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Executive Summary

This deliverable represents a collaborative effort to synthesize social science contributions produced for the DBE project with a view to deriving recommendations for a broadened framework of critical research and policy intervention in Digital Ecosystems (DE) research. In specific terms, the deliverable presents the main insights of research conducted by LSE and CENSIS and situates them in a discussion about the role of social science in the DBE and in EU integrated projects.

The role of social science in the project grew incrementally and was characterized more by 'opportunistic' than by 'designed' interventions. By 'designed' we mean those activities that were planned relatively in advance. The term 'opportunistic' refers to projects that were adapted to, or commissioned in response to evolving project needs. In particular social science research conducted in the project focused on:

a. The regulatory framework and the DBE knowledge base

The LSE regulatory team developed a taxonomy framework intended to support the establishment and modeling of a knowledge base of regulatory issues with trust at the centre. This taxonomy consisted of three different trust types, a set of regulatory issues relevant to the DBE and different types of operational perspectives. The three types of trust are type X, denoting the trust of participants towards the DBE, trust Y, which refers to the expectations of joining companies and trust Z, which refers to trust relations developing among DBE participants. These trust types apply to three different sets of regulatory issues are: (1) privacy and consumer protection, (2) e-signatures and security, (3) jurisdiction and consumer protection. At the same time, the specification of the relevant types of trust and regulatory issues depends upon whether one examines them from the point of view of DBE relationships, DBE actors, and software lifecycles.

b. SME recruitment, regional innovation, opportunities for collaboration at European and regional level, governance and the sustainability consultation process

Research in these areas of studies conducted by CENSIS helped build a detailed picture of the regional capabilities for DBE adoption. The principal finding from the various studies was that the introduction of the DBE, in its pre-prototype phase of development, seemed to reinforce existing socio-economic dynamics rather than acting as a catalyst for change. CENSIS engaged in collaboration with the STU (Salzburg Technical University) science team and completed their activities in the project by designing and implementing a survey aimed at assisting discussions on sustainability and governance. The relevant report was being finalized at the time this deliverable was submitted.

c. Interdisciplinarity, inter and intra dynamics of collaboration, strategic interaction with Open Source (OS) software communities

Research conducted by Evangelia Berdou (LSE) highlights some of the challenges of translating knowledge across different epistemic communities and communities of practice (CoP) operating within the DBE. In addition, her contribution highlighted two important characteristics of CoP- their knowledge and structural embeddedness - and indicated how

they relate to the sustainability and scalability of DEs. Her research on dynamics of collaboration in OS software communities helped formulate a dual strategy for interfacing with them.

d. *SME engagement and governance*

The research conducted by Dr. Mary Darking (LSE) on SME engagement resulted in the elaboration of a grounded theory of SME engagement relevant to processes of high innovation. Dr Darking argued that adapting engagement practices to the specific regional and sectoral contexts in which SMEs work and to the specific needs and concerns they express in a way that inspires trust, confidence and belief lies at the core of successful engagement practice. Her work on governance helped identified six dimensions of governance relevant to digital ecosystems: (1) constitution and balance of interests, (2) culture and communication, (3) credibility, attunement and trust, (4) organization and synchronization, (5) licensing and regulation, (6) technological dimension.

Despite their different starting points, requirements and foci these contributions have significant theoretical and methodological affinities and aimed to:

- Balance the need for the market exploitation of the DBE with the necessity to maintain the open, collaborative character of the project.
- Ground debates in current research and literature.
- Formulate theory and research in view of **real** policy questions and strategic actions.
- Provide insights and recommendations on the basis of empirical data collected with validated methodologies.
- Collate and synthesize points of view of involved and potential stakeholders.

The proposed social research agenda for DE research evolves around the following, broadly defined dimensions of investigation:

a) *Community & Stakeholder dimension:* *Dynamics of cooperation and communication between and across project boundaries.*

b) *Spatial and Network Dimension:* *ICTs and development, socio-economic networks, regional development and global connections.*

c) *Technological dimension:* *DBE as a standard and innovative technological platform*

The wider argument to be drawn from this study is that social science research can contribute significantly to the design and deployment of cutting-edge, large-scale technological projects and that social science research should therefore be more closely integrated with integrated projects' research agenda.

Introduction

This deliverable represents a collaborative effort to synthesize social science contributions produced for the DBE project with a view to deriving recommendations for a

broadened framework of critical research and policy intervention in Digital Ecosystems (DE) research. The deliverable consists of the principal findings of the main social science contributions within DBE and an account of collaboration with other disciplines in the project.

The issues surrounding the development, deployment and implementation of DEs are complex. Social science research conducted within the context of the DBE supported specific activities and its role grew incrementally, culminating in social science researchers contributions to discussions on governance and sustainability.

This deliverable focuses on contributions that adopt an explicit social science perspective; deliverables that relate to an area of interest in social science, but which, for example, adopt a business perspective, are not included in this study.

This report is structured as follows. Chapter 1, written by Evangelia Berdou, presents the principal issues investigated within the project and contextualizes social science contributions within DBE research. Chapter 2, written by Silvia Elaluf-Calderwood and Panayiota Tsatsou, outlines the contribution of the LSE regulatory team relating to the knowledge base and regulatory framework of DBE. Chapter 3, written by Antonella Passani, outlines CENSIS contributions, which focused on regional development, SMEs (Small and Medium sized Enterprises) recruitment and policy issues. Chapter 4 is Evangelia Berdou's (LSE) contribution on the dynamics of collaboration within open source (OS) communities, and between different actors within a DBE. Chapter 5 presents Mary Darking's (LSE) work which spans a number of issues relating to SMEs and technological innovation and DBE governance. In each chapter the researchers reflect upon the collaboration experienced within the project. Chapter 6, written by Evangelia Berdou, recapitulates the lessons learned at the level of research outcomes, and through the research process, and provides a base for the discussion of a broader social science research agenda for DE research.

1. Background to social science contributions in the DBE project

This section briefly discusses the role of social science within the DBE project and outlines some of the challenges and opportunities it presented to social science researchers who were asked to provide timely and relevant insights capable of informing specific actions. The DBE project provided some unique opportunities for researchers to become involved in an important initiative that was motivated by an open, collaborative approach and which aimed to enable SMEs to take advantage of the potential offered by information and communication technologies on their own terms.

In this regard the DBE represents an important scientific, technological and business proposition, and also constitutes an ambitious policy intervention involving many different actors and, therefore, a variety of competing viewpoints, interests and agendas, both disciplinary and political. As Melody and Mansell (1983:113) point out: "Examination of research theories, methods, results and policy proposals by contending interests in a real-world policy context can provide a more rigorous critical assessment of views than any provided in the more antiseptic atmosphere of professional journals and meetings." As the contributions to this deliverable demonstrate, involvement in the DBE project not only

created exciting research opportunities; it involved a responsibility to inform important initiatives at many levels of interaction and accompanying difficulties in terms of positioning among competing agendas.

As will become apparent the four groups of contributions to this deliverable had different starting points. This is largely a result of the different requirements placed on each type of contribution. The work of the LSE regulatory team, for example, was expected to be consistent with the work of the computing and business modelling domain, which it directly fed into. This demanded a more rigorous formalization of the knowledge and insights gained at both theoretical and empirical levels, than the work conducted in the context of other deliverables.

Another factor that contributed to the different character of each group of contributions relates to the specific project dynamics. The role of social science in the project grew incrementally and was characterized more by 'opportunistic' than by 'designed' interventions. By 'designed' we mean those activities that were planned relatively in advance. The term 'opportunistic' refers to projects that were adapted to, or commissioned in response to evolving project needs, such as the deliverable on the dynamics of collaboration in OS communities. This is not to say that 'opportunistic' interventions did not emerge or were not needed in other fields. In such an intensively innovative and integrated project as the DBE, the research agenda continuously evolves as research questions and problems are refined and re-refined and interdisciplinary collaboration highlights new connections and new areas for study. However, unlike other scientific domains, such as computing, business, and the natural sciences, social science's research agenda was less strictly defined in terms of outcomes and adopted approaches. This created both challenges and opportunities for social science researchers who had freedom in formulating their projects, within the parameters by other partners' requirements, but who initially lacked a framework for coordinating their actions.

The role of social science in the DBE is connected to the wider the role of social science in EU integrated projects and should be viewed in connection with the fundamental question of commensurability between social sciences, computing, and natural sciences, which was frequently discussed within the project

The Information Society Technologies directorate does not provide statistics or reports that would have allowed us to assess the role of social science in integrated projects. However, a viewpoint commonly expressed by technologists, in workshops and at meetings,¹ is that although the input of social science forms an integral part of the effort to understand the implications of the Information Society and to design a policy framework that will allow all citizens to partake equally, the role of this discipline in the design and deployment of innovative technologies and infrastructures is considered limited. This view contrasts with the positive feedback on social science contributions that was expressed in the 2nd DBE project review that took place in Tampere, Finland on 17th and 18th January 2006. These two

¹ These viewpoint, which were reported by Dr Mary Darking, were expressed in the workshop "Towards a network of digital ecosystems: which technology, which research and which instruments?" (http://www.digital-ecosystems.org/events/2005.05/workshop_3ya2.html, last accessed 01/2007) held on 18 May 2005 in Brussels.

perspectives are a small indication of the differing, and often contrasting, ideas and expectations about what social science can or cannot contribute to DE research.

One of the first questions that comes to mind when trying to resolve these differences is what is meant by 'social science'. Reference to the object of study, such as innovation, communication, regional and socio-economic dynamics does not encompass the breadth and depth of disciplinary perspectives, epistemological differences and variety of research traditions included under the term 'social sciences', no more than does the term 'computer science' reveal the different approaches with respect to design and implementation.

In the context of the DBE the process of defining the scope and form of social science input was time consuming and involved intensive dialogue among the cooperating parties. Despite their different starting points and aims, the social scientists involved in the project formulated their theoretical approaches and grounded their empirical work in light of real policy questions and actions, while taking into account the innovative and developing character of the infrastructure and the needs of the various actors.

The contributions presented in this deliverable combined the following strands of social research: stakeholder and policy research (LSE regulatory team), economic sociology and, in particular the areas of research focusing on economic embeddedness, regional development and industrial organization (CENSIS and Berdou), information systems studies and in specific Actor-Network theory (Darking), theory of the 'commons' (Darking) organizational studies and in particular the Communities of Practice perspective (Berdou). In terms of applied methodologies research conducted within the project was empirically driven and employed both quantitative and qualitative methods, such as Social Network Analysis and surveys (CENSIS), participant observation (Darking) and interviews (Berdou, Darking, LSE regulatory Team).

2. Contribution to the regulatory framework by Silvia Elaluf-Calderwood and Panayiota Tsatsou (LSE)²

2.1 Introduction

Task B11 of WP32 highlights the importance of regulatory issues in digital business among SMEs in Europe, and the significance of establishing trust relations that empower regulatory stability in DBEs. This was pursued through the establishment of a knowledge base of regulatory issues. A taxonomy of regulatory knowledge was built, which aimed to support trust relations in key areas of regulatory interest.

B11 begins by contextualizing key terms and issues. The adoption of new forms of e-commerce and e-business in the SME sector has been identified by policy makers as a key priority for the fostering of innovation and competitiveness in European SMEs in global markets (EU Commission, 2005).

² The LSE regulatory team was led by Dr Gordon Gow.

As envisioned by Nachira (2002:18) the DBE can significantly contribute to those goals, as it is intended “to create an integrated, distributed pervasive network of local digital ecosystems for small business organizations and for local e-governance which cooperates exchanging dynamically resources, applications, services and knowledge.” However, in order for this vision to be realized, it is necessary to promote trust relationships among DBE participants by enabling and supporting the creation of services and transactions that are compliant with EU sector-specific and local regulatory requirements. Research findings indicate that lack of awareness and expertise about regulatory issues often creates uncertainty in e-business adoption among small business organizations. (I need a reference here). This is supported both by the interview findings conducted with the SMEs and by the relevant literature (Pavlou, 2002; Rosenbaum and Davenport, 2003).

From this perspective, the complexity of regulations applicable to e-commerce and e-business transactions and the lack of knowledge and resources on the part of SMEs to address this complexity are identified as barriers that need to be overcome in order for the DBE vision to be realized. The creation of a knowledge base of regulatory issues in e-business was suggested by Nachira (ibid) as a way of tackling the complexity of regulations applicable to e-business and the lack of knowledge and resources among SMEs to address this complexity.

The LSE team involved in this task adopted this suggestion and the requirement that the creation of such a knowledge base should be an “evolutionary systemic process” (Nachira, 2002:13) due to the range and complexity of norms and laws that will apply to numerous business organizations operating in different sectors and across various jurisdictional domains. In addition, the research needed to take account of the immense challenges associated with technological, organizational and cultural differences that affect the activities of SMEs (Burn 2000; Hornby et al., 2004). These two sets of requirements formulated a research agenda that aimed to develop a model that facilitates specific knowledge transfer autonomously through the interactions of a “virtual learning community” (ibid:14) and the development of a taxonomy framework.

This taxonomy consisted of three different trust types, a set of regulatory issues relevant to the DBE and different types of operational perspectives. The three types of trust are type X, denoting the trust of participants towards the DBE, trust Y, which refers to the expectations of joining companies and trust Z, which refers to trust relations developing among DBE participants. These trust types apply to three different sets of regulatory issues, which in the context of the research are termed the building blocks of trust: (1) privacy and consumer protection, (2) e-signatures and security, (3) jurisdiction and consumer protection. At the same time the specification of the relevant types of trust and regulatory issues depends upon whether one examines them from the point of view of DBE relationships, DBE actors, and software lifecycles.

Empirical research conducted within the context of the project validated this framework and confirming our hypothesis that the regulatory domain is central to building trust relationships in services and technological solutions, in business activities and in access to information. It was therefore decided that the establishment of trust should be based on a baseline understanding of the policy and regulatory domain within which the DBE is being

conceptualized, created, and implemented. This foundation is referred to as the “Generic Knowledge Base” and is intended to provide fundamental perspectives on a range of issues that have been identified in the literature as essential factors for establishing trust relationships in e-business settings, and specifically for EU SMEs.

2.2 Key Findings: Literature Review, Taxonomy Framework & Empirical Case-Studies (D32.1 D32.3 M32.2.)

D32.1: Literature Review

In the first deliverable of this task (D32.1) a review was carried out of literature relevant to the DBE vision. In this review the thematic notion of trust was adopted as the initial point of focus. The notion of trust is seen as key to the establishment of a knowledge base of regulatory issues, and a key enabler of e-business. This focus highlighted three trust categories.

The building blocks of regulatory trust

Both academic commentators and practitioners are increasingly recognizing that trust is a critical enabler of e-business (Clarke, 2002; Keen, 2000; Sultan, et al., 2002; Swan and Rozenbaum, 2004) and is the foundation of the digital economy (Pavlou, 2002; Shankar, et al., 2002). In the context of online commerce, electronic networks provide increased possibilities for opportunistic behaviour compared to other settings (Clarke, 2002; Javernpaa and Tractinsky, 1999; Mansell and Collins, 2004; Pavlou, 2002) enabling companies to engaging in e-business activities (Shankar, et al., 2002).

Taking up the theme of trust, the literature review identified three ‘building blocks of regulatory trust’, which constitute a continuous regulatory challenge for digital business ecosystems while being central to building trust relationships in services and technological solutions, business activities and in access to information. Berkey (2002) refers to three categories of international regulatory issues related to e-business: privacy and consumer protection; e-signatures and security; jurisdiction and consumer protection (see below for definition).

In the task of developing a knowledge base of regulatory issues we adopted Berkey’s scheme of international regulatory issues in e-business as the building blocks of regulatory trust. These building blocks act as the foundation for a more complex investigation and analysis of regulatory issues relevant to sector-specific and local implementations of trust relationships in DBE.

D32.3: Taxonomy

In the second deliverable (D32.2), the outcomes of the literature review were formalized into a taxonomy framework intended to support the establishment and modelling of a knowledge base of regulatory issues with trust at the centre. The second deliverable, therefore, presents a transposition of the main findings of the literature review into a basic

taxonomy framework intended to identify, classify and assess regulatory issues relevant to the DBE vision and arising in sector-specific and local implementation business cases.

The taxonomy framework is described below. Issues are classified according to trust types, regulatory building blocks and operational perspectives.

Trust Types

The first classification adopted for the taxonomy framework is based on the notion of trust. Three main types of regulatory trust in a DBE environment can be identified based on the model suggested by Meents, Tan and Verhagen (Meents, et al., 2003): trust type X (trust on the part of new joiners of the DBE); trust type Y (expectations of established DBE participants from joining companies); trust type Z (trust relationships among the DBE participants themselves).

Building blocks of regulatory issues

The literature refers to the building blocks of regulatory trust, representing the domains of the regulatory environment that should be priorities in the development of e-business initiatives: privacy and consumer protection (i.e. processing, control and distribution of personal and consumer data); e-signatures and security (issues related to the sharing of information over digital media); jurisdiction and consumer protection (jurisdictional issues, and means for resolving cross-border disputes).

Operational Perspectives

Finally, the taxonomy framework can be classified from different operational perspectives because “they provide a better insight into certain [regulatory] issues, for example to whom they are important and at what time during the lifecycle they become crucial” (Schoubroeck Van, et al., 2001).

The following perspectives were adopted: DBE relationships (internal or external or both); DBE actors (SME Service Providers who provide software component services, SME Users who consume DBE services, and Business Analysts who help users to get connected and establish BML (Business Modelling Language) profiles and Service Providers to facilitate integration into service chains and make services compatible; and software lifecycles (internet development tool and Open Source).

M32.3: Knowledge Base for Regulatory Issues (pilot study)

Following completion of D32.2 in May 2005, milestone M32.3 aimed to present the preliminary results of the fieldwork. Pilot interviews with five SME drivers selected to represent key variables identified in the taxonomy of D32.2 were reported on. The objective was to inform subsequent investigations into sector specific and local implementation issues for deliverable D32.4. Key findings included:

- **On the taxonomy:** With respect to the building blocks of trust in different business domains and localities, SMEs confirmed the validity of the three blocks developed in the

taxonomy model. Each SME approaches privacy and consumer protection, e-signatures and security, and jurisdiction and consumer protection from a sector-specific and local-implementation perspective.

- **Issues beyond the taxonomy:** In addition to confirming the relevance of regulatory issues with regard to trust and SME participation in DBEs, the report highlights issues judged by SMEs to be relevant to the sustainability of the project in the long term, such as DBE governance and DBE legal constituency.

2.3 D32.4: Locational Issues for the Implementation of the Knowledge Base

D32.4 (October 2005) was the last deliverable within the task and presented the final results of the fieldwork following M32.2. This document reports on the empirical work of task BII, which connects with previous work encompassed by the task. It reports on interviews with seven SME drivers representative of key variables identified in the taxonomy of regulatory issues, and discusses sector-specific and local implementation issues and integrates them with the regulatory issues reported in M32.2.

Key findings in this report include:

- **Sector-specific and local implementation issues related to regulation and trust:**
 - *Sector-Specific issues*
 - *Identification and Security:* Sector-specific issues engendering business risks.
 - *Privacy/Consumer Protection:* Risk associated with business clusters consisting of companies sharing customer information in the same business domain.
 - *Contractual Issues:* Contracts adapted to different business domains, suggesting their potential impact on the business potential of the DBE.
 - *Local implementation issues*
 - *Local implementation of the DBE vision:* A process that occurs within a small community with various interface levels between SMEs, developers and users, as well as regional catalysts.
 - *Gradual process of local implementation:* A better way to establish a meaningful local strategy for adoption and packaging of DBE software and development in the business community.
- **The taxonomy model:** SMEs seem to confirm the validity of the three building blocks of trust developed in the taxonomy model, whilst each SME approaches these building blocks from a sector-specific and local implementation perspective.
- **Issues beyond the taxonomy model:** Besides confirming relevant regulatory issues, this report highlights issues regarded by the SMEs as relevant to the sustainability of the project in the long term, such as DBE governance, DBE legal constituency and DBE platform workability.

Areas for future research include:

- **Future research based on taxonomy model:**
 - *DBE relationship:* DBE legal identity, integration of e-signatures, SME competition, security, trust, reconciliation between business objectives and technical models within the DBE environment, and governance issues.
 - *DBE actors:* Identification, security, contractual issues, DBE platform workability, trust relationships and long-term commercial incentives for the development of Open Source

middleware.

- Software life-cycles: intellectual property (IP) issues, middleware ownership and the Open Source ideal, lack of documentation for DBE software features and releases, and insufficient commercial basis for the DBE platform.

These three taxonomy perspectives could foster future research into DBEs with respect to the evolving character of the knowledge base in regulatory issues, required legal provision and implementation of regulation.

- **Future research on DBE sustainability:** Just as it is necessary to define a short, medium and long-term sustainability strategy for the DBE, it is also necessary to differentiate between the technical and business sustainability of the DBE vision. In terms of the business sustainability of the DBE vision, the legal constituency of the DBE as well as the role of the business domain in the adoption of this legal form, are of particular significance. Hence, research into B2B governance should be high on the agenda, as it intrinsically affects the sustainability of and raises questions about one company governance vs. a multiple-company type foundation.

2.4 Contribution to other tasks in WP32

The above findings are regarded as critical for the future of the DE, and must be the subject of further research. B11 was intended to provide empirically generated insights for other workpackages that might be relevant to activities in the field.

More specifically, task B11 directly contributes to C52, Contracts and Agreements, and C46, Knowledge Base Model of the Regulatory Framework. Through collaboration, it has been possible for task B11 to provide input into and receive feedback from the research involved in these two tasks BML could in future be applied in conjunction with software annotated tools to create electronic libraries of trust issues based on domains or sectors, which could be populated by future DBE members. This model is still under development and will be influenced by the overall DBE research work. The modelling of the taxonomy to produce computational models has great significance for emerging socio-technical and computational research by EU research partners.

In the case of C52, WIT (Waterford Institute for Technology) has highlighted the need to develop a library of contracts that can be used to fill the meta-model being developed by C46. Working with a new partner, the University of Zaragoza, discussions were instigated with a view to putting this plan into action, while the task's aims, through the B11 research work, have been to foster the process of putting this plan into action.

After the interviews with SMEs were completed, C52 WIT found that use of e-signatures by the case study region (Aragon) was minimal. Hence, WIT's work is now addressing the poor exploitation of this technology feature as a preliminary step to the introduction of e-contract software. This is an example of how the Knowledge Base of Regulatory Issues is being used to identify areas where SMEs are in line with or will have to comply with EU, national or regional regulatory frameworks.

Finally, the business workpackages at the core of the DBE draw on some of the findings from the literature review D32.1 and the taxonomy framework D32.2 to expand their

own business models for drivers and new DBE consortium partners. To extend their impact, the business workpackages could exploit the business-related empirical findings and SMEs' views on the business potential of the DBE, as expressed in documents M32.3 and D32.4.

2.5 Collaboration with other partners and appropriation of findings

When the project was established, the approach of DBE partners to the definition and scope of the workpackage "Knowledge base of regulatory issues" (WP32) was diverse and sometimes not well defined. During the course of the project, a general process of learning to define what can be expected from the package has taken place, followed by an increased awareness of the results of the work package, all of which led to important contributions from all DBE partners to the discussions on DBE sustainability and governance in the advanced stages of the DBE project.

The scope of the workpackage included multidisciplinary collaboration between social science researchers, computer science researchers, law specialists and business units. Achievement of this objective involved an iterative cooperative effort, in which social scientists played a more important role compared to previous EC projects, such as Ecommlex, ALIVE, Legal IST, TrustCom, PRIME.

From the point of view of the LSE regulatory team special care was taken to ensure a social science output that would be consistent with the later work to be undertaken by the computing science researchers. This led to the elaboration of case study models, and research categories and models that were similar to or were based on computing model tools. This approach is reflected in the taxonomy framework used to elaborate the regulatory issues Knowledge Base Model. In the course of this collaborative process social science researchers were able to highlight emergent issues regarding the implementation and sustainability of the DBE vision. In specific collaboration with the science group reflected upon the development of a Knowledge Base Model (ISUFI), model that is BML based. The collaboration with the business units provided the strategy behind the development of a further research plan covering the areas of governance, sustainability and legal presence on the DBE vision after the end of the EU supported project.

During the project development work, WP32 fieldwork undertaken by LSE researchers identified social issues, which were made known to the overall DBE community. These issues concerned the sustainability, future governance and current and future legal identity of the DBE vision. Although not discussed in much detail in the early stages of the project, because of the pressing nature of other activities, such as the bootstrapping process, during later multidisciplinary meetings, such as the Annual General meeting, particular agendas and conventional approaches to organizing strategies to address these issues emerged quite strongly. In these multidisciplinary settings, the WP32 social scientists were able to deliver reminders about the need to maintain the DBE vision foundations as close as possible to the foundations of the Open Source movement. The social science research work in this WP32 was accordingly modified to include further basic research on exploring how to approach the core issues identified, using open source principles. Most of the findings in this section are detailed in D32.4 and are still very much the subject of ongoing discussion within the DBE community. Further work is being programmed in the OPAALS (Open Philosophies

for Associative Autopoietic Digital Ecosystems) project. OPAALS is a Network of Excellence Research project funded under the sixth framework).

In reflecting on the interaction of the social science researchers in the DBE project, two main areas of difficulty can be identified. The first is related to the self-evolutionary process employed in social science research to define the objectives and aims of the research work completed, and which can sometimes be oblivious to other research fields. In the case of the DBE and particularly WP32, the social science approach has been carefully crafted to produce a rigorous piece of research work, grounded in cutting edge research which suited other partners' needs and in particular those of the business and computing communities, whilst taking into account the demands of critical research. Critical research is more exploratory in terms of social implications and policy making based on recommendations relevant to the DBE.

The second difficulty is associated with multidisciplinary work and is related to communication among researchers from diverse research backgrounds and the problems of trying to make sense of different researchers' aims and agendas. Characteristic of the demands of an intensively interdisciplinary project is that fact that a lot of effort was made in order to synthesize the different approaches with regard the aims and scope of the WP32. One of the difficulties was that partners working on WP32 had to define its scope and limitations very tightly after the original partner responsible of this deliverable (IESE) left the project. Since then the energy the members of the wp was focused in teaching and providing a better understanding of the differences between law, application of law, regulatory issues, framework and taxonomy models within a Digital Business Ecosystem. These issues were solved by good channels of communication and trust being developed between DBE partner members.

3. SME recruitment, regional profiles, funding opportunities and governance consultation process by Antonella Passani (CENSIS)

3.1 Introduction

CENSIS has been involved in several different tasks since the beginning of the DBE project, some of which were introduced during the second and third years of the project in response to the specific needs of the DBE consortium. The research activity was adapted to partners' requirements and was underlined by an action research approach, i.e. an effort to establish a feedback process between the DBE's technological and 'social' development, and the research activities. More specifically, CENSIS conducted ethnographic research on the regional dimension of the DBE (WP.27, task B41; WP.31 tasks B42 and B34, WP.9 task C37), provided support for Regional Catalysts (WP.27, task B45) and contributed to the governance and sustainability debate (WP.34, task B46, WP 35 task B32)

An important aspect of CENSIS research, which cut across its various tasks, was tracking the DBE's development process. Due to the innovative character of the DBE, the consortium soon recognized the need to record project development and to capture the

insights gained during its various phases. This was deemed necessary for the SME engagement process and related SME activities, because of the lack of related research.

Social science research conducted within the context of the DBE, and particularly by CENSIS, focused not just on technology, but on the relation between technological innovation and social relations. The presentation of research activities, methodologies and findings according to workpackages, should not diminish the importance of their interdependencies. A key question in the tasks completed by CENSIS was whether the introduction of the DBE would reinforce already existing business and social relationships and/or whether it would create new links between local players, thus improving their territorial social capital (Coleman, 1988;Portes, 1998;Woolcock, 2001) ,i.e. the level and quality of collaborations among local players. Social capital can be defined as the advantageous access to people and resources that a person or an organization has due to its position in various social networks.

3.2 WP 27 - Task B41 Social Capital and SMEs recruitment and WP 9 – Task C37 Simulator Evolutionary Environment Simulator

The activities involved in this task, which complements the SMEs' recruitment activities, aimed to:

- Describe the three partner regions in terms of attitudes to collaboration, and social capital;
- evaluate whether the DBE can improve territorial social capital and be an efficient instrument for SME cluster creation.

CENSIS undertook two network analysis studies. The first focused on driver SMEs and the second on implementers. The network analysis interview guide was developed in collaboration with the Regional Catalysts (RC), and was validated by RCs and SME drivers³. Collaboration with RCs proved crucial for all research activities carried out by CENSIS as they constituted a privileged channel for information, and provided valuable access points.

The Social Network analysis:

- Formulated a complex social matrix of relations and links between driver and implementer SMEs, RCs and other local actors,
- Compared DBE regions from the perspective of collaboration and existing network dynamics.

The evaluation of networks in terms of social capital was essential for two reasons. First, the examination of networks, which can be regarded as relational infrastructures between actors, provides a useful way to define the context in which these actors operate, and provides a description of some of their characteristics in terms of their ties and overall

³ Driver SMEs are the SME software producers which developed applications on top of the DBE platform. SME implementers were the SMEs that would use DBE software at the level of services. Regional Catalysts were the organizations active in DBE's areas of deployment which were entrusted to perform the tasks associated with DBE deployment at the regional level.

connectivity. Secondly, investigation of a network's composition helps to identify important actors, whose engagement in the DBE could contribute to the sustainability and the scalability of the ecosystem.

The social matrix derived from the first network analysis gives important insights into the recruitment process and its underpinning social dynamics. It also offers valuable information on the leadership systems in the regions, the profiles of the stakeholders and the social architecture of the three participating regions. As a result, it reorients the recruitment process by pointing to the importance of intermediate actors, such as Chambers of Commerce, entrepreneurial associations and development agencies, which due to the trust afforded them by SMEs, can act to facilitate the uptake of the DBE.

The second stage, which also involved implementer SMEs and their users, describes the ecosystem as it has grown and become populated. The results of this analysis are significant in terms of the DBE's sustainability and its transferability to other regions.

During the second year of the project CENSIS researchers collaborated with researchers from the science disciplines, particularly with computer scientists working on the EVE (Evolutionary Environment) simulator. The EVE simulator improved the visualization of data produced within the context of social network analyses by introducing additional variables and adding a dynamic dimension to the depiction of the data. From this we were able to derive a visualization of the growth of the territorial networks during the process of SME recruitment, which clarified the network view by singling out missing links. The results of this collaboration could be used in training and engagement activities, since they are able to demonstrate, in a concrete way, the advantages of information and communication technology (ICT) adoption. For the computer scientists this collaboration gave access to real data and provided a different perspective from the simulation.

3.3 WP 3I – Task B42 Innovation cluster benchmarking report

Task B42 was the first research activity carried out by CENSIS for the DBE project. The aim was to develop a methodological tool to enable a comparative examination of the regions under study. Three partner and one associated region were examined from a static and a dynamic point of view. The central themes of the research were: social capital, regional capability for innovation, ICT usage, and SME's mind-sets towards ICT. The methodology combined qualitative and quantitative techniques and adopted a multidisciplinary approach, drawing from economics, sociology and media studies. The study, which used primary and secondary statistical data, provided a comprehensive overview of practices related to the promotion of innovation at regional level.

The results show that in the context of promotion of innovation, regions vary considerably, but share some common difficulties. Following a review of several variables such as regional skills, potential, limitations, and attitudes, specific measures were suggested to improve regional DBE adoption. An evaluation tool to measure the regional readiness for DBE implementation - the Regional Maturity Grade tool - was also proposed. This

represented the first in development towards a set of tools designed to enhance transferability of the DBE project. The Regional Maturity Grade tool could become a (self) assessment instrument for other regions interested in implementing DBE.

A second deliverable, which is currently being finalized, employs the Regional Maturity Grade tool and inputs from another CENSIS research activity to track the path followed by partner regions by structural characteristics.

3.4 WP 27 – Task B45 SMEs recruitment process and collaborative problem solving

The activities of this task were aimed at sustaining and supporting SME recruitment by providing RCs with a space for dialogue and recording the recruitment process itself.

The use of focus group methodology in an online environment enabled comparison of the process as it unfolded across the three partner regions, in order to identify synergies and resolve difficulties. The task activities also involved a process of tacit knowledge exploration. In order to reinforce this aspect of the task, an *interactive mental map* was constructed. The contents of the interactive mental map were built by CENSIS and visualize the main issues involved in past and future SME recruitment.

Focus group activities were initiated through a working mental map based on the definition of SME engagement. This map provided a visual representation of individual perceptions on a specific topic. A mental map usually takes the shape of a diagram and represents semantic or other connections between portions of information. By presenting these connections in a non-linear manner, mental maps encourage brainstorming, facilitating the free expression of opinions. This initial working definition was broken down into three dimensions. SME engagement is defined as a complex process - set in motion primarily by RCs, and through them by the entire consortium – which can be defined both procedurally and temporally and which involves calls of interest, communication, training and support activities.

The three dimensions of analysis were:

- Operative management: The planning and implementation of calls for bids designed to involve a large number of SMEs in the DBE project;
- Communication: The process of communicating the goals and function of the DBE as a project, a technological solution, and an approach to local and business development;
- Ecosystem population: Involving long-term implications of SME recruitment for the evolution of the DBE platform and for its development into a community. Issues relevant to this dimension include social capital, local development and governance.

The initial mental maps were grounded in the literature, internal project documentation and insights from activities in the business domain. The methodology adopted offers concrete possibilities for the sharing of ideas and different points of view, and resulted in an improved mental map, which incorporated feedback from partners and SMEs to capture more accurately the complex issues underlying the recruitment process.

3.5 WP 35 – Task B32 DBE Synergies with local and national R&D programmes

Task B32 originally aimed to explore possible connections between the DBE project and the European Research Area (ERA), i.e. analyse possible analogies and synergies, delineate possible steps for interconnection and examine ERA growth as a vehicle for DBE sustainability by activating channels of communication and exchange. During the second year, the focus shifted towards examining national and regional Research and Development (R&D) programmes; subsequently attention has focused on concrete funding possibilities and programmes that could contribute to the project's sustainability.

The first deliverable focused on the ERA programme, outlined its strengths and weaknesses and described its relation to the Lisbon strategy. It examined regional and national programmes in the three partner regions, taking into consideration established links with the DBE and future possibilities for collaboration. This deliverable examined how the DBE was introduced in the regional policy framework of the associated regions of Trento and Piemonte and prioritized the most promising programmes and policies for the future development and integration of the DBE. The study concluded that funding possibilities will depend on how the DBE is implemented in the participating territories. As a multidimensional project, underpinned by an open, collaborative approach and a sensitivity towards regional issues and SME needs, the DBE is open to different interpretations and, consequently, differing implementation possibilities. The first deliverable of WP 35 maps the aspects of the DBE which received most attention. This “definition exercise” was important in terms of transferability: by identifying possible synergies among DBE and national/regional programmes in the three associated regions, it is possible to identify similar possibilities for cooperation in other territories.

The second deliverable focused on the connections developed by the DBE project outside the partner regions. Lastly, deliverable 35.4.2 examines the links developed among DBE, DE cluster projects, other regions, open sources communities and EU projects.

3.6 WP 34 – Task B46 Delphi process

Task B46 supports the sustainability and governance debate by implementing a wide process of consultation.

The task is in line with previous attempts to hold open discussions on these topics, but was designed to avoid difficulties encountered in the past associated with different visions of DBE's future development. The task uses the Delphi technique and aims at development of a consensus on future governance and sustainability scenarios. This technique is suited to situations where there is little or no hard data available to support forecasting and was adapted to project specific needs. The technique is more commonly implemented by questioning a panel of invited experts. These experts have access to the anonymized views of the other panel members. This iterative process usually results in a consensus after a few rounds of exchange. In the case of the DBE the process involves around 260 people who were involved in the DBE during its life cycle.

The anonymity of contributions is meant to minimize any influence from personality, status, or allegiance in the process. However, the facilitator knows and records the attributions of each contribution. Thus, the process is both transparent and auditable.

The main goal was to reach a consensus on governance and sustainability issues, but provided a cross-section of different approaches which are not necessary compatible. At the time of writing the process had just entered its second and final phase; the first phase had a high response rate. Besides project partners, numerous other actors, such as representatives from regions interested in the DBE, or people who were exposed to the project in conferences and roadshows, gave their input. The study is expected to focus on the debate and to clarify the different approaches and suggested solutions in relation to the sustainability issues.

3.7 Reflection on collaboration

The success of the research activities described above was depending on collaboration among the project partners. During the research process different types of collaboration were established and in retrospect several paths of reciprocal learning can be identified. It is clear, for instance, that many changes were introduced in terms of task description, methodology and even task goals. In our assessment these changes are related to a radical shift in the partners' perceptions about what social science could contribute to the project.

At the beginning, the role of social science was seen as quite separate from DBE's technological development and the recruitment practices of SMEs. The research that was originally planned was mostly quantitative, relying on secondary data and focusing on the long-term implications of the project for socio-economic relations. However, after the project's first semester this approach was revised significantly and attention was refocused from conclusions based on secondary data to collection of primary data. In addition, the innovative and emerging character of DBE and the specific goals of the tasks called for more ethnographic, qualitative research. For example, examination of SME recruitment necessarily involved investigation of SMEs as they started to engage with the project and with the project's partners *in practice*.

CENSIS research activities benefited greatly from the following collaborations:

-*With RCs*: Collaborating with RCs enabled an ongoing, reciprocal exchange of knowledge and insights. Their input was crucial for CENSIS as they helped collecting the data needed to build the profile for each region and organized access and communication with the SMEs. RC took advantage of CENSIS research by taking into consideration the recommendations made by its researchers. They provided and received important feedback on governance issues, local development models and territorial strategies.

-*With other social science researchers*: There has been an ongoing collaboration, with the LSE. In particular, our analysis benefited greatly from the work of Dr Mary Darking. It is interesting to note that in the case of WP27 the research conducted by CENSIS and LSE without initially being coordinated, adopts a similar theoretical and methodological approach. Neil Rathbone provided substantial feedback in setting up and implementing the Delphi process. In our view, the collaboration among social scientists has been very productive. To

facilitate coordination of research activities a dedicated ‘Moodle’⁴ space was set up to keep track of the different social science related tasks, and to build a pool of knowledge and avoid overlaps.

-With business domain partners. This collaboration was very productive, especially in terms of governance and sustainability issues. Business domain meetings provided the opportunity to share findings and insights across the business and social science domains and work towards common goals. Business domain partners evaluated CENSIS research outputs positively. In particular the research on social networks has been used in business conference in order to underline the social basis of the DBE and the process of technological innovation. The concept of social capital was recognized as useful by other partners and has been applied in different ways. The work carried out by CENSIS and Intel on the production of a presentation video dealing with the territorial dimension of DBE and its inter-regional focus is another example of collaboration. The videos, which were aimed at policy makers, gave the opportunity to communicate our research outputs through a medium not usually employed in social science research. Another example is the DBE website on which methodologies used by CENSIS are presented as orientation material for possible new regions.

-With computer science researchers: The simulator provided the possibility to initiate an interesting collaboration with STU (Salzburg Technical University). During this collaboration a common vocabulary was developed and an understanding was reached with regard to our respective task aims, possible points of contact, and the methodologies applied in the two different research fields. This exchange process did not begin until the third year of the project, but, given the difficulties entailed in such demanding interdisciplinary research, the results are promising. It is our recommendation that this type of collaboration should be encouraged in future initiatives.

4. Inter and intra community collaboration in open, collaborative Digital Ecosystems by Evangelia Berdou (LSE)

4.1 Introduction

Cooperation between epistemic communities, that is communities built on the basis of an academic discipline, is regarded as a crucial element for the realization of the DEs’ ambitious interdisciplinary research agenda. At the same time, the sustainability of emerging DEs largely hinges on the cultivation of ties with existing Free/Open source (F/OS) software communities. Within the context of the research these two types of communities along with other groups of DE stakeholders, such as SMEs, were examined as communities or networks of practice (CoP)/(NoP), that is, more or less tightly knit communities, formed through the pursuit of a shared enterprise, which act as repositories of experience and knowledge (Wenger and Lave, 1991).

The researcher’s contribution to the project highlighted two important characteristics of CoP/NoP - their knowledge and structural embeddedness - and indicated how they relate

⁴ Moodle is a widely used OS e-learning platform.

to the sustainability and scalability of DEs. Knowledge embeddedness relates to the dependency of knowledge on the social context, which makes it difficult to translate across different CoP, domains and networks. Within the context of the research this aspect also involved examination of the appropriation of complexity theory ideas by social sciences. Structural embeddedness refers to embeddedness of economic action in social relations and the way “the quality and network architecture of exchange relations influence economic activity” (Uzzi, 2001:208). Following this discussion of the concepts of knowledge and structural embeddedness, the findings of the three studies conducted for the DBE project are presented.

The first study consists of an internal report ‘In the Cocoon: translating complexity across communities and networks of practice in a collaborative open source project’ (Berdou, 2005) and the second consists of deliverable D18.3 entitled ‘Report on the Socio-economics of Free/Open Source: Working together at the intersection of the gift and exchange economies: sustainability and scalability in F/OS’ (Berdou and Dini, 2005). Both studies examined the dynamics of collaboration between the different groups of actors involved in the project and in the wider, envisioned ecosystem. The internal report focused on the dynamics of cooperation and the implicit decision making processes of three groups of stakeholders internal to the project: regional catalysts, SMEs and BML designers. Deliverable D18.3 provided a framework for critically understanding the main socio-economic dynamics of F/OS from the perspective of the interrelated activities of three groups of actors involved in the wider F/OS process of development, deployment and adoption: volunteer communities, businesses and public institutions. The intensive discussions on the commensurability of the social and natural with the natural sciences that took place between the author and Dr Paolo Dini are reflected in the contribution made to deliverable D18.1 ‘Report on DBE specific use cases’ entitled ‘Complexity and the Social Sciences’.

4.2 Knowledge and structural embeddedness

The concept of knowledge embeddedness is closely linked to the view of learning, working and innovation encapsulated by the CoP perspective. The CoP perspective was originally developed to account for forms of learning and patterns of socialization that take place within and across the boundaries of traditional organizations.

The theory has its roots in social constructivism, which emphasizes the importance of culture and context in understanding what occurs in society. Lave and Wenger (1991), the scholars who first elaborated the theory, argued that a society’s knowledge is situated in the relations among practitioners, their practices, and their social organization and political economy. Communities of practice, which may include such disparate groups as a team of fire-fighters, office secretaries, or hackers, arise mainly through the pursuit of a shared enterprise. The socially embedded character of knowledge, however, which makes the CoP very effective in organizing and sharing knowledge among its members, creates considerable problems in attempts to codify and communicate this knowledge across group boundaries. In essence, the CoP perspective argues that:

- Practice is highly localized and knowledge is inextricably connected to the social processes that create and maintain it;
- knowledge exchange and communication between and across different communities and networks of practice are not straightforward. In addition to the difficulties created by the loss of context that the codification of knowledge entails, there are additional barriers that may hinder cooperation, such as diverging agendas.

The concept of structural embeddedness was first developed by the American sociologist Mark Granovetter. In his seminal article 'Economic Action and Social Structure: The problem of embeddedness' (1985) he argued that "continuing business relations often become overlaid with social content that carries strong expectations of trust and abstention of opportunism" (ibid:490). Granovetter (ibid:482) defined economic embeddedness as the: "argument that the [economic] behaviour and [economic] institutions to be analysed are so constrained by social relations that to construe them as independent is a grievous misunderstanding".

Granovetter developed this idea partly in response to what he regarded as "undersocialized" and "oversocialized" accounts of human action. The former is consistent with the neoclassical economics perspective that "disallow[s] by hypothesis any impact of social structure and social relations on production, distribution and consumption"(Granovetter, 1985:483). The latter is more common to some branches of sociology and emphasizes, for example, the importance of social processes, norms and values, at the expense of the political and economic structures permeating many aspects of economic life. If the concept of knowledge embeddedness argues for distinctiveness, the idea of structural embeddedness emphasizes connections that are expressed through the frequently overlapping character of digital, social, economic and professional networks. These ties need to be taken into account as they shape the landscape of DE and can therefore influence their development.

4.3 Internal Report: "In the Cocoon: translating complexity across communities and networks of practice in a collaborative open source project"

In this report the points of contact and departure in the strategies of regional catalysts, early SME adopters (software producers) and DBE designers at the beginning of the project, were mapped and some concrete recommendations made as to were offered about how to improve DBE's bootstrapping process. We conducted 15 interviews with representatives from each of the three groups, which revealed some of the difficulties that can arise in the construction and translation of social complexity into business and computing models and practices.

a. Regional Catalysts (RC)

RC representatives were assigned responsibilities primarily related to DBE adoption and dissemination. Although specific goals were clearly identified in the DBE project's Technical Annex, how these activities were pursued in practice was largely influenced by the

dynamics of the region and the networking capacity and skills make-up of the RC representatives. The gradual elaboration of the SME recruitment strategy and the specification of opportunity spaces did help to structure and focus activities. However, the communication of the project's business message was a significant challenge for RC partners, who were required to translate the scientific and technical vision of the DBE into concrete business opportunities for SMEs. In addition to these primary tasks, RC representatives had to play a coordinating role in contacts between SMEs and the various research teams in the project. Interviewees pointed to the difficulties involved in brokering knowledge between practitioners and researchers and creating bridges between these two different modes of engagement, but also referred to the moral implications of SME engagement, and the way that RC activities transformed them and informed their understanding of a Regional Catalyst.

b. Early SME adopters.

In relation to early SME adopters, the interviews showed that although in terms of supporting the development of new services and applications the productive capacity of the DBE was acknowledged, the DBE was primarily perceived as a conduit for networking and for marketing existing services and applications. The technological and business aspects of the DBE were generally perceived and discussed by interviewees in relation to one another. As the attitude of SMEs to open source demonstrates, this is characteristic of the problem-solving, hands-on engagement approach of their representatives, which focuses on the immediate opportunities and implications of DBE technology and design for their particular business. The results also indicate that this might reflect their attitude to the scientific aspects of the DBE, for example, the automated recommender of services. This raised some interesting questions for the project: As the technological and scientific aspects of the DBE translated into opportunities or hindrances as perceived by SME drivers, the DBE researchers were faced with the task of: a) clarifying their own assumptions about business and (re)aligning them with the realities of business practice; b) maintaining a balance between the needs and requirements of SMEs and the scientific, technological and political visions of the DBE.

c. BML designers

The BML designers' aim was to develop a tool that would allow the integration of collaboration between software developers and software users, and that would foster the creation of new value chains within and across traditionally defined business domains. To this end, the team of developers initiated a methodology that was aimed at a combination of top-down and bottom-up design approaches. During the first phases of the project, however, BML developments were predominantly guided by the top-down design approach, which involved examination of the existing standards. This involved balancing the platform's requirements against the dynamics of the industry, and networking with organizations such as OMG. The two major turning points in BML development were the decision to adopt a lighter and more abstract meta-model, and the decision to adopt an emerging standard (SBVR) that would allow business participants to specify their needs without any technical knowledge of UML modelling techniques.

The wider implications of these strategies for the sustainability of the DBE were investigated and some concrete recommendations to improve the bootstrapping process were made. The study highlighted:

i) challenges involved in setting up the RC network in addition to the business perspective, i.e. where RC intermediaries are located in the economic and political-industrial spectrum of each region and their technological and business orientation.

ii) the importance of a SME recruitment strategy to the process of bootstrapping. It was argued, in particular, that one way to reach out to open source communities would be to involve SMEs with experience in open source development community processes, from the early stages of the project. There is the possibility that engagement of OS communities will become increasingly difficult if the DBE is developed at the level of applications using proprietary standards.

iii) some long term implications of aspects of BML implementation, for example: how the adopted and/or imported ontologies and standards used by different business communities within the same domain will scale up within the context of the project and how the various vocabularies will be integrated and maintained across different domains.

It is important to remember that different interpretations of domain models do not result only from diverging viewpoints; they are often linked to competing interests associated with the use of specific standards and domain models.

4.4 Report on the Socio-economics of F/OS: Working together at the intersection of the gift and exchange economies: sustainability and scalability in F/OS (D18.3)

This deliverable drew on doctoral research (Berdou, Forthcoming 2007), which adopts a holistic view of the F/OS process taking account of the intersecting activities of volunteer communities, businesses and policy. It was suggested that a twofold strategy for involving F/OS communities in the DBE would be an important aspect of the DBE project. More specifically, the study indicated that:

- a. Volunteer communities incorporate both mundane and unique characteristics in terms of software development and social organization. Community managed F/OS projects are often structured in ways reminiscent of traditional software development processes in terms of their use of technical tools, negotiation of goals and priorities, and editing and reviewing processes. However, they are also underlined by unique dynamics such as intensive modularization of tasks, parallel debugging processes, and a highly developed sense of shared ownership and responsibility. At the same time, ideas about the social foundations of these communities, such as their purely meritocratic basis, are being revised as a result of studies that develop more elaborate frameworks of membership and participation.
- b. The boundaries between the gift economy, the purview of communities, and the exchange economy, where proprietary development takes place, are more permeable than was originally assumed. The interconnections between the two

value systems are intensified by the progressive commercialization of F/OS. Examples include companies contributing to community development and volunteer developers exchanging their reputational benefits for more senior and better paid positions, or improved access to venture capital.

- c. The business appropriation of F/OS raises more general issues with respect to software business models. In addition, there seems to be a considerable gap between the rhetoric about the business potential of F/OS, and the barriers to formulating and implementing strategies to leverage it. Copyright concerns and lack of know-how regarding the social and technical aspects of F/OS development are considerable barriers to its adoption by SMEs. Some of the most prominent business models are based on combinations of F/OS and proprietary code. However, companies that appropriate F/OS often make no contribution to the communities and do not reveal code. The virtuous cycle between business and F/OS code that is frequently assumed in discourses on open source is rarely realized in its ideal form, that of a synergistic relationship between companies and communities.
- d. The sustainability and scalability of F/OS are dependent on a wide range of policy issues, particularly patents and reverse engineering legislation. On another level of policy intervention, in recent years public institutions have shown increasing interest in F/OS and commitment towards open standards, but frequently lack the social, technical and legal know-how to participate fully in the F/OS process. F/OS is seen as a means for advancing industrial development and as an integral part of the provision of e-Government services for administrations, the business sector and citizens. However, the policy framework providing public support for F/OS is very fragmented. This is largely due to how the issue is framed within the policy domain. One side in the debate over the welfare benefits of F/OS software is dominated by neoliberal arguments that consider public support as having the potential to distort the basis for competition in the software market. The other side includes those that argue that the benefits of F/OS are not strictly economic, but are more related to opportunities for businesses, administrations and citizens for improved provision of and access to products and services.

Based on the above, two strategies for involving F/OS communities in the DBE were proposed:

- i. Predicated on the distinctive characteristics of community development and knowledge embeddedness, it was argued that the DBE should aim to facilitate learning among volunteer developers to enable them to become familiarized with the project's code base and to cultivate a sense of shared ownership. Since it was not possible to involve communities from the early stages of the project, providing high quality documentation, maintaining active task lists and providing support via mailing lists and IRC (Internet Relay Chat) channels would encourage participation of volunteers.

ii. Based on a recommendation in the internal report related to the embeddedness of F/OS in the commercial world it was suggested that the opportunities offered by overlapping networks of contacts and partnerships between companies, public organizations and volunteer communities should be exploited. Given the limited timeframe of the DBE project this strategy is likely to be the more viable of the two. The involvement of companies with connections with the F/OS world would create multiple points of entry, enabling communities to become involved in various aspects of DBE development, at the application and platform levels.

4.5. Complexity in the Social Sciences

The contribution made to deliverable D18.1 contextualized the links between biological, physical and social systems proposed by Dr Paolo Dini in a discussion about the connections between the social sciences and the set of ideas underlying complexity theory (Berdou, 2005). The contribution aimed at improving understanding of the difficulties as well as the possibilities of combining these two perspectives in an interdisciplinary framework that encompasses the conceptual depth and the methodological rigour of both fields.

Following discussion of the applications in social science that clearly link to complexity theory, attention was drawn to some of the problems that have emerged in applying the concepts and methods of complexity theory in the context of the social sciences. Two central, interrelated issues emerge. First, the extent to which the concepts in complexity theory can be used metaphorically; and second the ability of social complexity theories to model social processes. This raises two, more fundamental problems. The first concerns the way that researchers from the two different communities communicate across disciplinary boundaries. The second relates to the underlying commensurability of notions across the two fields, and questions the suitability of complexity related ideas for modelling social processes. The contribution indicated that complexity related notions and ideas are being mobilized by different agendas and made part of widely disparate social science programmes. All these appropriations, however, seem to be characterized by a common desire to develop a new language and a new perspective for approaching old and new problems.

More specifically, scientists trained in the natural sciences, mathematics, and computer science are frequently apprehensive about how scientific concepts are appropriated by researchers in the social sciences. One of their main concerns is that complexity theory is often used as a metaphor, a discursive strategy that fails to further our understanding of the phenomena under investigation, and of complexity theory itself. Social scientists, on the other hand, have concerns that the application of complexity ideas in social processes is frequently superficial and lacks the conceptual depth and richness attained by corresponding ideas in social theory. The contribution highlights the epistemological, conceptual, institutional and communicative barriers that appear to discourage interdisciplinary cooperation, while at the same time pointing to some of the factors that contribute to the popularity and the wide diffusion of complexity-related ideas, such as the utility of its focus on movement and emergence in expressing the complex transformations of globalization.

Given the difficulties of settling long-standing epistemological issues, it was suggested that it must be the willingness to engage with the notions of each field at a level that does not merely gloss over important conceptual differences and which involves a degree of understanding about the different research methodologies and traditions, that should be prioritized. Intensive interdisciplinary projects, such as the DBE, offer scientists from both fields a unique opportunity to cooperate on the basis of concrete and challenging problems that require mobilization of the analytic powers of both paradigms.

This contribution proposed two lines of social research to add conceptual depth to the underlying complexity theory approach of the DBE project and to facilitate the elaboration and formulation of actual solutions. The first relates to economist Christopher Freeman's work (Freeman, et al., 1982; Freeman and Perez, 1988; Freeman and Soete, 1987), which deals predominantly with the long run evolution of technologies and processes of incremental and radical change. The second focuses on social network analysis (Wasserman and Faust, 1994) (SNA) - a perspective that has benefited enormously from advances in computing, statistics and mathematics. It is suggested that Freeman's ideas present us with a body of theoretical and empirical work that can enrich our understanding of the co-evolution of technical, economic and institutional change and DBE's position within these dynamics, and that SNA presents us with a set of concepts and techniques that complement the informational and statistical aspects of the DBE topology.

The issue of the commensurability between the social and the natural sciences has also been addressed by Dr. Paolo Dini and Francesco Nachira (Forthcoming 2006) in their article on 'The Paradigm Structural Coupling in Digital Ecosystems'.

4.6 Appropriation of findings and adoption of recommendations

The research informed the discussion on the sustainability and scalability of the DBE both theoretically, by indicating the importance of knowledge and structural embeddedness for various project actors, and pragmatically, by making specific strategic recommendations with regard to recruitment, engagement, deployment and interdisciplinary collaboration. These ideas imply an alternative view of sustainability than is formulated strictly by short-term business considerations.

As the internal report and DI8.3 indicate, knowledge and structural embeddedness have numerous implications for the sustainability and scalability of DEs. For example, the problems involved in knowledge codification associated with the socially embedded character of knowledge, are important:

- for understanding the opportunities and barriers associated with encouraging use of ICTs to facilitate knowledge codification (Steinmueller, 2000). This is especially important for the design of BML;
- for understanding the difficulties involved in developing a policy framework aimed at translating the lessons learned at the level of distinct CoP to the level of

institutions. This is also relevant for the development of a governance framework for DEs;

- for understanding the challenges involved in the communication and coordination between widely different epistemic communities and networks of practice with divergent priorities.

At the same time the notion of structural embeddedness is useful for understanding:

- how DEs are embedded in the existing socio-economic landscape and how their development is framed by existing cooperative dynamics;
- how DEs affect this landscape in their own right and, in particular, whether and how they disembed existing cooperative relations from established networks of collaboration.

The relevance of the research findings, and specifically the strategies proposed for engaging F/OS communities, increased as discussions on DBE governance and sustainability progressed. The findings of deliverable D18.3 related to connecting with existing F/OS communities, for example, were summarized for the purposes of the sustainability meeting that took place at the LSE in March 2006 and recommendations were adapted to specific project goals and needs.

Short-term actions, such as improving project documentation to facilitate learning and the identification of the open source initiatives relevant to the DBE, were proposed. The difficulties of acting on these proposals were related to the limited resources of DBE developers at the time, and the pressing, short-term, business considerations of the DBE. Thus, although the research informed the debate on DBE governance and sustainability, its influence on actual project actions was limited.

5. Social science research on SME engagement and DBE governance by Mary Daring (LSE)

This section provides details of social science research carried out as part of Workpackage 27 SME Engagement, and Workpackage 32 DBE Regulatory Framework. In both cases, the main emphasis of the research was on the significance of SME engagement and its importance to the realization of the DBE policy vision. Section 5.1 summarizes the author's contributions to this work. In the remaining sections, three separate but inter-related areas of work are described and the respective findings summarized.

5.1 Introduction

The main themes in this work cut across a wide range of complex research areas including sustainability, governance, regulation, training, and engagement. In pragmatic terms, these are all areas related to the DBE project at an operational level since establishing, enriching and preserving key DBE relationships is a core endeavour of the project. However, the complexity and breadth of these multi-dimensional issues constituted too large an area of activity for business domain partners to address. Building syntheses and identifying connections across these dimensions is work best suited to social science researchers who are

able to propose and develop frameworks for discussion to ground debate in current research, and to collate and synthesize differing viewpoints within the project. This approach proved particularly useful in the case of discussions on sustainability and governance.

Table 5.1 presents the deliverables, reports, written contributions and academic publications prepared during the course of this work.

Table 5.1 Summary of deliverables, reports, written contributions and academic publications

| |
|---|
| Deliverables |
| ▪ D27.2-Studying SME engagement practices |
| Milestone Report |
| ▪ M32.5 Discussing and acting on DBE Governance Issues: towards a consolidated framework |
| Contributions to other deliverables |
| D34.5.2 Sustainability Plan section on ‘Understanding the difference between sustainability and governance’ |
| ▪ D32.5 Knowledge Base of Regulatory Issues |
| ▪ D32.7 DBE Regulatory Framework Final Deliverable, sections 2.1.5 and 7 |
| ▪ D18.7 Social Science Final Deliverable, section 5 |
| Other written contributions |
| ▪ Text for DBE website on SME training and engagement |
| ▪ Text for discussion threads and blogs on DBE governance |
| ▪ Survey and discussion agenda document for computing domain |
| ▪ Book chapter on DBE governance for DBE book edited by Francesco Nachira |
| Publications |
| ▪ Darking, M, Whitley, E.A. and P. Dini, (forthcoming) 'Governing diversity in the digital business ecosystem', Communications of the ACM |
| ▪ Darking, M. and Whitley, E.A. (Forthcoming) 'Innovation, Object Lessons and Invisible Technologies', Science Studies |
| ▪ Whitley, E.A. and Darking, M. (2006) 'Object Lessons and Invisible Technologies', <i>Journal of Information Technology</i> , Vol 21, 3, 176-184 |
| ▪ Darking, M, Whitley, E.A. and P. Dini, (2006) 'The Challenge of building public technology infrastructure: issues of governance and sustainability in a digital business ecosystem', <i>The Proceedings of the 14th European Conference on Information Systems</i> , Gdansk, Poland |

In the contributions listed in Table 5.1, the methodological approach combined theoretical and pragmatic outcomes, through the adoption of action-oriented research approaches. It was not difficult to find means of conducting and disseminating research that

addressed the practical concerns of the project. In terms of dissemination, blogging, developing discussion threads and converting research results into web site text were all used as appropriate. Similarly, the research process was designed to meet practical as well as theoretical ends. For example, the interviews with SMEs conducted for D27.2 provided the opportunity to consult SMEs and enabled their views to be brought to project meetings. Similarly, the survey of DBE developers on sustainability motivated and framed discussion in the computing domain, as well as being a significant contribution to governance research.

Two distinct but inter-related areas emerged from the author's original research into SME engagement. The first arose out of discussions on sustainability; the second from related discussions on DBE governance. In both cases the author attempted to provide a framework for discussion founded in current research in these areas in order to help project participants reach a consensus. The culmination of this work was the development of a DBE governance taxonomy, which is discussed in section 5.3.

The following sub-sections summarise the findings taken from original research on SME engagement, detailed in D27.2, contributions made to DBE sustainability, and research on governance and the DBE regulatory framework, carried out as part of WP32.

5.2 Engagement Practices

- D27.2-Studying SME engagement practices
- Text for DBE website on SME training and engagement

This research takes a cross-regional view of the processes through which SMEs became engaged in the DBE project. Research findings were based on fieldwork carried out with RCs and potential SME drivers during project months 20-26. This was a significant period as it marked the beginning of a programme of training and recruitment events across each of the DBE regions. It also marked the period when the first components of the DBE technology were released to SMEs. This context provided a unique opportunity for social science research. Whereas some of the other social science contributions provide high-level, socio-economic insights into the regional, business and IT environments in which SMEs operate, this deliverable was able to capture a bottom-up view and to capture the micro-detail of the 'first contact' between SMEs and the DBE project/technology and whether and how the interest of individual SMEs was sustained.

The purpose of this deliverable was not only to make these findings available to other project participants, but also to provide a methodological argument for why engagement is an area of research that should be studied as it occurs 'in practice'. Valuable data, insights and feedback on engagement can be gathered through the use of grounded research methods based on the study of practice; thus the main argument of D27.2 is that practice and strategy should always be maintained in an iterative relationship through the balancing of strategic and grounded viewpoints.

Deliverable 27.2 proposes an empirically grounded theory of engagement based on conceptual analysis of fieldwork texts. Table 5.2 presents the two core concepts of attunement and credibility and the six sub-concepts or dimensions that emerged from the

analysis. Together these concepts and dimensions constitute a theory of engagement relevant to processes of high innovation organized by means of a project entity that seeks SME engagement.

Table 5.2 Grounded Theory of Engagement: Concepts and Dimensions

| Core Conceptual Categories: Attunement and Credibility Adapting engagement practices to the specific regional and sectoral contexts in which SMEs work and to the specific needs and concerns they express in a way that inspires trust, confidence and belief lies at the core of successful engagement practice | |
|---|--|
| 1. Engaging with technical innovation | Specific engagement challenges associated with fostering interest in advanced technical artefacts which exist as concepts but have yet to achieve a stable physical form |
| 2. Regional Perspectives | The background and situation of regional catalysts varied as did the credibility of regional actors |
| 3. SME Perspectives | Characteristics and requirements with respect to engagement as stated by SMEs |
| 4. Engaging with project instruments | The roles and entities created by the project – such as the role of driver or regional catalysts or contractual processes of engagement |
| 5. From research project to community | Open source principles have been adopted by the project yet the changes required to move from project to community are significant |
| 6. From first contact to engagement | The process through which attunement and credibility were fostered over time through one-to-one communications and the design and ‘staging’ of training events. |

The research methodology and design allowed first-hand feedback from engagement and training events. It engaged driver and potential driver SMEs in a process of feedback and consultation through semi-structured interviews. In addition to presenting, analysing and providing results from the data collected, D27.2 offers a full report on practical contributions, which at the time of writing, fed into other tasks and sub-projects, and assisted and supported the engagement process.

5.3 Governance and sustainability

- Sustainability from a Social Science Perspective in D34.5.2 Sustainability Plan
- DBE Governance Internal Report M32.5
- Book chapter on DBE governance for DBE book edited by Francesco Nachira
- Survey and discussion agenda document for computing domain
- Text for discussion threads and blogs on DBE sustainability

Research in this contribution area fell within the remit of task B11 in workpackage 32. The need for a social science contribution to governance and sustainability was signalled initially by a request from the DBE reviewers at the 2nd annual review, first to consider a multi-stakeholder approach to sustainability requirements, and second, to separate the notions of governance and sustainability. Therefore, in a revised sustainability deliverable D34.5.2 the author contributed sections on multi-stakeholder analyses and understanding the difference between governance and sustainability.

A multi-stakeholder analysis was beyond the current remit; however, since one important dimension of DBE governance involved understanding how coordination of the DBE developers could be sustained after the funded period of the project, the researcher undertook to conduct a survey in the computing domain to enable the development of a sustainability discussion agenda. In order to follow up on this consultation the researcher attended a computing domain meeting where sustainability issues were discussed and some fundamental decisions taken. For example it was agreed that all contributions to the coding effort should be voluntary. At the suggestion of the researcher, it was agreed that an organizational structure for the developer group should be put in place independent of the project structure. It was decided that there was a need for someone to manage the execution environment and some to manage the development environment. These decisions were documented and the meeting notes were circulated among the developers. The researcher designed and oversaw a nominations process to decide on who should take on these two management roles for an initial trial period of two months. At the end of this period the researcher was no longer working on the DBE project.

In terms of distinguishing between governance and sustainability, the theoretical basis for this was Elinor Ostrom's seminal work 'Governing the Commons' (1983). According to Ostrom's definition, which has been generally accepted as being the archetypal definition of the commons, the DBE and its open source code base act as a 'common pool resource' or resource system from which resource units are extracted. However, there is a limit to how many resource units can be extracted from a common pool before the resource system itself becomes compromised, hence the need for careful governance.

Traditionally, much of the literature on the commons has focused on the governance requirements of natural resources, such as common land, air and water, where the focus of sustainability is on how to prevent over use and depletion of a common pool resource. Theoretically, 'digital commons', such as the DBE, do not comply with this conceptualization since the DBE infrastructure does not diminish, and in fact expands, with use. Whilst it is conceivable that the capacity of the physical infrastructure could be exceeded and in this sense over use could occur, in fact the more business models that are described within the infrastructure, the more connections and combinations are possible, which, in turn, enhances efficiency and usability. Thus, in the case of the DBE, rather than limiting appropriation to ensure sustainability, there are advantages in allowing open access to the infrastructure and encouraging use. In this sense, the DBE is more similar to a public good - where there is no need to limit appropriation and the key question becomes one of how to organize and motivate stakeholders to share responsibility for maintenance and provision - than to a private good or common pool resource.

In the development of this work the theoretical problem remains that traditional models for talking about 'commons' require the phenomenon in question to 'fit' some form of fundamental classification based on how it is governed (i.e. whether centrally governed by a public body or managed by a private company according to market principles); on its material classification (for example, as a natural or digital resource); or based on its economic classification according to the theory of goods (i.e. as a private, public or common good). As

an open source infrastructure, the DBE does not ‘fit’ any of these classifications. It does not lend itself to being managed by either public or private governance arrangements, since it is the product of a partnership between the two. Similarly, it does not fit with the traditional economic classification of goods as either public, private or common. In effect, it is the regulatory environment created by the general public licences that protect individual components of the infrastructure, which have the most significant constituting influence on the infrastructure as a whole, but these licences are the product of norms and policy actions rather material classification.

An alternative theoretical framework was identified by authors such as Jonathan Liebenau and Alain Bourdeau de Fontenay (Libenau and de Fontenay, 2006e) who made contributions related to how we understand relationships between knowledge, technology and regulation (Benkler, 2006; Lessig, 2003). Liebenau and de Fontenay (2006e) argue for a re-conceptualization of the commons that calls for a shift in focus away from the classification of goods and governance arrangements, towards the study of ‘exchange conditions’ more broadly. This allows for an analytical levelling of markets, organizations and institutions and also allows the focus to be drawn away from property rights, which whilst central in some market-based situations are not as relevant in others. What this reveals is that there is a spectrum of coordination and decision-making mechanisms that need to be considered when studying the governance of common resources; from informal norms and agreements to formally legislated arrangements. This theoretical foundation was used in the development of a governance taxonomy designed to provide a framework for digital ecosystems governance discussions, and which is detailed below.

Drawing on the key characteristics of digital ecosystems and the observation that governance involves a spectrum of processes, rules and interactions, six ‘dimensions of digital ecosystem governance’ can be identified. Integrating key findings from social science research carried out as part of the DBE project, Table 5.3 links the characteristics of the digital ecosystem context to dimensions of governance. Cutting across organizational, regulatory and technological frameworks, these dimensions should be considered as inter-related and at times over-lapping concepts for further research and discussion on the topic of digital ecosystems governance.

Table 5.3 Six Dimensions of Digital Ecosystems Governance

| Characteristic of digital ecosystems | Dimension of digital ecosystem governance |
|---|--|
| Shared values, common vision, participation and membership - constitutional documents such as manifesto, bill of rights or code of practice | Constitution and balance of interests |
| Transparency, inclusion, due process, policy, procedure and accountability | Culture of communication |
| Alliance forming and regional coordination, allowing for diverse governance models and diverse | Credibility, attunement and trust |

| | |
|---|----------------------------------|
| membership | |
| Distributed template, lightweight organization and synchronization for aligning codebase infrastructure development; association and alliance forming | Organization and synchronization |
| Knowledge and technology licensing, regulatory framework for digital ecosystems e-business interactions and legal definitions relevant to DBE entity | Licensing and regulation |
| Choice of software development methodologies, technological directions and infrastructural standards; association and alliance forming | Technological dimension |

In order to establish a policy vision for the digital ecosystem, the values and priorities encapsulated by that vision need to be embedded in a constitutional document such as a manifesto, a bill of rights or some other statement of common purpose. Defining the constituency to whom the bill of rights or common values applies is another important aspect of constitution building.

In terms of ensuring the operational viability of the infrastructure, there are a number of tangible areas that questions of governance can be applied to. For example, questions surrounding the maintenance and development of the DBE code base; security; and the extent to which identities can be trusted and data securely shared via the DBE infrastructure. Sharing business models is also a significant and tangible area that requires constitutional support in the form of a code of practice for SMEs to ensure interests are protected. In addition to these operational questions, governance of the DBE regulatory framework is an extremely influential area of the ecosystems environment, which is accompanied by specific governance requirements. And as a set of processes that have consequences for the infrastructure as a whole, the evolutionary environment is another area that will require some form of governance or coordination.

5.4 Governance and the regulatory framework

- D32.5 Knowledge Base of Regulatory Issues
- D32.7 DBE Regulatory Framework Final Deliverable, sections 2.1.5 and 7

This work forms part of workpackage 32 and corresponds to internal report M32.5, which was added to the description of task B11 in amendment 5 (accepted by the Commission in November 2005). In the amended description of workpackage 32, the scope of work was originally limited to identification of governance concerns that may influence current and future SME participation in the DBE. The main purpose at this time was to ensure that the task of creating a knowledge base of regulatory issues was firmly underpinned by SME needs and concerns. On this basis, the report was intended to build on social science fieldwork with SMEs, as part of workpackage 27 Studying Engagement Practices (Deliverable D27.2) and as

part of task B11 Knowledge Base of Regulatory Issues in workpackage 32 (Internal Report, M32.2).

The research underlying this report was carried out over a five month period from January to May 2006. The research activities were event-driven and the approach was action oriented. In line with this methodological approach, a number of research interventions were made including attempts to stimulate open debate on sustainability issues through the use of internet-based blogs and discussion forums, and through contributions to sustainability discussions and deliverables. In addition, two academic articles and a book chapter were published on the topic of DBE governance.

Internal report M32.5 was designed to consolidate and contextualize the research contributions and interventions associated with this work. The first section of the report provided an overview of events and discussions within the project related to governance that took place after the 2nd annual review. The second section drew upon SME views regarding governance, collected through research interviews carried out for deliverable D27.2 on SME Engagement Practices and deliverable D32.4 Locational Issues for the Implementation of the Knowledge Base. Many of the issues identified in these interviews had implications for governance and the DBE regulatory environment. Trust, which was identified as a building block of e-business regulation by researchers in WP32, was equally relevant to governance arrangements. There were also responsibilities such as data protection and security that SMEs felt could be addressed through appropriate governance arrangements. These findings were analysed and incorporated into the DBE governance taxonomy outlined in the section above. The original remit of internal report M32.5 concerning SME participation in the formation of a regulatory framework is fulfilled by the contribution made to this deliverable, D32.7 DBE Regulatory Framework Final Deliverable, sections 2.1.5 and 7.

5.6 Collaboration and appropriation of findings

SME engagement, a central component of the DBE project, was the explicit focus of work carried out for deliverable D27.2 SME Engagement Practices. It was also the basis of research on governance carried out as part of workpackage 32, task B11 'Knowledge Base of Regulatory Issues', detailed in internal report M32.5. Other areas that engagement research contributed to include: DBE website development; DBE training; and DBE sustainability. Each of these areas was developed as dimensions of engagement previously identified in D27.2. Feedback on training experiences and development of the DBE website provided an important means to consolidate and disseminate regional and project experiences of engagement. Equally, discussions surrounding DBE sustainability were inevitably concerned with how to sustain SME engagement beyond the funded life of the project. In addition, to these dimensions, the relevance of the DBE regulatory framework to SME engagement was seen as constituting a part of the general contributions made to workpackage 32 and internal report M32.5. The findings from these contributions were incorporated into the DBE governance taxonomy, which was designed as a preliminary framework for organizing discussions on the future governance of the DBE.

A wide range of collaboration with other DBE partners was achieved in the course of this research. RCs in all three DBE regions helped to set up interviews with SMEs they had

recruited. The cross-regional overview that this support facilitated was invaluable to the engagement research that was carried out. Collaboration with social science researchers from CENSIS was extremely valuable in forging links between bottom up research and broader socio-economic regional analyses. Discussions held in meetings in the business domain provided opportunities for collaboration between social science researchers and those responsible for creating a sustainability plan. Collaboration with the computing domain over sustainability was more challenging. However, developers were very ready to complete the survey that was sent to them and to take part in discussions.

Written contributions to other deliverables were requested by workpackage leaders at various points; these are detailed in Table 5.1. These written contributions were often the result of collaboration in meetings. Meetings provided forums for feedback on research findings and allowed the views of SMEs to be heard and incorporated into any decisions. For example, the researcher attended meetings of the group responsible for web site development and was able to offer opinions on web site design informed by engagement with SMEs. A similar model of engagement was applied to training, although appropriation of social science inputs was less evident in this area.

5.7 Appropriation of findings and adoption of relevant recommendations

With respect to engagement and governance research, appropriation of the findings from the DBE project was evident in the discussions they inspired and in the dissemination of research outcomes across a range of deliverables. However, whilst this appropriation was relatively strong within the project, within the general context of Framework Programme funding, these results and recommendations have achieved less visibility. The most important characteristic of the DBE - and that which sets it apart from other funded technology platforms - is the centrality ascribed to SMEs in both the *use* and *production* of the infrastructure. An iterative relationship between use and production means that SME business and technology aims are definitively inscribed into the design and development of the infrastructure. The most agile and responsive means through which this iterative relationship can be expressed is through the use of open source development methods and licensing. The client-oriented nature of both SME business aims and open source developments provides an important match and the ability to move with market trends that larger companies and technology providers are unable to simulate.

The combination of open source infrastructure and SME centredness makes the DBE unique as both a policy intervention and in terms of comparable products and developments in the technology market. Both using and developing the infrastructure for their own objectives, creates a significant opportunity for SMEs to define a regulatory, technological and business environment that serves their specific needs. Business opportunities and new technological developments are inter-related; boundary-pushing in one area invariably leads to new incentives to development in another. However, dominant technological standards and infrastructures, together with the regulatory environment for business and technology production, form a context that can either advance or impede the potential for SMEs to compete. Understanding the inter-locking relationships between these diverse areas and

increasing the capacity for SMEs to influence the environments in which they work enables a positive context for innovation that has so far been ignored.

SMEs constitute a seed-bed for innovation from which outstanding new products and services continually emerge. They are close to the market in the sense that they are in continuous dialogue with their client or customer base and are therefore able to see opportunities emerge and respond quickly. SMEs are in a position to see markets and mobilize opportunities that larger companies - for which larger coordination efforts would be required - are either unable or unwilling to act upon. However, the route to market for SME products and services is often restricted by prevailing market conditions. The dominance of larger companies, especially in the context of technology markets, means that SME products and innovations are frequently channelled through the business and development strategies of those companies, according to their particular rationale for determining how technology markets are likely to develop. This channel undoubtedly constitutes a significant means by which the products of smaller companies are developed. However, the overall impact is that the business and technology environment of smaller companies continues to be defined by the business vision of larger technology companies.

6. Discussion & Conclusions

6.1 Underlying themes, common approaches and convergent insights

This subsection summarizes the main insights afforded by social science research and highlights common underlying themes and convergent insights. The contributions included in this report span the duration of the project and concern different aspects of the DBE's development: from recruitment, engagement and training to deployment, and long-term sustainability. In particular, social science work focused on:

The regulatory framework and the DBE knowledge base. The contributions made by the LSE regulatory team emphasize the importance of regulatory issues for establishing a trust base among DE participants and argue that all aspects of DBE development, deployment and implementation need to be founded on a baseline understanding of the relevant policy and legal domains. Drawing on the e-commerce literature, the team refined the notion of trust and developed a formal model outlining its various expressions at different levels of interaction. The developed taxonomy framework is based on three dimensions of trust: participants' trust towards the DBE platform, the trust between participants in the ecosystem and the expectations towards joining companies. The work conducted also outlined the domains that are relevant for the regulatory environment. These are: privacy and consumer protection, e-signatures and security and jurisdiction and consumer protection. Their empirical work with SMEs confirmed the importance of the DBE's governance and legal constituency as key issues for the future.

- a. The formalized outputs of its work and specifically the taxonomy framework, was used by the BML team and the model developed were empirically validated through interviews with SMEs. These interviews clearly indicated that the institutional framework of the DBE, that is, the established governance mechanisms and the

system's legal representation, is a crucial issue that will directly affect the ecosystem's sustainability.

- b. *SME recruitment, regional innovation, opportunities for collaboration at European and regional level, governance and sustainability consultation survey.* CENSIS' work covered different aspects of the DBE bootstrapping process and its deployment and was characterized by a strong regional focus. Its work was strongly connected to RC activities and helped to build a detailed picture of the regional capability for DBE adoption. A central theoretical concept guiding CENSIS' work is the idea of social capital, which draws attention to the networks of individuals that help to embed economic interactions in social relations. The two social network analyses performed across four regions provided valuable insights into the key relationships affecting deployment of the platform. The principal finding from the various studies was that the introduction of the DBE, in its pre-prototype phase of development, seemed to reinforce existing socio-economic dynamics rather than acting as a catalyst for change. CENSIS engaged in collaboration with the STU science team and completed their activities in the project by designing and implementing a survey aimed at assisting discussions on sustainability and governance.
- c. *Interdisciplinarity, inter and intra dynamics of collaboration, strategic interaction with F/OS communities.* Evangelia Berdou's work focused on the dynamics of collaboration both within the context of DBE research project at an epistemic as well as at a practical level, and between the project and volunteer, community-led F/OS communities. Her work draws primarily on the CoP perspective and evolved around the concepts of knowledge and structural embeddedness, i.e. the ideas that knowledge is context specific and therefore hard to translate across different contexts and that economic action is embedded in socio-economic relations. It was argued that both these concepts are crucial for the sustainability and the scalability of DEs. Deliverable D18.1 which focused on the socio-economic of Free/Open source software made specific recommendations on how the DBE could link with existing volunteer Free/Open communities.
- d. *SME engagement and Governance.* Dr Mary Darking's work on SME engagement adopted a grounded theory approach to examine how first contact between SMEs and the DBE project was achieved and how the interest of individual SMEs was sustained. She argues that practice and strategy should always be kept in an iterative relationship through the balancing of strategic and grounded viewpoints. Her research on governance drew from theory on 'the commons' to develop a governance taxonomy designed to provide a framework for discussion of digital ecosystem governance, which cuts across organizational, regulatory and technological frameworks. An argument was made for the need to adopt a multi-stakeholder approach in relation to the consultation process on issues of governance and sustainability.

Despite their different starting points, requirements and foci these contributions have significant theoretical and methodological affinities. The notion of structural embeddedness employed, for example, by Berdou is compatible with the concept of social capital adopted by CENSIS. Both of

these ideas are linked to the notion of trust, which was elaborated by the LSE regulatory team. At the same time, sustainability and governance constitute two of the main points of convergence in all four contributions. These two issues became increasingly prominent as the project drew to a close and questions about the future of the DBE became more pressing. In addition, all social research activities have been concerned, in one way or another, with SMEs. This is no surprise; SMEs are the primary beneficiaries of the platform and their successful engagement is a prerequisite for its existence.

In short, social science contributions in the context of the DBE project aimed to:

- Balance the need for the market exploitation of the DBE with the necessity to maintain the open, collaborative character of the project.
- Ground debates in current research and literature.
- Formulate theory and research in view of real policy questions and strategic actions.
- Provide insights and recommendations on the basis of empirical data collected with validated methodologies.
- Collate and synthesize points of view of involved and potential stakeholders.
- Provide an opportunity for reflecting upon different aspects of DBE development.

6.2 Elaborating a social science research agenda for Digital Ecosystems research

This deliverable focuses on the social science contributions conducted within the context of the DBE project. In accordance with the integrated character of the project these contributions constitute specific project needs. They do not however constitute a cohesive approach to social science research for a number of reasons. This subsection builds on the insights afforded by these contributions to make concrete suggestions regarding social science approaches, traditions and methodologies applicable to DE research. Some of these issues are already being addressed in OPAALS.

The suggested framework evolves around the following, broadly defined dimensions of investigation:

a) Community & Stakeholder dimension: Dynamics of cooperation and communication between and across project boundaries.

This aspect of research should examine the dynamics of cooperation and communication between different epistemic communities, communities and networks of practice situated between and outside the ecosystem's boundaries on the one hand, and DE stakeholders on the other.

These dynamics should be examined from both a structuralist and a socio-constructivist point of view. The socio-constructivist perspective, which is founded upon the idea that language and knowledge do not correspond blindly to a given reality, but express specific agendas and world views, is useful in investigating questions of interdisciplinarity, communication and knowledge codification. These issues are crucial for understanding the difficulties involved in exploiting ICTs to build a thriving, interdisciplinary research community, the challenges involved in enabling SMEs to express their needs and

requirements on their own terms, and the difficulties of translating knowledge and insights across communities or stakeholders with divergent agendas, such as volunteer F/OS communities and business communities. The first two issues are being investigated in the first phase of OPAALS.

Structural analysis should examine the involvement of actors in DEs, such as SMEs, research communities, policy makers, large corporate players, F/OS communities, by taking account of their institutional profiles, and the aims, interests and agendas, networks and resources they bring to the project, and the way that these bear upon the decision making processes and broader project dynamics. This type of examination is called stakeholder analysis and is widely used in policy research.

The difference in examining the dynamics of cooperation and communication at the level of stakeholders and at the level of CoP is that communities and NoP usually operate outside established organizational boundaries (for example a programmer may work for a SME or a government organization), whereas stakeholder analysis is concerned with traditional organizations and assumes that individuals primarily represent the agenda of their organizations. These two perspectives are complementary, since in reality individuals operate according to the norms of their CoP, but at the same time, are obligated to support the interests of their organizations.

b) Spatial and Network Dimension: ICTs and development, socio-economic networks, regional development and global connections.

In his seminal work ‘The Rise of the Network Society’ Castells (2000) discusses the transformation of location patterns of core economic activities under the new technological regimes for advanced services and manufacturing. Castells argues that this new industrial space is characterized by the simultaneous dispersion and concentration of advanced services and that despite popular claims decentralization is hierarchically organized around established centres of human and exchange capital. These dynamics are of crucial interest to the DEs which are designed to act as catalysts for regional development and are, therefore, deeply embedded in the regional dynamics of innovation and exchange.

This aspect of the research, consequently, should draw on the traditions of geography (Amin and Thrift, 1994; Sassen, 2005; 2005; Scott, 1998) and economic sociology (Granovetter, 1985; Uzzi, 2001) to examine the different geographical and network dimensions of DEs; the factors underlying the continuities, interconnections and/or gaps existing between the different types of socio-economic networks that constitute it, the way that these networks are organized in space and the “changing movements of cooperation and competition between firms and locales” (Castells, 2000:424). In addition this dimension should investigate how DEs become embedded in an existing regulatory, and socio-economic landscape and how they affect the regional dynamics of cooperation, innovation and ICT adoption, both in the short and the long term. The work conducted within the DBE touches on this area of investigation. However, a more comprehensive effort is needed in order to map cooperative ties, help pinpoint opportunities for synergies and examine more theoretically the interaction between

the local and the global as SMEs become disembedded and re-embedded in their industrial and geographical activity domains.

c) ***Technological dimension: DBE as a standard and innovative technological platform***

Social science researchers involved in the DBE project have argued that DEs are not just about technology. However, the technological dimension of DEs remains an important area of investigation. In examining the DE as an innovative technological platform it is suggested that the body of work related to techno-economic approaches focusing on processes of standardization and the diffusion of innovation might be particularly useful. The work of Christopher Freeman (Freeman, et al., 1982; Freeman and Perez, 1988; Freeman and Soete, 1987) and the Systems of Innovation (Edquist, 1997) approach offer two ideal starting points for elaboration of an agenda that examines DBE as a innovative techno-economic platform.

The *Systems of Innovation* approach studies the process through which innovations emerge at national, regional or sectoral level. The value of the approach lies in its broad conceptualization of the conditions of innovation. Proponents of this perspective take into account a broad spectrum of organizational, institutional and technological dynamics, which are considered as interdependent and historically and contingent. The underlying argument of the approach is that innovation requires interaction between organizations operating in different institutional contexts and that its success hinges upon the ability of one institution to learn from another and to be able to translate knowledge acquired to another context. This approach could be particularly useful for DEs especially since the contexts of their adoption, deployment, and further development vary widely from one region to the other.

Christopher Freeman's work, which is in part, connected with the Systems of Innovation approach, is particularly relevant in considering DBE both as part of a wider complex of policies and interventions as well as an evolving technological framework and platform for innovation. Some of the insights from his work demonstrate that the effects of changes that the DBE is designed to implement will depend on a number of associated institutional and regulatory policies, as well as on a cluster of incremental innovations pertaining to different aspects of its deployment and development. Another implication of Freeman's work concerns the way DEs will work in concert with existing technologies, platforms and standards. The balance between the incremental and radical innovation is another question that needs to be addressed within the context of DE research.

Building on a scheme developed by Williamson (2000), it is possible to map these dimensions to levels of DE socio-economic activity:

■ ***Embeddedness: Structural, cognitive, cultural embeddedness, informal institutions, norms, traditions***

This level covers structural, cognitive and cultural dimensions of embeddedness, informal institutions norms and traditions. The question of trust, social capital, the relationship between the exchange and the gift economy, the context specific character of knowledge are some of the issues that are included under this broad area of investigation.

■ **Institutional environment:** *Formal institutions legal and policy framework, technology standards*

This level of investigation concerns the formal rules of the game, the legal and policy framework encompassing the function of DEs, the ecology of the participating formal institutions, the influence and interaction with established technology and industry standards.

■ **Governance:** *Decision making processes, dynamics of representation, defined rights and responsibilities.*

This level concerns the processes and mechanisms through which DEs are governed and the way they interact with other governing institutions and global value chains.

■ **Resource allocation and management:** *Sources of funding and economic sustainability.*

This level concerns the way DE resources are allocated and managed both informally and formally.

6.3 Concluding Remarks

This deliverable has presented the main insights provided by social science contributions within the context of the DBE project. Their presentation is framed in discussion of the role of social science in the project and the difficulties involved in formulating practical recommendations grounded in cutting-edge research in the context of an intensively interdisciplinary integrated project.

The wider argument to be drawn from this study is that social science research is relevant in the design and deployment of cutting-edge, large-scale technological projects and that social science research should therefore be more closely integrated with integrated projects' research agenda. This deliverable builds on the project contributions to develop a basis for an overall social science research agenda for DE research.

Bibliography

- Amin, A. and N. Thrift, eds (1994). *Globalization, Institutions and Regional Development*. Oxford: Oxford University Press.
- Benkler, Y. (2006). *The Wealth of Networks: how social production transforms markets and freedom*. New Haven, CT: Yale University Press.
- Berdou, E. (2005). 'Complexity in the Social Sciences.' In *DI8.1 Report on DBE-Specific Use Cases*, edited by Dini, P. and E. Berdou, pp.25-35. London: Media and Communications Department, London School of Economics and Political Science.

- Berkey, J. (2002). 'Outline of International e-commerce regulatory issues.' in *Intel/Unitar Campus of New Information and Communication Technologies and Diplomacy Proceedings*, New York, US, 12-15 February 2002, (eds),
- Castells, M. (2000). *The Information Age: Economy, Society and Culture volume 1: The rise of the network society*. Oxford: Blackwell.
- Clarke, R. (2002). 'e-Consent: a Critical Element of Trust in e-Business.' *Proc. of 15th Bled Electronic Commerce Conference. Bled, Slovenia, available at* <http://www.anu.edu.au/people/Roger.Clarke/EC/eConsent.html>.
- (2002). 'Trust in the context of e-business.' *Internet Law Bulletin* 4, no. 5: pp.56-59.
- Coleman, J. S. (1988). 'Social capital in the Creation of Human Capital.' *American Journal of Sociology, Supplement: Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure* 94: pp.S95-S120.
- Dini, P. and F. Nachira (Forthcoming 2006). 'The Paradigm of Structural Coupling in Digital Ecosystems.' In *Toward Business Ecosystems*, edited by Corallo, A., G. Passiante and A. Prencipe: Edward Elgar.
- Edquist, C., ed. (1997). *Systems of innovation: technologies, institutions, and organizations*. London: Pinter.
- Freeman, C., J. Clark and L. Soete, eds (1982). *Unemployment and Technical Innovation*. Great Britain: Frances Pinter (Publishers).
- Freeman, C. and C. Perez (1988). 'Structural crises of adjustment, business cycles and investment behaviour.' In *Technical Change and Economic Theory*, edited by Rossi, G., C. Freeman, R. Nelson and G. Silverberg. Great Britain: Pinter Publishers Ltd.
- Freeman, C. and L. Soete, eds (1987). *Technical Change and Full Employment*. Oxford; New York: Basil Blackwell Ltd.
- Granovetter, M. (1985). 'Economic Action and Social Structure: The problem of Embeddedness.' *The American Journal of Sociology* 91, no. 3: pp.481-510.
- Javernpaa, S. L. and N. Tractinsky (1999). 'Consumer Trust in an Internet Store: a Cross-Cultural Validation.' *Journal of Computer Mediated Communication* 5, no. 2: pp.45-71.
- Keen, P. G. W. (2000). 'Ensuring E-trust.' *Computerworld* 34, no. 11: pp.46.
- Lessig, L. (2003). 'The Creative Commons.' *Florida Law Review* 55: pp.763-777.
- Libenau, J. and B. de Fontenay (2006e). 'Information and Communication Technologies from a Commons Perspective.' *Proceedings of the Annual Conference of the International Association for the Study of Common Property "Building the European Commons: from Open Fields to Open Source"*, University of Indiana Digital Library of the Commons.
- Mansell, R. and B. Collins (2004). 'Cyber Trust and Crime Prevention: a Synthesis of State-of-the-Art Science Reviews.' In *Cyber Trust and Crime Prevention*, edited by Mansell, R. and B. Collins. ? : ?
- Meents, S., Y. H. Tan and T. Verhagen (2003). 'Distinguishing different types of trust online B2B marketplaces. P.' *Proceedings of the Tenth Research Symposium on Emerging Electronic Markets 2003*, pp. 53 - 65.
- Melody, W. and R. Mansell (1983). 'The Debate over Critical and Administrative Research: Circularity or Challenge.' *Journal of Communications* 33, no. 3: pp.103-116.
- Nachira, F. (2002). 'Towards a Network of Digital Business Ecosystems Fostering the Local Development.' *Discussion paper available at: http://www.digital-ecosystems.org/ (last accessed 15.02.05)*.
- Ostrom, E. (1983). *Governing the Commons: the evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Pavlou, P. A. (2002). 'Institution-based trust in interorganizational exchange relationships: the role of online B2B marketplaces on trust formation.' *Journal of Strategic Information Systems* 11: pp.215-243.
- Portes, A. (1998). 'Social Capital: Its origins and applications in modern sociology.' *Annual Review of Sociology* 24: pp.1-24.
- Rosenbaum, H. and E. Davenport (2003). 'Situational Trust in Digital Markets: a socio-technical exploration.' *Ninth Americas Conference on Information System Proceedings*.
- Sassen, S. (2005). 'Electronic Markets and Activist Networks: The Weight of Social Logics in Digital Formations.' In *Digital Formations: IT and New Architectures in the Global Realm*, edited by Sassen, S. and R. Latham, pp.54-88. Princeton: Princeton University Press.
- (2005). 'The Embeddedness of Electronic Markets: The Case of Global Capital Markets.' In *The Sociology of Financial Markets*, edited by Cetina, K. and A. Preda, pp.38-61. Oxford; New York: Oxford University Press.
- Schoubroeck Van, C., H. Cousy, D. Droshout and B. Windey (2001). 'Virtual Enterprise Legal Issues'. K.U Leuven University - ALIVE Project.
- Scott, A. J. (1998). *Regions and the World Economy: the Coming Shape of Global Production*. Oxford: Oxford University Press.

- Shankar, V., G. L. Urban and F. Sultan (2002). 'Online trust: a stakeholder perspective, concepts, implications, and future directions.' *Journal of Strategic Information Systems* 11: pp.325-344.
- Sultan, F., G. L. Urban, V. Shankar and I. Y. Bart (2002). 'Determinants and Role of Trust in E-Business: A large Scale Empirical Study'. Center for eBusiness@MIT and McCann Erickson, NFO.
- Swan, M. and H. Rozenbaum (2004). 'The social construction of trust in e-business: an empirical investigation.' *Americas Conference on Information Systems*, available at: <http://aisel.isworld.org/pdf.asp?Vpath=AMCIS/2004&PDFpath=SIGEBZ01-1766.pdf> (last accessed 15.02.05).
- Uzzi, B. (2001). 'Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness' In *The Sociology of Economic Life-2nd ed.*, edited by Granovetter, M. and R. Sweberg, pp.207-238. Boulder, Colorado, Oxford, UK: Westview Press.
- Wasserman, S. and K. Faust (1994). *Social Network Analysis: Methods and Applications*. Cambridge; New York: Cambridge University Press.
- Williamson, E. O. (2000). 'The New Institutional Economics: Taking Stock, Looking Ahead.' *Journal of Economic Literature* 38, no. September 2000: pp.595-613.
- Woolcock, M. (2001). 'The place of social capital in understanding social and economic outcomes.' *ISUMA-Canadian Journal of Policy Research* 2, no. 1: pp.11-17.