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WP12: Socio-Economic Models for Digital Ecosystems

Task 12.2 – Governance in Digital Ecosystems

Deliverable 12.2: Governance research literature review and taxonomy development

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Short Description: This deliverable outlines a taxonomical framework designed to support the collaborative development of digital ecosystems governance research. The taxonomy aims to assist digital ecosystems researchers - particularly those in non-social science domains - in understanding and locating the governance implications of their research in relation to existing bodies of academic work on this subject. Research strategies and methodological suggestions are proposed to support the ongoing collaborative development and population of the taxonomy. In order to demonstrate how the taxonomy can support the development of digital ecosystems governance research a small empirical study is formulated. The objective of this process is to show how the taxonomy could act as a supporting framework for a collaborative tool and repository for governance-related digital ecosystems research.

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Domains	<p>Specify the scientific domains involved in this deliverables and clarify to which extend they are covered by this report</p> <ul style="list-style-type: none"> - Social science domain - fully covered - Computing domain – to the extent that governance issues impact on technical architecture and on OS community development - Science domain – to the extent that ideas on systems theory and cybernetics overlap and scientific principles relating to the Evolutionary Environment hold governance considerations
Targets	<p>Specify which is the target of this deliverable (Domain researchers, public administrations, SMEs, Scientific communities on specific domains, etc.)</p> <ul style="list-style-type: none"> - Digital ecosystems researchers interested in governance issues from all 3 domains - Those working at local government and policy level to implement digital ecosystems - SMEs interested in framing their experience of participating in digital ecosystems



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Executive summary

This deliverable continues the development of a taxonomic framework for understanding governance in the context of digital ecosystems. This work began during the final phases of the Digital Business Ecosystem project and culminated in a book chapter (Darking, 2007) and journal article (Darking et al., in print) on digital ecosystem governance. Previous research established that digital ecosystems governance is far-reaching, multi-dimensional and constantly shifting. Any methodology that sets out to engage with (i.e. to build knowledge around or definitions of) digital ecosystems governance therefore has to confront and incorporate these key characteristics.

The overall aim of this research is to develop a taxonomic classification of key terms and relevant research that can support the ongoing collation and consolidation of governance research on digital ecosystems. To that end this deliverable contains 3 main components. The first component is a literature review of past and current governance research. The review of literature supports the view that governance research is inherently multi-dimensional and forms the basis for the initial taxonomic classification of governance related themes and issues.

The second component of this deliverable is a set of research strategies and theoretical suggestions to support researchers in using the taxonomic framework. The proposed strategies and assumptions are based upon a number of key theoretical concepts concerning infrastructures as 'objects of governance'. These are that: infrastructures are comprised of heterogeneous socio-technical actors; infrastructures can never be known in their entirety; infrastructure can never be controlled; and that the scale and scope of infrastructure are constantly shifting. The research strategies and theoretical suggestions proposed are intended to provide researchers with a pragmatic approach to addressing these fundamental characteristics and therefore support the development of knowledge and research in this area.

In order to demonstrate how the taxonomy, research strategies and theoretical suggestions can be used in conjunction with one another, a worked example is provided whereby the literature-based taxonomy is used to develop a design for fieldwork.

Finally a proposal is put forward for creating a wiki-based version of the governance taxonomy. The intention underlying this proposal is to encourage the ongoing, collaborative development of the taxonomy across the OPAALS Network of Excellence. In this context the taxonomy would act as an underlying framework for the wiki content transforming it from a 'flat' classification of research themes and concepts into a 3-dimensional touch point for different aspects of digital ecosystem governance. In this capacity, the wiki space also has the potential to act as a link between new DE governance concerns and established research, giving those involved a 'place to start'; an idea of the potential ways there are to frame these issues; or simply a sense of what other similar dialogues might be taking place on similar topics. Eventually the wiki could form a potential conduit for 'live' or current governance issues; whether these are issues relating to specific characteristics of the technical infrastructure or regulatory concerns regarding a particular aspect of European business law.

It should be noted that over the period in which this task has been carried out several changes have been made to its scope and context, and to its positioning within the

OPAALS Network of Excellence: the task has moved from WP10 Community Building to WP12 Socio-Economic Models for Digital Ecosystems; the amount of person months dedicated to this task has been reduced by 60%; the topics of knowledge and innovation previously central to this task are now accounted for by a new workpackage WP11 Bridging Digital Ecosystems Research to Regional Development. The task has retained its original focus on digital ecosystems governance. The underlying themes of innovation, knowledge, regulation and sustainability have been subsumed into the taxonomy, however, the degree to which they can be individually explored and integrated into this deliverable has been reduced considerably. In addition, the fieldwork component for this task has also been reduced. For the purposes of this deliverable, only the fieldwork design is presented here although it is hoped that there will be scope to carry out data collection in the coming months. This shift in focus has been compensated for by the development of a fully operational taxonomy (it was proposed to only develop 3 dimensions in the task description) with supporting research strategies and a proposal to turn use this taxonomy as the basis for a collaborative wiki to facilitate the exploration and development of governance issues across the OPAALS network.

1. Introduction

This deliverable outlines a taxonomical framework designed to support the collaborative development of digital ecosystems governance research. The taxonomy aims to assist digital ecosystems researchers in understanding and locating the governance implications of their research in relation to existing bodies of academic work on this subject. Research strategies and theoretical suggestions are proposed to support the ongoing collaborative development and population of the taxonomy. In order to demonstrate how the taxonomy can achieve this objective a small empirical study is formulated. The objective of this process is to show how the taxonomy could act as a supporting framework for a collaborative repository of governance-related digital ecosystems research issues and concerns.

The topic of governance is multi-dimensional, dynamic and far-ranging. It has been studied by a number of different subject disciplines; according to a range of different theoretical perspectives; in relation to a variety of social contexts. As a totality, governance research cannot be said to exist as a unified field of research. Whilst this statement could be true of many fields of interdisciplinary research, it is especially true of governance research. Whilst a recognised field of enquiry can have within it many different factions, in general, there is nonetheless recognition that an inclusive field of research exists. However, for governance research no such recognition exists: historically there has never been a sense of commonality; and there is no indication that convergence may take place in the future. Whilst accepting the absolute nature of this fragmentation, it is nonetheless clear when we step back and consider the reality of digital ecosystems 'in practice' that concepts from the full scope of governance research are applicable (and in many cases required) in order to take full account of governance implications.

The structure of the taxonomical framework described in section 3 is derived from a broad classification of the governance literature that emerged through a grounded process of identifying, selecting and grouping governance research from across the full spectrum of published academic research on governance. A summary of the literature review upon which the taxonomy is based is provided in section 2. The review and taxonomy aims to provide an overview of academic research on governance and consequently includes a range of disciplinary, inter-disciplinary and topical perspectives. This serves three purposes: firstly, it brings the full scope of governance research concerns to the fore allowing their applicability to digital ecosystems to be critically considered; secondly, it supports the appropriate selection of research tools; and thirdly, it creates a 'map of the territory' for digital ecosystems researchers within which they can locate current and future governance research, contextualising the governance implications of their applied and theoretical work as they occur.

Particular problematics associated with carrying out research into the governance of infrastructure are outlined in section 3 and some research strategies and theoretical suggestions for addressing these challenges are proposed. Together, these strategies and suggestions are designed to support the ongoing, collaborative population and development of the taxonomy. The taxonomy itself does not bind researchers to any particular theory or methodology. This is an important aspect of its design that is derived from what, in technological terms, has been described as the 'meta' approach to digital ecosystems design philosophy, where lock-in to one particular model, language or approach is structurally avoided at the design level. I would argue that the same 'meta' or

flexible design principles should be applied to research and design relating to digital ecosystems governance. The taxonomy provided here is therefore designed to foster a pluralistic approach to research through its emphasis on breadth and choice.

In order to illustrate how the taxonomy could be used and developed an application of the strategies and methodological ideas is provided in section 5. A fieldwork design is developed as a worked example of how the taxonomy can support researchers in the framing and problematisation of their work.

The approach to governance research outlined here would be facilitated through the development of a wiki space and in the final section it is proposed that the taxonomy and associated research strategies and approaches developed in this deliverable could act as a framework for such a space. The interactive and collaborative characteristics of wiki development and maintenance fit closely with the aims of this deliverable. As a repository, the wiki would hold together the different dimensions of digital ecosystems governance research whilst providing a means for instantaneous cross-referencing between applied and theoretical areas of research. The wiki would also provide a community repository for references, concepts and research issues relevant to digital ecosystems governance that could be updated as new research is identified or carried out. A proposal and basic template for the wiki design are described in the final section of this deliverable.

2. Governance: a fragmented field of research

The taxonomical framework proposed in this deliverable is developed from a review of research on governance which is presented here in its shortened form. Since one of the primary aims of the taxonomy is to help researchers link governance issues they come across within their own research to those discussed in existing publications, the classification scheme proposed is based on the groupings commonly referred to within relevant subject disciplines and academic journals. This classificatory approach fulfils the dual purpose of exposing the basis according to which ideas relating to governance have been organised for other researchers to view, retrace, challenge or add to, whilst also placing in the foreground a theoretical assumption about knowledge that is central to this research. By explicitly drawing attention to the formal mechanisms (i.e. the journals and subject disciplines) through which governance research comes to exist, the *socio-epistemic* construction of knowledge is placed in the foreground. In the context of this research it is argued that a socio-epistemic understanding of knowledge (that is to say an understanding of the distinctive ways in which social groups formulate, represent and validate knowledge practices) helps to foster a critical understanding of the political dimensions of knowledge creation and knowledge sharing. It is argued that such reflexivity with regard to politics is particularly important when discussing governance which is, in and of itself, an innately political phenomena.

From a grounded analysis of the topic of governance undertaken across the whole disciplinary spectrum of academic journals, 5 groupings or classifications have been created. These groups correspond to the presence of governance research across the mainstream academic journals. These 5 classifications are: political science and policy research; organisation and management literature; economic and socio-economic perspectives on governance; governance and regulation; governance and IT. Organising the literature-base that underpinning the digital ecosystems governance research taxonomy around key academic journal publications will create a strong foundation from which to: draw on existing research; develop new conceptualisations; and identify gaps in the literature. In addition to these 5 categories, a 6th classificatory dimension has been created in order to draw out synergies occurring at a theoretical level. This dimension should assist in cutting across disciplinary divides and moving beyond the limitations of journal-based classifications.

The literature review and taxonomy provided in this report should be considered 'a first attempt' to create a literature base and repository of theoretical concepts relevant to the study of digital ecosystem governance. Some sections require further development and it is possible there are areas that have been overlooked, but the basic range and scope of the literature referred to should be considered representative of relevant governance research at this point in time. As new research is produced and new issues associated with digital ecosystem growth and integration are documented, this review will shift and change prompting the addition of new dimensions and classifications.

To facilitate the cross-referencing of applied or current digital ecosystem governance areas of debate or concern with existing research, a list of example areas of application are provided at the end of each classificatory section. As further links between the applied or practical issues associated with digital ecosystems growth and the existing literature are drawn, this system of cross-referencing practical concerns with the dimension(s) relevant

to them will further assist researchers in developing and formulating their research agendas.

2.1 Political science and policy research

Much of the research, literature and concept development concerning governance has been carried out by authors from within the fields of political theory and public/social policy. Within this field Rüdiger, Wurzer and Zito (2005) note that the term 'governance' used to be treated as a synonym for 'government' but that these two terms now exist as analytically distinct terms. Having established this distinction, Marinetto (2003) describes how the concept of governance denotes a relatively recent shift in the way government is studied. Citing the work of leading governance theorist Rod Rhodes he describes how there has been a shift from an exclusive focus on the 'core executive'; to an approach that includes those actors and institutions outside the central state (Marinetto, 2003; Rhodes, 1997). In pragmatic terms, this shift has occurred through an increased policy emphasis on partnerships and networks (Ferlie and Pettigrew, 1996; Flynn, 1997). Externally, it has occurred through the integration of multi-level governance structures such as those enacted by the EU (Hoohe and Marks, 2003; Scott, 2002).

The shift that Marinetto describes is consistent with the critique that Rose and Miller (1992) offer of a historic tendency to over-objectify 'the state'. Drawing on Foucault's discussion of governmentality, they argue that the state has "neither the unity nor the functionality that was ascribed to it" and that instead of focusing on 'the problem of the state' they argue it is more productive to study 'problematics of government' and "the many and varied alliances between political and other authorities that seek to govern economic activity, social life and individual conduct" (1992:173). However, at a generic level there is a recognition that governance requires the application of a set of ethics or values, such as representation and accountability, to governing processes (Morrell, 2000; Sorenson and Torfing, 2005). This stands in contrast to processes that are assessed purely in terms of efficiency or economic yield.

Governance, as considered by political science and policy researchers, has become the focus of researchers who study development. This is largely due to recent emphasis placed on the concept by organisations such as the World Bank, The Millennium Commission and the UK government in its 'Commission and the Report on the Commission for Africa' (Lewis, 2006). The World Bank has developed 6 aggregated performance indicators designed to capture 6 dimensions of institutional or governance quality. They define governance as 'an authority exercised for the common good' and suggest it should include: selection and monitoring of authority; capacity to effectively manage resources and enact sound policies; and ability to engender the respect of citizens and the state for the country's institutions (Kauffman, 2006). The 6 dimensions Kauffman refers to are:

1. *Voice and accountability*—measuring political, civil and human rights
2. *Political instability and violence*—measuring the likelihood of violent threats to, or changes in, government, including terrorism
3. *Government effectiveness*—measuring the competence of the bureaucracy and the quality of public service delivery

4. *Regulatory burden*—measuring the incidence of market-unfriendly policies

5. *Rule of law*—measuring the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence

6. *Control of corruption*—measuring the exercise of public power for private gain, including both petty and grand corruption, and state capture

Development in terms of encouraging governments and their institutions to adopt certain ethical codes is one approach to generating advantages for countries' citizens. Another approach is to support industrial, technological and economic innovation through trans-national research and associated funding programmes. Since the industrial revolution the funding of innovation through science and technology research programmes has been perceived as central to economic development and prosperity (Freeman and Soete, 1997). As such this is a highly competitive arena where large corporations and nation states are perceived to 'hold the strings'. Questions have been raised over the ethical implications of science research funding and the extent to which national governments should aim to steer the objectives of science-based research away from opportunism towards the 'greater good'. However, these distinctions are not clear cut. For example, close ties between weapons programmes and government-led science and technology initiatives are well-established. In addition to questions of funding is the question: do all significant innovations emerge from publicly funded research programmes? Some inventions that have 'changed the world' were not products of funded research programmes. In the last 10 years, science research has become more closely associated with environmental sustainability issues. In this context, science has been both a source of competing research recommendations and a resource for generating potential solutions to local and global environmental issues. Particularly with respect to common pool resources scientists are increasingly becoming involved in multi-stakeholder discussions concerning governance and sustainability of natural resources.

Other highly relevant topics and concepts in this area are summarised in Table 1 below.

Table 1 Topics, concepts and example references relating to governance from political science and policy related fields of research

Topic and concepts	Example references
Governance and ethics	Morrell, 2000; Sorenson and Torfing, 2005
'Governance without government' in a network society	Rüdiger et al., 2005; Marinetto, 2003; Rhodes, 1997; Bovaird, 2005; Rosenau, 1992
Government control displaced upwards to regional and international organisations	Pierre and Peters, 2000
Multi-level governance structures (such as the EU) and 'new modes' of governance	Hooghe and Marks, 2003; Scott, 2002
	<i>Continued</i>

Topic and concepts	Example references
Public reform conceptualised as organisational reform 'from hierarchy and bureaucracy to networks and markets'	Hill and Lynn, 2005; Legrand, 1993; 1999
Governance as policy implementation increasingly exercised through partnerships and networks	Ferlie and Pettigrew, 1996; Flynn, 1997; Ham, 1996a; Harrison, 1993; Flynn, Williams and Pickard, 1996
Discussion of governance and the coordinating characteristics of organisational types i.e. hierarchy, market, networks	Exworthy, Powell and Mohan, 1999; Rhodes, 1997, 2000)
Governance and participation	Lovan, Murray and Schaffer, 2004; Byrne, 2001
Governance and development	Kauffman, 2006
Governance and science	Freeman and Soete, 1997

Application to digital ecosystems

- Evaluation of local, multi-level and global policy contexts for digital ecosystems
- Objective evaluation of digital ecosystems as a policy instrument
- Implications that governmental processes within European Parliament and European Commission have on digital ecosystems future
- Funding, integration and dissemination of digital ecosystem science research
- Use of science concepts to underlie models of service distribution within the Evolutionary Environment (EvE)

2.2 Organisation and Management literature

The organisation and management literature includes research that draws on social, political, economic and cognitive theory. Economic perspectives tend to dominate this body of literature but these do not emanate from an exclusively neo-classical position with institutional, evolutionary and behavioural approaches to economic study included. Formalised approaches in the form of Weber's discourse on bureaucratic organisation and the Tayloristic, scientific school of management theory are now studied as historical perspectives on organisation and management, but their impact is still current within both research and practice in this area. More recently, approaches from complexity theory have been used to dislodge conventions regarding linearity and causal relationships and a tendency to disregard change over time (Haynes, 2000; Stacey, 2003).

To say the relationship between organisation, management and governance is currently under-explored within this literature is not strictly accurate. Extensive research exists on

two very specific manifestations of governance: corporate governance (cf. Hokisson and Turk, 1990); and governance in the context of transaction costs (cf. Sampson, 2004). Within these two related bodies of research neo-classical economic approaches dominate. Corporate governance research focuses on the very particular social context of large, share-holder owned corporations and their governing boards. Economic, legal, behavioural and ethical implications of boards are examined in terms of transaction costs, strategy formation and ethical issues such as self-interest, disclosure, board composition (Surrendra, 2005). Corporate governance is linked to incidents of market failure through asymmetric information and incomplete contracts. This can and does result in opportunistic and occasionally criminal behaviour. Government regulation of corporate governance is therefore a key area in which governments are forced to 'intervene in the market'. For a very thorough review of literature on corporate governance and government regulation (the latter only considered in the UK context) see Department of Trade and Industry report by Filatotchev et al. (2007) <http://www.berr.gov.uk/files/file36671.pdf>

Other relevant areas of organisation and management literature include those authors who write about the post-industrial society in which organisational forms and means of production are described as shifting from centralised bureaucracies to teams, markets and networks. Within this literature is a theme concerning the 'runaway world' according to which it is argued traditional notions of control have to be set aside due to rapidly increasing levels of complexity and associated levels of risk within society (Giddens, 1999; Beck, 1999; Ciborra, 2000). This is also a theme that is apparent in 2nd order cybernetics and complexity theory (see section 3.2).

Strategy is a significant area of the management literature and the relationship of governance to strategic alliance formation, organisation design and innovation are explored by a number of authors from a range different perspectives (Ami and Zott, 2001; Arora, Fosfuri and Gambardella, 2001). The emergence and recognition of networks (Castells, 1996; Benkler, 2006) has brought with it a consideration of the concept of governance in the context of networks. The notion of non-hierarchical or cooperative workflows where firms are not physically co-located is one that has come about through the introduction of new collaborative technologies (Colombo and Francalanci, 2003). This model of interaction is radically different to conventional models of business-to-business interaction. Expanding on this notion of unconventional business-to-business interactions is research on clustering and more recently, extended clustering. In the latter case, smaller organisations interact with one another not because they necessarily share physical resources but through the virtual exchange of services. Frequently technology-mediated or based, such exchanges remove the need for organisations to be physically co-located thus creating potential for more dynamic and innovative collaborations to be formed (O'Callaghan, 2007).

Table 2 Topics, concepts and example references relating to governance in organisation and management literature

Topics and concepts	Example references
Corporate governance as a means of addressing problems of over-diversification and loss of strategic control	Hokisson and Turk, 1990; Filatotchev et al., 2007
Ethics and corporate governance	Surrendra, 2005
Corporate governance and transaction costs – alignment of governance structures with transaction for more efficient outcomes	Sampson, 2004
Governance, management and control (or loss of) in a post-industrial society	Ciborra, 1993; Giddens, 1999; Beck, 1999
Strategy and governance	Forbes and Frances, 1999; Ami and Zott, 2001; Gulati, Nohira and Zheer, 2000
Governance, innovation and organisation design	Arora, Fosfuri and Gambardella, 2001; Westerman et al., 2006
	Continued

Topics and concepts	Example references
Economic sociology and governance in the context of networks	Jones, Hesterly and Borgatti, 1997; Kogut and Zander, 1996; Castells, 1996; Benkler, 2006
Organisational and economic-related literature on new organisational forms such as ‘extended dynamic clusters’	O’Callaghan 2007; Mansell and Steinmuller, 2000
Governance as patterns of control and coordination within cooperative workflows	Colombo and Francalanci, 2003

Application to digital ecosystems

The potential contribution of this body of literature to the study of digital ecosystems governance is considerable. Below are a few of the applications.

- Provides examples of business coordination, transactions and technology use to support business process modelling.
- Offers a ‘theoretical bridge’ between cognitive / psychological approaches and business activity through the study of knowledge and information;
- Offers a resource for understanding and characterising a range of organisations and inter-organisational relationships;
- Provides research tools and concepts relevant to both neo-classical and other complementary approaches to the study of economic phenomena;

- Also includes potential for exploring 'non-economic' perspectives on knowledge, information and organisation

2.3 Economic and socio-economic perspectives on governance

In general, economic and socio-economic theories are used to describe concepts of organisation and exchange within economic systems. Mainstream economics is based on the neo-classical model where 'the market' constitutes the sole basis for economic exchange. Associated with the neo-classical model are certain axioms or logics that are taken to be self-evident such as: the rational actor; perfect knowledge; and stable tastes and preferences. A complementary perspective to neo-classical economics is institutional economics (which is considered again in section 4). In relation to governance research, the study of corporate governance dominates the economic literature. The applicability of corporate governance research to other contexts or situations is extremely limited hence the applicability of current mainstream economics to contexts such as those produced by digital ecosystems is limited.

One notable exception to this general observation is the work of Oliver Williamson who the Academy of Management Review describe as being as one of the leading writers on governance of our time (Mahoney, 1997). Williamson writes from the perspective of new institutional economics. He draws purposefully on interdisciplinary perspectives, considering: the fundamental importance of information (Arrow, 1974), organizational innovation (Chandler, 1962), transaction costs (Coase, 1937), and behavioural assumptions (Simon, 1947). Williamson uses new institutional economics to understand how law, economics and organization theory shape fundamental issues concerning the role of institutions in the negotiation of contracts. Williamson's contribution to transaction cost theory has had enormous consequences for the way in which both governance and ICTs are studied. His analysis of organisational forms, notably market and hierarchies (1975), is an early influential example of how analysis of organisational form has been used in the study of governance as a coordinating mechanism (see also Shapiro, 1987; Shaila and Kavan, 2005). Williamson's assertion was that governance mechanisms to support the fair exchange of contracts are necessary safeguards and can be achieved: through a better understanding of behaviour; through organisational innovation; and through a recognition of the importance of information.

There is a close relationship between strategy and this area of the governance literature due to the critical, strategic decision-making nature of how contracts should be conceived of, negotiated and executed (Forbes and Frances, 1999; Ring and Van de ven, 1994). From this perspective, key distinctions are drawn between socially embedded relations where participants draw on historical or social dimensions to regulate an interaction or arms-length relations where the negotiation is purely market or transaction-based (Granovetter, 1985). This distinction has been applied to the contractual arrangements involved in IT outsourcing (Uzzi, 1997; Lacity and Wilcocks, 1998). However, this whole area of the literature is founded on a 'rent-based' view of inter-organisational interactions where only 2 motivations exist for entering into a contractual relationship: to attain rents via the capture of value via efficiency-seeking; or via the creation of value through innovation. Other models of economic activity, such as the gift economy, which are not concerned with the creation of value through rents do not fit with this mode of analysis. This is significant in the case of digital ecosystems since open source technologies are non-rent-based.

Important topics relating to governance within this area of the literature are listed in Table 3 below.

Table 3 Topics, concepts and example references relating to governance in the economic and socio-economic literature

Topics and concepts	Example references
The 'three forms of governance': market, hierarchy and network	Williamson, 1975; Shapiro, 1987; Shaila and Kavan, 2005; Ring and Van de ven, 1994
Strategy and governance	Forbes and Frances, 1999; Ami and Zott, 2001; Gulati, Nohira and Zheer, 2000
Embeddedness of economic transactions	Granovetter, 1985; Powell, 1991; Kickert, 1997;
Arms-length versus embedded governance structures (especially in IS outsourcing)	Uzzi, 1997, 1999; Jarillo, 1988; Lee and Kim, 1999; Lee <i>et al.</i> , 2004; Lacity and Wilcocks, 1998
Non-market-based economic forms i.e. gift economy,	Cheal, 1998;

Application to digital ecosystems

- Socio-economics cited by European Commission as the driver of digital ecosystems development. Understanding and refining this assertion from an academic standpoint
- Corporate governance literature could inform debates involving any emerging needs regarding the design of digital ecosystems governing body/bodies (e.g. implications of strategic alliance formation, incumbent interests, property interests and perpetuity).
- Economic modelling such as cost-benefit analysis as a common tool or language for regional and European policy makers to assess digital ecosystems as a post-industrial technological environment for organising economic activity (e.g. Rivera Leon, 2007)
- Embeddedness of knowledge and socio-economic relationships (e.g. Berdou, 2007)
- Exploration of digital ecosystems as creating a new context for economic organisation (i.e. hybrid form of market, hierarchy, network, extended or virtual clustering)

2.4 Governance and regulation

Regulation describes the policy practice of placing restrictions (either legal or rule-based) on those aspects of social and economic behaviour considered potentially detrimental to the common good. Regulations are often designed to account for particular circumstances or factors relating to particular kinds of social contexts: such as the use of health and safety regulations in the workplace; or the use of financial regulations in banking.

Governments have increasingly used regulation in preference to other policy instruments. The institutional nature of regulation requires an interdisciplinary approach to research that includes law, political science and economics. Regulation is often associated with the way risk is perceived assessed and managed in different social contexts (i.e. the risk of injury in the workplace or the risk of financial fraud in banking). There is a long tradition of, and continuing tendency to, devise ways of measuring and quantifying risk (Black, Lodge and Thatcher, 2005; Hutter, 2005).

In relation to regulation, one understanding of governance applies to the role of the state in setting the parameters for regulation and ensuring a level of compliance. Constitutional economics focuses attention on the character of regulation and the cultural significance it holds in constructing a participatory, trust-based context for social interaction. From this perspective, deterring exploitative behaviour is important but it is recognised that the manner in which this is done can cast social interactions in a certain light (i.e. as ultimately pernicious or fundamentally harmony-seeking). Frey argues that,

“the constitution should fundamentally convey trust towards its citizens and politicians. Distrusting public laws risk(s?) destroying the positive attitude of citizens and politicians towards the state. Civic virtue can be maintained and fostered by direct citizen participation via popular referenda and initiatives.” (1997: 1043).

Analysis of governance and regulation can be extended beyond the relationship of citizens and governments. In the context of institutional economics, legal, political and economic understandings of governance become much closer to one another, to the point where legislation, organisation, politics and in some cases technology can all be considered as aspects of governance. From this perspective, control and authority have the potential to be shared among many stakeholder or interest groups. The role that regulation or legislation plays in cementing these relationships is a crucial part of the institutional process, particularly in situations where governance relationships are in the process of being developed. The character or mode of regulation is now recognised as a – if not ‘the’ defining – characteristic of communities and standards bodies, and is increasingly impacting on the cultural landscape of business and technology. Benkler (2006) describes a regulatory battle taking place within and between all layers of the digital environment: from physical hardware interoperability standards; to transmission protocols; to software; up to content. This battle is evident in the contrasting modes of copyright and licensing regulation that exist and in contrasting attitudes toward intellectual property (Lessig, 2003). The success of open source technologies and related business models has led to two types of analysis in this regard: the first type attempts to find suitable theoretical models for understanding how commonly-owned technologies can inspire business interactions (see cf. von Krogh, 2006); the second attempts to understand the organisational basis of open source technology production (cf. Franck and Jungworth, 2002; O’Mahony, 2007).

The broad range and scope of regulation means that regulatory discussions quickly become embroiled in particular aspects of a context and/or the connotations associated with specific legal acts and instruments. This is particularly the case where trans-European e-business interactions are concerned. The complex regulatory landscape SMEs have to negotiate is recognised as being obstructive. The complexity of regulatory systems, the need for constant feedback and a capacity to adjust to constant environmental change has led some authors and policy makers to employ analytical and modelling techniques derived from 2nd order cybernetics, complexity and systems theory (see section 3.2).

In terms of this research, maintaining a focus on governance within the context of digital ecosystems requires looking at questions such as those described in Table 4 below.

Table 4 Governance and regulation in the context of digital ecosystems

Topics and concepts	Example references
Regulation and risk	Baldwin, Scott & Hood, 1998; Hood, Rothstein & Baldwin, 2001; Sunstein, 2002; Black, Lodge and Thatcher, 2005; Hutter, 2005
Institutional ecology; regulatory and constitutional culture	Benkler 2006; Frey, 1997; Hosein, Tsiavos and Whitley, 2001
European business regulation (particularly with respect to SMEs)	Hornby, Goulding and Poon, 2004; Blois, 1999; Pearce, Branyiczki and Bigley, 2000; Loebbecke, 2003;
Licensing, patents and intellectual property rights	Lessig, 2003; 2004; Cunningham, et al., 2007
Free Libre and Open Source Software (FLOSS) Licensing	von Krogh, 2006; van Wendel de Joode, 2005; Grand, et al., 2004; Franck and Jungworth, 2002; O'Mahony, 2007

Application to Digital ecosystems

Regulation has a fundamental impact on the development of new technologies and the ways in which business interactions are conducted. One of the aims of digital ecosystems is to foster a regulatory environment that encourages and supports innovation through the production of commonly-owned technologies produced under General Public License. The policy assumption in this instance is that such licensing will help support decentralisation of the technological infrastructure supporting business-to-business interaction and knowledge services. In conjunction with this, as a policy intervention, digital ecosystems aims to support the development of a regulatory environment that fosters and encourages trans-European business interactions between SMEs. There are a number of different dimensions to this but a particular focus is to understand the techno-regulatory environment through which smaller organisations are committed to using centralised security, trust and identity services (Loebbecke, 2003)

Both kinds of regulation – that pertaining to technology and that pertaining to business interactions – are institutionally generated and therefore form a significant aspect of governance. This premise could suggest that this particular area of governance is characterised by centralised, hierarchical sets of relations based on a logical development and constitution of law. However, in reality the processes through which regulatory environments are shaped are subject to economic and political forces. These forces do not necessarily favour smaller organisations (who lack the lobbying capabilities of larger organisations) and which do not necessarily produce decisions that necessarily follow a logical course. Supporting the formation of a regulatory environment that is conducive to the aims of digital ecosystems therefore carries with it a contingent requirement to promote a recognition of SMEs and their requirements. Providing a vehicle that highlights the need for dialogue between smaller organisations and European policy makers is therefore an important aim of digital ecosystems.

- General public licensing and its capacity to generate public technology infrastructure that support an innovation environment for SMEs
- Analysis of the risk that infrastructural lock-in and technology convergence can create an uncompetitive environment and of the implications that policy interventions such as digital ecosystems have
- Development of regional and European feedback mechanisms for understanding barriers and opportunities within SME business-to-business technology-based interactions
- Trust conditions underpinning business-to-business interactions and the capacity for these to be decentralised

2.5 Governance and IT

The pervasive nature of information and communication technologies means that there are multiple contexts and multiple associations at play when we speak of IT and the concept of governance. The primary meanings that can be derived from published research relate to:

- IT outsourcing relationships and the negotiation of contractual arrangements (between firms) that underpin them (Shaila and Kavan, 2005; Lacity and Wilcocks, 1998);
- the use of IT in achieving the aims of e-government programmes in which IT is taken as an opportunity to improve citizens' access to public services (Moon, 2003);
- the coordination of technological communities and fora e.g. FLOSS communities and open content communities such as Wikipedia (O'Mahony, 1999);
- and a specific usage of the term 'IT governance' adopted by practitioners, consultants and now researchers to describe a framework of IT decision-making within and between corporations (Weill and Ross, 2004).

The theories and concepts developed in these areas of technology research are quite distinct and relate to quite specific social contexts and chart quite different experiences with technology. For example, within e-government the process is one of gradually introducing new technologies into public services and understanding how this reconstitutes relationships between governments and citizens. In social networking, open content and FLOSS communities, new social contexts have co-evolved alongside new technologies and technology licensing. In many senses researchers are catching up with these changes. The world depicted by IT outsourcing and IT governance research is a corporate world of decision-making hierarchies and contractual relationships.

One area of technology research that is not highlighted through a topical consideration of IT and governance is the significant body of social theory and philosophy that considers the nature of the technological artefact: as social construction; as an actor; as political force; a tool; or *gestell* (Orlikowski and Iacono, 2001). Within this area of theorisation authors try to understand what kind of fundamental freedoms technology can be said to grant and which it takes away. In terms of providing in depth analyses of information technology this research offers a great deal of insight into the social and political consequences of technology design and has much to offer the study of information technology in all of its varying forms.

Table 5 Topics, concepts and example references relating to IT governance

Topics and concepts	Example references
IT Governance, strategic alignment and leadership	Peterson and Fairchild, 2003; Patel, 2002; De Haes, and Van Grembergen, 2008
Mapping design of IT Governance to IT architecture	Ribbers, Peterson, and Parker, 2002
Governance in the context of e-Government	Moon, 2003; Lankhorst ,2007 (use of SOA)
IT, Governance and Modelling Coordination	Malone, 1987, Peterson, 2001; Weill and Ross, 2004;.Sambamurthy and Zmud, 1999
IT outsourcing and governance	Cullen, Seddon and Willcocks, 2005; Shaila and Kavna, 2005
Open source and open content communities	Lakhani and von Hippel, 2003; Franck and Jungworth, 2002; Fleming and Waguespack, 2005; Grand et al., 2004; O'Mahony, 2003; 2007)
Theorising the IT artefact and IT infrastructure	Orlikowski and Iacono, 2001; Latour, 1991: Ciborra, 2003; Star and Ruhleder, 1996

Applications to digital ecosystems

The specific context of research on IT governance and outsourcing renders its applicability to digital ecosystems governance fairly limited at this point in time. However, research on open content and open source communities has direct relevance to a number of different areas within digital ecosystems governance. In addition, research that looks specifically and in detail at how IT artifacts are constructed and the potential structural equalities that can become embedded within technology design at both artefactual and infrastructural level is particularly pertinent to the study of digital ecosystems. Specific areas of research might include:

- Open content policy design for the Open Knowledge Space
- Synchronisation of projects within digital ecosystems technology development
- Governance and evolution of a digital ecosystems open source community of technology developers
- Analysis of specific technological aspects of digital ecosystems architecture such as the peer-to-peer network or the Evolutionary Environment to reflexively and transparently examine potential for structural inequalities

2.6 Theoretical perspectives for studying Digital Ecosystems governance

I would argue that in developing a conceptual framework for discussing research relevant to digital ecosystems governance it is important to begin from a point where a range of theoretical approaches and research tools could be adopted. From this perspective,

selecting a theoretical approach is considered in terms of appropriacy, given the research questions under examination.

In the context of digital ecosystems governance a significant degree of reflexivity is required regarding the use of models. The technological, regulatory and policy contexts of digital ecosystems imply the use of numerous models (i.e. models depicting SME business transactions that are embedded in business modelling languages; regulatory models for carrying out e-business; economic modelling; performance indicators to support regional policy maker decision-making). Since each of these models or systems of models can influence the distribution of activities within digital ecosystems it becomes necessary to periodically step back and consider the social and economic consequences of such models in terms of the structural inequalities they may or may not contribute to. Therefore, in aiming to develop a conceptual framework for research on digital ecosystems governance, one set of questions and debates that require attention are those that ask: who is able to participate in modelling activities?; are the fundamental assumptions behind the models employed clear / appropriate / commensurate?; when is it timetabled for these assumptions to be re-examined in the light of new feedback or changing circumstances?

It could be argued that the research space constructed for examining digital ecosystems governance has an important role to play in bearing witness to the ways in which standards of accountability and transparency are maintained in different areas of the digital ecosystem. The type of theoretical perspectives adopted will shape the way in which these kinds of debates are carried out. For example, if econometric approaches were to dominate then different kinds of feedback that does not emerge from large data sets would be missed, and theoretical debate would focus on the implications and internal ramifications produced by different measures and data sets. If an institutional approach were to dominate then this would have implications for the kind of economic assumptions used within socio-economic models with, in general, a more socially-embedded approach to understanding economic relations taking precedence.

Politicians and policy makers often turn to academic research for a theory or set of theories that will help underpin the policy process. In the 1980s, game theory was a popular perspective taken from economics and used by politicians as a rationale for building policy programmes. In the UK during the 1990s, Tony Blair adopted a number of socio-political ideas proposed by sociologist Anthony Giddens and his 'third way' approach to politics and governance. Some authors question what exactly it is that grand theory can offer policy programmes. One argument is that it simply creates a sense of coherence; a common language or set of values according to which policy debates can be conducted. However, critics argue that putting policy into practice is a complex process and the idea that a single theory can hold the key to all social issues taking place in innumerate social contexts amounts to a politics of convenience rather than a credible way of promoting participation and democracy.

As part of this task, three theoretical approaches appropriate to the study of digital ecosystems governance are briefly summarised. These approaches are: Institutional economics and the study of the commons; systems theory related approaches (including complexity theory and 2nd order cybernetics); and critical approaches to the study of power and ontology. With respect to constructing a literature base and common research resource for studying governance (and given that it is impossible to be a-theoretical) I have (lightly) applied the 3rd approach to the construction of this conceptual framework.

2.6.1 Institutional economics and the commons

Institutional economics offers a complementary approach to the study of economic exchange that focuses on the role that institutions play in mediating economic activity. Institutions are analysed in terms of the durable laws, rules and norms through which the behaviour of individuals and organisations is shaped. Researchers commonly make use of Giddens' theory of structuration to show how organisational, regulatory and IT related issues shape socio-economic activity (Orlikowski, 2000; Barley and Tolbert, 1997). The concept of 'ecology' (organisational ecology; institutional ecology; knowledge ecology) is being increasingly used by theorists using institutional approaches (Nickerson and Muehlen, 2006; Benkler 2006).

Within institutional economics is a body of research dedicated to the study of common property (Hess and Ostrom, 2006; Olson, 1965). This research has received greater attention in the past 10 years due its focus on social contexts where environmental and sustainability issues are a key concern and due to the Free/Libre and Open Source Software (FLOSS) movement in which common digital resources are created (Van de Joode, 2006). Governance is a key theme within research on the commons. This is because it is often the case that common resources are relied upon by multiple users. In such cases, mutually agreed upon arrangements have to be made to allow fair access to users whilst ensuring that the common resource does not deteriorate through overuse. These issues are addressed within the development literature in terms of creating governance conditions that include local populations, not just governments and businesses (Argrawal and Yadama, 1997; Berkes and Folke, 2006). Digital ecosystems presents an interesting case in this regard since an inverse relationship to overuse and sustainability applies, That is to say that compared to the traditional context for commons research, which is natural resource systems, the sustainability of digital commons is threatened by under-use as opposed to over-use. Ostrom herself acknowledged that governance in relation to multi-use, multi-group commons entail much more uncertainty and complexity than the governance of single-use, single-group commons. In both cases Ostrom emphasises the importance of feedback emphasising that time-specific, system level feedback is needed as well as larger-scale trends analysis if resource deterioration is to be captured in time to intervene.

Within an empirical setting, it can sometimes be difficult to methodologically identify instances of governance. Associated theories create the impression that governance activities are somehow distinct and rarefied when compared to the every day activities of governments and organisations. However, there is a move to understand governance in less abstract terms as simply coordinating activities or 'working practices' (Mansell. 2006; Liebenau and de Fontenay, 2006e).

Table 6 Topics, concepts and example references relating to digital ecosystems governance and institutional economics

Topics and concepts	Example references
Structuration, institutions and IT	Giddens, 1984; Orlikowski, 2000; Barley and Tolbert, 1997; Shaila and Kavan, 2005
Institutional and ecology perspectives	Chengalur-Smith, Shobha & Anna Sidorova (2003; Nickerson and Muehlen (2006); Benkler, 2006
Sustainability, development and the commons	Argrawal and Yadama, 1997; Baland and Platteau, 1996; Berkes and Folke, 2006)
Governance, collective action and the commons	Hess and Ostrom, 2006; Olson, 1965; Dolšak and Ostrom, 2003; Edward and Steins, 1998; Markus, Steinfield, Wigand and Minton (2006)
Governance as working rules and coordinating actions	Mansell (2006); Liebenau and de Fontenay (2006e)

2.6.2 Second order cybernetics and systems theory

Cybernetics and systems theory belong to a family of theories that includes autopoiesis and complexity theory. These theories share common origins that are often traced back to the work of mathematician Karl Ludwig von Bertalanffy and his General Systems Theory (1951). Philosophically, systems approaches aim to break down the analytical boundaries erected by scientific and sociological disciplines and study phenomena holistically, 'as they are'. For example, if a biologist and a sociologist were presented with a typical classroom scene and asked to provide a discipline-specific account of what they saw in front of them, their descriptions would draw on completely different tools, methods and analytical distinctions.

Early systems theorists including von Bertalanffy used systems theory to highlight issues of commensurability between the sciences. The prevailing assumption was - and still is - that the 3 major sciences (in the form of physics, chemistry and biology) provide a commensurate, epistemic platform on which scientific knowledge from one discipline can be easily integrated with that from another. On this basis it is understood that Science provides us with a comprehensive basis for understanding and constructing knowledge about the world. This assumption is further reinforced by the fact that the sciences use a common language – in the form of mathematics - for theoretical development and modelling. The assumption is that mathematics itself is an expression of pure logic and as such is devoid of any cultural idiosyncrasy or historical bias. Systems theorists were among the first to refute these two assumptions and to highlight the value of allowing empirical phenomena to take precedence over theory. Boulding (1956) describes this as follows:

“...because in a sense mathematics contains all theories it contains none; it is the language of theory, but it does not give us the content. At the other extreme we have the separate disciplines and sciences, with their separate bodies of theory. Each discipline corresponds to a certain segment of the empirical world, and each develops theories which have particular applicability to its own empirical segment. Physics, Chemistry, Biology, Psychology, Sociology, Economics and so on all carve out for themselves certain elements

of the experience of man and develop theories and patterns of activity (research) which yield satisfaction in understanding, and which are appropriate to their special segments". (1956: 197)

As a starting point for building knowledge or developing understanding, privileging the 'pre-theoretical', empirical world is not a tenet that is exclusive to systems theory and related approaches. Phenomenology and certain branches of anthropology contain a similar premise (Bateson was an anthropologist and Checkland adopts a phenomenological perspective in his 'Systems Thinking'). However, in terms of methodologies, terminologies and desired ends, the trajectories they follow from that common starting point differ greatly.

A branch of systems theory is cybernetics which was originally associated with the study of control systems. Interestingly, the Greek root of the term (cyber) means 'to steer' which is the same root meaning attributed to governance (Ashby, 1956). Whilst first order cybernetics conceptualised control in terms of a single, controlling component within a system (such as a thermostat that controls the release of hot water within a heating system), second order cybernetics takes a recursive position and adopts a more radical view of control. According to this approach, all components within a system are understood to play a part in the control dynamic and the role of the observer or person creating the model is also understood to have fundamental implications. Implicit within these ideas is a constructivist notion of the relations between subject and object. Another important theme within second order cybernetics is that of 'unmanageability' which refers to the increasing complexity of the world and to Ashby's Law of Requisite Variety¹. Ranulph Glanville describes the issue as follows:

Systems rapidly become so complex—so rich in variety—that they are no longer realistically computable (they are transcomputable). Thus, questions concerning their controllability are raised (2000:2)

Although 'increasing complexity' is a general theme within the organisation and management literature, as is the uncontrollable nature of technological systems and society more generally, cybernetics has seen limited application within these areas of the published academic literature. After a short appearance in the late 60s and early 70s in the management journals it has since been 'out of favour' largely due to its tendency to produce deterministic accounts of human behaviour (even though determinism is not a characteristic of second order cybernetics).

Current examples of research that has used cybernetics, systems or complexity theory include: the use of 2nd order cybernetics to generate regulatory models (Kingston-Howlett, 2001); the use of systems theory to analyse complex knowledge environments (Star and Ruhleder, 1996); and a growing body of management related research (particularly management in policy oriented environments, change management and knowledge management) based upon complexity theory.

¹ Ashby's Law of Requisite Variety states that for a system to be governable the controlling system has to be able to reproduce the exact same number of possible variations in behaviour as the system it is controlling, or else it will be ineffective.

Table 7 Topics, concepts and example references relating to digital ecosystems governance and systems theory

Topics and concepts	Example references
Systems theory	von Bertalanffy, 1951; Boulding, 1956; Bateson, 1979; 2000
Cybernetics and second order cybernetics	Ashby, 1954; Glanville, 2000
Current examples of second order cybernetics research applied to governance	Turnbull, 2003; Kingston-Howlett, 2001; Limone and Bastias, 2006
Current examples of research using systems theory	Star and Ruhleder, 1996; Lanzaarza and Morner, 2003
Current research on complexity/chaos theory	Haynes, 2003; Stacey, 1995; Urry, 2003

As research on governance is so fragmented (and in many senses this fragmentation could be said to be due to disciplinary segmentation of the type Boulding describes) it could be argued that systems theory and second order cybernetics could offer a means of re-focusing research on the specific empirical systems and contexts in which digital ecosystem governance is understood to take place. However, I would argue that in flattening out the epistemic landscape in this way part of the institutional fabric of knowledge is lost and there are important questions to be asked about the consequences of this. Other kinds of critique such as those involving power and ontology link epistemological questions of what knowledge is back to their social context, as described below.

2.6.3 Power, ontology and critical analysis

Critical perspectives relating to power, ontology and governance have their roots in the work of Michel Foucault among others. Embedded within this approach is what Nikolas Rose calls a kind of 'historical ontology' or 'history of the present'; a reflexive recognition that knowledge (its bounds, its biases, its claims) is rooted in the social practices, conventions and power constructs of its time. This contrasts with a constructivist approach to understanding knowledge - and the privileging of knowledge - as relative rather than necessarily political. Rose describes this distinction as follows:

"It is now a commonplace, of course, to refer to the objects of the scientific imagination as 'socially constructed'. This is especially common where the social and human sciences are concerned. [...] But the language of social construction is actually rather weak. It is not very enlightening to be told repeatedly that something claimed as 'objective' is in fact 'socially constructed'. Objects of thought are constructed in thought: what else could they be? So the interesting questions concern the ways in which they are constructed. Where do objects emerge? Which are the authorities who are able to pronounce upon them? Through what concepts and explanatory regimes are they specified? How do certain constructions acquire the status of truth?" (1999:x)

A body of theory that bears close relation to these ideas are those derived from ethnomethodology and the anthropological study of associations and alliances between human, symbolic and material 'actors'. In the context of governance, this mode of analysis focuses attention on the ways in which stable networks of actors and resources are

formed. It looks particularly at the way in which interests are translated between groups of actors and consequently inscribed within the material and technological resources they acquire.

A particular benefit that this approach has to offer the study of digital ecosystems governance is that it purposefully draws analytical attention away from questions of size and scale. This perspective is particularly useful when considering the place of SMEs within governance arrangements. Typically overshadowed by ‘larger’ actors, ensuring that SMEs have a voice within digital ecosystems governance will ensure that the infrastructure and business paradigm the digital ecosystem offers remains aligned to their interests.

Table 8 Topics, concepts and example references for the study of digital ecosystems governance from the perspective of power, ontology and critical analysis

Topics and concepts	Example references
Governance, knowledge and historical ontology	Foucault, 1974; Rose, 1999;
Governance and the constitution of objects	Law and Singleton, 2001; Whitley and Darking, 2006
Ethnomethodology and actor-networks	Garfinkel, 1967; Latour, 1991; Callon and Latour, 1981

Conclusion

Taken as a whole the literature on governance is informed by a range of disciplinary and interdisciplinary perspectives. What is significant for researchers approaching this area of research for the first time to appreciate is that each of these perspectives offers a different approach to identifying, selecting and framing governance issues. Some of these approaches are more context-specific than others and consequently do not lend themselves to the analysis of other social contexts and phenomena. It is also difficult to simply ‘take’ seemingly relevant concepts from different disciplines and combine them. It is during the process of problematisation and research design that this fragmentary characteristic of governance research poses the most issues for researchers. It is therefore precisely at this point in the research process that engagement with the taxonomy proposed in the following section will support.

3. Taxonomic framework for supporting digital ecosystems governance research

The purpose of the taxonomy described in this deliverable is to support researchers in their efforts to problematise digital ecosystems governance issues by providing a point of access to existing research. By considering the many different ways in which governance is understood, researchers will be able to:

- find a means of conceptualising their particular set of research concerns
- select a body of literature to contribute to
- identify new analytical perspectives from which to review and analyse their results
- identify what element of their research would constitute a new or unique contribution to existing research
- include their results within the taxonomy for other researchers to see

The taxonomy described in this deliverable has been designed specifically to support digital ecosystems governance at a point in time when this area of research has yet to establish itself as a consolidated sub-field of research. As contributions to digital ecosystems governance research become published and begin to proliferate, a further version of this taxonomy offering a more specific approach to theorisation could be developed. However, the utility of having a root taxonomy that links digital ecosystem governance research to the existing body of published governance research will always remain.

The primary taxonomical dimensions were derived from a broad classification of the governance literature. This classification emerged through a grounded process of identifying, selecting and grouping governance research from across all fields of published academic research. Within each dimension various research topics and themes have been identified. Each topic or theme is linked to some example literature that will assist researchers in the task of understanding exactly what kind of governance research, articles and journals are relevant to this area. Including all disciplines and research areas serves three purposes: firstly, it brings the full scope of governance research concerns to the fore allowing their applicability to digital ecosystems to be critically considered; secondly, it supports the appropriate selection of research tools; and thirdly, it creates a 'map of the territory' for digital ecosystems researchers within which they can locate current and future governance research, contextualising the governance implications of their applied and theoretical work as they occur. As new research is produced and new issues associated with digital ecosystem growth and integration are documented, this review will shift and change, no doubt prompting the addition of new topics, themes - and perhaps even dimensions - to the taxonomy.

No system of classification is atheoretical or devoid of assumption on the part of the classifier and to assist other researchers in following the underlying logic of the taxonomy, two specific design assumptions are noted here. In encouraging researchers to consider the whole scope of governance research an underlying intention of the taxonomy is to promote an appreciation of the fact that in practical terms, digital ecosystems governance is likely to be characterised by its diversity and accordingly will require the application of a diverse range of research theories and tools. Whilst the development of specific governance models and frameworks underpinned by specific disciplinary, theoretical or stakeholder assumptions is inevitable (and to some extent required), I would argue that

these efforts should always be located within a broader spectrum of possibilities, to guard against hegemony and ensure that justifications for particular 'modes of domination' do not find their expression through associated research philosophies.

The second design assumption stems from a *socio-epistemic* understanding of knowledge - that is to say an understanding of the distinctive ways in which social groups formulate, represent and validate knowledge practices - as opposed to a positivistic or absolutist one (Walsham, 1997). This approach emphasises the socially constructed nature of fact and knowledge and explicitly draws attention to the mechanisms (i.e. the journals and institutionalised subject disciplines) through which bodies of research come to exist. In this sense, the socio-politically constructed nature knowledge is placed in the foreground. In the context of this research it is argued that a socio-epistemic understanding of knowledge helps to support a critical understanding of the political dimensions of knowledge creation and knowledge sharing. I would argue that such reflexivity with regard to politics is particularly important when discussing governance which is, in and of itself, an innately political phenomena. Within political arenas, there is always the possibility that for a number of reasons, certain ways of analysing or describing governance actions will be perceived as undesirable and could as a result prove more difficult to pursue. In addition, from an epistemic point of view, every subject discipline, knowledge base or research approach used to develop a rationale for talking about governance will limit or frame possibilities in order to generate focus. However, this framing process has political consequences since it necessarily includes certain phenomena and pushes others to the margin.

It is because of this underlying assumption about the socio-epistemic character of knowledge, that the taxonomical dimensions proposed are based on a set of easily identifiable subject groupings that are commonly referred to within a range of relevant subject disciplines and academic journals. This classificatory approach is designed to fulfil the dual purpose of exposing the basis according to which ideas relating to governance have been organised for other researchers to view, retrace, challenge and add to, whilst also tacitly placing in the foreground assumptions concerning knowledge as a collective, socio-epistemic phenomena.

3.1 Taxonomical dimensions

The dimensions of the taxonomy are designed to generate initial structured points of access to existing governance research. Individual researchers can use the taxonomical dimensions together with the themes and topics grouped within them to explore and problematise the particular applied and theoretical questions on governance that they come up against. The 6 taxonomical dimensions are:

- Political science and policy research
- Organisation and Management
- Economic and socio-economic perspectives on governance
- Governance and regulation
- Governance and IT
- Theoretical frameworks for studying governance

Within each dimension are topics and themes derived from the literature, which in turn are linked to indicative references. Whilst the boundaries between dimensions, topics and

themes are tangible, overlaps and anomalies will inevitably occur. These occurrences are important to recognise and account for within the ongoing construction of the taxonomy. For example, overlaps can provide an interesting basis for developing interdisciplinary research questions or expanding previously context-specific research areas to include new social dimensions. Topics, themes or empirical examples that at first appear anomalous could act as ‘seeds’ for developing new areas of research that could at some future point form a new topic, theme or taxonomical dimension.

In terms of future development, the crucial point to observe is that the dimensions, topics and themes listed here are not hypothetical. They are constitutive of an existing, observable example of research that can be openly sourced by any other researcher. Without this tangible and traceable link to existing research the sense-making capacity of the taxonomy is reduced and its ability to inform the development of new research agendas is undermined. One of the socio-epistemic requirements of academic research is that researchers build upon existing knowledge, framing their research in terms of ‘gaps in the literature’. The taxonomy has the potential to support researchers in this task so long as it remains rooted to a literature base.

The taxonomy, together with the full list of associated topics and themes is provided in the table below

Table 10 Taxonomy of governance research

1. Political science

- Governance and ethics
- ‘Governance without government’ in a network society
- Government control displaced upwards to regional and international organisations
- Multi-level governance structures (such as the EU) and ‘new modes’ of governance
- Public reform characterised as a change from bureaucracy and hierarchy to markets and hierarchy
- Governance as policy implementation increasingly exercised through partnerships and networks
- Discussion of governance and the coordinating characteristics of organisational types i.e. hierarchy, market, networks
- Governance and participation
- Governance and development

2. Organisation and management

- Corporate governance as a means of addressing problems of over-diversification and loss of strategic control
- Ethics and corporate governance
- Corporate governance and transaction costs – alignment of governance structures with transaction for more efficient outcomes
- Governance, management and control (or loss of) in a post-industrial society
- Strategy and governance
- Governance, innovation and organisation design
- Economic sociology and network governance
- Organisational and economic-related literature on new organisational forms such as ‘extended dynamic clusters’
- Governance as patterns of control and coordination within dependent inter-organisational processes

Continued

3. Economics and socio-economics

- The 'three forms of governance': market, hierarchy and network
- Strategy and governance
- Embeddedness of economic transactions
- Arms-length versus embedded governance structures (especially in IS outsourcing)
- Different economic forms i.e. gift economy, exchange economy

4. Governance and IT

- IT Governance, strategic alignment and leadership
- Mapping design of IT Governance to IT architecture
- Governance in the context of e-Government
- IT, Governance and Modelling Coordination
- IT outsourcing and governance
- Open source and open content communities
- Theorising the IT artefact and IT infrastructure

5. Regulation

- Regulation and risk
- Institutional ecology; regulatory and constitutional culture
- European business regulation (particularly with respect to SMEs)
- E-business regulation and trust
- Licensing, patents and intellectual property rights
- Free Libre and Open Source Software (FLOSS) Licensing

6. Theoretical approaches

- Structuration, institutions and IT
- Institutional and ecology perspectives
- Sustainability, development and the commons
- Governance, collective action and the commons
- Systems theory
- Cybernetics and second order cybernetics
- Complexity and chaos theory
- Governance, knowledge and historical ontology
- Governance and the constitution of objects
- Ethnomethodology and actor-networks

3.2 Research strategies and theoretical suggestions to support taxonomy use

The utility of the taxonomy presented in this deliverable will only be realised if it achieves its aim of supporting the ongoing, collaborative development of digital ecosystems governance research. To this end, some research strategies and theoretical suggestions are made in this section to support researchers in using the taxonomy.

3.2.1 Research strategies to support taxonomy use

The research strategies outlined here should enable digital ecosystem researchers to work with the taxonomy and eventually integrate their research findings into this complex body of work. As governance and digital ecosystem develops as a distinct area of research, precedents will exist to make this process of association easier. Researchers will be able

to build upon an existing knowledge base of digital ecosystems research. Indeed, the strategies outlined here are potentially more relevant to earlier phases of digital ecosystems governance research; when this knowledge base has still to be established. Taking this context into account it is foreseeable that the strategies described here may eventually be surpassed. Nonetheless, the classification system offered by the taxonomy can still act as a framework for a repository of digital ecosystems governance research facilitating links between different research issues and concerns. Three simple research strategies for working with the taxonomy are identified below.

At a pragmatic level, the taxonomy offers 3 points of access to researchers. The first point of access is the primary taxonomical dimensions themselves. Through reading the overview of each dimension and exploring the themes and sub-topics within them, the taxonomy should assist researchers in locating their research interests within a particular area of literature. By seeking out and exploring some of the indicative references provided researchers should be able to develop a line of enquiry and formulate a set of research questions that will eventually result in a contribution to this area of literature.

A second pragmatic strategy is to consider the 'applications to digital ecosystems' section contained within each dimension. This aspect of the taxonomy is designed to facilitate cross-referencing between relevant theoretical and conceptual resources, with applied areas of research. This area of the taxonomy will hopefully be expanded on through collaboration with other researchers and eventually, as research on digital ecosystems grows, hypothetical examples will be replaced with existing research.

A third strategy is to look at the reference list associated with the taxonomy and identify known authors or journals. Tracing the linkages between these references and the taxonomical dimensions is another potential means of exploring ways of conceptualising a particular set of research concerns in terms of existing governance research. If a particular set of journals or area of research appears to be missing it might be interesting to consider whether or not this points to the absence of a particular topic or theme which the researcher could develop themselves.

3.2.2 Additional notes on using research strategies

With regard to the first strategy, finding a 'fit' between an area of research concern and one of the primary taxonomical dimensions may prove difficult. As with any other research area, gaps and biases exist within governance research. The taxonomy can only offer the *potential* for orientation among existing research concerns and the *possibility* of forging linkages. However, if the process of identifying a suitable topic, theme or dimension proves problematic this could point to a gap in the literature which the planned research could contribute towards filling. Therefore it is worth noting where and when problems of orientation occur.

Only one of the dimensions - political science and policy research - is heavily discipline specific. That said, as an object of analysis policy relates to multiple social situations and its consequences often require inter-disciplinary interpretation. Nonetheless, this body of literature is rooted in the work of government and it is therefore not necessarily appropriate to employ concepts and theories from this area to discussions that are not concerned with the actions of government. However, the primary themes of political science are power, authority and the means by which they find their expression in society. Therefore,

questions of power, ethics and process within process of technology development, for example, could be fruitfully analysed from this perspective.

The taxonomical dimension of organisation and management is linked to a particular body of literature within which very different disciplinary and interdisciplinary perspectives are employed. For example, the organisation and management literature draws concepts from psychology, sociology, economics and political science. The socio-economic and economic dimension is largely comprised of literature from sociological and economic subject disciplines, however, economic perspectives tend to dominate this area. Those dimensions that appear to link governance to a particular object, such as regulation or information technology together with the theoretical dimension are the most broad ranging, with regard to both the social contexts they refer to and the relationships they aim to conceptualise. For example, information technology has the capacity to span a wide spectrum of literature, disciplinary perspectives, social contexts. However, the IT artefact itself is rarely theorised in the same way that other objects of analysis, such as 'society,' are. Some areas of governance research are extremely context-specific and extending the scope of these is only appropriate in very specific instances. For example the topic of corporate governance rarely, if ever, extends itself to include social contexts beyond that of large shareholder owned organisations.

With respect to the second research strategy it is important to bear in mind the dynamic characteristic of digital ecosystems research and the fact that different areas of applied ecosystems development will come into focus at different times. There could be many reasons for this but fundamentally, digital ecosystems are designed to promote innovation, particularly localised innovation and therefore it can be assumed that change will be a constant. The aspects of that change that ultimately form the focus of attention in the context governance research and debate is a separate issue. Focus can be politically generated and researchers should remain critical about how, when and why a particular debate has been framed in a particular way at a particular time.

In general, it is important for researchers to consider the implications of that disciplinary framing hold for their research topic. Where knowledge building is dependent on the use of discipline-specific theories, concepts or techniques it may be appropriate to seek expert advice on using these or to develop ideas in dialogue with a co-author from who has knowledge of the concepts in question.

In problematising an area of interest researchers should avoid the tendency to imagine they must identify or define a whole, or totalising system of relationships. It is unlikely that this will ever be possible or desirable since it necessarily implies a 'top-down' approach that may overlook spontaneous initiatives happening from the ground-up. One potentially successful approach is to allow for the possibility that multiple relations could be formed and that these relationships could consolidate around a range of different objects. The object in question and the way in which it consolidates could be the very source of contention among a group of stakeholders. In many cases, simply defining 'what' a digital ecosystem is in a particular instance can prove problematic. Some theoretical suggestions for addressing these issues of working with complex objects of analysis are provided in the following section.

3.3 Theoretical suggestions to support taxonomy use

Previous research on digital ecosystems established that ecosystems governance is far-reaching, multi-dimensional and constantly shifting (Darking, 2006; Darking et al., 2008). These characteristics make this area of research extremely interesting to explore but nonetheless challenging. In this section, some theoretical suggestions are made aimed at supporting researchers who have not considered these kind of issues previously.

3.3.1 *Objectification and governance*

The taxonomy will prove most useful to researchers at the point they begin to frame and problematise their governance research. Problematisation is essentially an issue of identifying ‘what’ will form the object of study. As objects of governance - i.e. as ‘things’ that require governance – complex, innovative socio-technical infrastructures such as the digital ecosystem present researchers with a particular set of problematics. The ‘object’ of analysis can be surprisingly difficult to define. Indeed, it can be precisely this process of definition that is at the very heart of a governance issue or debate. Setting boundaries through defining ‘what’ is being discussed has the potential to include or exclude potentially controversial aspects of the topic at hand. Similarly, deciding what level of prior or expert knowledge is required to take part in such discussion will include or exclude potential participants. Especially in processes of infrastructural innovation, building sufficient shared knowledge and consensus around ‘what’ is under examination holds an intrinsic relationship to ‘what’ governance constitutes in a given scenario. If a set of parameters or definition is adopted in the course of a research design process that does not reflect this complexity, the relevance of the resulting research findings can be undermined. This can occur if, for example, the problematisation in question implicitly takes the standpoint of one stakeholder exclusively where the object in question holds implications for multiple stakeholders, or where problematisation favours one particular kind of expert knowledge (such as technical expertise) over another. The fact that these questions occur when carrying out research in this area leads to the clear conclusion that governance research draws *processes of objectification* to the foreground of analysis.

3.3.2 *Complex characteristics of infrastructure*

As well as having particular consequences for processes of objectification, previous research has identified some specific issues associated with the study and conceptualisation of infrastructures themselves. Stemming from sociology of science and phenomenological traditions the following key characteristics have been identified:

- infrastructures can never be known in their entirety
- infrastructures are never built *de novo* but always upon an *installed base*
- infrastructure cannot be controlled; it can only be locally adjusted
- the scale and scope of infrastructure are constantly shifting
- infrastructure becomes invisible but for strangers is a target object to be learned about
- to those for whom it is invisible, infrastructure only becomes visible again during breakdown

(Ciborra, 1983; Bowker and Star, 2002; Star and Ruhleder, 1996; Monteiro and Hanseth, 1996)

As ‘objects of governance’, therefore, infrastructures pose particular issues that researchers need to take into account. Their innate complexity means that no single

person or group will have the complete overview. In a functioning ecosystem, local innovation is constant and prolific and therefore unknowable from any centralised or totalising standpoint. The implication of this for governance is that critical decision-making processes should always include multiple stakeholders. This is particularly true of digital ecosystems which have been conceived of as a means to actively inspire and facilitate local business and technology innovations. The potential diversity of these local innovations is such that instating narrowly conceived governance conditions could easily disrupt or limit the capacity building potential of the ecosystem.

3.2.3 Complexity and consensus building

In addition to the particular problematics of studying infrastructure is the impact that multiple stakeholder perspectives have on complex knowledge sharing and building processes. As in many multi-stakeholder environments, stakeholders concerned with the development or use of digital ecosystems bring with them:

- different kinds of expert knowledge
- different sets of concerns focusing around different processes or components
- different levels of engagement with specific social groups or contexts
- a desire to achieve different ends

These elements introduce levels of complexity into potential research scenarios that are difficult to contend with. Establishing what the object of concern is for each stakeholder and foregoing any assumptions that stakeholders are necessarily 'talking about the same thing' is an important place to start in analysing a complex knowledge building process. Mapping out areas of individual and common concerns is an important part of any governance discussion and plays an intrinsic role in strategic or priority setting processes. If overlooked, misunderstandings and conflicting priorities can become impacted increasing potential for protraction and ultimately deadlock.

Complexity theorists and those authors who have engaged with theoretical ideas such as ontological radicalism have suggested that in terms of building knowledge, it is not simply the case that these stakeholders are looking at the same easily definable object (i.e. 'the infrastructure') from different perspectives, it is the fact that objects exhibit multiplicity; they actually *are* different things to different people in different situations. For example, the digital ecosystem can be understood to be: an area of research funded by the European Commission; a service oriented technological architecture; a means of promoting SME business collaboration; or a fantastical technologists dream that will never become functional. Although these understandings are not mutually exclusive stakeholders' knowledge will be in some sense organised around these kind understandings. It is tempting, even necessary sometimes, to simply flatten out these complexities by applying a single standpoint, theory or disciplinary perspective. However, the extent to which this constitutes an unhelpful level of reductionism, where significant dialogical processes are masked in favour of conceptual simplicity, should be noted because of the potential impact this can have on (mis)representing governance issues and debates.

3.2.4 Political construction of focus and significance

A key aspect of the methodology and theoretical assumptions underpinning this work is that the focus of concern or objectification of governance issues is a dynamic process. In practical terms what this means is that governance issues and concerns will come in and

out of focus. This dynamic element of governance research and debate is related to the significance of timing and political events. Certain stakeholder groups may be powerful enough to construct or even manipulate this dimension of governance but more often than not situations arise from unknown or unseen processes and through unintended consequences. Nonetheless, the phenomena of 'hot' (as in politically volatile and contentious) governance topics coming in and drifting out of focus is an important characteristic of this research area.

3.2.5 Combining research strategies and theoretical suggestions

The taxonomy, the 3 research strategies and the theoretical suggestions can be combined into a series of steps that researchers might find useful to follow. Following these steps will support researchers in problematising their individual area of interest in terms of existing governance research and in developing their overall research design. Table 10 below sets out the strategies and suggestions as a series of steps that may prove particularly useful to researchers from non-social science backgrounds or who have not previously carried out governance-related research.

Table 10 Strategies and suggestions expressed as 'research steps'

	Step	Strategy / suggestion
1	Identify a general area of interest	This can be expressed as a broad statement of research interests
2	Describe the primary objects of analysis in this area (taking into account theoretical suggestion 3.2.1)	Allow for the fact that defining objects may be a potential source of controversy that could in itself form an important research focus
3	Describe the dominant relations and social context(s) in which these objects occur (if there is one)	Use this step to focus in on what the significant relationships are within the research scenario you wish to study
4	Where there was ambiguity around step 2 revisit these issues in the light of step 3 to see if any clarification results.	Pinning down key 'sets of relations' and stakeholder perspectives can help refine analytical objectives (see 3.1.1 on objects and sets of relations)
5	Use one of the 3 research strategies described in section 3.2.1 to locate your work within a particular area of literature	For additional insight and support into this process, refer to the notes on framing provided in section 3.1.2
6	Construct a research question bearing in mind the theoretical suggestions made in section 3.2	The theoretical concepts in section 3.2 may help to unlock a key controversy or paradox which the research question can focus on
7	Use the taxonomy to develop other dimensions of your research question and overall research	Whilst a single theme or topic may form the core focus of a research question consideration of the other dimensions, topics and themes might prompt secondary lines of enquiry

8	Consider how your research findings contribute to or expand the dimension, topic or theme	
9	Add a link to your research findings within the literature base of the taxonomy and the theme or topic you have contributed to	On completion, research results should be integrated with the taxonomy with the addition of references and where applicable new entries to the 'applications' section
10	Where appropriate - and in dialogue with other users of the taxonomy - consider adding a new topic or theme to the taxonomy	For the taxonomy to retain its use as a common reference point it must remain relatively stable. However, it is also important that it reflects new development

In the following section, these steps are used in the development of an example fieldwork design.

4. Research example to demonstrate taxonomy role and function

In this section the research steps described above are put into practice and a working example of fieldwork design development is provided. A running commentary of the research choices and decisions is provided in relation to each step. The culmination of this process is a research design and set of semi-structured interview questions. This is an example research design to demonstrate the function of the taxonomy.

4.1 Worked example with commentary on how to construct a research design using the taxonomy, research strategy and theoretical suggestions

1	Identify a general area of interest	This can be expressed as a broad statement of research interests
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I have been researching small and medium-sized enterprise (SME) engagement in digital ecosystems since the second phase of the Digital Business Ecosystems (DBE) project in November 2004. SMEs have been identified as the primary stakeholders of digital ecosystems so I consider their perspective on digital ecosystems to be one of the most significant to document and research. Rather than using hypotheses and extrapolated models, my preference is for qualitative empirical research where I spend time with the SMEs to find out what their experience of digital ecosystems is. In this instance I am interested in finding out what bearing governance has on their current involvement with digital ecosystems.

2	Describe the primary objects of analysis in this area	Take into account the fact that defining objects may be a potential source of controversy
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The primary objects of analysis in my area of interest are: SMEs, governance and the digital ecosystem. The SMEs are clearly identifiable as groups and organisations. As this is a small, example study, I will select one specific regional group of SMEs to make contact with. Defining governance in this context is certainly problematic, largely due to problems associated with consolidation. The particular local and national circumstances of this region have meant that finding the means to sustain interest and involvement in digital ecosystems has proven to be a particular challenge. It has therefore been difficult for the individuals and organisations acting as 'regional catalysts' in this area to consolidate relationships and form any kind of distinct group. In addition, digital ecosystem technologies themselves have not visibly (from the SME perspective) advanced or consolidated since the DBE project ended. On these issues, the theoretical point regarding objectification (section 3.1.1) is particularly relevant and could help support clarification of exactly what questions this study needs to ask. Problems of objectification should be explored where a sense of ambiguity surrounding 'what' should be studied overrides a sense of clear definitions. In this example there is ambiguity around 'what' is governance? As well as - governance of 'what'? Referring to the taxonomy may help the

process of selecting theoretical resources that can compensate for these ambiguities (without masking over them).

3	Describe the dominant relations and social context(s) in which these objects occur (if there is one)	Use this step to focus in on what the significant relationships are within the research scenario and how these might impact on the previous step
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The dominant relations in this scenario are the relationship of SMEs to one another; to the digital ecosystem technology; and to other significant regional actors, such as catalysts, SME incubators and relevant local government actors. As a specific social context has been selected - the West Midlands region in the UK - then these relationships need only be considered at a regional level. The potential for generalising results in relation to other regions' relationships will be limited, however, by selecting appropriate theoretical resources there should be potential for developing concepts that may be used to explore examples of SME governance research in other research contexts.

4	Where there was ambiguity around step 2 revisit these issues in the light of step 3 to see if any clarification results.	Pinning down key 'sets of relations' and stakeholder perspectives can help refine analytical objectives (see 3.1.1 on objects and sets of relations)
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In the context of this and many other studies, ambiguity exists around the concept of governance itself; how its role and application should be understood. Given the relationships outlined above, in this research scenario one might assume that governance would play a part in guiding, legitimating and clarifying the assignment of rights and responsibilities in 4 different ways: *within* groups of SMEs; *between* groups of SMEs; between groups of SMEs and local government/agencies; and between SME groups and digital ecosystem technologies. In the example of SMEs in the West Midlands, difficulties in achieving consolidation at political, technical and social levels means that distinct or formal group formation around digital ecosystems is not in evidence. Therefore, formal manifestations of governance are also unlikely to be in evidence. This has implications for how governance is conceptualised in relation to this research scenario. A focus on purely formal means of governance such as, for example, regulation is unlikely to yield much empirical insight. A conceptualisation is required that can account for a spectrum of formal and informal governance activity.

5	Use one of the 3 research strategies described in section 3.2.1 to locate your work within a particular area of literature	For additional insight and support into this process, refer to the notes on framing provided in section 3.1.2
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Taking into account the key relationships and context under consideration together with the type of governance conceptualisation required, it should now be possible to locate this study in relation to the literature described in the taxonomy using one of the three research strategies described in section 3.1. Any of the dimensions in the technology could provide a possible research direction so the process is one of 'best fit', where the characteristics of the research scenario and the aims and methods proposed by the researcher are matched to the dimensions of the taxonomy. In this research scenario I am proposing to conduct

empirical research into an embryonic digital ecosystems community or social group. At this point in time, digital ecosystem technologies have not reached a point of consolidation; they are not yet functional as a platform for carrying out SME business transactions or technology development. Therefore, governance perspectives such as those cited in dimension 3 'Economic and socio-economic perspectives' and dimension 5 'Governance and technology' are unlikely to provide the appropriate resources for this study. It is a distinct possibility that they may provide interesting perspectives in the analysis phases of this research, but in terms of identifying the core concepts to underpin this study, dimensions 1 'Political science and policy research', 2 'Organisation and Management' and 6 'Theoretical perspectives on governance' are likely to offer a better fit.

In terms of the organisation and management dimension, a number of possible approaches exist. If it were the intention of this study to develop a design for how the SMEs in this research scenario could hypothetically interact within a designed network or organisation then there would be three interesting themes to pursue: governance, innovation and organisation design; economic sociology and network governance; and organisational and economic-related literature on new organisational forms such as 'extended dynamic clusters'. It is possible that having studied what is empirically taking place in this region it may be relevant to relate some of these perspectives to this particular scenario and hypothesise about which directions SMEs might pursue in terms of network and cluster formation. However, the current loose and informal nature of relationships and the stated research aim to base this study on empirical as opposed to hypothetical relationships, means that these themes are not appropriate to use as the foundation for this study.

In terms of the first dimension relating to political science and policy related research, it is common for research and analysis in this area to focus specifically on the role of government and government agencies. Digital ecosystems is a policy intervention and local agencies have been mobilised to try and integrate ecosystems concepts and technologies into their regional development plans. However, in this particular region this level of integration has been a challenge. At both a regional and a national level adoption of digital ecosystems as a policy initiative has been hindered by the absence of tangible business and technological output. Within the governance literature in this dimension is the theme of participation which, unlike other research approaches in this area, tends to switch the focus of analysis round from government and what it aims to achieve, to a focus on stakeholders and the degree to which they are able to access, take part in and engage with government initiatives. This particular theme seems like it could be an interesting one to pursue with regard to this study. It highlights the importance of addressing if and how key stakeholders in policy initiatives (such as SMEs and digital ecosystems) are able to participate and exert influence over the policy actions that are aimed at them. Participation is seen as a defining attribute in systems of democracy and as such its use also sensitises researchers to issues of exclusion.

The sixth dimension on theoretical perspectives relating to governance has the potential to provide a basis for the type of conceptual development concerning governance required by this study. It was noted in relation to point 4 above that governance in this context should be understood as occupying a spectrum of potential action: from informal to formal. This sits well with some of the concepts described in the first theme within this dimension relating to institutional economics and the commons. There are a number of authors who use the idea of that there exist a spectrum of formal and informal means through which 'social rules' are generated and transformed (Giddens, 1984; Mansell, 2006; Liebenau and

de Fontenay, 2006e). These approaches may be of use in conceptualising governance in the context of this study.

6	Construct a research question bearing in mind the theoretical suggestions made in section 3.2	The theoretical concepts in section 3.2 may help to unlock a key controversy or paradox which the research question can focus on
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In the previous step, the capacity of SMEs to participate in digital ecosystems has been identified as a relevant core theme for this study. The advantage of this theme is that the basis of participation is not prescribed so different manifestations of participation can be captured. The central research question for this study has therefore been kept intentionally open. On the basis of the steps outlined above the question is: by what means do SMEs participate in digital ecosystems governance? By identifying the means by which SMEs participate it should then be possible to understand to what extent they can coordinate activities or exert influence via that participation. It should also help to identify what barriers to participation exist. The findings from fieldwork conducted from this standpoint should also be able to offer a new perspective on what governance is in this context and whether or not participation should be considered a significant concept.

7	Use the taxonomy to develop other dimensions of your research question and overall research	Whist a single theme or topic may form the core focus of a research question consideration of the other dimensions, topics and themes might prompt secondary lines of enquiry
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The theme of participation is non-prescriptive so many different potential forms of participation can be included within the data collection and analysis. For example: participating in digital ecosystem technological development via engagement in open source communities could be seen as participation; being involved in building social networks in connection to digital ecosystems could also be a possibility; as could being involved in other related European projects. These kind of possibilities can be built into a semi-structured interview guide (the interview guide relating to this research is included at the end of this section). Looking through the taxonomy dimensions at this stage and including references to concepts and lines of analysis identified in step 5 within the planning of data collection tools could also lead to some interesting results.

8	Consider how your research findings contribute to or expand the dimension, topic or theme	
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At this early stage of digital ecosystem governance research there are minimal links between dimensions, topics and themes. However, once research examples are added these links will grow and consolidate. This study could produce some interesting results linking ideas of participation to technology development, generating a link between dimensions 1 and 5 that did not previously exist. This could also point to an idea of how to frame the study as a contribution to existing academic research on governance.

9	Add a link to your research findings within the literature base of the taxonomy and the theme or topic you have contributed to	On completion, research results should be integrated with the taxonomy with the addition of references and where applicable new entries to the ‘applications’ section
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In order for other researchers to be able to build on the thematic and conceptual links that have been constructed in this study it is important to reintegrate findings into the taxonomy. References and ‘applications to digital ecosystems’ sections should both be updated.

10	Where appropriate - and in dialogue with other users of the taxonomy - consider adding a new topic or theme to the taxonomy	For the taxonomy to retain its use as a common reference point it must remain relatively stable. However, it is also important that it reflects new development
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It is intended that the taxonomy act as a collaborative resource for digital ecosystems governance researchers. As such, its development should also be carried out through dialogue and collaboration. If a particular study suggests that a new theme or topic should be included then this addition should be discussed with other researchers using the taxonomy. A proliferation of dimensions, themes and topics could make the taxonomy unusable so it is important that a form of consensus is reached every time such an addition is sought.

4.2 Resulting research design with semi-structured interview questions and notes

The research design developed in the section above is comprised of qualitative data collection in the form of semi-structured interviews with between 3-6 SMEs in the West Midlands. These SMEs all took place in the Digital Business Ecosystem integrated project in which the first digital ecosystems technological components were developed. The core research question around which data collection and analysis is to be carried out is: by what means do SMEs participate in digital ecosystems governance? The theme of participation will be developed using literature from the first dimension of the taxonomy which refers to political science and policy related research. The template for semi-structured interviews was developed with this literature in mind. However, the guide also makes reference to other dimensions, such as organisation and management, in order that data relating to this area of research will also come to light. A deliberately open approach was taken with the interview question design in order not to exclude any potential means by which SMEs consider themselves to be participating in digital ecosystems.

4.2.1 Semi-structured interview guide for carrying fieldwork on SME participation

1.) Of the DBE regional meetings and events the only very significant meeting I didn’t attend was the inter-regional meeting that took place in Finland right at the end of the

DBE. I believe your company gave a presentation there. That would have been one of your last formal points of contact with the DBE project.

a.) Did anything tangible come of that meeting for your company? Any social or business European contacts for example. Any ideas or improved understanding that you have been able to operationalise since?

b.) In general, was there any aspect of participating in DBE - any business contacts, any social contacts, any knowledge sharing, any technological concepts - that have remained with you or that perhaps you've even been able to make concrete in any respect?

c.) Were there any aspects that stick in your mind as complete dead ends at the end of the DBE? Ideas or directions that you would have been valuable to pursue but couldn't?

2.) The DBE project was ambitious in many respects. One area in which it was especially ambitious was that it aimed to include SMEs in the innovation process. In reality this meant that you were invited to participate at a point where concepts were still hazy and before there was anything concrete for you to see or engage with.

a.) Do you think this strategy was or has been a success?

b.) Do you think the reasoning behind this strategy was sound or flawed?

c.) Do you think the overall aim of allowing SMEs the chance to influence and shape the technology building process was achieved or to you knowledge is being achieved?

3.) There is a school of thought that says when governments or trans-government organisations such as the EU invite stakeholders to participate in a particular process in reality that offer can translate into a range of potential scenarios: from what's called 'token participation' where all the substantive decisions have actually been taken and what takes place is simply a process of consultation; to the other end of the scale where participants are actively encouraged to take on increasing responsibilities until they eventually have decision-making authorities within a group. On the scale below what level do you feel was reached in DBE?

i.) invitation to attend or join [potentially including formal process of contracting]

ii.) involvement in discussion fora – including face-to-face and online meetings and communication channels

iii.) feedback and suggestions from participants actively sought

iv.) events are ongoing and incorporation of feedback and suggestions is in evidence

v.) opportunities to take part in *organising* activities and events e.g. coordination of event schedules, meeting agendas, invitations

vi) decision-making and coordination responsibilities devolved to active participants

Derived from 'Arnstein's ladder of participation' (1969: 219) cited in Healey (1997:26)

Were there any 'glass ceilings', any upper limits to participation in place in terms of what the project would allow or in terms of what you could take on?

4.) Could your participation in and since the DBE have been *organised or managed* better? For example, would you have preferred to have had more updates or been more involved in communications or decision-making?

5.) Do you consider yourself to be *still participating* in digital ecosystems? In what ways, at what levels and by what means do you consider yourself to be *still participating* in digital ecosystems?

[possible areas to explore]

- Participation implies that there exists 'something' to participate in,
- it implies that what there are means by which you can participate,
- it implies a capacity to contribute (communication channels, open source) and have a voice (communication channels, significant networks), and are able to shape events in some way or other.

6.) To what extent do you feel it is within your capacity to *increase your level of participation* should you so wish to? Are there any significant people, web sites, communication channels that you would go to if you wanted to update yourself or increase your level of participation?

4.3 Research Results

Unfortunately it has not been possible to gather and analyse fieldwork results within the time frame of this deliverable. It is intended that this work will be carried out at a later point and that the results will be reintegrated with the taxonomy as described in steps 8 and 9 in section 4.1.

5. Proposal for collaborative Wiki on digital ecosystems governance

In this section, a proposal is put forward for creating a wiki-based version of the governance taxonomy described in this deliverable. The primary intention of this proposal is to encourage the ongoing, collaborative development of the taxonomy across the OPAALS Network of Excellence. In this context the taxonomy would act as an underlying framework for wiki content transforming the taxonomy from a 'flat' classification of research themes and concepts into a 3-dimensional touch point for different aspects of digital ecosystem governance.

5.1 Methodological and practical benefits of developing the taxonomy as a wiki

Methodologically, the wiki provides the possibility of contending with some of the more complex characteristics of digital ecosystems governance that have been outlined throughout this deliverable. As a collaborative research tool, wikis are extremely well-placed to cope with these multi-dimensional, far-ranging and dynamic characteristics of governance. Linking together different pages enhances researchers' ability to cross-reference different aspects of the taxonomy. As the research strategies outlined in section 3.1 suggest, moving between dimensions, applications and references are very helpful ways of gaining a sense of familiarity with the varied ways governance is conceptualised.

The dynamic way in which governance issues and debates can alter in focus and the multiple ways in which governance research can be framed would ordinarily be difficult to keep abreast of. However, a wiki-based taxonomy would enhance visibility, allowing researchers to remain aware of significant changes without the need for them to necessarily impact on their own work. Also, having a taxonomy that is not founded on a single theoretical or conceptual premise but which points toward published research potentially permits the taxonomy to expand in any direction. From an open starting point it then becomes interesting to see where convergence occurs. Again, this convergence should be visible through linking together research via the taxonomy and through the use of meta-tagging as a means of identifying key concepts as they emerge.

Initially it is proposed that the digital ecosystems governance would contain 3 separate but inter-linked areas.

Table 10 Areas of the proposed structure of digital ecosystems governance research wiki

Area	Name	Description
1	Taxonomy	including, overviews, references and application examples
2	Support pages	including an introductory pages and pages outlining relevant strategies and theoretical approaches
3	Collaborative pages	working pages where OPAALS researchers are invited to collaboratively explore the governance implications of their work in relation to the taxonomy

The text and organisation of the first two areas would initially be based on the text and structure of this deliverable. These would be consequently developed through use and feedback from other researchers. For the third area, researchers who have some specialist understanding of governance would be asked to work with those who didn't but who nonetheless need to explore the governance dimensions of their work. For example, governance dimensions of technological design and implementation may need to be considered by the computing domain. The taxonomy could form a means for them to either explore these issues for themselves, providing a 'place to start' and enabling them to find comparable instances of research where these issues may have been explored. Alternatively they can enlist the support of a governance researcher to assist them in orientating their work. As further links between the applied or practical issues associated with digital ecosystems growth and the existing literature are drawn, this system of cross-referencing practical concerns with the dimension(s) relevant to them will further assist researchers in developing and formulating their research agendas.

5.2 The wiki as a 'moving window' of governance issues

One of the key characteristics of digital ecosystems governance identified in this deliverable is that this is a dynamic field of research. The innovative, infrastructural and multi-stakeholder nature of digital ecosystems mean that new governance issues will constantly emerge. It is important to incorporate this dynamism into the taxonomy without taking away its potential to act as a stable repository. It is therefore proposed that the taxonomy could exist in parallel to a space in which current governance issues debates could be recorded *as they arise* within the ordinary conversations and debates taking place within the project. This would provide a 'moving window' of governance issues and concerns emerging from digital ecosystem design and implementation contexts.

This parallel space could also be a place for researchers to discuss those aspects of their applied or theoretical research that they think may be related to issues of governance (such as, for example, the recent discussion of 'virtual super-peers') but which they are not in a position to fully explore the trans-disciplinary implications of themselves. Through hyperlinks and meta-tagging, links could be forged between the two spaces where issues from the 'moving window' could be linked to the repository of existing research and concepts in the taxonomy. This would allow researchers who are perhaps uncertain about how to analyse their research in terms of governance the opportunity to benefit from considering other related examples and from theoretical contextualisation. This would also foster an important level of reflexivity within the community of digital ecosystems researchers, supporting them in being able to consider the implications of their design approaches in terms of the 'ethos' of digital ecosystems. As further links between the applied or practical issues associated with digital ecosystems growth and integration are documented and links between this and the existing literature are drawn, this system of cross-referencing practical concerns with the dimension(s) relevant to them will further assist researchers in developing and formulating their research agendas. Eventually the wiki could form a potential conduit for 'live' or current governance issues; whether these are issues relating to specific characteristics of the technical infrastructure or regulatory concerns regarding a particular aspect of European business law.

6. Conclusion

This deliverable has developed a taxonomic framework designed to assist researchers in relating digital ecosystems to the complex body of published academic research on governance. Previous research established that digital ecosystems governance is far-reaching, multi-dimensional and constantly shifting (Darking, 2007; Darking et al., in print). Any methodology that sets out to engage with (i.e. to build knowledge around or definitions of) digital ecosystems governance therefore has to confront and incorporate these key characteristics. In this deliverable, research strategies, theoretical suggestions and a proposal to develop the taxonomy as a wiki space have all been made with these aims in mind.

In order to demonstrate how the taxonomy, research strategies and theoretical suggestions can be used in conjunction with one another, a worked example is provided whereby the literature-based taxonomy is used to develop a design for fieldwork. In the original task description, the findings from this research were to be reintegrated with the taxonomy to demonstrate how research outcomes can be used to expand and develop dimensions of the taxonomy. Ultimately, it was not possible to carry out data collection within the time frame of the task and so this final stage has not been completed. However, this does not mean that the deliverable as a whole has not achieved what it set out to; in fact, it has probably achieved more. In the original task description only 2 or 3 dimensions of a taxonomy were to be developed in relation to the literature and fieldwork results. It was thought at this point that the taxonomy should be developed using a 'grounded' approach where taxonomical dimensions would be derived from analysis of the fieldwork data. However, in the course of developing the taxonomy it was recognised that the as a research tool, a classification of the academic literature would be of more relevance and utility than a taxonomy based on fieldwork data. As such, a complete taxonomic framework was developed together with supporting resources and a proposal to develop the taxonomy as a wiki-based collaborative tool.

In this form, the taxonomy can support the ongoing, collaborative development of the taxonomy across the OPAALS Network of Excellence. As such, it can foster a reflexive approach to governance research where researchers from across the all three domains can discuss and develop governance-related aspects of their research.

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