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A sociology of the translation of ERP systems to financial reporting

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DIPARTIMENTO DI SOCIOLOGIA E RICERCA SOCIALE

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Introduction

The study deals with the organization of techno-scientific thought and its devices – models, maps, representations – and how techno-scientific thought cohabits with other forms of knowing, namely economics and law. Its specific aim is to examine the progressive reshaping of the financial reporting triangle through the creation of accounting competence by the suppliers of Enterprise Resource Planning systems. An empirical case study on an ERP system in transition to financial accountability provides the basis for reflection within organization studies on the forms of knowledge involved in technological production.

In the recent literature, ERP systems have been interpreted within a framework of radical modernization or ‘reflexive modernization’ [Hanseth *et al.* 2001] of enterprise information systems. It is argued that the desirability of the changes brought by ERP systems may lead to their surreptitious and improper occurrence, with political forms of representation being bypassed. On the other hand, radical modernization of the domain of corporate information systems increasingly informs the public and parliamentary debate on reforming the control systems employed by the democratic institutions. Indeed, a recent law, the 2002 Sarbanes-Oxley Act, passed by the American Congress to bring systemic and radical change to the financial reporting system has given rise to a new area of application for ERP systems.

The need for this change arises from a series of corporate scandals concerning the auditing system in the United States, where an independent auditor could simultaneously perform the roles of advisor and inspector. As a consequence, recent legislation, notably the Sarbanes-Oxley Act, has prohibited consultancy work by independent auditors and expressly covers activities concerning information systems. It has thus created new opportunities in the financial accounting sector for the suppliers of ERP software systems.

This study seeks to introduce a new epistemological paradigm into the social study of ERP systems. This paradigm is derived from actor-network theory and incorporates the political aspect of technological production and its forms of representation –

schemes and models. The analysis which follows is based on data from a case study, and it will try to answer the following questions: How it is possible for ERP systems to replace the independent auditor in the financial reporting triangle? How can the two actors be compared, given that one is a technology and the other a human being, one the product of a private firm and the other the representative of a government authority? The study will seek to answer these questions by drawing on Michel Callon's sociology of translation [Callon 1986].

The empirical case study concerns a system of enterprise modelling which will be called 'Epistémé', with 'Company' denoting the Scandinavian organization that has developed it. The case study describes the conditions for the legitimation of accounting competences by a specific class of technologies in organizations (ERP systems) as a collective experiment involving consumers, enterprise architects, and American government agencies. The study reports results of fieldwork of three months' duration conducted in 2004 at Company, where the researcher attended training courses, interviewed managers, observed the activities of the system developers, and examined scientific, promotional and strategic documents.

The article is structured into two parts: a theoretical part, in which literature and epistemological positions are discussed; and an empirical one, in which a case study is presented. The argument develops along three dimensions: one sociological, one political, and one more markedly normative. The first section introduces three issues raised by the massive spread of ERP systems: political representation, social membership, and the issue connected with the debate on reforming the control systems of the democratic institutions (*Section 1*). Then analysed is how the literature has treated the diffusion of ERP systems outside manufacturing industry, noting that whilst there is a large number of studies on application of ERP systems in the public sector or higher education, few have been produced on the passage of ERP systems to the financial sector (*Section 2*). The literature survey will show that enterprise modelling, in all the cases described, is an activity distributed across a network of actors that never belong to the same *social world*. Then introduced are three epistemological perspectives on the social worlds connected with ERP systems

(*Section 3*): ethnomethodological (3.1), phenomenological (3.2) and deconstructivist (3.3).

Each of these perspectives is presented in general terms, and then with a case study. I observe how these theoretical apparatuses substantially resume the *technology production/technology use* dichotomy and are not suited to explaining the recent extension of the relational domain of technological production to the legislator (*Section 4*). Three main positions have been adopted by studies deriving from these epistemological perspectives on how ERP systems are implemented and used. The first position holds that user organizations often adapt themselves to the system, rather than the other way round; the second that even the most prescriptive systems are ‘localized’ by the users; and the third that mutual adaptation takes place.

In *Section 5*, I address the topic of representation through treatment of the concept of the ‘public’ in social studies on information systems. I consider the ‘located accountabilities’ approach used in the literature to be inadequate because it emphasises bilateral relationships (5.1), assumes that the public is socially and culturally stable (5.2), lacks historical reflection (5.3) and neglects technology as a device to fix social relations (5.4).

I have therefore selected *actor-network theory* as a new epistemological paradigm enabling researchers to add the normative domain to the factors currently considered in the literature (technique, human factor and economy) so that they can grasp the process of ERP-system construction as result of this collective (*Section 6*). Within this paradigm, using elements taken from Michel Callon’s sociology of translation of [Callon 1986], I shall present a case study on a Scandinavian software company (called ‘Company’) and how it has addressed the financial accounting market as a new area of application for its enterprise modelling software (called ‘Epistémé’). Before setting out the case study, I shall give some methodological details (*Section 7*) and provide some normative information on the financial accounting sector, describing the concept of the reporting ‘triangle’ and the changes made to it by the Sarbanes-Oxley Act (*Section 8*). Subsequently, in the empirical part of the study, I shall describe the four ‘moments’ or stages in the process of translating Epistémé from the manufacturing sector to the financial

accounting sector. The first moment, that of ‘problematization’ (*Section 10*), concerns formulation of the research question by the modellers (‘Having proved to be the best means to analyse the impact of IT investments on organizations, can Epistemé do the same for financial aspects?’) and the ‘interdefinition’ of the actors participating in its resolution (population of users, enterprise architects, and US government agencies). The second moment, of ‘interestment’ (*Section 11*), is when the modellers use various devices to intervene between the actors in the network and their other potential ties. The third moment, ‘enrolment’ (*Section 12*), is when the relations among the network actors are arranged in an alignment that strengthens their interdependencies. The fourth moment, ‘mobilization’ (*Section 13*), is when the set of actors in the network are mobilized by the modellers to show the solution to their research question and to reformulate the financial accounting triangle.

In conclusion (*Section 14*), the normative theme will be resumed in discussion of reforming the control systems of democratic institutions. I shall discuss three aspects of the Sarbanes Oxley Act in light of the case study, concluding that ERP systems as collectives of actors are not neutral but elusive, prone to conflicts of interest. They are distributed, and they do not centralize control functions. And because they are to be used for supervision, they must be subject to a distributive analysis of responsibilities.

1. Literature on Enterprise Resource Planning (ERP) systems

By transforming themselves from applications to individual productive functions (like expert or business process re-engineering systems) into systems to control organizational action in its entirety [Davenport 2000], and by introducing new technology on pre-existing technology [Scott and Kaindl 2000; Light 2001], ERP systems have been interpreted from a perspective of the radical modernization or ‘reflexive’ modernization [Hanseth *et al.* 2001] of enterprise information systems. Because the introduction of ERP systems into

organizations does not replace human labour, it is not a portent of revolutionary change. The desirability of the changes brought by such systems makes them unnoticed and impolitic. Instead, the effect of ERP systems based on enterprise models may be cumulative. According to the analysis by Rowland and Gieryn [Rowland and Gieryn 2006], in the United States the majority of the top 500 companies in the Fortune classification table use ERP systems produced by models, and globally more than 60% of companies have adopted them. In 1998, the suppliers of ERP systems has produced 17.5 million dollars in profits [PriceWaterhouseCoopers 1999] which in 2000, including consultancy, rose to 40 million [Willcocks and Sykes 2000]. ERP systems are so widespread that also software companies like IBM and Microsoft adopt them to manage their organizations [O’Leary 2000].

But it is not only the political system that tends to be replaced. Sociological analysis is also eluded. The category of ‘accountability’ [Garfinkel 1967] in its sociological version cannot be used to make ERP systems ‘visible-and-reportable’. What is specific to accountability in technological production is its ‘dismemberment’ [Beck 2005, 3] from the social context, understood as a community of humans with some sort of shared affiliation. Proposed by a sociology for ERP systems is not a social community, but a number of humans and non-humans still to be organized into new forms by the use of ERP technology [Marres 2005].

Moreover, the radical modernization of the domain of enterprise information systems represented by ERP informs the debate on reforming the control systems of democratic institutions. Enterprise architecture has been considered one such control system by the Information Technology Reform Act¹ passed by the American Congress, and by the more recent Sarbanes Oxley Act². These laws contain provisions concerning “sound and integrated information technology” [CCA 1996] and “graphical representations” [SOA 2002] that government agencies

¹ Clinger-Cohen Act of 1996, Public Law, 104-106, 110 Stat. 684 (1996), 40 U.S.C. 11315.

² Sarbanes-Oxley Act of 2002, Public Law, 107-204, 107th Cong., 22nd sess. (30 July 2002).

and companies must possess to justify investments of public money and guarantee the reliability of their accounting procedures.

These legislative measures, which do not concern the American system alone³, represent a shift from the idea of a 'manager state' – with the ability and means to intervene directly in the market – to the idea of a 'regulatory state' [La Spina and Majone 2000] which delegates the regulation of not only the market for private goods but also the one for public goods to private actors. The state oversees this transfer through specific regulatory authorities which supervise the action of private actors in the market for goods considered of value to the community. Because the laws issued by the regulatory authorities establish internal control procedures in the form of monitoring techniques, they participate in constructing what in anthropology is called the 'audit culture' [Strathern 2002]. Information systems play a crucial role in this cultural shift. Michael Power, a leading analyst of the audit phenomenon, maintains that a distinctive feature of the audit culture is the change to a conception of system accountability [Power 1994] where technology is seen as a more 'neutral' system of control. In reality, as Nissenbaum argues [Nissenbaum 1996], whilst close attention is paid to the reliability and safety of the system, the conditions in which information systems are commonly developed and used, together with the popular conception of the nature, capacities and limitations of computerization, contribute substantially to obscuring the features of accountability. Nissenbaum identifies four barriers against accountability: *(i)* the problem of a diffused responsibility that is commonly analysed in terms of a single individual and not in terms of collective action, with a consequent reduction in responsibility because, in a computerized society, software is the product of action involving people in different organizations; *(ii)* the view that bugs in software are inevitable, and which consequently breeds the dangerous conception that the engineers are absolved from blame; *(iii)* the view of the computer as a

³ For the Italian case, see also, L. 262/2005, Titolo III Disposizioni in materia di revisione dei conti Art.18, punto 8.

scapegoat, with increasing agency assigned to non-humans that tend to absorb human accountability, and (iv) the issue of ownership without liability, with an extensive debate on intellectual ownership which tends to obscure the equally important discussion on liability that must attach to ownership.

2. The problem of the similarity and difference between enterprises and other areas of application of ERP systems

In computer engineering, the term ‘model’ refers to the tool used to guide the writing of the code for applications. The model is a protocol for the communication of specifications among engineers. For enterprise architects – to whose community the modellers in our case study belong – a model furnishes guidance for visualizing the organization’s entire activity [Zachman 1987]. Before the advent of enterprise architects, there coexisted in organizations a wide range of models each with its own application: the model used for software development in Visio; the model for product development in CAD; the business processes model in applications of Business Process Modelling (BPM). Since the advent of enterprise architects, a single basis (the enterprise architecture) is used to model every organizational activity, whether it concerns products, processes, people, or computer systems. Having somehow integrated operations within the enterprise, the suppliers of ERP software have sought to generalize it to other areas such as universities, the public sector, and finance, which in principle are different from those for which the systems were originally conceived. The problem of the similarity and difference between these new areas and the context in which ERP systems were first developed – the enterprise – has been addressed by several studies. Whilst the issue of applying ERP systems to universities has been widely discussed, less attention has been paid to their applications in other areas – finance for instance.

In regard to universities, Pollock and Cornford [Pollock and Cornford 2004] discuss their similarity with enterprises. Their approach is to consider the distribution of this notion and to

analyse where the suppliers of ERP systems off-load responsibilities for their final performance. The construction of similarity between university and enterprise as areas of application for ERP systems does not take place, for Pollock and Cornford, within the boundaries of the organization alone. Rather, it is the result of relations that the university has established with the system, its suppliers, various internal departments, and other institutions involved in similar technological projects.

Again with regard to universities, Wagner and Scott [Wagner and Scott 2006] maintain that the notion of 'best practice' is fundamental for the project carried forward by the suppliers of ERP systems. With this slogan, after implementing the system in a single important university, ERP suppliers can propose the same product to other less central clients in the same sector, claiming that it incorporates the best organizational practices adopted by the 'big players'. Wagner and Scott describe how an ERP best practice system, rather than being exhaustive, results in reality from a socio-political decision process which involves a small interest group [Scott and Wagner 2006].

A study with a more explicit bearing on enterprise information systems based on models for their application in the financial sector has been conducted by Fleishmann and Wallace [Fleishmann and Wallace 2005]. The authors, in describing the case of a system based on models to support decisions about the granting of credit to clients, stress the relative decision-making power of the actors involved: modellers, clients, consumers, and the public more indirectly affected by the decisions of banks. In all the cases considered, modelling is an activity distributed in a network of heterogeneous local and global actors whose natures and ontological statuses differ. Modellers, consumers, clients, advisors and the public indirectly affected by the use of models do not belong to the same *social world*.

In the next section, I shall investigate the epistemological roots of the issues mentioned in regard to the social study of ERP systems. I shall do so in light of the three predominant positions taken up in the debate: ethnomethodological, phenomenological, and deconstructivist.

3. For a sociology of ERP systems

Investigation of the social worlds involved in the implementation, adoption and use of corporate information systems has epistemological roots in the Work Practices and Technology group at the Xerox PARC headed by John Seely Brown. There Lucy Suchman and her group had imported concepts from ethnomethodology into the study and design of technical artifacts. Besides the ethnomethodological perspective, social studies on ERP systems have also adopted phenomenological [Ciborra *et al.* 2000] and deconstructivist [Kallinikos 2004] perspectives. In the next section I shall investigate how, according to these three perspectives, social worlds and forms of knowledge are distinguished in the analysis of ERP systems.

For each perspective I shall present its theoretical background in general terms and then describe a study on ERP. Three questions are asked about each perspective:

- What do ERP systems do in organizations?
- What are the social worlds/knowledge forms involved?
- What is the relationship between them?

The purpose of the first question is to determine whether the paradigm of the perspective is representational or performative – that is, whether the interest is the quality of the representations or whether it is in who constructs the representation, when, and for what purpose. Then, if the paradigm is performative, it is asked how many social worlds/knowledge forms participate in the construction of the representation (question two) and what their relations (question three) are. In so doing I can understand whether the discussion is restricted to two voices (technology production/technology use) or extended to others.

3.1. *The ethnomethodological perspective*

I introduce the ethnomethodological perspective per se before relating it to the study of ERPs. In doing so I shall quote the words of the founder of the ethnomethodological programme, Harold Garfinkel, and then describe how this perspective was adopted by Lucy Suchman in her article “Representing Practice in Cognitive Science” [1990].

The ethnomethodological perspective is concerned with the link between representations of action contained in a culture, and interpreted by traditional sociology as a guide for human action, and the methods by which members construct reality locally [Garfinkel 1967].

I then discuss an essay by Andy Crabtree, Mark Rouncefield, Peter Tolmie entitled “‘There’s Something Missing Here’: BPR and the requirement process”, which uses the ethnomethodological perspective in analysis of a corporate information system [Crabtree *et al.* 2001].

The ethnomethodological perspective derives from Garfinkel’s critique of Durkheim’s conception of the nature of social facts. Contrary to Durkheim’s view that a fundamental principle of sociology is the objective reality of social facts, the ethnomethodological perspective assumes that the reality of social facts is a process of continuous accomplishment in the concert of daily life activities. Thus the mission of ethnomethodology is to study the artful and ordinary modes by which the process of accomplishment is learned, applied and taken for granted by members.

When applied to the study of physical and biological facts as social facts, the ethnomethodological perspective clearly distinguishes between situated practice and planning, describing representations in their use. In her study on cognitive science practices, Suchman [1990] conducts a critique on the planning model in which a representation is conceived as able to control human action. The plan, considered as a set of detailed actions, operates as a programme able to control human action. The action is viewed as derived from the plan, so that the plan becomes a substitute for action. Once this substitution has been

accepted, the problem of action is taken as solved. The remaining task is to refine the model.

According to Suchman, however, the plan is a useful tool with which to discuss human action. But its relationship with action is not that of a substitute but of a resource which is part of the situated practice. The function of the plan, therefore, is not to provide a specification or a structure to control local interactions but to orient the course of action beforehand. Plans specify the extent to which the specification is useful, and they are vague on precisely how far it is meaningful to quit the specification and rely on the availability of contingent and ad hoc answers.

3.1.1 Essay

The first perspective on large-scale information packages is the ethnographical one exemplified by a study carried out by Andy Crabtree, Mark Rouncefield and Peter Tolmie entitled “‘There’s Something Missing Here’: BPR and the requirement process” [Crabtree *et al.* 2001].

TAB. 1. ERP Typology, Case Study, Data and Proposed Solution in the essay

Crabtree A., Rouncefield M., Tolmie P., There is Something Else Missing Here: BPR and the requirement process	
ERP typology	Business Process Re-engineering, Process Models, Process Maps
Case Study	1.re-engineering of a client service for a container shipping company; 2.elaboration of a process map for the opening of a number of smaller Lending Centres by a major High Street Bank.
Data	Observation, minutes of conversations.
Proposed solution	Consider as core processes activities more detailed than the level of transactions.

The object of study is requirement specification for a business process re-engineering system in continuous organizational change. The contention of the authors is that there is something missing in the requirement specification phase as described in

their case studies. That ‘something missing’ is real-world real-time practices by which process maps – tools for requirements specification – are produced. The objective of the study is to propose the use of the ethnographical method to grasp practices in a more detailed manner.

Two case studies are cited. The first concerns a project to develop a prototype for a global client service to support the activities of a container shipping company. The client service consists of the following activities: evaluation and pricing; export handling; allocation; documentation and import handling. The second case study concerns a major Wall Street bank taking on the work of a number of smaller lending centres throughout North-West England. The object was to ensure that every single process in which the banks engaged would be done in exactly the same way. For this purpose a process model and a process map (‘quick-maps’) were elaborated so that anyone could come in and do the job by following the map.

In both cases, attention is drawn to the practices of business process re-engineering and its devices. These practices respond to continuous organizational change by identifying core processes, which are then treated as requirements for the information system building. The criticism made by the authors of business process re-engineering practices is that they do not reflect the contingent and negotiated nature of their production. Furthermore, the supporting devices are not sufficiently detailed to grasp the ‘real-world, real-time’ nature of work processes. The model stops at the level of the identification of transactions and fluxes as system requirements, while what should be addressed is something deeper-lying. The alternative approach proposed is to consider the existence of instances situated at a deeper level as core activities to inform the design. Comparing work activity to a linguistic game, the authors indicate these instances as the building blocks that give sense to the activity and without which the activity is meaningless.

TAB. 2. Table of questions

What do ERPs do in organizations?

ERPs are part of a practice and are a resource for action. They are not destructive per se; they are part of a practice and only exist as part of that practice. The practice of which they are part is that of identifying core processes among organizational transactions to deal with the problem of continuous organizational change. The idea that plans are resources for action maintains the ambiguity about whether it is possible to operate on this relation. The use of the terms ‘reasoning’ and ‘sensitizing’ in the essay seems to indicate a direction for intervention on the relation.

What are the social worlds/ knowledge forms involved?

The ethnomethodological perspective, both in its theoretical elaboration and in its practical application, resides at a local level of detail. In situ knowledge is the knowledge possessed by members by which they negotiate the objectivity of their daily lives. It is the only ‘true’ knowledge. No other knowledge is considered as such. Scientific and pre-scientific knowledge are fused in practice and must be studied with the same instruments.

What is the relationship among social worlds/ knowledge forms?

The elaboration of the representational bond as a relationship of resource seems to suggest a temporal characteristic by which scientific knowledge (the planning model) is located in a temporal solution beforehand and afterwards the practice-based knowledge. The objectivity of the planning model does not coexist with the objectivity of in situ knowledge. It comes before and after it in temporal terms.

3.2. The phenomenological perspective

I shall introduce the phenomenological perspective per se before relating it to the study of ERP systems. I shall refer to the essay “On Multiple Realities” by Alfred Schutz [Schutz 1971] in which he discusses the nexuses among various orders of reality (the essay concentrates in particular on the nexus between the world of daily life and the world of scientific contemplation) and their specific features. I shall then pass to the phenomenological reading of ERP systems as proposed by Claudio Ciborra and colleagues [Ciborra *et al.* 2000].

In his essay “On Multiple Realities”, Alfred Schutz [1971] traces some of the consequences of the analysis of our sense of reality conducted by William James in his *Principles of Psychology*. James states that there are different and distinct

orders of reality, each of them with its own specific and distinct mode of existence. He calls them “sub-universes” and provides as” an examples the world of physical things (as the reality par excellence), the world of science, the world of ideal relations, the world of tribal idols, the various supernatural worlds of mythology and religion, and others. The popular mind, he says, conceives these worlds in more or less unrelated manner, and when it considers one of them, it temporarily forgets its relationships with the rest. Every object of which we think refers to at least one of these sub-worlds. “Each world, when we participate to it, it is real in its way; but the reality disappears together with the attention⁴. Schutz extends this approach beyond the psychological sphere to turn it into a philosophical problem. He concentrates on the relation between daily life and the world of scientific contemplation. To clarify this relation, he coins the term “finite provinces of meaning”. Each province of meaning is characterized by a specific cognitive style. All experiences within a province of meaning are per se coherent with the cognitive style and compatible with each other. But what is more important, for my analysis here, is the concept of the ‘finiteness’ of a sub-world that clarifies its relation with the others. Each province is finite because it is not possible to refer one province to another via a transformation formula but only with a leap due to a trauma.

3.2.1 *Essay*

The study that reveals the presence in the literature of a phenomenological perspective in analysis of large-scale information packages in organizations is entitled “From Control to Drift”, written by Claudio Ciborra and colleagues.

The essay is a collection of six intensive case studies regarding the development and implementation of information infrastructures in global enterprises. I shall concentrate in particular on the section that deals with the concept of strategic alignment between business and technology (pp. 15-40).

⁴ James H., *Principles of Psychology*, New York: Henry Holt, 1890. vol II, cap.XXI pp.283-322.

In this section, Ciborra *et al.* discusses ideas, models and prescriptions in the managerial literature on the construction, implementation and monitoring of corporate information infrastructures.

TAB. 3. ERP Typology, Case Study, Data and Proposed Solution in the essay

Ciborra C. and Associates, FROM CONTROL TO DRIFT, The dynamics of corporate information infrastructures, Oxford University Press, 2000.

ERP Typology	Global Information Infrastructure
Case Study	Relationship between business and IT: the concept of strategic alignment.
Data	Bracketing of the concepts of 'technology' and 'strategy'. Phenomenological approach.
Proposed solution	Comprehension of information infrastructures based on empathy, intuition and evidence.

They develop the innovative concept of 'global information infrastructures' (ERP systems for global enterprises), claiming that the literature on this topic lacks originality in that it uses the same style of debate as in the field of Information Systems. In particular, the *vis critica* of the essay is the concept of 'alignment' between business strategies and information infrastructures. Strategic alignment in the managerial literature means the matching of information infrastructure functions with business strategies. The interdependencies foregrounded by Peppard in his diamond diagram are: global business strategy, global business model, global business drives and global information strategy [Peppard 1999].

The study of the concept of strategic alignment is for Ciborra an appropriate context for questioning the status of the abstractions frequently found in the management science literature and their relationship with what happens in the field.

The question is this: what happens when the various areas of strategy, organization and technology are connected in the same geometrical representation? Do we have a new and better organizational performance? The answer is 'no'. This geometrical representation has a limited impact on the organization's 'primordial soup of anonymous practices and events' [De Certeau

1984]. This is because knowledge of, and exposure to, theories may not be enough to learn a new behaviour [Argyris and Schon 1996]. According to Ciborra, a representation that does not work, such as that of strategic alignment, causes a breakdown. Breakdowns are opportunities to adopt a different vision of the organization’s lived world, one more closely tied to evidence, intuition and empathy than to geometrical models.

TAB. 4. *Table of Questions*

<i>What do ERP systems do in organizations?</i>
Management models, geometrical representations with lines and squares remain confined to the world of abstractions and have no impact on organizational life. Technology, as it is commonly conceived, does not exist. It is an epiphenomenon that must be comprehended by starting from comprehension of the organization. Large-scale information packages as forms of intervention are of dubious effectiveness because they are based on abstract models.
<i>What are the social worlds/ knowledge forms involved?</i>
The essay examines the relation between an abstract, scientific knowledge based on geometrical representations –the management – and a pre-scientific knowledge based on intuition, empathy and evidence –the manager.
<i>What is the relationship among social worlds?</i>
The former (scientific knowledge) does not yield understanding of the latter (pre-scientific knowledge), but the latter yields understanding of the former.

3.3. *The deconstructivist perspective*

By ‘deconstructivist perspective’ I mean a research approach to artefacts and representations intended to reveal the concepts, assumptions, politics and implications contained, embodied, inscribed in artefacts and in the representations by their authors, designers or engineers.

This perspective can be said to have been initiated by the philosopher Langdon Winner in his “Do Artifacts have Politics” [Winner 1980], where he stresses that technologies are not neutral but may irreversibly embody forms of oppression. Winner’s

argument is that tangible artefacts (including architectural space and other material and spatial devices) embody social relations (that is, forms of power).

The example given is that of the design of New York's parkway bridges by the urban planner Robert Moses. Winner notes that the bridges were designed at a low height by Moses in order to keep buses – and the people who at that time⁵ could not afford a car – away from the Long Island beaches. The analysis of this example ends by affirming that not only do artefacts have politics but their politics are the most perverse because they are concealed behind a facade of objectivity, efficacy and functionality. This perspective has been applied in the same way in a study on information systems in organizations [Leigh Star 1999]. In her article, “The Ethnography of Infrastructure”, Susan Leigh Star writes:

“There are million of tiny bridges built into large-scale information infrastructures, and millions of (literal and metaphoric) public buses that cannot pass through them.”⁶

3.3.1 Essay

TAB. 5. ERP Typology, Case Study, Data and Proposed Solution in the essay

Kallinikos Jannis, Deconstructing information packages: organizational and behavioural implications of ERP systems, Information Technology & People, Vol.17 No.1 2004.	
ERP Typology	Enterprise Resource Planning systems
Case Study	SAP/R3 – “Material Management”
Data	Abstract and context-free analysis
Proposed solution	ERP systems can be improved by the use of new media to support a broader variety of forms of involvement.

⁵ Robert Moses was an urban planner in New York from 1920 to 1970.

⁶ Susan Leigh Star, The Ethnography of Infrastructure, in «American Behavioural Scientist» 43 (1999) 377-391.

I now analyse a study representative of the deconstructivist perspective. The article is entitled 'Deconstructing Information Packages: Organizational and Behavioural implications of ERP systems' [Kallinikos 2004]. The aim of the study is to 'lay open a set of implicit yet crucial organizational and behavioural premises onto which large-scale information packages such as ERP systems are built' [Kallinikos 2004].

The essay does not analyse the system's implementation and adaptation to different organizational realities. It affirms that independently of the implementation of ERP systems, the organizational and behavioural premises that they imply cannot be completely erased. For an abstract and context-free study is legitimized.

Kallinikos deals with ERP systems and acknowledges their ever more rapid spread into organizational realities. The specific technology treated in the study is SAP/R3, with the focus on its "material management" module. The author says that the conclusions drawn by the study of this specific technology may be valid for any large-scale integrative information package. The 'material management' module is an information package for the evaluation of suppliers. It furnishes the categories with which to record information about the supplier and a database of past interactions. The totality of relevant operations for identification of the interaction with the supplier are classified as follows:

- (1) purchasing
- (2) external service management
- (3) vendor evaluation
- (4) inventory management
- (5) invoice verification
- (6) warehouse management
- (7) consumption based planning
- (8) material ledger

Each of these categories is divided in other sub-categories, which are again divided into sub-categories.

The essay stresses the implications of this technology for human agency, organization and work practices. In particular, it states that large-scale proactively-oriented systems like ERP imply

very selective modes of participation (adherence to the procedural logic and the data and transactions track that the system presupposes).

ERP systems are not only descriptive; they are also normative or, more appropriately, performative. The meaning of the best practices proposed by such systems is that of indicating modes of actions, more than the shared codification, automation and integration of transactions.

Kallinikos compares the ERP system's implications of a procedural character for human action and relates them to other forms of involvement. Anderson [1983] distinguishes between declarative knowledge (knowledge regarding facts and relations in a specific domain) and procedural knowledge (know-how). Here, learning consists in the shift from the first type to the second type of knowledge. Anderson emphasises that declarative and procedural are only two states of knowledge, and that knowledge acquires form through different transformations [Engestrom 2001; Nonaka 1994; Weick 1979].

In humans, procedural knowledge is transformed in a way such that it can yield understanding in terms that differ from the procedural knowledge itself. Dealing with the world often implies procedure mutations as a response to the changing conditions or as a consequence of a procedure's inadequacy. The option for a procedure presupposes a tacit definition/reading of the situation [Goffman 1974]. Before individuals apply their know-how, they must frame the situation and decide which sort of behaviour is appropriate, even if the framing is provisional [Weick 1993].

Framing is an highly complex cognitive activity that cannot be separated, without serious consequences, from the system of meaning that backgrounds a particular social context. In his analysis of the Mann Gulch disaster, Weick shows what happens when the framing, or 'sense making' as he puts it, is separate from action. Ambiguous or urgent situations require innovative responses. This skill is related to the ability to read/frame a situation. When rigidly dissociated from framing, actions lose their intentionality and tend to degenerate into meaningless procedures that may have devastating consequences.

The procedures uploaded in the system, however inadequate, can only be changed in the next revision.

This contrasts with the fact that the capacity to evaluate procedural modes is not one of the competences pertaining to procedural knowledge. Judgement on the goodness of a procedure cannot be based on the procedure itself. Knowledge of the world constitutes the background where procedural knowledge becomes meaningful and useful [Goffman 1974].

TAB. 6. Table of questions

<i>What do ERP systems do in organizations?</i>
ERP systems have profound implications for organizations. They select forms of involvement. They proceduralize action. The technology predicates a meticulous segmentation of operations in order to make the system able to monitor them. Large-scale information packages aim to construe a general mapping of organizational transactions and fluxes to make managers able to monitor them.
<i>What are the social worlds/ knowledge forms involved?</i>
Declarative knowledge (knowledge about facts and relations in a specific domain) and procedural knowledge (know how).
<i>What is the relationship among social worlds?</i>
Declarative knowledge and procedural knowledge are parts of a complex cognitive system. Procedural knowledge and declarative knowledge sustain each other. Rigidly separated from the other, they tend to degenerate into mechanistic and non-imaginative modes of acting and thinking.

4. *Applicative outcomes*

The foregoing review has outlined the topics and perspectives in the literature on ERP systems. It has presented the three dominant theoretical apparatuses used to study ERP systems (see TAB. 7). But the epistemological perspectives adopted in study of ERP systems produce bilateral narratives. These theoretical apparatuses are inadequate to take up the challenges raised by large-scale information systems like ERP.

The social worlds introduced by these perspectives are given a dualist structuring between on the one hand the domain of practices and, on the other, that of models, systems and plans with different degrees of relation. By emphasising the central

importance of local redesign for the success of ERP systems, ethnomethodological, phenomenological and deconstructivist studies fail to recognize the role of other actors in stabilizing the system: for instance, the production chain, the developers, the physical environment, the competent authorities, legislators, interest organizations, and the scientific community.

TAB. 7. Synoptic table

<i>What do the representations used by ERP systems do in organizations?</i>	
Ethnomethodology	Must be more detailed. Must be vague enough to leave space for ad hoc responses and precise enough for the specification to be useful.
Phenomenology	They create breakdowns
Deconstructivism	Must be related to action.
<i>What are the social worlds/ knowledge forms related?</i>	
Ethnomethodology	Planning model/in situ knowledge
Phenomenology	Scientific world/pre-scientific world
Deconstructivism	Procedural knowledge/declarative knowledge
<i>What is the relation between the social worlds/ knowledge forms?</i>	
Ethnomethodology	Planning model and in situ knowledge stand in a resource relation of. There is a temporal factor whereby planning takes places before and after the course of action.
Phenomenology	There is no relation. There is a 'leap' between scientific knowledge and pre-scientific knowledge.
Deconstructivism	Declarative knowledge permits revision of procedural knowledge.

The studies on the implementation, adoption, and use of ERP systems deriving from these epistemological perspectives depict a monolithic technology on the one hand, and an organization with only the binary choice of changing itself or changing the system, on the other. In some cases, they show that user organizations adapt to the system rather than the reverse. Davenport [1998] discusses how ERP systems typically force users to replace informal ways of working with a more formal 'business process template' incorporated in the software. The benefit of this type of

standardization for the suppliers is that they need prepare only small number of variations on the system, while the benefit for the user organizations is that they have easy access to updated versions. The disadvantage for the suppliers is that they have to forgo the high value-added market of customized solutions, while the customer organizations may find that the standardized solutions do not match the requirements of their specific work processes. It thus happens that, in the bilateral conflict of interests, the software suppliers discourage client organizations from adapting or modifying their systems by producing updates and new software compatible only with the standard version. This phenomenon has also been called 'default power' in the literature [Koch 1999].

Other studies more closely based on ethnographic methods show that even the most prescriptive systems are 'localized' by consumers. Scott and Wagner [2006], in their already-mentioned study, describe how the standard formats of ERP systems are 'compromised' through user 'skirmishes' and resistances, so that a more localized system emerges.

A third position is represented by those who, in seeking to reconcile the previous two positions, emphasise that technology and organization are often aligned through a combination of complicated organizational changes, on the one hand, and reconfiguration of the software on the other. This process has been called 'mutual adaptation' [Orlikowski 1992].

Evident in these results is the lack of a sophisticated conceptualization of the processual ordering of the numerous competing accounts of the evolution of ERP software within organizations. Much of the current research on ERP systems is restricted by its use of only short-term results. It is based on 'snapshots' of reality which emphasise only single phases or aspects of the life-cycles of software packages (usually the implementation phase). The studies deriving from these epistemological positions do not adequately address the long-term co-evolution of artifacts and their contexts of use. The objective of such studies is to show that the possibility for these systems to work is an 'accomplishment' by the users, which reconcile the mismatch between the system and work practices. According to these studies, If ERP systems are able to

work in different contexts, this is due to a substantial local effort of re-design around the user organization's practices and culture.

Most of this literature tends to emphasise the clash between specific organizational processes and the system's generic presuppositions during the implementation of ERP. This reflects the presence of a predominant narrative: that the context is always different, unique and distinguished by idiosyncratic practices, while the technology is both 'singular' and 'monolithic' [Pollock *et al.* 2007; Grimm *et al.* 2006].

Discussing technology from the perspective of the conflict between engineering and practice-based forms of knowledge prevents conceptualization of the collective arrangements that stabilize a technology. I suggest that the role of ERP (and the specific engineering view of organization on which it is predicated) should be considered in relation to other forms of knowing involved in corporate 'disclosure' (finance, economics, and the legal framework). The above-mentioned theoretical approaches cannot be used to discuss legal regulations as a circumstance that influence information packages design and use.

The US Congress has recently issued regulations that directly and explicitly address the use of computer-based information packages by public and private enterprises. The relations that influence information technologies design and use are thus extended beyond business processes or human factors to politics. The specific case is that of the Sarbanes-Oxley Act passed 'to protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the security laws' (H.R.3763, p. 1), and which in section 404 covers Enterprise Architectures as a form of corporate disclosure.

I submit that the recent raise of the legal interest to information technologies must be added to the other factors (technical, human and economic) already considered in the literature that discusses ERP systems design and use. This highlights the need to consider the process of constructing large-scale corporate information packages as a collective undertaking.

The actor-network approach adopted here suggests a vision of the world in terms of the emergence of competing 'actor-networks' in which various elements are combined or 'enrolled' in alliances [Latour 1987]. This approach is used in order to show

that, for example, success in translating the use of ERP systems among organizations operating in different sectors depends on competition among actor-networks. The argument will be that similarities and differences among organizations in different sectors are not objective phenomena amenable to the researcher but depend on the ways in which they are built and translated through the construction of alliances.

5. The concept of the 'public' in the social studies of information systems

The second thematic area drawn upon by this study concerns the political domain as configured by recent legislation like the Sarbanes Oxley Act and its cumulative implications for the use of ERP systems. I shall try to answer the following questions. How it is possible for ERP suppliers to take over the role of the independent auditor in the financial accounting triangle? How can the two actors – one a technology, the other a human being, one the product of a private enterprise, the other the representative of government agency – be compared?

I shall reprise the concept of 'the public' as treated in social studies on information systems, observing some of its aspects that warrant closer examination.

In this case, too, Suchman has been a pioneer in the study of the political aspects of design practices. In 1993 she entitled one of her articles "Technologies of Accountability" [Suchman 1993] and in 1994 she published "Working Relations of Technology Production and Use" [Suchman 1994]. A reworking of this last study gave rise to "Located Accountabilities in Technology Production" [Suchman 2002]. Suchman distinguishes three design practices on a scale of increasing accountability: 'design from nowhere', in which the designer is only concerned about the system's accountability, i.e. that it should perform the function for which it has been designed; 'detached intimacy', where accountability extends to the community to which the engineer belongs; and 'located accountability', where the designer is politically accountable for his/her actions to a public broader than the community of engineers to which s/he belongs. The

efficacious aspect of the notion of 'located accountability' is that it goes beyond Garfinkel's notion of accountability as 'member's concern' to adopt a deliberately political stance. As pointed out by Eriksen [Eriksen 2002], the concept of 'located accountability' implies being aware and reflexive with regard to one's participation in various communities and the possible benefits of boundary-crossing networking [Eriksen, op.cit., 182]. Each of us must face the personal challenge of accountability for one's actions in what can be broadly termed a 'commonal' sense [Eriksen, op.cit., 182]. The design and use of technologies are collective outcomes for which each of us is somehow responsible.

However, even making reference to Suchman's previous writings [1993; 1994] on accountability in design practices, it is difficult to find clarification of the of the broad and 'commonal' sense in which the designer must assume responsibility for his/her actions. A similar point concerning the concept of 'located accountability' has been made by Neyland and Woolgar [Neyland and Woolgar 2002], who write:

'across the wide range of ethnomethodological studies of accountability, the analytic status of the 'public', that is, the nature and identity of those for whom practical actions are 'publicly observable' varies considerably. The nature of the 'public observation' also varies.' (Neyland and Woolgar 2002, 263).

Ethnomethodological investigations vary considerably in the extent to which they specify the precise nature and occasion of the public observation and reporting which may ensue from the accountable character of practical action. In studies of face-to-face conversational exchange, the parties can inspect the adequacy of an utterance as, say, an answer to a preceding question. Other studies, especially workplace studies, are concerned with how certain practical accomplishments are rendered accountable for certain specific audiences: for example, welfare agencies, coroner's offices, law courts, and juries [see e.g. Drew and Heritage 1992; Luff *et al.* 2000]. In yet other studies, the 'public' is a more diffuse set of (potentially significant) others, often dispersed temporally and physically. For example, Lucy Suchman's [1993] study of 'technologies of accountability' shows how work (the monitoring

and recording of aircraft movements) in an airport operations room is oriented both to the immediate interactants – the pilot, the crew on the aircraft parking ramp, other parties in the operations room – and, via the medium of the nationwide computer system, to unspecified other potential participants. Luff and Heath [1993] similarly show how the detailed in situ work of an architectural practice is oriented to a range of individuals and organizations outside the office: ‘structural engineers, drainage engineers, building contractors, fire officers, and the clients’ [Luff and Heath 1993, 208].

Suchman’s study on the prototyping of a document-coding system for a large law firm [2002] is also an attempt to detail relations of production and use in technology production. As a member of a very large enterprise engaged in the production of new technologies, Suchman describes the complex network of socio-material relations in technology production and rejects the simple dichotomy between technology production and use. She shows that industrial research comprises a number of disciplinary distinctions (computer science, electrical engineering, mathematics, cognitive psychology, etc.) and a number of other roles such as product design, development, manufacturing, finance, and so on, each of which is itself a complex world comprising distinctive concerns, identities, accountabilities and working practices. Technology use (as represented by the example of the large law firm) has the same complexity. There are lawyers, senior managers, directors of technology, document analysts working in support of the attorneys and the supervisors of the document analysts.

Despite the variety in the extent to which ethnomethodological thought specifies the precise nature and occasion of public observation, it does not provide theoretical tools with which to explain the connections among various accounting rules. The analytic status of the public – that is, the nature and identity of those for whom practical actions are ‘publicly observable’ – varies considerably. The nature of the public observation varies as well. Consequently, it is not always clear whether accountability involves the mere ‘recognizability’ of action (for example, that it is an answer to a question) or whether it also involves sanctionable consequences (for example, as a result of the deficiency of your

action, you will be penalized). This lack of sophisticated conceptualizations of the ongoing ordering of the multiplicity of alternative and competing accounting rules reveals itself in:

- i)* an overemphasis on the bilateral relationship;
- ii)* an assumption that the public is socially and culturally stable;
- iii)* a lack of historical reflection;
- iv)* a lack of interest in technology as a fixing device.

5.1. Overemphasis on the bilateral relationship

In line with ethnomethodological interest in the local temporal achievement of social order, the default assumption of these studies is that the relevant ‘public’ is the body of immediate co-present interactants. This emphasis on bilateral relationships (e.g. user/system, user/manager) tells us nothing about the social dimension. Latour [1994] observed in this regard that ethnomethodology explains sociality but not society. Simmel [1955] said the same thing long ago: relations between A and B are not enough to explain their actions and identities: these become intelligible only when embedded in the indirect and sometimes invisible relations bearing upon them. One must always add a third party, C, and adopt its point of view, for the relationship between A and B to become visible and reportable.

5.2. Assumption of the public as socially and culturally stable

When the ethnomethodological analysis of the public is not performed on immediate co-present interactants, it is very general. For example, Suchman [2002] describes third parties in terms of their nature and ontological status as ‘knowledgeable others’, ‘practitioners of other forms of work’, ‘extended network of socio-material relations and forms of work’. In Suchman’s example of the document-coding practice prototyped for the large law firm, the project proves to be an ‘effort to develop a work-oriented’ understanding of accountability [Suchman 2002, 9]. On

the site of technology use, publics (plural) become public (singular). As demonstrated by Suchman's example as well, in order to avoid vagueness, ethnomethodological approaches seem to assume that the public is socially and culturally stable. Although theirs is no longer Durkheim's consensual rule-governed society, it is nevertheless a society consisting of a vast but stable repertoire of fragmented micro-rules. The propensity to assume the stability of the public is a legacy of ethnomethodological thought, rather than being a failure of scholars in the information system field. A hidden naturalism, a tacit assumption that everyone has the same basic normality structure, something akin to the universal mind, has been indeed ascribed to ethnomethodology [Lynch and Bogen 1994].

5.3. Lack of historical reflection

Further evidence of disregard for the need to explain the connections among accounting rules of different publics is provided by the lack of historical reflection in ethnomethodology. The 'natural attitude' or the 'structure of normality' are not only culturally produced but are also temporally and spatially bounded. Accountability, says Mary Douglas [1992] is the cornerstone of modern institutions, in accordance with the dominant 'forensic' model of human beings. Individual persons must be able to account for themselves – both in the human court and on Judgement Day. What is more, adds Meyer [1986], such accountable persons are necessary for both the market and the state to be possible. Hence derives the invention of the 'legal person' which makes organizations accountable as citizens, producers and consumers. This invention in turn requires a set or sets of rules of accounting, of collectively accessible means to create appropriate accounts. These rules concern both the method and the logic of accounting, and they are synonymous with what is often called 'a social context' [Czarniawska-Jorges 1992a]. The recent shift from the idea of the 'state manager' – with the capabilities and the instruments to intervene directly in the market – to the idea of a 'regulatory state' [La Spina and Majone 2000]

which delegates regulation of the markets for both private and public goods to private actors, can be seen as a radical modernization of institutions. The state oversees this shift via specific regulatory authorities which supervise the action of private actors considered valuable for a community by implementing regulations. As these regulations establish internal control procedures in the form of monitoring techniques, they help create what in anthropology has been called an 'audit culture' [Strathern 2002]. Arguably, one effect of the recent rise of audit culture has been the progressive erosion of the two analytical distinct senses of an 'accountable' entity: i) able to provide and account (where the public consists only of those who are able to provide account) and ii) accountability as a radical property for being part of a social action (where the public consists of many more human and non-human entities). The original distinction in ethnomethodology was between accountability as the description provided by people of their context and behaviour and accountability as an intrinsic part of these activities. The accounts given by people when asked to be accountable were not considered to be consequentially linked with the property of things and actions to be accountable. Thus, explicit accounts were not of interest to ethnomethodology. The historical conditions have changed since 1935, when Garfinkel first coined the term 'accountability' while attending accounting classes. The explicit aspect of making accounts and the radical property of social action meet in one turn rendering new publics.

5.4. Lack of interest in technology as a fixing device

Ethnomethodological studies view public observation as an opportunity to retrieve relations of production and use often concealed in design by the myth of the lone producer of technology or by the use of abstractions. However, the public is retrieved by detailed study of in situ socio-material practices. A transparent report on the details of socio-material relations can produce a stable notion of the public achievable as a requirement of system development. An opportunity is being missed by

instrumentally subsuming technology stability to the ethnomethodological notion of public stability: the opportunity, that is, to retrieve precisely those socio-material relations that are the focus of ethnomethodology scholars. There is where I depart from those many information system scholars who use the concept of public observation within the ethnomethodology framework. Technology, I believe, is not a means to achieve this public; rather, it is the field of inquiry in which what the public is can be discovered. There is nothing (but ‘universal human nature’) in ethnomethodology to fix various actions and accounts and make situations repeatable and relatable to one another. Latour [1994] regards technology as such a fixing and connecting device. Ethnomethodologists fail to realize that the ambiguity of context in human societies is partially removed by a gamut of tools, regulations, walls and objects, of which they analyse only some. They thus look for interactional micro-rules with which ambiguity can be fixed.

I shall incorporate the public into a hybrid heterogeneous network of humans and non-humans and use the same method to analyse the strategies which enlist bodies, material, discourses, techniques, feelings, laws, organizations, and perspectives.

6. A new epistemological paradigm

The concept of the public in ethnomethodology is too narrow, and it is anthropomorphic. My interest here is in the public as a hybrid heterogeneous network of humans and non-humans. To develop my argument further, I must remedy ethnomethodology’s lack of concepts for the ‘nature and identity’ and the ‘ontological status’ of the missing third party (that is, ‘public observation’) that makes an action accountable. In order to assign a nature, identity and ontological status to the ‘phantom public’, we may resort to actor-network theory.

Actor-network theory has never been codified into a full-fledged theory; it is better described as an interpretative approach and a literary genre [Czarniawska and Hernes 2005]. Its two

sources of theoretical inspiration are actant theory [Greimas and Courtes 1982] and the notion of translation [Callon 1975].

Actant theory is a version of structuralist analysis introduced by the French semiologist Algirdas Greimas [Greimas and Cortes 1982], who propounded the notion of ‘narrative program’: a change of state produced by any subject affecting any other subject. Greimas speaks of grammatical subjects which may or may not reveal themselves as persons. He accordingly replaces the term ‘character’ with the term ‘actant’, “that which accomplishes or undergoes an act” [Greimas and Cortes 1982], because it applies not only to human beings but also to animals, objects and concepts. Narrative programs are linked together in a logical sequence to form a narrative trajectory. The epistemological features of Actor-Network Theory (ANT) of interest here is that ANT can be used to describe publics as:

1. dynamic (the public changes);
2. relational (as the public changes, a question arises: what are the synchronic and diachronic relations of publics with each another?);
3. historical (before this public there was another public);
4. and multiple (in multiplicity, reality is performed and enacted rather than observed).

The question of ‘the other’ so central to recent theory and scholarship has been framed by ethnomethodologists with inadequate sophistication. There are more ways to be ‘other’, and vastly more ‘others’ than the most tolerant soul alive can conceive. Technology production needs ‘others’; it needs to discipline them and to convince them. The ‘others’ involved in the conviction process are not only those involved in in situ interactions.

The circulating system of scientific facts [Latour 1999, 70] is an adaptation of Greimas’s narrative trajectory to description of the making of technological objects. Latour [1999] uses the example of the French researcher Joliot and the construction of the nuclear reactor to demonstrate that scientists (and technologists as well) need to *i*) mobilize referents from the empirical world, *ii*) convince colleagues, *iii*) find sponsors and *iv*) give the public a positive image, and all this at the same time. The ‘public observation’

changes in each of these loops. As the example of Joliot demonstrates, the publics that made his actions accountable were from time to time neutrons, colleagues at CNRS, directors of the Union des Minières and readers of the journal *Nature* [Latour 1999, 80]. As the public changes, so does the object. Public observation enacts the object observed. In other words, the nuclear reactor does different things as it is presented to different publics. This implies not just plurality but multiplicity.

The sociologist Annemarie Mol has demonstrated the concept of multiplicity by citing the example of anaemia [Mol 1999]. There are at least three performances of anaemia: the clinical performance, where a patient tells a doctor how he feels and the doctor observes the outside of the patient's body; the statistical performance: the haemoglobin level in a person's blood is measured and compared against the standard haemoglobin level; the pathophysiological performance, which depends on finding, for every single individual again, the dividing line between the haemoglobin level sufficient to transport oxygen through the body properly, and the abnormal level. The objects of each of these various diagnostic techniques do not necessarily overlap with those of the others. Mol's example shows that multiplicity is different from plurality. In plurality there are mutually exclusive, discrete perspectives existing side by side in a transparent space, while at the centre the object of attention is singular, intangible, untouched. In multiplicity, reality is performed and enacted rather than observed. Instead of being seen by diverse watching eyes while remaining untouched in the centre, reality is manipulated by various tools used by diverse practices [Mol 1999, 77].

The proposal put forward with these examples is that there are different and incomplete deep structures being enacted in different social locations. Each produces different kinds of objects and different knowledges about those objects. This approach is already apparent in Michel Foucault's post-structuralist analysis of the body. In the classical epistémé the body is a site for the enactment of symbolic power relations (for instance in the form of torture), while in the modern epistémé it is turned into a functional and (self) disciplined machine, a structured set of ordered and productive relations. Foucault identifies different 'deep strategies' with which to order relations [e.g. Foucault 1976].

The question to be answered is how different epistémé enacted by different publics relate to each other. The method is translation. Translation is the process of making connections, of forging a passage between two domains [Serres 1982a]. Translation is an act of invention which combines and mixes varied elements. Michel Callon, one of the founders of actor-network theory, summarizes this version of translation in the following way:

Considered from a very general point of view, this notion [translation] postulates the existence of a single field of significations, concerns and interests, the expression of a shared desire to arrive at the same result...Translation involves creating convergences and homologies by relating things that were previously different. [Callon 1980, 211].

Callon emphasizes that translation takes place on a common site where varied 'significations, concerns and interests' commingle. More precisely, Callon stresses that there exists a loose structure or 'network' of associations among ideas, things, people and resources [see Callon 1986; Callon *et al.* 1986] around which and through which translation processes are enacted. The act of making 'something new', whether it be the discovery of an object or the formulation of a theory, occurs through the forging of novel associations; it is almost a kind of bricolage [see Latour 1987b]. Not all acts of bricolage are equally serendipitous, however. John Law [1997] notes that translation can also be seen as a kind of distortion. To translate is to transform, and in the act of transforming a breach of fidelity to the original source is necessarily committed. Law puts the point more strongly: translation ('traduction') is also a kind of betrayal, a treason ('trahison'). The four moments that constitute the different phases of the general process that Michel Callon calls 'translation' [Callon 1980] are:

- i) *problematization*: The double movement that implies the formulation of a question and the inter-definition of the actors that renders one actor indispensable in the network is called by Michel Callon *problematization* [Callon 1980].
- ii) *Interestment*: as Michel Callon defines it [Callon 1986], interestment is the group of actions by which an entity

attempts to impose and stabilize the other actors it defines through its problematization. The different devices used to implement these actions are named interestment devices. The interestment is to be in-between (inter-esse), to be interposed.

- iii) *Enrolment*: this designates the device by which a set of interrelated roles is defined and attributed to actors who accept them. Interestment achieves enrolment if it is successful. To describe enrolment is thus to describe the group of multilateral negotiations, trial of strength, and tricks that accompany the interestment and enable them to succeed.
- iv) *mobilization*: according to Callon [Callon 1986], the term mobilization emphasizes all the necessary displacements for a chain of intermediaries to result in a sole and ultimate spokesman. To mobilize, as the word indicates, it to render entities mobile which were not beforehand.

7. Methodology

The materials examined by this study were gathered during three months of ethnography-inspired fieldwork at the production site of an enterprise modelling tool, which here is termed 'Epistemé'. The production site was a Scandinavian software company – which is called 'Company'. In situ observation of modellers at work on the production site was carried out in order to determine how the realities of the modellers' practice were transformed into statements about how enterprise models were constructed, and of how, in their turn, scientific statements were transformed into technological products.

The present study of technological practice takes as its methodological vantage point the semiotic analysis of inscriptions [Latour 1986]. A first advantage of the method is that software, deliverable documents, scientific papers, mails and marketing materials, build a world of their own that can be studied as such in relative and provisional isolation from the other aspects.

The second advantage of conducting some sort of semiotic analysis on technological texts lies in the very limitation of the theory. It allows us not to consider the creation of a text as the

result of social, economical and political conditions. By bracketing off the question of the referent (there exist only internal referents generated by the text itself) and by bracketing off the question of the locutor (authors and readers are built into the texts and may not relate to any authors and readers in the flesh), the texts deploy their own categories. This does not imply that only inscription phenomena are used, without explaining that they are interesting because they are functional to organizational practices. It is instead to appeal to the material substrate of inscriptions in order to understand the genesis of enterprise modelling and the construction by modellers of the accounting competence that enables them to adopt a symmetrical attitude among 'business-critical activities' as some of the same things in comparison to 'compliance with legal requirements', referring to other theories only when the process of material explanation is inadequate.

The tools used by the modellers to develop Epistémé are of various types, but their final outcome is always a software program, a scientific article, or a selling model in which symbols can be read from a very poor repertoire (diagrams, containers, objects, relationships, blots, bands, columns). Studying how the translation process performed by the modellers is inscribed in software programs, scientific articles, selling models or newspaper articles cannot be enough. It fails to capture the amplitude of the social practices involved in modelling and can only grasp marginal aspects. My interest here is the innovations in writing and imaging that take place in the modelling so that it can mobilize an increasing number of actors and replace the independent auditors in the financial accounting triangle after the Sarbanes-Oxley Act.

More precisely, I want to explain, with the concept and empirical knowledge of Company modellers and their models, how a small number of Scandinavian people working only with paper, signs and software become as powerful as the representative of a governmental authority and how, by working with software, deliverable documents, scientific papers, mails and marketing materials, on fragile inscriptions immensely less than the things from which they are extracted (the enterprise), they were able to dominate populations of users, enterprise architects and US government agencies.

7.1. Access to the field

The largest Italian automobile company was involved in an European Project together with Company and was particularly interested in Epistemé, the modelling platform. Epistemé is a desktop application of the Enterprise Modelling tools family delivered by Company. As the lead developer of Epistemé said, it is a modelling system of the enterprise's flows and transactions originally developed at Volvo to manage the supply chain of automobiles. The University of Trento, Department of Sociology and Social Research, was running at that time a Laboratory of Information Engineering and Organizational Analysis. This laboratory became a 'Competence Centre' for Company and it set up an Epistemé research group. As a complement to this project, a PhD student who had worked for nine years at Company came to the Laboratory. The research group used Epistemé in training sessions to represent the internal organization of the Laboratory. In February 2004, some preliminary field visits were organized to prepare the field. Before departing, the PhD student was interviewed on his experience of working with Company. During the preliminary field visits, the manager of European research activities and an anthropologist who had formerly worked as a resident researcher at Company were interviewed.

7.2. The field

The field where the research took place was the headquarters of Company. The organizational area was called 'Enterprise Architecture, Enterprise Modelling Business Center': in particular, the group observed was engaged in developing European research projects, of which there were many ongoing at the time of the fieldwork. The stay at Company lasted three months from September 2004 to December 2004. An office at the second floor, shared with an employee whose role was Enterprise Architecture trainer, was made available to the researcher. Company is located in the business area of a Scandinavian capital city.

I was introduced to the Company employees by the manager of European research activities, who was also my ‘mentor’ during my stay. I met the employees (around 150) in person, visiting them in their offices together with the manager. I was presented as a ‘knowledge worker’, and this was the description also used by the Company newsletter. The managers and the employees all spoke English with me. The group that I closely observed during my stay was the ‘European research activities’ group within Company’s Research & Development Business Unit (BU).

7.3. Materials

The data were obtained by means of regular weekly interviews with the managers of the company’s Product Business Unit and Research & Development Business Unit (BU), and with developers working in its R&D BU. In progress at the same time as the field study was an EU research project – here termed ‘MINERVA’. The MINERVA requirements were discussed, at their various stages of modelling, with the developers working on them. Further data were collected from the minutes of meetings held by the modellers with one industrial project partner and from the MINERVA deliverable documents. Other sources of data were scientific papers published by the manager of the Research & Development Business Unit (BU): in particular, the papers “From Enterprise Modelling to Enterprise Visual Scenes” (2003) and “The Foundations of AKM Technology” (2003) and a tutorial presentation of the MINERVA project: “Enterprise Modelling Purpose, Core Concepts, Technologies Methodologies and Implementation”.

Company has a branch in North America. Data on Epistemé’s American market were gathered from mail exchanges between the North American branch manager and the Product Business Unit manager at the headquarters in Scandinavia. Of particular interest was the interview of 18 November 2004 with the Product Business Unit Manager. Company White Paper of 12 October 2004 was also analyzed. Among the marketing materials found to be of relevance were the customer success stories of the U.S.

Census Bureau, U.S. Food and Drug Administration, National Oceanic and Atmospheric Administration, Federal Aviation Administration. As regards Enterprise Models sales in the US, I shall cite the General Accounting Office Report⁷ on the implementation level of Enterprise Architectures by government agencies, which was made available to me by the Product Business Unit manager.

Epistemé models were gathered by browsing the server terra2\projects1akm-ii\models1akmii where examples of models used as prototypes were collected.

8. The Sarbanes-Oxley Act and the Financial Reporting Triangle

Before the case is described, this section gives some normative information on the of the financial accounting sector, introducing the concept of the financial reporting triangle and the changes wrought to it by the Sarbanes-Oxley Act. Subsequently, in the empirical part of the study, I shall describe the four ‘moments’ in the process of translating Epistemé from the manufacturing sector to the financial accounting sector. The first moment, that of ‘problematization’ (Section 10), involves the formulation of the research question by the modellers (‘Having proved to be the best means to analyse the impact of IT investments on organizations, can Epistemé I do the same for financial aspects?’) and the interdefinition of the actors participating in its resolution (population of users, enterprise architects, and US government agencies). The second moment, ‘interessment’ (Section 11), concerns the various devices used by the modellers to intervene between the network actors and their potential other ties. The third moment, ‘enrolment’ (Section 12), arranges the relations among the network actors into an alignment that strengthens their interdependencies. The fourth moment, ‘mobilization’ (Section 13), is when the set of actors in the network are mobilized by the

⁷ Us General Accounting Office, Information Technology: A Framework for Assessing and Improving Enterprise Architecture Management (Version 1.1), GAO-D3-584G (Washington D.C., April 2003).

modellers to demonstrate the solution of their research question and to reformulate the financial reporting triangle.

The context in which the study of the modellers at Company and their models must be framed is that of the dotcom crash. A corporation operating in the market for energy by-products collapsed in 2001 because of off-balance financial speculations accommodated by means of special purpose entities (SPE). After the disclosure of these frauds, the company, called Enron, previously a “market high-flier”, declared itself bankrupt, thus dissipating the retirement funds of all its employees. Arthur Andersen, one of the big five audit firms worldwide, was also implicated in the scandal. It was guilty of acting as both an external auditor and consultant, thereby supporting the Enron frauds [Barzi 2002]. A new regulation, the Sarbanes-Oxley Act was issued to bring about a systemic and radical change in the institutional and regulatory landscape of the audit system. Software companies like Company sought to convince CEOs that the competences of independent auditors transferred to them by the SOA could be delegated to their Enterprise Resource Planning systems. They presented their ERP system modules as control systems designed to ensure that the organization could identify and report on all events in compliance with the provisions of the Act.

The Financial Reporting Triangle is the activity system that guarantees disclosure of the corporation’s financial events [Cullinan 2004]. It consists of the CEO, an independent auditor, and the internal audit committee. One of the SOA’s purposes was to modify the roles of the Financial Reporting Triangle. And it also prohibited consulting activities by audit firms, so that the task of assuring the accuracy of financial disclosures, which was previously performed by auditors, is now undertaken by management. One of the SOA’s provisions states that the Chief Executive/Financial Officer (CEO/CFO) must submit the annual financial disclosures to the Security and Exchange Commission (SEC). Some of the documents that must be submitted to the SEC are those that the CEO/CFO had previously to present to the auditor in the form of a management representation letter, which remained a private document between the CEO and the auditor. The documents that the CEO must now submit are

public and have legal effect. However, the CEO cannot have first-hand knowledge of all national certification standards or understanding of the events being certified and of the effects of the reports on the events being certified. Rather, he relies on properly designed control systems to ensure that the organization has rightly identified and reported all events compliant with the procedures imposed by law [Burrowes *et al.* 2004]. Now that all the competences previously undertaken by auditors, with the relative legal sanctions, are part of CEO responsibilities, management must find an actor on which to off-load this commitment. Software companies like the one examined by my case study are competing to be this actor.

Software firms whose websites state their strategies to meet the challenges of SOA are Popkin, Troux, Mega and Staffware with Axentis⁸. For example, Troux, markets a software package called the “Sarbanes Oxley Policy Pack” that includes pre-built policies and compliance reports for SOX (i.e. SOA) controls across the IT environment. The sections of the act most frequently cited by the software companies’ web materials are Sections 302 (‘Corporate Responsibility for Financial Reports’) and 404 (‘Management Assessment of Internal Controls’), each of which concerns the transfer of the testifying duty from the auditor to the management. Axentis is even more specific in listing the sections of the Act covered by the functionalities supplied with its technology. Section 409 (Real Time Issuer Disclosure) is added to sections 302 and 404. On reading the web materials provided by Axentis⁹ and other software firms, one notes a tendency to stress the competences of models and modellers in terms of regulations. Indeed, software companies are seeking to convince CEOs that the competences of independent auditors transferred to them by the SOA can be easily delegated to a modelling system. Basing my analysis on the Company case study, I shall seek to answer these questions: How can ERP replace independent auditors in the financial reporting triangle? How can the two actors be compared, given that one is a technology and the other is a human being, one

⁸ WS, Sarbanes-Oxley Study, 7 June 2004.

⁹ Axentis, Sarbanes-Oxley Solutions, Beyond Compliance to Confidence, http://www.axentis.com/downloads/Axentis_SOX_Brochure_web.pdf.

is a product of a private software vendor and the other is the representative of a government authority? I shall study this phenomenon by drawing on Michel Callon's sociology of translation [Callon 1986].

9. Company modellers and the enterprise modelling tool

To examine Company materials, I follow an actor through the 'story': the modellers and the enterprise modelling tool – what I call Epistemé. My analysis will accompany the modellers of Company from their origins in manufacturing to the ongoing activity of framing their modelling tool as a CEO support tool for financial reporting to take the place of independent auditors since the Sarbanes-Oxley Act.

The story began in 1985 when fifteen people founded Epistemé AS. In two years, with five thousand Norwegian kroner¹⁰, they developed for Volvo a visual modelling system which took the name of 'Epistemé'. In 1994, the group of modellers that had developed Epistemé was acquired by AT&T, an American corporation. They were then acquired by NCR. The focus of NCR was the American professional services market (banking, finance, retail). NCR used Epistemé to furnish what it called 'visio-consulting' services. By means of Epistemé visual modelling, the NCR consultants introduced, supported and presented the results of their consulting activity. Epistemé was a tool used internally for consultancy activity, but it was not available for purchase. The product was the consultancy, not Epistemé. However, the Epistemé group was not happy with this arrangement. The outcome was the acquisition of Epistemé by Company in 2000. At that time, Company was active in the field of Artificial Intelligence. From the original use of expert systems for the management of operations in oil plants, Company was turning to application of these systems in support of work in the public sector. Company did not have a tool with which to construct "knowledge execution frameworks" applying experience from the consulting projects to the industrial sector, and then to

¹⁰ Today, 5 thousand Kroner are equivalent to just over 600 euro.

the public sector. A simple tool, one which did not require code to write, special editors or any further expert competence was needed. Epistemé proved to be that tool.

My accompaniment of the Company modellers through the story divides into four ‘moments’ which constitute the different phases of a general process that Michel Callon calls ‘translation’ [Callon 1980] and during which the identity of actors, the possibility of interaction, and the margins of manoeuvre are negotiated and delimited.

10. The problematization, or how modellers become indispensable

When Epistemé came into being, Company was split into two divisions: Company Solutions, which continued with the consulting business in the Norwegian public sector; and Company Technology, which was dedicated to Epistemé product development and sales on the international market for Enterprise Architecture. The question of modellers in Company Technology at that time was simple:

“Having proved to be the best means to analyse the impact of IT investments on organizations, can Epistemé do the same for financial aspects?”

After a large number of failures of IT investment by government agencies, the US Congress passed the Information Technology Management Reform Act, also known as the Clinger Cohen Act of 1996, prescribing the creation of a new role in organizations: that of a Chief Information Officer. Amongst other things, the CIO would be responsible for “facilitating the implementation of a sound and integrated information technology architecture for the executive agency”.¹¹ These few lines in Section 5125 gave rise to what became Epistemé’s main market: US government agencies. At that time, it was an open market. Agencies began by using Word, Excel and Power Point, but they

¹¹ Clinger-Cohen Act of 1996, Public Law, 104-106, 110 Stat. 684 (1996), 40 U.S.C. 11315.

found that these could not capture the architecture satisfactorily. The agencies therefore needed other formats for the data and they started with diagrams and drawing tools. Once again they found that the tools were unsuitable. So they ended up with modelling tools like Epistemé that combine the graphic and visual format with a kind of database where data can be stored and relationships visualized.¹² Epistemé proved to be the best tool for this purpose.

For Company modellers, the Sarbanes-Oxley Act concerned “some of the same things”.¹³ The question put to them was: “Do we have control – finance control; business control – with what is happening in your enterprise?”.¹⁴ The financial aspects of enterprise architecture could now be well captured for the first time. Company modellers offered Epistemé technology to pull together architecture and investment strategies into a single solution. With the aid of Epistemé, investment decisions could be made on the basis of “enterprise visibility – from an agency’s strategic goal all the way down to a piece of software sitting on a person’s computer – they need no longer be treated as stand-alone systems”.¹⁵ This also implied, as Company White Paper of October 2004 stated, that compliance with legal requirements was considered to the same extent as numerous other business-critical activities.

“Whether you are dealing with legal regulations like Sarbanes-Oxley and Basel II, tightening information security, or trying to make the right IT choices to support dynamic company-wide business initiatives, an Enterprise Architecture (EA) can play a key role in your success.”¹⁶

The expertise needed to deal “with legal regulations” and to try “to make the right IT choice” were, from the modellers’ point of view, the same things. This symmetry was produced through definition of a set of actors that, to quote the modellers, go from “an agency’s strategic goals all the way down to a piece of software sitting on a person’s computer”. Modellers defined the

¹² Excerpt from interview with PF, 18-11-2004, Oslo.

¹³ Excerpt from interview with PF, 18-11-2004, Oslo.

¹⁴ Excerpt from interview with PF, 18-11-2004, Oslo.

¹⁵ BW, ‘Clinger-Cohen Fulfilled?’, <http://www.few.com/article84551-11-14-04-Print>, published 15 Nov 2004.

¹⁶ Using Your Enterprise Architecture To Manage Risk Safely, Company White Paper.

identities of these actors in such a way as to establish themselves as an obligatory passage point in the relational network that they were building. The double movement that leads to the formulation of a question ('Having proved to be the best means to analyse the impact of IT investments on organizations, can Epistemé do the same for financial aspects?') and the interdefinition of the actors (users, scientific community and government agencies), and which renders modellers indispensable in the network, is called problematization by Michel Callon [Callon 1980].

10.1. The interdefinition of the actors

The definitions of the actors, as they were depicted in interviews with managers, deliverable documents, scientific papers, mail exchanges and marketing materials were rather rough. However, they were sufficiently precise to explain how these actors were necessarily concerned with the question formulated. These definitions, as given by the modellers themselves, can be summarized as follows.

- *People*: People do not want 'applications'. People want services. From the application point of view a human being is a data manager with fewer competences. The big six software companies (Microsoft, IBM and the others) continue to adopt the concept of 'application'. The modellers prefer the concept of 'service'. So they have not gone into the Business Process Modelling market but have positioned themselves on the market slice of Enterprise Architecture.¹⁷ Epistemé emancipates human beings from being data managers to becoming information managers. This can be achieved by shifting from tools to services; a shift which will satisfy those who want a service.

¹⁷ Excerpt from interview with FLI on 09-02-2004, Oslo.

- *Enterprise Architects:* The scientific audience has been selected by identifying the shortcomings of competing approaches (Enterprise Modelling and System Engineering). After fifteen years of industrial enterprise modelling, visual models are still consultancy tools for understanding and resolving complexity. Currently they have three industrial applications: Enterprise Architecture Development, Business Process Modelling and Enterprise Performance Analysis. The largest market segment is Enterprise Architecture, which has been created by the inadequacies of the current of System Engineering approaches attempting to integrate and provide solutions to all industrial challenges. EA has arisen from the “inadequacies” of system engineering in providing solutions to “all industrial challenges”. EA also differs from Enterprise Modelling (EM). All the characteristics of Enterprise Models, their approaches and their uses in the industrial sector, reveal that Enterprise Modelling is just another technology island in the non-interoperable industrial tools and systems landscape. The goal of visual models, by contrast, is to provide solutions in an integrated way to all industrial challenges.

- *Governmental Agencies:* The format of the proposal for IT investments that agencies must submit to the OMB is called ‘Exhibit 300’. Epistemé was described by Company modellers as a product able to accelerate and facilitate completion of the models necessary to obtain a ‘Delegation of Procurement Authority’ (DPA), that is, OMB’s approval of IT investments.¹⁸ Epistemé performs a very specific role: that of dynamically generating the format to obtain funding, to which the general name of ‘Capital Asset Planning’ is given. In an article entitled ‘Clinger Cohen Fulfilled? Agency Officials are Taking Enterprise Architecture and Capital Planning Seriously’, Company modellers have written: “Cohen might be gratified by the sophistication of agencies compliance with the act. Company headquarters is reassuring Secretary of Defence Cohen, because for more than a year some agencies have been

¹⁸ BW, “Generating Exhibit 300 using an Epistemé Model”, Presentation to Epistemé User Group, October 2003.

developing prototype models for a single line of business that could be duplicated department wide”.¹⁹

Part of the problematization is that modellers of Company also reveal what themselves are and what they want. Company is an organization based on consulting projects, and the revenues from these projects are not enough to support a large group dedicated to development of Epistemé. Building a product company without venture money is very difficult. Some capital expenditure is always needed before obtaining revenues. Company had to raise the money from the consulting business and put it into product development to build the market and the sales force.²⁰ In the fall of 2003 venture capitalists injected six million dollars into Company. With these six million dollars Epistemé was to be developed into a viable product, and a buyer had to be found. There were different selling models. Either licences could be sold, with partners and customers themselves doing the development, or solutions could be sold.²¹ If Epistemé was sold as a tool, it would be an open toolbox like blank sheets of paper. The customers would have to decide for themselves what methodology to use and what modelling to do. This could only be done by mature organizations, and even so the cost of the tool was only a small fraction of the cost of the project. And Company would only obtain revenues from the tool if they sold it in this way.²² Excluding the case of ‘mature’ organizations – where the model could be developed by internal experts – Epistemé was not yet a package that could be sold as an individual product. The problem was combining the work of the modellers with a good package and producing an attractive selling model. Then and only then would the solution be found. A solution is typically something that out of the box very soon has a value because it provides reports and analyses in a specific domain.²³ The solution was a limited and specific use of Epistemé with more immediate actual value than could be achieved with a blank sheet of paper.

¹⁹ See note 13.

²⁰ Excerpt from interview with ED, 2004, Oslo.

²¹ Excerpt from interview with ED, 2004, Oslo.

²² Excerpt from interview with ED, 2004, Oslo.

²³ Excerpt from interview with ED, 2004, Oslo.

Now retired, one of Company modellers was a manager at a big aircraft manufacturing company. Because he had been in Scandinavia for three years and knew Company from working on joint projects, he recognized the potential of Epistemé and wanted to sell it as a product in the United States. He was able to interest his former company and other big North American firms. A small flow of revenues began, and Company created a Washington branch called 'Company North America'.

Now Company modellers want to do some of the same things with public companies after the Sarbanes-Oxley Act.

10.2. The definition of obligatory passage point

The modellers do not restrict themselves simply to identifying a few actors. They also show that the interests of actors lie in admitting the proposed research program. The argument which they develop in their interviews, deliverable documents, scientific papers and marketing materials is constantly iterated:

if the people want to shift from tools to services; *if* enterprise architects want to escape the non-interoperability island; *if* the governmental agencies want to have the delegation of procurement authority by OMB, *then* they must:

- (i) know the answer to the question: Having proved to be the best means to analyse the impact of IT investments on organizations, can Epistemé do the same for financial aspects? and
- (ii) recognize that the duplication of Epistemé to the scale of the entire organization can benefit each of them.

The problematization possess certain dynamic properties: it indicates the movements and detours that have to be accepted, as well as the alliances that have to be forged. The population of users, the enterprise architects and the government agencies are

fettered: they can not attain what they want by themselves. Their way forward is blocked by a series of obstacles-problems:

- the population of users is constantly threatened by the 'Big Six', which adhere to the concept of applications;
- the enterprise architects risk being limited by vendor proprietary templates like System Engineering and Enterprise Modelling;
- government agencies risk being unable to perform the full complement of management practices necessary for effective enterprise architecture management as requested by the General Accounting Office (GAO).

As for the Company modellers, their entire project revolves around the ability of Epistemé to capture financial aspects. For these actors the alternative is clear: either they have to change direction or they have to recognize that Epistemé must constitute an "accounting competence" in the stead of independent auditors in the financial reporting triangle.

The problematization involves a system of alliances or associations among entities that defines their identities and what they want. In this case, a holy alliance have to be formed in order to duplicate enterprise architectures department-wide and enable Epistemé to capture financial aspects as well.

11. The devices of interestment, or how the population of users, enterprise architects and government agencies are locked into place

Each entity enlisted by the problematization can submit to being integrated into the initial plan, or inversely, refuse the transaction by defining its identity, its goal, projects, orientations, motivations, or interests in another manner. In the case of Epistemé, the situation is never so clear cut, because as the phase of problematization has shown, it would be absurd for the observer to describe entities as formulating their goals and

identities in a totally independent manner. They are formed and are adjusted only during action.

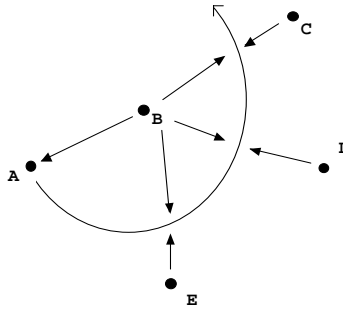
Interestment, as Michel Callon defines it [Callon 1986], is the group of actions by which an entity (here Company modellers) attempts to impose and stabilize the other actors that it defines through its problematization. Various devices are used to implement these actions. Interestment is to be in-between (interesse), to be interposed. But between what? Let us return to the Company modellers. During their problematization they joined forces with people, enterprise architects, government agencies and Honourable Cohen²⁴ in order to attain a certain goal. In so doing, they carefully defined the identities, the goals and the inclinations of their allies. But these allies are tentatively implicated in the problematizations of other actors. Their identities are consequently defined in other competitive ways. It is in this sense that I understand what Callon [Callon 1986] means by interestment. To interest other actors is to build devices which can be placed between them and all other entities who want to define their identities otherwise. A interests B by cutting or weakening all the links between B and the invisible (or at times quite visible) group of other entities C, D, E, and so on, that may want to link themselves to B (see Figure 1).

The properties and identity of B (whether it is a population of users, enterprise architects or governmental agencies) are consolidated and/or redefined during the process of interestment. B is a “result” of the association which links it to A. This link disassociates B from the C, D and E’s (if they exist) that attempt to give it another definition. Michel Callon calls this elementary relationship, which begins to shape and consolidate the social link, the ‘triangle of interestment’ [Callon 1986].

The range of possible strategies and mechanisms adopted to bring about these interruptions is unlimited: anything goes. It may be pure and simple force if the links between B,C and D are firmly established. It may be seduction or a simple solicitation if B is already close to the problematization of A.

²⁴ Honourable Cohen is the Secretary of Defence of US Government that issued the Clinger Cohen Act, also known as “Information Technology Reform Act”.

FIG. 1. *The triangle of interestment*



Except in extremely rare cases when the shaping of B coincides perfectly with the proposed problematization, the identity and 'geometry' of the interested entities are modified throughout the process of interestment.

11.1. How the population of users is locked into place

I can illustrate what an interestment device is by describing the visit a team of Company modellers to an industrial partner, a Greek telecommunications company, to gather 'data' to be implemented in the Epistemé model. Access to the organization is described by a Company modeller thus:

"I enter a company and I have a contact with a referent, who gives me the data. The referent has limited knowledge, that is, unstructured. It is tacit."²⁵

The modeller first supplies the data-gathering process with the credentials of a referent ("I have a contact with a referent, who gives me the data"). Then he immediately discredits it, ascribing to that referent 'limited', 'tacit' and 'unstructured' knowledge about

²⁵ Excerpt from interview with ST on 10-01-2004, Rovereto.

his/her daily work practice. The interestment of modellers here is to be in-between the referent and his own knowledge of the organization. In order to do so, modellers typically: (i) do not provide transparent access to their modelling methodology; (ii) select only users that are configured users, that is, computer experts that are not representative of the majority of enterprise referents; (iii) replace role holders with substitutes; (iv) translate requirements in a way that users do not easily understand; (v) do not show the model until the end. All these are ‘machinations’ intended to sever the connections through which the modellers have gained access to the organization, to let the model be the obligatory passage point to gain an accurate representation of it.

11.1.1 Not providing transparent access to the modelling methodology

Company modellers talk of requirement gathering as a three-stage process comprising ‘proof of concept’, ‘pre-roll out’ and ‘roll out’. The first step, ‘proof of concept’, consists in the conceptual simulation of what an enterprise architecture system could do in the specific case. The second, ‘pre-roll out’, is a pilot test of the system, often carried out with a minimum of data inserted in the model, or in a single area of the organization. The third is the ‘roll-out’, that is, when the system is fully active.²⁶ Many more tools and skills emerged from the case study in addition to the fully active system as defined by Company modellers. The fully active system instead resulted from the accordance of these other tools and skills.

One of these tools was a questionnaire used by Company modellers to interview the representatives of the Greek company. The questionnaire was structured and gathered information on the roles of the company’s representatives in Product Portfolio Management. The number of missing details concerning the way modellers apply the questionnaire, highlights a lack of interest by them on the accountability of their methods of data collection. In the remaining, I will present modeller’s practice of eclipsing details

²⁶ Excerpt from interview with ST on 10-01-2004, Rovereto.

concerning the questionnaire as an archetype of the ‘machinations’ to make an obligatory passage point.

11.1.2 Selecting configured users in representation of all users

Firstly, the questionnaire has an entry for the date but not one for the place where the interview is conducted. Secondly, none of the interview transcriptions fully respect the order of the boxes. The structure of the interview transcriptions is formatted as a series of text boxes. Each question is set in a grey text box, the answer in a white text box. For some interviews all the answers are transcribed in just one text box. In other cases, some text boxes are left empty, or the minutes are transcribed outside the boxes. The representatives of the Greek company are the Product Manager and five employees with executive functions. The referents have the following roles: Business Unit Manager, Business Development Manager, Project Manager, Quality Engineer, Team Leader/Engineer and Product Manager. All those roles are to some extent related to the activity of Product Portfolio Management. A Company modeller says that these referents have little imagination in proposing an ‘ideal world’ where they can solve collaboration problems with an enterprise model.²⁷ The most imaginative of them is the computer expert: the Team Leader Engineer. His answers to the structured interview focuses on his desire to have a workplace where different aspects of product development can be managed on the same integrated platform:

The best way is to have an integrated approach and a workplace with this sequence: write specification, create plan, assign engineer, fix bugs (when they have the results), in here or there, major revision, ...

The imagination, and the need, of a computer expert are then taken as a representation of the imagination, and the needs, of all users.

²⁷ Interview with modeller HJ, 12 October 2004.

11.1.3 Replacing role holders with substitutes

It is interesting to note that for the remaining roles only the Project Manager performs his own role in the interview. In two cases (Business Development Manager and Business Unit Manager), the referents perform a role that is not their usual one. In the case of the Business Development Manager, there is a consultant in the manager's place. There is a substitute also in the case of the Business Unit Manager. What is a weakness – the absence of people possessing the right knowledge about the company's business – according to the interestment logic of the modellers, become a strength. For reasons related to the imperfect information created in the situation – the knowledge of referents standing in for others is by definition 'limited' – the more structured knowledge of a model becomes a support. What at first appears to be another mediation that moves away from the 'data' – substitutes represent someone's other knowledge about the organization – is precisely what the modellers are looking for as a reason to adopt the model: it will give structure and form to the 'limited', 'unstructured' and 'tacit' knowledge of the referent's substitutes.

11.1.4 Translating requirements in a way users do not easily understand

The model itself is produced from a reduction processes. The modellers structure the referents' knowledge by making it smaller and smaller. By means of the structured questionnaire, an algebraic and cardinal ordering is given to the referents' knowledge. Afterwards, when the questionnaire describes 'the main activities' of the referents, a double entry table takes the place of plain text boxes. There are rows and columns, and the cardinal ordering turns into a Cartesian ordering. The rows contain step-by-step descriptions of each manager's activity. The columns contain the categories of the activities carried out by the managers (e.g. system design, checking the status of the work, resource allocation). The referents' knowledge is then clustered and prioritized. A gap analysis is finally performed. The output

from the process is barely recognized to referents as their own original knowledge.

11.1.5 Showing the model only to the end

To the series of changes of state of referent knowledge reported there is another one that should be added. The modellers usually present their models with Power Point slides. To save memory and time, and also for technical reasons, the presentations are not made directly with the modelling system but with Power Point, one of whose principal functions is the public nature of the presentation: it provides a ‘theatre of proofs’ [Latour 1986] in which the engineer points to a picture on a big screen, showing the functionalities of the model to a public of users. Crucial in this context is i) that the target of the representation should be present; ii) that the modellers that visited the organization of the pilot project be the same people presenting it.

11.2. How Enterprise Architects are locked into place

The actors that have to be enrolled to ensure success for the programme of the Company modellers are not just the employee of pilot projects referent organizations. They are also enterprise architects and government agencies. I have seen how the Company modellers imposed themselves as an obligatory passage point with the referents at the Greek organization with the collection of data and their reduction to a model. But still to be described is how the modellers address the scientific community of enterprise architects and government agencies.

The practical means selected by the Company modellers to interest the community of enterprise architects is a scientific paper given at a conference. This paper can be described with semiotic text analysis – also known as the ‘ethnography of inscriptions’ [Latour 1986] – as already mentioned in the methodological section.

I shall focus on the abstractions contained in this paper and in a tutorial on Epistemé where the model became available as a textual description. By ‘abstraction’ I mean the process whereby primary qualities (data, objective facts, numbers) are separated from the secondary ones that distinguish the model in use (sounds, perceptions, the hardware). Abstraction makes textual translation of the model possible.

The modellers begin this process by reducing the data obtained from the organization into a software-based model (as described in the previous section). They then translate this software-based model into a series of photographs, screen-shots and diagrams to accompany the text of the scientific paper and the tutorial (as described in this section). To be noted is that the addition of an ethnography of inscriptions to an ethnographic description of the requirements gathering conducted locally by the modellers yields understanding of how the software-based model is not the final representation of the organizational data but a link in a more complex chain of transformations.

The Company spokesman argues in the paper²⁸ that, after fifteen years of industrial modelling, visual models (of which Epistemé, he alleged, was the evolution) are still only consultancy tools with which to represent and resolve complexity. In the future they must become executable. The domain of Enterprise Architecture had arisen from the inability of system engineering to furnish adequate solutions to industrial problems. The enterprise architecture movement intends to distinguish itself from enterprise modelling in the following respects:

- knowledge about the enterprise yielded by enterprise modelling, like its approach and roles, was predetermined by vendor proprietary templates;
- the user interface of enterprise modelling was designed for use by system engineers, and it supported only a restricted number of modelling styles.

²⁸ Jardim-Goncalves R. et al. (eds), “CE: The Vision for the Future Generation in Research and Applications”, Swets & Zeitlinger, Lisse, 2003.

The consequences of these features are that enterprise modelling is just another technological 'island' in the panorama of non-interoperable industrial software tools. The goal of enterprise architects is to furnish integrated solutions to the problems of industrial software, contrary to the vendor-driven and engineer-oriented approach of enterprise modelling. Specifically, the technological objectives pursued by Epistemé are to furnish new approaches to the engineering of industrial solutions and to simplify industrial computing. This conception is called 'Active Knowledge Modelling' (AKM) in the article, and it matches the needs expressed by the user population as defined by the Company modellers:

People do not want 'applications'. People want services. From the tool point of view a human being is a data manager with fewer competences. The big six software companies (Microsoft, IBM and so on) continue to adopt the concept of 'application'. The modellers prefer the concept of 'service'. So they have not gone into the Business Process Modelling market but have positioned themselves on the market slice of Enterprise Architecture.²⁹ Epistemé emancipates human beings from being data managers to becoming information managers. This can be achieved by shifting from tools to services; a shift which will satisfy those who want a service.

In a certain sense, the Company spokesman argues in the paper, system engineering and enterprise modelling had poorly represented the population of users and their needs. Enterprise architects with their visual models are able to represent those needs better by simplifying industrial computing and by adopting an approach that is not vendor-driven and engineering-oriented. The paper maintains that this objective can be achieved through what it calls 'Enterprise Visual Scenes' (EVS).

The conception of active knowledge modelling (AKM) underlying Epistemé, and its visual interface represented by the enterprise visual scenes (EVS), are the two salient features of Epistemé which make it a system more evolved than traditional enterprise models.

²⁹ Excerpt from interview with FLI on 09-02-2004, Oslo.

In the next two sections I shall use a textual method to analyse Epistemé's underlying conception as represented by the AKM and then its interface as represented by EVS. An ethnography of the inscriptions contained in the scientific paper will show how the Company modellers produced, for an audience of Enterprise Architects, an interpretation of Epistemé designed to interest that audience. Given its distinctive con-textuality, this interpretation adds to and deepens the interpretation set out in section 11.1 above. It should be stressed, in fact, that in the present case, the software-based model representing the real organization furnished materials for a further representation, based on photographs, diagrams and screenshots, comprised in a scientific paper. A methodological focus on this further transformation reveals aspects of the base technological conception which are crucial for understanding of its subsequent implementation, adoption, and use in real organizations.

11.2.1 Visual metaphor

I shall begin by analysing the technological conception of Epistemé as denoted in the paper with the term 'enterprise visual scenes' (EVS). I shall focus on the use of the adjective 'visual'. The first innovative aspect of the Epistemé model is that it is a system intended to simplify industrial computing, doing so by replacing its vendor-driven and engineering-oriented aspects with a simplified and visual user interface.

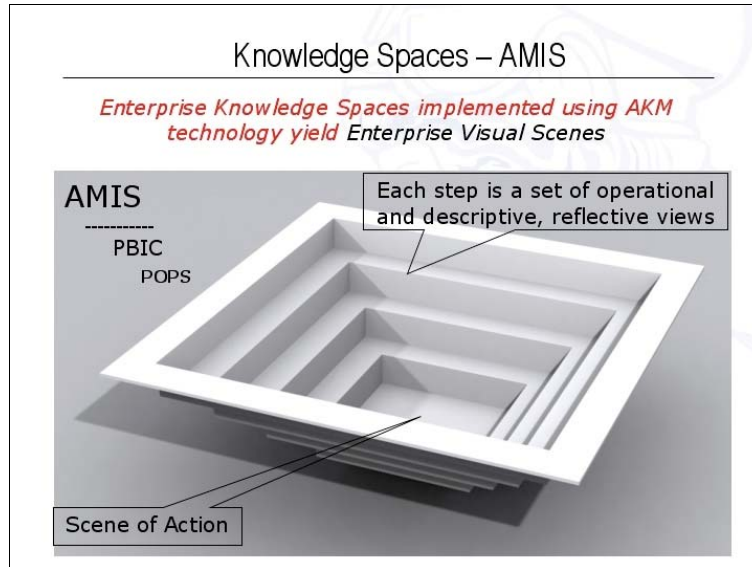
Whilst this is the technological aspect, its corresponding textual aspect is the metaphorical use of the adjective 'visual' in the expression 'enterprise visual scenes' synthesized into the acronym EVS. The paper's use of the term 'visual' to denote the model's interface operations relates to a pictorial aspect of visual metaphors whereby the fixing of the scene in a representation simultaneously determines a finite series of points of observation. This determination restricts the standpoints of observation and the ways in which it can be performed. The use of the visual metaphor in the textual description of Epistemé evidence that the observer's 'privileges' can still be pre-determined by the interface

EVS, so that it too is susceptible to the criticism made of traditional enterprise modelling, namely that it is pre-determined by the 'vendor proprietary template'.

According to this interpretation, the visual metaphor is therefore an interestment device. It enables the producers of the model (in this case the Company modellers) to interpose pre-established procedures acting as obligatory points of passage between the model and its user (i.e. the user of Epistemé).

This is confirmed by another source: the tutorial on Epistemé. One of the images used by the Company scientific spokesman in this case is the layout of a theatre auditorium (see FIG. 2). The central stage is surrounded by four banks of stalls. The figure serves during the tutorial to explain how, in the Epistemé modelling style, the object (the enterprise) can be represented from four different points of view: those of processes, organization, products, and information systems. By activating each of these 'points of view', the model can represent the organization in different modalities. A peculiar aspect of this image is the absence of the spectator/user. The stalls in fact are empty. The spectators/users – the object of Epistemé's choice to present itself as system to simplify industrial computing – has no role in the body of the text and in its images. Reference to the spectators/users is made only indirectly as the presence of empty space in the stalls. This is a critical aspect of Epistemé's representational relation with the spectators/users (those poorly represented by traditional enterprise modelling and supposedly better represented by the EVS interface of the Epistemé model), and at the same time it facilitates interestment of the enterprise architects by Company's scientific spokesman by providing them an enterprise space to be easily modeled.

FIG. 2. Enterprise Visual Scenes



11.2.2 Perspectivalism

Having discussed the visual aspect, I now turn to the second innovative feature of the model, which is denoted in the paper by the expression 'active knowledge modelling' (AKM). I shall focus on the use of the adjective 'active'. Epistemé is put forward as a system that not only enables the consultant to visually represent complex organizational contexts. It also comprises commands for the execution of certain software services run by an underlying model-based infrastructure. This service-execution function – not present in traditional enterprise modelling – is the 'active' aspect of Epistemé's underlying technological conception. This is the technological aspect; its corresponding textual aspect is the use of the adjective 'active' in the expression 'active knowledge modelling' synthesized in the acronym AKM. In this case, the abstraction process concerns the passage from the EVS structure,

which by the filtering of the visual metaphor only displays spatial data (see fig. 2) to the AKM structure, which can be called 'active' in that it can be rotated, flattened and translated without distortions or salient changes.

The abstraction process involves two characteristics of the figure: (i) it has four sides (each representing an aspect of the organization. AMIS: approach, methodology, infrastructure and platform; POPS: process, organization, product and system); and (ii) it is downwardly scalable.

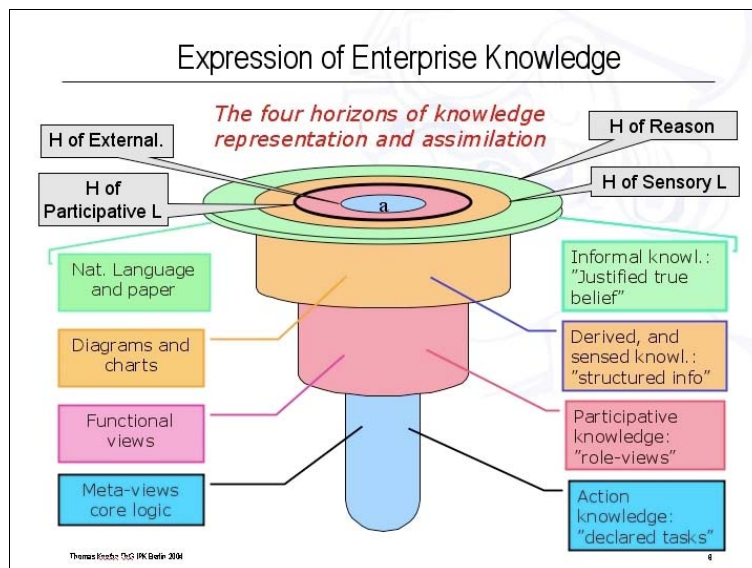
These two prime qualities deriving from the abstraction performed in the text through the use of the visual metaphor belong to the array of rhetorical features whereby the scientific spokesman can claim that the model is 'active'.

The potential of the abstraction process can be appraised if one bears in mind the representational relationship between the Epistemé's model conception and the spectator/user. It should be remembered that the purpose of the text was to highlight that users were poorly represented by traditional enterprise modelling and, conversely, are better represented by the EVS interface of the Epistemé model. To be stressed in regard to this mechanism is that its feature of having four sides (represented in the figure by the four raked banks of stalls surrounding the stage) derives from a more complex property to be represented: namely that the model is viewed by numerous observers. This corresponds, externally to the text, to the possibility that the simplified Epistemé interface can be utilized by different users within the organization (and not only the engineer). In this translation (and herein lies the abstraction), this property is made subservient to the need to depict the model in a Euclidean space. The 'active' aspect thus become calculable, and it is technically representable through the activation of as many views on the organization as the four different points of observation (AMIS: approach, methodology, infrastructure and platform; POPS: process, organization, product and system).

Secondly, the feature of top-downward scalability (represented in the figure by the raking of the theatre seating) derives from the more complex characteristic that the model is not only viewed by numerous observers but it is so at the same time. This corresponds, externally to the text, to the possibility that the

different viewpoints offered by the simplified Epistemé interface can be integrated, and their data shared. In this translation (and herein lies the second abstraction) this complex property is made subservient to the need for the active aspect to become technically representable through a ‘zoom-in/zoom-out’ functionality of the Epistemé model.

FIG. 3. Active Knowledge Modelling



The concentric circles in figure 3 represent the different languages of modelling: natural language, the diagrams, the functional representations, and the meta-model. The banks of stalls in figure 2 have been flattened onto the same plane in figure 3.

The ‘active’ functions of the Epistemé model described by the text are: (i) the simultaneous visualization on the screen of different views of the same object; (ii) access to different levels of detail (zoom-in), then returning to the overview (zoom-out).

Externally to the text, the first functionality corresponds to the intention of the Company modellers to furnish a product able to

reconcile different (and often conflicting) views of the organization: that of the manager and that of the employee, for instance. The second corresponds, externally to the text, to the technical requirement of interoperability among the various application levels: that of the infrastructure and that of the services.

By reducing the abstraction process to its original rhetorical purpose (to highlight that users were poorly represented by traditional enterprise modelling and, conversely, are better represented by the EVS interface of the Epistemé model), and reconstructing the representation that ties the conception of the Epistemé model to the call by spectators/users for simplification of industrial computing, one understands that the functionalities deriving from the need for interestment (by means of a scientific paper) of the enterprise architects' community in the Epistemé model signifies that the scientific spokesman attributes to the model characteristics different from those declared at the outset.

Each phase of the interestment process involves different contexts and different audiences. It therefore consists in a change and enrichment of the model's functionalities. These iterations result from negotiations and alliances with different actors. On the one hand they combine to modify the structure of the functionalities of the Epistemé model compared with previous versions; on the other, they enable the model to gain consensus among different audiences and to enrol diverse interests.

12. Enrolment: how to define and coordinate a population of users, enterprise architects and government agencies

No matter how constraining the entrapment device is, no matter how convincing the argument, the success of the interestment process is never assured. In other words, the interestment device does not necessarily lead to alliances, that is, to actual enrolment. The difficult is transforming a question into a series of linked statements: the call by Company for duplication of Epistemé to financial reporting now requires a much longer-term technological project comprising a larger number of negotiations.

The parties to these negotiations are not only the users of experimental projects or the audience of enterprise architects. Before enrolling the final partners (public companies doing financial reporting) without any resistance, the Company modellers have also to enlist the American government agencies.

Described thus far has been the way in which the know-how of the referents at a pilot organization was reduced to structured knowledge through requirements analysis conducted by a group of modellers (see *section 11.1*). Then described has been the ‘translation’ of the knowledge comprised in the software-based model into a scientific paper. In this translation, a single representative of Company spoke to an audience of enterprise architects, using a paper support, to announce the functionalities of the Epistemé model (see *section 11.2*). In each phase the model modified the initial assumptions, enrolling different interests.

In this section I shall describe the transactions conducted by the Company modellers with a substantial number of American government agencies, doing so in terms of an enrolment process. The term ‘enrolment’ denotes the device with which a set of interrelated roles are defined and attributed to a series of actors, which accept it.

Interestment achieves enrolment only if it is successful. To describe enrolment is thus to describe the multilateral negotiations, trials of strength, and stratagems that accompany the interestment and enable Epistemé to become a single product. Epistemé thus become an object able to proceed independently from its producer by virtue of an alliances formed by Company modellers with buyers.

One context where interestment can become enrolment is the market. According to Guesnerie [1996], a market is a coordination device in which: *(i)* agents pursue their own interests, and to this end perform economic calculations which can be seen as operations of optimization and/or maximization; *(ii)* agents generally have divergent interests which induce them to engage in *(iii)* transactions which resolve the conflict by setting a price.

This context differs from those described in previous sections and summarizes them. The calculations begun by the reduction of unstructured knowledge within a model, and with the translation of that model into a scientific paper, continues with an economic

transaction that set a price on the model for its sale to buyers: the American government agencies.

In 1996 the US Congress passed the Clinger-Cohen Act, also known as the Information Technology Reform Act, which required government agencies to endow themselves with “sound and integrated information technology architectures” to justify investments of public money in information technology. The Act did not stipulate the specific technology to be adopted by governmental agencies for developing, maintaining, and facilitating the implementation of a sound and integrated information technology architecture. For this was an open market where Company modellers placed themselves in-between governmental agencies and competing software drawing tools. Governmental agencies do not have qualified enterprise architects able to develop the modelling methodology needed to customize the format. So Company modellers end up by providing a very specific solution to perform reports and analyses in the domain of the impact of IT investments on the organization. The format of the proposal for IT investments that agencies must submit to the OMB is called ‘Exhibit 300’. Epistemé is developed by Company modellers as a product able to accelerate and facilitate completion of the models necessary to obtain a ‘Delegation of Procurement Authority’ (DPA): that is, OMB’s approval of IT investment.

In the A-B-C triangle discussed in *section 11* (FIG. 1), C, the party to be excluded does not surrender easily. Enrolment is also the stage at which Company modellers must defend themselves against the excluded parties which they have created in the transaction process.

In the case of government agencies, Company modellers have to defend their alliance not only against competing software solutions, but also against the controls that the General Accountability Office (GAO) performs on the adoption of enterprise architectures by executive agencies. On Company modellers’ side, there is an endeavour to celebrate “the marriage of capital planning and investment control process – the financial rationale behind funding requests – with enterprise architecture

models”.³⁰ For the GAO – the accounting office serving the US Government – there are instead problems encountered by government agencies in the adoption of Enterprise Architecture. In November 2003, a report by the General Accounting Office on progress by government agencies in adopting EA stated that progress by federal agencies toward effectively managing enterprise architectures is limited, with much work still to be done. Since the 2001 assessment of the maturity of enterprise architecture management by agencies, the percentage of them that have established at least a foundation for enterprise architecture management has remained virtually unchanged, decreasing from 53 to 48 percent. Further, the percentage of agencies performing the full complement of management practices necessary for effective enterprise architecture management is the same (about 4 percent). Only one agency (1 percent), the Executive Office of the President, reported performing all of the management practices that are indicative of effective enterprise architecture management.³¹ The reason for the limited progress is attributed to the scarcity of skilled architecture staff.

In an article entitled ‘Clinger Cohen Fulfilled? Agency Officials are Taking Enterprise Architecture and Capital Planning Seriously’, BW, Company’s North America manager, writes that “Cohen might be gratified by the sophistication of agencies’ compliance with the act”. Exactly one year after the GAO questionnaire, Company modellers reassure Secretary of Defence Cohen, adding: “For more than a year some agencies [...] have been developing prototype models for a single line of business that could be duplicated department wide”³². The insurance provided by Company modellers derives from the fact that, if applied to one single line of business, Epistemé will be “duplicated” on the scale of the entire organization.

³⁰ BW, ‘Clinger-Cohen Fulfilled?’, <http://www.fcw.com/article84551-11-14-04-Print>, published 15 Nov 2004.

³¹ US General Accounting Office, *Information Technology: A Framework for Assessing and Improving Enterprise Architecture Management (Version 1.1)*, GAO-D3-584G (Washington D.C., April 2003).

³² See note 30.

The enrolment of government agencies by the Company modellers, and in particular by the manager of Company NA, is achieved by the development of a very specific Epistemé function: that of supporting the paperwork required to obtain the DPA. The model contains and periodically furnishes updated data on the use of computer infrastructures by the government agencies. On the basis of these data, the government agencies may ask for investments in computerized infrastructures. Given the failure in the initial phases, the argument used to enrol the interest of the government agencies is the possibility of ‘duplicating’ Epistemé among various departments. There is since come about, through contacts with the government agencies, a shift to a modular interpretation of Epistemé. The model can be adapted to deliver specific services. But the underlying platform can be extended and, with the appropriate modifications, duplicated for other departments to produce further specific services. Epistemé has undergone further enrichment and its functionalities have diversified. But more important, new and powerful allies have been enrolled. Epistemé is ready to enter the new market of financial reporting described in the next section.

13. The mobilization of allies: are Company modellers representative?

An example of the “sophistication” by which government agencies use Epistemé is the marriage of the capital planning and investment control process – the financial rationale behind funding requests – with the enterprise architecture model that officials must incorporate into agency business cases contained in the OMB Exhibit 300s.³³ For Company modellers, in the novel feature of all this is that capital planning becomes an integral part of the enterprise architecture. This is a major milestone for them because the financial aspects of an enterprise architecture have never been captured well; but now the technology is available to pull together the architecture and investment strategy into a single solution. Investment decisions can be made on the basis of enterprise visibility – from an agency’s strategic goal all the way

³³ See note 30.

down to a piece of software sitting on a person's computer – and no longer need to be treated as stand-alone systems.³⁴ The alliances built by Company modellers with their problematization, interestment and enrolment are now useful to maintain that the same SOA that intended for the issuers to be a radical regulatory and institutional change in corporate accountability rules is something that can be approached *in the same way* as they approached the alignment of business processes with IT systems for government agencies.³⁵ The strategy to enrol public companies doing financial reporting as *some of the same things* as government agencies is presented in a Company White Paper of October 2004. This explores how organizations can safely manage risk by leveraging Enterprise Architecture (EA) tools for use in business process modelling, IT-business alignment, compliance with legal requirements, and numerous other business-critical activities. Whether organizations are dealing with legal regulations like Sarbanes-Oxley and Basel II, tightening information security, or trying to make the right IT choices to support dynamic company-wide business initiatives, according to Company White Paper, Epistemé can always play a key role in their success.³⁶ In the White Paper, compliance with legal requirements is listed together with business-critical activities. The expertise needed by public companies to deal with legal regulations and the expertise needed by government agencies to make the right IT choice are, for Company modellers, the same thing.

Who speaks in the name of whom? Who represents whom? These crucial questions must be answered if the project to replace independent auditors in the financial reporting triangle carried forward by Company modelers is to succeed. This is because, as with the description of interestment and enrolment, only a few individuals are involved, whether users, enterprise architects or governmental agencies.

Do the users really use Epistemé? This is the first part of the question. The answer, according to the modellers, is 'yes': not only do computer experts use models, but also the 'less imaginative'

³⁴ See note 30.

³⁵ WS, Sarbanes-Oxley Study, 7 June 2004.

³⁶ Using Your Enterprise Architecture To Manage Risk Safely, Company White Paper.

employees. The Engineering Team Leader is considered the official representative of the user population of the future. Company modellers negotiate the interestment of people through a handful of enterprise referents participating in the pilot project who represent their entire organization.

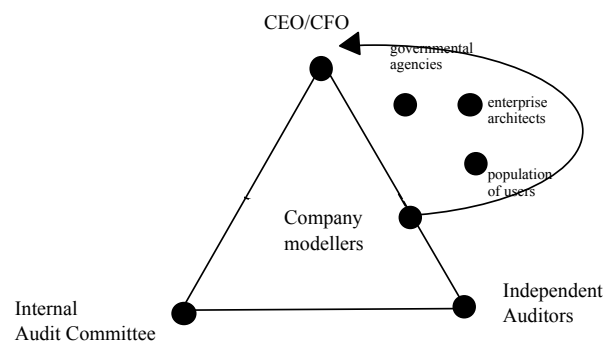
In the same way, a single modeller represented all the people participating the pilot project before an audience of enterprise architects. For more than a year some agencies (around thirty out of one thousand one hundred and seventeen) have been developing prototype models of Epistemé for a single line of business, so that it can then be duplicated department-wide, capture the financial aspects that have never been captured well, and be used by the remaining agencies.

A small number of individuals, scientists or government agencies speak in the name of the others. When an object is represented by another object, model or diagram, the epistemologists speak of *induction*; when a person is represented by another person, political scientists use the notion of *spokesman*. The question is however the same. The twin notions of representation must be used all at the same time to understand this last moment: the mobilization of Company modellers allies to replace independent auditors. Will the masses (people, enterprise architects, government agencies) follow their representatives? We are now in the position to answer our question: yes, it is possible for ERP and independent auditors to compete in the financial reporting triangle. Indeed, the two actors, one a technology and the other a human being, one a product of a private software vendor and one the informal representative of a government authority, can be compared. Representation is an issue in the Company modellers' transactions with the population of users, enterprise architects and governmental agencies, as well as in the independent auditors' transactions with the audit industry, their controlling authority, the issuers of the Act and the US Congress.

Properly speaking, it is not the population of users that have to be convinced but a few organization referents, mostly computer experts that take part in pilot projects. It is not the overall community of enterprise architects but a few colleagues who read the publications and attend the conferences. Only a small number of government agencies use Epistemé, and they use it only as a

prototype for a single line of business. This is how the notion of induction by which one can interpret the Epistémé model resembles the notion of spokesman, by which one can interpret the role of the independent auditor in the financial reporting triangle. In both cases, a few exemplars have been interested in the name of the masses they represent, or claim to represent. Company modellers have formed a relationship with only a few representatives – whether they be users, enterprise architects or governmental agencies. With this alliance, they form a program to replace independent auditor in the financial reporting triangle (see Figure 4).

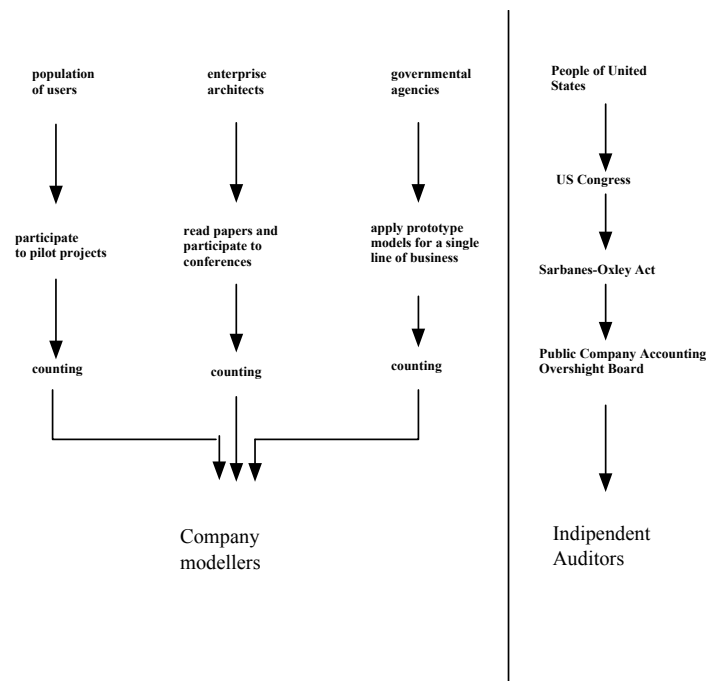
FIG. 4. *The financial reporting triangle reshaped*



Independent auditors, too, are SEC-approved client auditors, an informal extension of the Security and Exchange Commission (SEC). The audit industry is a self-regulating industry protected by the Public Oversight Board (POB), now Public Company Accounting Oversight Board (PCAOB) created by the SOA. The PCAOB is a private-sector, non-profit corporation created by the Sarbanes-Oxley Act of 2002 to oversee the auditors of public companies in order to protect the interests of investors and further the public interest in the preparation of informative, fair and independent audit reports. The issuer Senator Paul Sarbanes

is a Maryland Democratic senator, Chair of the Maryland Congressional Delegation. And Congressman Michael G. Oxley, the second issuer of the Act, has been elected in the 4th Ohio District, a rural area that contains some of Ohio's most productive farmland, and whose small cities are home to corporate headquarters and manufacturing facilities.

FIG. 5. Entities and their interposed spokesmen



On closer analysis, the modelling systems of Company modellers and the independent auditors of the audit industry both respond to the same questions: how many electors come forward to choose their representatives? How many users participate in pilot projects? How many enterprise architects read Company modellers' papers and attend Company modellers' conferences? How many government agencies buy Epistemé?

The symmetry is perfect. A series of intermediaries and equivalences are put into place which lead to the designation of the spokesman. In the case of independent auditors, the chain is somewhat longer. This is because Senator Paul Sarbanes and Congressman Michael G. Oxley stand between the tallying of the votes of Maryland and Ohio and the board to control the independent auditors. However, the result is the same. Although no vote is taken, the agreement of users, enterprise architects and governmental agencies with Company modellers is also based on the same type of general mechanism: the same cascade of intermediaries who little by little reduce the number of representative interlocutors.

The single Company modeller who writes papers and attends conferences speaks in the name of organization referents participating in pilot projects. The few success stories of use of prototype models of Epistemé in the single lines of business of some governmental agencies show that Epistemé can be duplicated department-wide. Once the transaction is accomplished, Company modellers speak in the name of the entire population of users and of government agencies. The Figure 7 shows how entities as different as independent auditors and enterprise models are constructed by interposed spokesmen (see FIG. 7). Using the notion of *spokesman* for all actors involved at different stages of the process of representation does not raise problems. To speak for others is to first silence those others in whose name we speak [Callon 1986]. It is certainly very difficult for a much smaller number of human beings to silence Ohio and Maryland human beings in a definitive manner, but it is even more difficult to silence users, enterprise architects and governmental agencies by using something that does not possess an articulate language, like Epistemé. This presupposes the need for continuous adjustments and interestment devices that are infinitely more sophisticated. Few Company modellers have become influential and listened to, because their model has become the 'head' of several populations. They have mixed together in it lay users, engineers and managers. These chains of intermediaries which result in a sole and ultimate spokesman can be described, according to Callon [Callon 1986], as the progressive *mobilization* of actors who render the following propositions

credible and indisputable by forming alliances and acting as a unit of force: “people will be emancipated from being data managers” *if* “enterprise architecture escapes the non-interoperability island” *if* “prototype models are duplicated department wide”, *and* to financial reporting. According to Callon [Callon 1986], the term ‘mobilization’ emphasizes all the necessary displacements. To mobilize, as the word indicates, is to render entities mobile which were not so beforehand. At first, the population of users, enterprise architects and government agencies were dispersed and not easily accessible. In the end, Company modellers say what these entities are and what they want. Through designation of the successive spokesmen and the settlement of a series of equivalences, all these actors are first displaced and then reassembled at a certain place and at a particular time. This mobilization or concentration has a definite physical reality which acquires material form through a series of *displacements*: (i) the know-how of the pilot organizations’ referents is *reduced* to structured knowledge; (ii) the structured knowledge thus obtained is translated into a paper representation that *replaces* former know-how; (iii) a transaction that implies the total *independency* of the product (the model) from the production process (requirement gathering of modellers in pilot organizations) can then take place; and (iv) the outcome of this process is announced to be *duplicated* department-wide.

Displacements are made possible by a cascade of *intermediaries* who little by little reduce the number of representative interlocutors: (i) instead of talking to all users, Company modellers talk to the Team Leader Engineer; (ii) instead of exhibiting the pilot organization referents to their colleagues at conferences, they show pictures, screenshots and diagrams; (iii) instead of applying Epistemé to all one thousand one hundred seventeen governmental agencies, they develop a prototype model for a single line of business; (iv) instead of developing a solution to deal with the new regulations of the SOA, they equate it to business-critical activities and talk of success stories with governmental agencies.

The choice of each intermediary, of each new representative meets this double requirement: it renders each new displacement easier, and it establishes equivalences which result in the

designation of Company modellers and their models as spokesmen.

The result is striking. A handful of Company modellers with their models can compete with independent auditors representing the Security and Exchange Commission that represents the US Congress that represents the people of United States to ensure that public companies can identify and report all events in compliance with the provisions of the Sarbanes-Oxley Act for the protection of investments and further public interests. This is because Company modellers and their models commit uncountable populations of users, enterprise architects and governmental agencies that in the future will duplicate the prototype models of Epistemé department-wide. These diverse populations have been mobilized. That is, they have been displaced from their sites to Company modellers' deliverable documents, scientific papers and marketing materials. They participate now, through interposed representatives, in the negotiations over the progressive reshaping of the Financial Reporting Triangle through the constitution of an 'accounting competence' by Company modellers. The enrolment is transformed into active support. The population of users, the enterprise architects and the government agencies that have adopted Epistemé are on the side of Company modellers in their project to replace independent auditors with their models in the Financial Reporting Triangle.

14. Concluding remarks

By means of the scheme of analysis proposed it is now possible to answer in the affirmative to the question 'it is possible for ERP and independent auditors to compete in the financial reporting triangle'. The epistemological passage that allows this conclusion to be reached is comprised in the principle of symmetry whereby induction and election can be considered as the same process based on the same twofold movement. The former is the displacement of an entity from one place to another. The latter is the selection of intermediaries that leads to the

selection of a spokesperson. Thanks to this epistemological transition, is possible to speak of ERP technology as a sophisticated ‘democratic’ process of political representation, and of the election of the independent auditors as a scientific process of simplification. Setting the symmetry between human and non-human at the level of the notion of representation (and not of other aspects of human agency), the field is cleared of possible prejudices concerning the political legitimacy of using the technology.

That said, it is necessary carefully to consider the ways in which the relationship with technology is established and formalized in organizations and in the political arena. In conclusion, I shall resume the aspect of this study devoted to the analysis of norms on the use of technology. I shall dwell upon on the relationship with technology as evidenced by the case of the Sarbanes-Oxley Act in regard to ERP systems and their use in financial reporting. I shall mention certain aspects of the potential replacement of independent auditors with ERP systems, concentrating on *(i)* neutrality, *(ii)* centralization, and *(iii)* the liabilities implied by this change.

14.1. The neutrality aspect of the translation of ERP systems

By shifting liability and legal sanctions concerning financial declarations to the CEO, the legislator has sought to create a space neutral to the conflicts of interest that have characterized auditors in the US. As a consequence, because some of the auditor’s roles are not covered, the CEO will look to ERP systems for support in ensuring that the organization reports all events in accordance with the conditions imposed by the Sarbanes-Oxley Act. This consequence – which is also envisaged by the Act – corresponds to the issuer’s intention to have enterprise models which support financial reports with visual descriptions. What the technology is required to prevent, by replacing the auditor’s support for the CEO in the context of financial accounting, is not only system crashes but also interest clashes.

According to the analytical scheme proposed by this study, the groups of populations in whose name Company modellers and their models speak are elusive, and interest clashes may take place at any moment. Entities may refuse the transaction and define their interests in another competing manner.

The consistency of the chain put into place is strictly measured by the solidity of the equivalences and the fidelity of a few rare intermediaries who negotiate their representativity and their identity. The consensus and the alliances that make up the actor-network [Callon 1986] of Company modellers and their models can be contested at any moment. Translation becomes treason, dissidence, betrayal and controversy.

14.2. The centralization aspect of the translation of ERP systems

Advertising by software providers promotes an accounting competence by ERP systems that can replace one of the independent auditors. In addition, the Sarbanes-Oxley Act mandates that some of the tasks previously performed by auditors must now be undertaken by managers. These conditions clearly seek to introduce a model-enacted centralization process of enterprise governance which replaces the former financial reporting steering system.

According to the scheme of analysis proposed, organizational-events control systems like ERP do not ensure centralization. Rather, the intermediaries who negotiate their representativity with Company modellers and their models are much more dispersed than the heterogeneous system of actors of the Financial Reporting Triangle. Company modellers and their models exist once a long chain of representatives has been put into place. This chain comprises entities as different as populations of users, enterprise architects and government agencies.

14.3. The responsibility aspect of the translation of ERP systems

One of the provisions of the Sarbanes-Oxley Act states that the Chief Executive/Financial Officer (CEO/CFO) must submit the annual financial disclosures to the Security and Exchange Commission (SEC). Some of the documents that must be submitted to the SEC are those that the CEO/CFO had previously to present to the auditor in the form of a management representation letter, which remained a private document between the CEO and the auditor. The documents that the CEO must now submit are public and have legal effect.

According to the scheme of analysis proposed, in addition to the Act provisions mentioned, it is feasible that when managers delegate to organizational-events control systems the task of ensuring that the organization identifies all events in compliance with the Act, this will be accompanied by the delegation of some of the legal effects to software companies. According to the scheme of analysis proposed, indeed, along the chain of intermediaries represented by Company modellers and their models it is possible to identify who is responsible for what, thus distributing legal effects on technology.

14.4. A new approach to regulations concerning ERP systems

FIG. 6. The Epistemé logo



The figure shows the Epistemé logo. This represents the planet Earth as it enters a box. The planet represents the empirical data, the box represents the Epistemé model. The Earth easily fits into the model, and no additional work seems necessary. The

figure represents the process of producing a technological model according to the Company modellers: the dependence of one form of knowledge (the abstract knowledge of the model) on the other (the empirical knowledge represented by the planet Earth) is eliminated. The globe automatically moves into the box.

The way in which the Sarbanes-Oxley Act interprets the application of organizational-event control systems in financial accounting is very similar. Specific provisions do not apply to the adoption and use of technology. Mention is only made of the use of 'graphical representations' [Section 409]. While consultancy by independent auditors on information systems is specifically prohibited, it is not specified who must deal with this aspect, and how.

A sociology of the translation of ERP systems to financial reporting enables technology to be examined in a manner different from how it is interpreted by both the Company modellers and the issuer of the Sarbanes-Oxley Act. It distinguishes itself from the positions taken up in the literature which reaffirm, in their applicative results, a *technology production/technology use* dichotomy. The sociology of translation furnishes understanding that if situated knowledge, real life and procedural knowledge are mundane, so too are the planning model, geometrical representation and declarative knowledge embodied in ERP systems. By proposing symmetry between the notion of induction and that of spokesperson, between human and non-human at the level of the notion of representation (and not of other aspects of human agency), it is possible to describe as never before the ERP technology as a process with high 'democratic' potential. With their models, the Company modellers mobilize a rich assemblage of social worlds that comprises user populations, enterprise architects, and government agencies. The result of the modellers' machinations is compared to the democratic mechanism of vote-counting that allows a citizen to be represented by politicians, commissions, regulatory authorities, and independent auditors.

According to the scheme of analysis proposed, it is necessary carefully to consider the way in which the use of information systems is formalized and discussed in a legal text. ERP adoption and use requires further negotiation and association work.

Accurate description of the additional association and negotiation work necessary to for a technology to function must be an integral part of legislation on information systems. According to the scheme of analysis proposed, this additional work can be summarized by the four moments of translation presented above [Callon 1986].

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A sociology of the translation of ERP systems to financial reporting

Gian Marco Campagnolo

How it is possible for ERP systems to replace the independent auditor in the financial accounting triangle after the Sarbanes-Oxley Act? How can the two actors be compared, given that one is a technology and the other a human being, one the product of a private firm and the other the informal representative of a government authority? This study seeks to answer these questions by introducing a new epistemological paradigm into the social study of ERP systems. This paradigm is derived from actor-network theory and incorporates the political aspect of technological production and its forms of representation – schemes and models. The analysis is based on a case study concerning a system of enterprise modelling and the Scandinavian organization that has developed it. The case study describes the conditions for the legitimization of accounting competences by a specific class of technologies in organizations (ERP systems) as a collective experiment involving consumers, engineers, and American government agencies.

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