communities“. Depending on the experiences with the initial sub-communities, the project starts in the next phase to foster the interaction between the regional communities, with the aim to build a trans-European DBE community. This is done by increased communication of showcases, application experiences and organization of a public conference. The project encourages cross-regional cooperation but also competition among sub-communities, thereby using stronger sub-communities to pull weaker ones. Sharing from strong core actors is explicitly made transparent and highly rewarded.

The *fourth phase* is named „sustain community actions“. In this phase the project will handle over more responsibility to strong actors of the DBE community. This demands the parallel set-up of the future governance organization. In that governance organization the driving community members will take responsibilities.

The *fifth phase* of our engagement model is called „enable take-over and step-out“. In this final phase the project has to prepare to step-out of the direct responsibilities for maintaining momentum in the DBE community e.g. for organizing events or providing training and bootcamps. Knowledge has therefore to be transferred to key players and further actions have to be planned together with them and possible sponsors. The knowledge transfer and training infrastructure has to be taken-over by key actors or sponsors of the DBE community

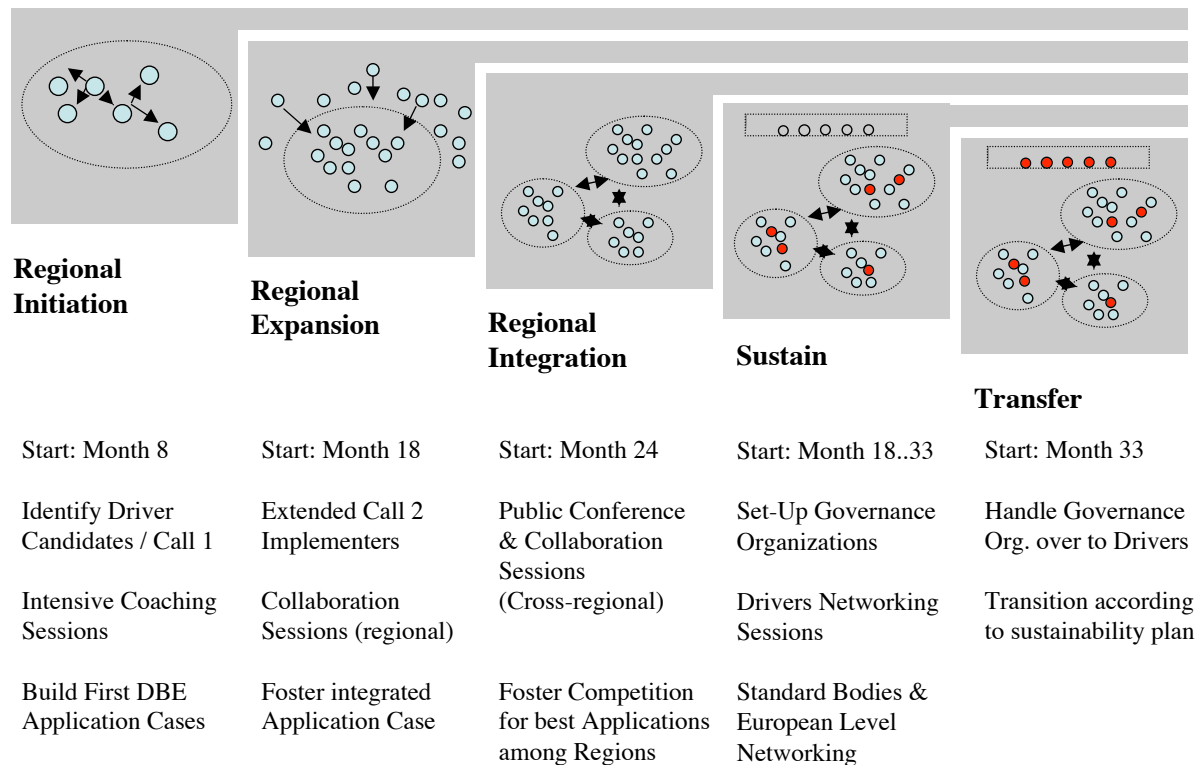


Figure 3: Phases of the DBE engagement strategy

### Sustainability beyond the funded project time

A main challenge of the project with regard to this engagement strategy is the discrepancy between funded project time and the time that a digital business ecosystem would probably *need* to evolve through these phases. In that sense, we might be forced due to project and funding limitations to start actions of the *fifth phase* – the take-over by the community – too early compared to the real progress of the community formation.

As this scenario is highly probable, the project has decided to develop a sustainability plan. This covers the set-up of a light DBE governance organization in parallel to the second half of the project time but also a plan for actions beyond the *official*<sup>5</sup> end of the DBE project. Financial support for these actions is a central question – such that the project currently investigates alternative public and private sources. These are expected to be mostly regionally based. We think that attraction for regional sponsors will grow once small regional DBE communities have formed and first application scenarios become visible.

<sup>5</sup> By „official end“ we refer to the end of the FP6 funding of the DBE project in November 2006



In addition, the European Commission has indicated to continue the engagement in the digital ecosystems area based on the promising first experiences from the DBE project. But whereas a technology can easily be transferred between projects, the regional SME communities are more fragile. In return, there is also the SME's demand for the longterm security of their actual investment into the project and the DBE technology that we have to take seriously.

There is certainly the risk of damaging the regional DBE communities – f.e. with regard to trust or commitment - in the transfer to one or several new digital ecosystems related projects in the seventh framework programme. This is f.e. just a consequence of the necessary ramp-up time for any new project.

Our opinion is that these sustainability issues are not just a feature of the DBE project. They concern all European innovation projects that work with bottom-up emerging communities and deeper SME involvement.

To cite one other example: the European Living Labs Initiative. The initiative defines a Living Lab as an open access, standards based multi-site, multi stakeholder research and development infrastructure which provides an experiential platform for researching, sensing, prototyping, validating and refining complex solutions in multiple and evolving real life micro-all contexts (Deweever, 2005). In that sense, the initiative comes very close to what the DBE project is doing on the regional level but tries to move even one step further and abstract this engagement environment from a specific technology innovation. However, such an initiative demands even more a longterm sustainability perspective for participating SMEs and other members of a regional Living Lab community.

### **Conclusion and impacts for European ICT innovation policy**

In order to summarize some learnings, we need to come back to the three characteristics of the open method of co-ordination and the new approach to EU innovation policy that we have cited in the very beginning of the paper: bottom-up emergence and multiple governance levels, mobilization of a wider range of actors – with a strong focus on SMEs, increased support for learning, mutual cooperation and peer governance.

The DBE project certainly reflects many characteristics of the new approach. It is deeply multidisciplinary and trans-European. It leverages European regional strengths and interacts with regional SMEs as well as Open Source communities and standard bodies. The technology paradigms chosen correspond to the policy objectives of openness and decentralization. First emerging phenomena become visible – like the self dynamics of regional communities and promising SME usage cases outside of the project's original focus domains.

However, the regional activation and multiple actor involvement that can be achieved by this type of project have led also to serious questions of sustainability and longterm perspective for those who engage. In a sense we must face the possible critique of taking SMEs half way out on an adventurous technology or even business route and then possibly leaving them stranded before they reached their goal.

As it was discussed in the paper those SMEs that can deal best with our approach are also those that are already very advanced with regard to the necessary business experiences and technology competences. In addition they are advanced with respect to new organizational

forms, Open Source governance and open models of innovation (see f.e. Chesbrough, 2003). These SMEs certainly benefit from a closer integration into European ICT innovation projects in the same way as the projects benefit in return. They are also experienced enough to take those elements out of the project that might be beneficial for their business and products. Finally their effort to engage with the project is limited given the competences they already possess.

However, in the light of the overall EU innovation policy objectives, these SMEs make-up an important but only a small fraction of those who are intended to benefit from European Commission spending on research and innovation. Still the digital divide problem persists. The experiences from the DBE project already indicate that it will not be solved entirely through even more intelligent or easy-to-use technology. A careful engagement and community building is necessary. We have to answer how that can take place in the context of limited project funding times and ever new consortiums and technology approaches.

The Swedish Institute for European Policy Studies (Radaelli, 2003) has critically noted that the open method of coordination has been examined *in vitro* instead of in context. We are convinced that the right basic direction has been chosen in designing a European ICT innovation strategy. However, at the level of concrete innovation policies there is still need for improvement. This must be based on lessons drawn from major projects of the sixth framework programme.

In that context, achieving continuity of engagements with regional communities and stable nurturing of these communities with a focus on the weaker members demands attention. We have to acknowledge that SME's and other actors' time perspectives are not consistent with the 3 to 4 years rhythm of projects funded by European framework programmes. The deeper the projects intend to engage with these actors and the larger the addressed communities are the more careful attention has to be paid to a strategy of engagement and longterm sustainability.

This demands a closer cooperation of political actors on the European levels as well as the country and regional levels. Thereby European Commission funding might trigger innovation activities that are taken-up by regional institutions with funding being gradually taken over by regional institutions with the progress of the activity. In the same way deeper co-operation between related projects of the same or subsequent framework programmes have to be installed. Thereby regional SME communities might interact with multiple related projects in a coordinated way. Finally governance and sustainability beyond the funded period of projects have to become a central concern.

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