MULTI-INSTITUTIONAL COLLABORATION IN THE PUBLIC SECTOR: AN ISSUE OF KNOWLEDGE NETWORK DESIGN

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December, 2001

Keywords: Action-Research, Actor, Alignment, ANT (*Actor-Network Theory*), CoPs (*Communities of Practice*), IT artifact, Organizational Learning, Technology Drift.

Paper submitted to the ECIS Doctoral Consortium 3rd to 5th June 2002, AIS region 2 (Europe, Africa, Middle-East)

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ABSTRACT

Different companies operate within different boundaries. Sometimes their purposes intersect, meaning that the companies compete, cooperate, or belong to a same organization and must *act together*. The concept of *Public Sector* traditionally inscribes in this kind of *fair interception*. In the Public Sector arena, the common goal is *community welfare*. To pursue this common goal, institutions of a same sector must *align*. To conceive appropriate forms of alignment has led us to a proposition concerned with the design and development of a *knowledge network*. Acting in the *Road Safety Sector* and *Information Systems* area, we have adopted a research trend that stresses the eminent *socio-technical* character of this area. The research methodology adopted is an *Action-Research* approach that uses *Actor-Network* and *Technology Drift* theories, takes up *Communities of Practice* and *Organizational Learning* models, and endorses *workgroup* practices and *workflow* processing. Actor-Network Theory provides a fruitful concept of process-oriented *alignment*[1] that involves categories like actors, work-routines, behaviors and roles. We identify key actors and propose an actor-network capable of supporting a stable, flexible and light information infrastructure. Once we analyze and understand actor's behaviors, we can *inscribe* in the network patterns of response and we can *translate* actor interests and needs, in order to achieve our main goal - improved road safety in Portugal. A socio-technical system, in order to stabilize, must drift from a single-purpose network into a multi-purpose network reflecting the interests of *all key actors*. All key actors participate in a continually evolving process. We need to define policies to guarantee permanent and participated evolution, assuring ongoing revisits to redesign and redevelop the network.

1. INTRODUCTION

This research intends to justify the proposal of a stable information infrastructure that is able to act as a way of both reducing car accidents and increasing road security in Portugal. This proposal falls within a research trend that originated in the social and sociological areas but became increasingly adapted to support approaches to socio-technical research in Information Systems.

With the proposals of Hirschheim [1992], Nissen et al. [1991] e Achterberg et al. [1991] in the beginning of last decade, a shift occurred in the traditional area of Information Systems research, towards a more qualitative and socially oriented trust. More recently we can refer Walsham [1997] proposals. Our research follows this trend. Using Action-Research as the mainstream, we have defined four pillars to conduct to a proposal for the design and development of a *knowledge network*:

- Actor-Network Theory (ANT);
- Technology Drift;
- Communities of Practice (CoPs);
- Organizational Learning.

[1] According to ANT *alignment* is the achievement of a process of bottom-up mobilization of *heterogeneous* "things" [LATOUR,1996]

ANT accounts for the primacy of these four pillars, in the sense that it supports all the three others. So, enrolling a cascade of methodologies, we could define the following tree, guiding our approach to the final objective, the referred *knowledge network infrastructure*:

Action-Research → Actor-Network Theory → Technology Drift
→ Communities of Practice
→ Organizational Learning

In the paragraphs that follow, we carry out a brief review of the literature, concentrating on Actor-Network Theory, Technology Drift, Communities of Practice, and Organizational Learning. We then describe our motivations and goals, before we move on to an explanation of our research method and approach. We then explain the main results expected, and conclude with an estimation of limitations.

2. LITERATURE REVIEW

2.1 Actor-Network Theory

Actor-Network Theory evolved from the work of Michel Callon and Bruno Latour at the Ecole des Mines in Paris. Their analysis of a set of *negotiations* describes the evolving development of a network in which both human and non-human actors assume identities according to prevailing strategies of interaction.

Actors are "*entities that do things*" [LATOUR,1992], kinds of “atoms” in action performance. An actor-network is a set of evolving links between actors, their actions and all the surrounding influencing factors. Actors are represented in this infrastructure and they *act*, they are *actants*! This means both that their behavior is *translated*, that is re-interpreted or appropriated by other’s interests, and *inscribed*, that is embodied in patterns of use in the network. In fact, the design and development process *belongs* to the key actors. Bruno Latour defines both those important concepts: “*translation* refers to all the displacements through other actors whose mediation is indispensable. In place of a rigid opposition between context and content, chains of translation refer to the work through which actors modify, displace and translate their various and contradictory interests.” [LATOUR,1999]; “*inscriptions* are transformations through which an entity becomes materialized into a sign, an archive, a document, a piece of paper, a trace. Usually but not always inscriptions are two-dimensional, super imposable, and combinable. They are always mobile, that is, they allow new translations and articulations.” [LATOUR,1999].
In this way, actors perform actions that influence other actors. The actors are entities that can be human, technological, or sociological, they can be things (artifacts), or concepts (norms, paradigms). The term network is defined as a "*group of unspecified relationships among entities of which the nature itself is undetermined*" [CALLON,1993]. An actor cannot act without a network and a network consists of actors. In fact, the actor-network is both the infrastructure and the context. In theory, ANT is a conceptualization of technology and society in a constructivist approach. ANT focuses on how infrastructures get constructed by their participants.

The identities and qualities of the actors are defined during *negotiations*. The most important of these negotiations is *translation*, an interaction in which actors: develop common definitions and meanings; define representatives; and co-opt each other in the pursuit of individual and collective objectives. “Translation rests on the idea that actors within a network will try to *enrol* (manipulate or force) the other actors into positions that suit their purposes. When an actor's strategy is successful and it has organized

other actors for its own benefit it can be said to have translated them" [CALLON,1986]. The infrastructure must then stabilize: "stability and form of artifacts should be seen as a function of the interaction of heterogeneous elements as these are shaped and assimilated into a network" [LAW,1990]. This stability, meaning ongoing order, is continually negotiated as a process of aligning interests.

2.2 Technology Drift

We can consider the development of IT infrastructures in a *close environment*, meaning that a single authority can control all the elements of the infrastructure, and in *open environments*, meaning the opposite [HOLMSTROM,2001]. In open environments, IT design and development cannot be fully controlled. We can state even further, that IS/IT developments of significant size or complexity can never be fully controlled or planned [CIBORRA,1997]. The open-ended process of developing IT infrastructures imposes that technology cannot be viewed as fixed artifacts distributed to humans. This open-ended character means that a mutual adaptation of society and technology is essential. Which suggests that we should accept both technology and human actors as entities dynamically shaped by an heterogeneous network of all the relevant actors/factors. To understand how and why people adapt to technology and how and why technology adapts to people is what is considered the *technology drift* (TD). Technology changes as it becomes incorporated into preexisting social and technological contexts [HOLMSTROM,2001]. "Technology drifts during implementation because of numerous decisions along the way by many actors", "Rather than unidirectional and fully controlled, technological development itself is part of a wider dynamic in which it is as much shaping as it is shaped" [HOLMSTROM,2001]. Recognizing this facts, it is important to evolve from goal to process, from IT implementation to infrastructure drift [ORLIKOWSKI & HOFMAN,1997]. This is the reason why we believe that ANT combines so perfectly with TD.

2.3 Communities of Practice (CoPs)

The sense in which we use the concept of C*ommunities of Practice* has originated in the early 90s. It is plainly related with the network society, network companies, knowledge network, knowledge sharing, distributed leadership, cooperative work and learning organizations. Etienne Wenger [1991] can be situated in the deep root of CoPs theory, but others have joined in recently, with significant contributions, such as Mary Jo Kim [2000], Manville and Foote [1996], Verna Allee [2000], John Seely Brown and Paul Duguid [2000], Chris Kimble and Paul Hildreth [2000], Jim Botkin [2000], and Nancy Dixon [2000].

Communities of Practice are groups working together, sharing the same goals, using the same or different expertises, sharing an informal ambience in which there are no hierarchies. The elements of the group act as pears, working collaboratively on the same problems, from different perspectives, and pursuing a shared goal, that is, envisaging the same final practical results. These people can operate geographically and functionally from different places and cultures. They can belong to the same department of the same organization, to different departments of the same organization or, even, in the case we are concerned with, belong to different institutions. They are committed to action, not to theoretical conceptualizations.

2.4 Organizational Learning

Using Chris Argyris's and Donald Schön's [1974] model of organizational learning we stress the two different paradigms of learning (see Table 1).

Goal and culture embody the existing values, hierarchies, leadership style of the company in the context of the overall purpose of attaining goals. They represent company structure, which is less dependent on conjuncture. In a systems approach, the company, with this body of fundamental constraints, will define strategies in order to meet the goals. Strategies define practical actions that will conduct to practical results.
The most common learning process establishes a loop between the last two steps, aligning the strategies with intended consequences, in a fine tune approach.

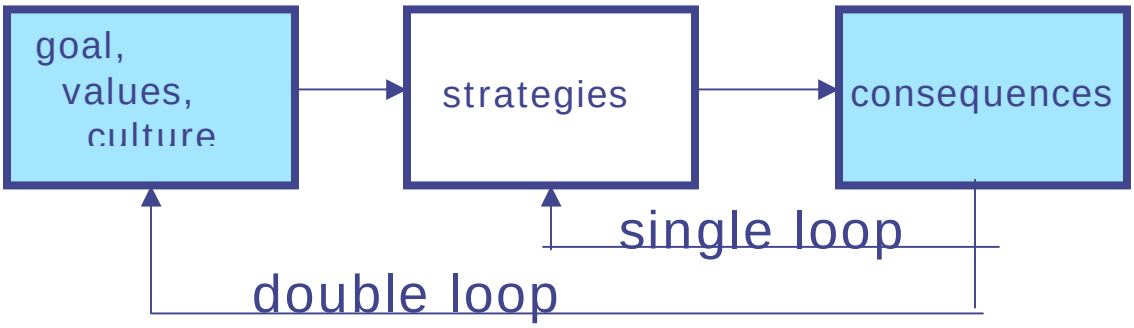

Table 1

This kind of approach is limited and merely operational, not allowing significant qualitative improvements and innovation. It represents a maintenance learning ability, not adjusted to an environment in which changes are sometimes drastic. When drastic change occurs, it is necessary to envisage a deeper process of learning, questioning the organizational context. It is sometimes necessary to disrupt the ongoing logic, to replace existing habits and values. This does not mean political or ideological fundamentalism, but represents a way to achieve more effective actions. It is, then, necessary to redesign processes and, sometimes, even the organizational style and structure. This is the sense of the double loop learning process. It is a creative rupture with the established practices.

3. RESEARCH MOTIVATIONS AND GOALS

Public Sector institutions traditionally operate in vertical sectors that lack an horizontal view. Most public institutions tend to operate by themselves, sometimes overlapping responsibilities, other times leaving gray areas of non-action. We support that it is convenient to dynamically group public institutions in clusters of similar, well identified, goals and take advantage on what we define as fair interceptions in order to define fair cooperative strategies. Assuming that the main goals of the Public Sector are community measurable welfare, our approach evolves into the notion of aligning actions with the purpose of producing effective results, measured by the social effects achieved. We concentrate on the Road Safety Sector because we have been acting in this arena for a long period. Having a multiple set of different institutions and agents in this sector, we defined a sub-set of five main institutions in order to test our

purposes. These are the Ministério da Administração Interna (MAI) – Internal Administration Ministry, Direcção Geral de Viação (DGV) – General Division on Road Traffic, Prevenção Rodoviária Portuguesa (PRP) – Road Safety Portuguese Prevention, Brigada de Trânsito (BT) – Road Traffic Police, and Instituto de Estradas e Portugal (IEP) – road design control and maintenance, and traffic sign placement and maintenance. We consider this sub-set as a significant sample not only because these are the main institutions, but because they represent a complete functional set of responsibilities. In fact, we can say that the MAI handles overall institutional control and legislation, DGV is information oriented and promotes official activities and institutional cooperation, PRP is education oriented, BT runs car, drivers and accident control, and finally IEP is road maintenance and traffic sign oriented.

All these institutions directly or indirectly report to the MAI, but they tend to act somehow in a non collaborative and independent way. The result is Portugal being one of the most dangerous countries in Europe, in terms of Road Safety[1].

Designing and developing an actor-network with the key actors of the five institutions is a social and technical task involving human, social and technical *actants*. In this process an actant-network emerges [LATOUR,1992;CALLON,1986]. Actant-networks are associations of many different actants or actors which interact through what John Law has called *heterogeneous engineering* [LAW,1987;1992;1994;Latour,1988]. "An actor network is simultaneously an actor whose activity is networking heterogeneous elements and a network that is able to redefine and transform what it is made of". [CALLON,1987;1993]

This actant-network is in fact an infrastructure we refer to as a *knowledge network*. An infrastructure that includes laws, norms, acting paradigms, practical phenomena, behaving cultures, technological artifacts, skills, practices, organizational arrangements and contracts, in an environment of ongoing cooperation-negotiation that shares a goal –reducing car [2]accidents. This infrastructure must be stable in an ANT sense. “The more stable a network is, the better it defines its components. The possibilities decrease for other networks to untie the connections in order to redefine an actor for his/her/its own purposes” [STALDER,1997].

These concepts are complex because, in other terms, ANT is based on no stable theory of the actor; in other words, it assumes the radical indeterminacy of the actor [CALLON,1997]. But “many actors make up a *network* of interests which becomes *stable* as they are *aligned* together” [MONTEIRO,1996].

4. RESEARCH METHOD AND APPROACH

Using *ANT*, the research will identify the key actors in the process and will attempt to establish proposals for their inter-relation-negotiation in terms of an ongoing process to design and develop an actor-network supported by a light and flexible infrastructure. Relying upon the actions and attitudes of the identified actors, we wish to propose solutions to *inscribe* in the network patterns of behavior leading to a *translation* that is adjusted to the goal – to reduce car accidents and increment security in the Portuguese road infrastructure. The result must be translated into mechanisms that support a stable actor-network in which irreversibility is balanced by the need of agility and the avoidance of crystallizations.

Identifying the key actors is a relational, *Action-Research*, process that will be developed in the field. We will not only analyze artifacts, installed equipment and existing infrastructures, but also interact in the

[1] In IRTAD site, see graphic - http://www.bast.de/htdocs/fachthemen/irtad//utility/p45.pdf
See annex.
[2] Car here meaning any kind of *traffic artifact*, that is, cars, bikes, motorcycles, lorries, …

field with institutional representatives. This means that we will not use an interview approach, but rather a kind of diary study [4]. In fact, all these "*things*" or "*entities*" are transformational agents whose styles, motivations and purposes must be plainly understood.

Using the concept of *CoPs*, the research must identify and propose collaborative working practices and effective processes grouping the human actors in their actor-network constraints in a way that contributes to the emergence and sharing of knowledge. The purpose is to use this knowledge in practical actions aligned with the main goal. This implies the use of workgroup applications and workflow analysis in order to design processes and facilitate the sharing of inputs and the sharing of knowledge in an actor-network negotiation context.

The main advantage of using the *Technology Drift* concept is to strengthen the awareness that specifications of an infrastructure emerge from the actors and should always adapt to all the key actor's needs [CIBORRA,2000], meaning that the negotiation process is an ongoing process in a double loop learning approach, as we described in the *Organizational Learning* section [ARGYRIS & SCHON,1978].

Our sources of data and information are the immense material available in the institutions themselves (for example DGV has an statistical department that gives input to the National Statistics Institute in what concerns road victims, and has several regular publications), journals, magazines, TV programs, the Internet and some associations like ACP, the Portuguese Automobile Association.

5. EXPECTED RESULTS

Three main objectives dominate our concerns in this research. One is the design and development of an infrastructure in the terms we have defined, this objective, *per se*, being, we believe, a quite complex and important project. The other is to explore a cultural shift in the methodologies traditionally used in IS/TI design and development. In fact, and avoiding the mainstream academic and professional trends in the IS sector, we intend to illustrate that a socio-technical approach like this one, using methodologies like action-research and ANT, is an enlightening approach likely to contribute to better and more effective results. Finally, the process of heterogeneous construction, in which every involved actor is contributing to the purpose of design and development, this kind of endemic bottom-up process[5], may be, not only a very good way to deal with complex IS systems, but also an important educational and social process by itself. All the involved actors, and even infrastructure users, may feel that important things belong to themselves, and human actors may be more aware of unusual connections and phenomena dependencies, as they may be more aware of their own responsibilities.

All these experiences, understanding different points of view and feeling that one (actant, *actor*) is an important piece of *what and how* things are going on [HOLMSTRÖM,2001], all this new awareness, may potentially be amplified, in its consequences, by the fact that all the methodologies applied and processes adopted in this research could also be used in the non Public Sector by companies with different departments or locations, or even by different companies competing in the same or different markets.

[4] Henry Mintzberg used diary studies in different approaches, namely in his PhD dissertation in 1968, and in *The Nature of Managerial Work*, in 1973.

[5] Henry Mintzberg stated, "*people placed at the so-called bottom in organizations have heads too, in fact often very good ones*" and was surprised by "so little time spent on communicating".

6. LIMITATIONS

Most of the limitations we envisage may relate to Public Sector style, meaning we find many people not motivated to innovate and even not believing in any attempt to do things in a different way. Moreover, in Portugal there is the habit of nominating Public Sector Directors using political criteria, which implies two negative consequences: often, the person nominated is not the most competent in the field; and changes in the political arena imply changes in the direction of the institutions, most of the times implying changes of policies. These facts tend to turn communication with public entities a difficult job.

Another limitation is that IT/IS literacy is sometimes poor, which inhibits an operational use of applications and tools that would allow better participation in the design and development of the infrastructure. In fact, this process is a process in which every actor has a place and key actors are critical. To participate in workgroup practices and increment the potential of *CoPs* requires a TI background that is sometimes absent or poor.

Finally, a cultural aspect relates to the country itself. We think that cooperative work is, unfortunately, the exception in Portugal, a country where people tend to work by themselves and are very dominated by a hierarchic/bureaucratic culture.

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Annex – institution's missions and graphic

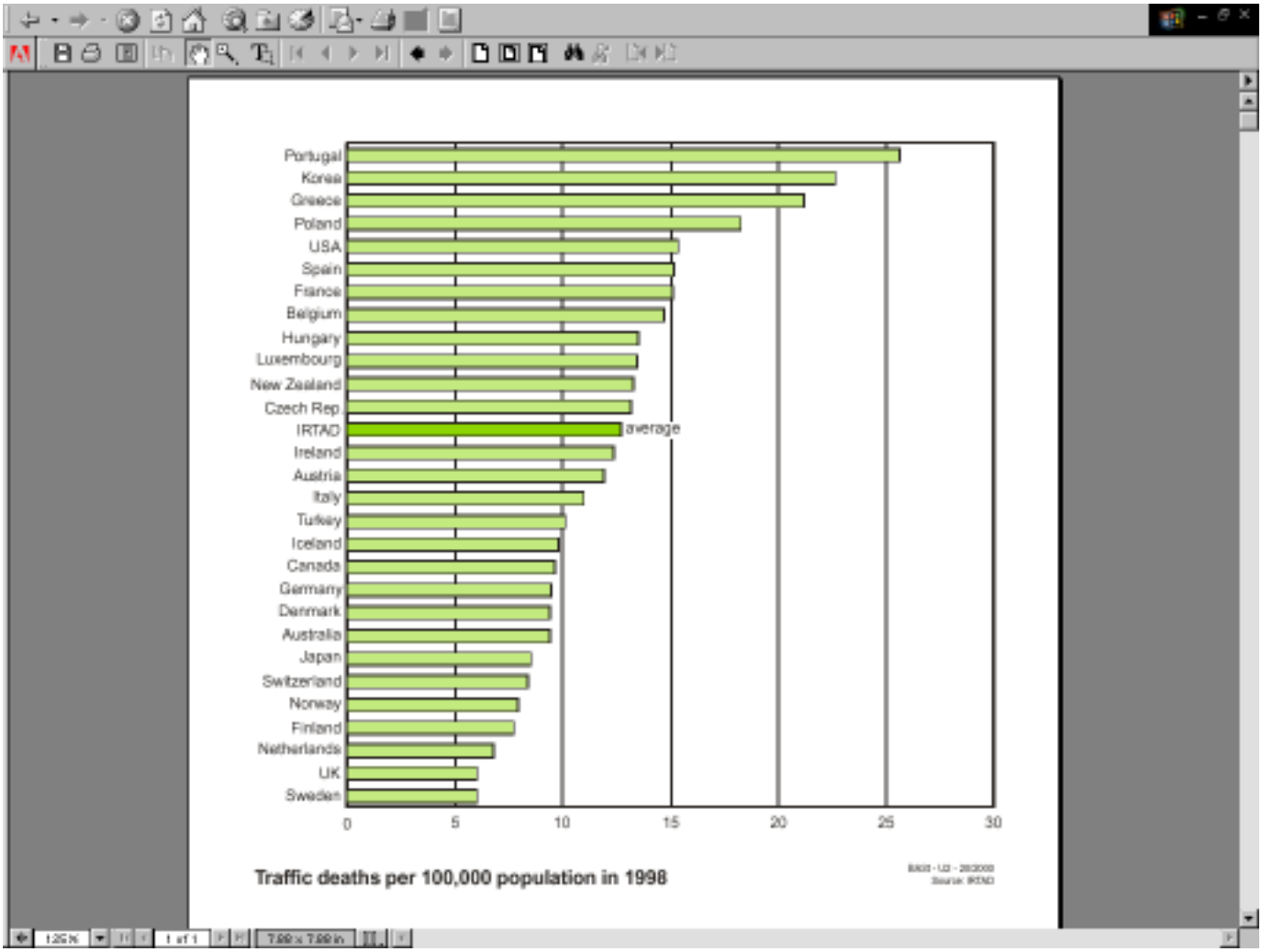
MAI – MAI has control over the Internal Security, Protection and SOS Services, Road Security. Internal Security is assured by PSP – Polícia de Segurança Pública – Public Security Police ruling over cities, and GNR – Guarda Nacional Republicana - Public Security Police ruling over rural areas. They both report to MAI. DGV also reports to MAI, in fact to Secretário de Estado da Administração Interna, who reports to Ministro da Administração Interna.
http://www.mai.gov.pt/data/mai/

DGV – is a state institution with the responsibility to administrate the security of road traffic system, studying, promoting and practicing the necessary measures to address an effective and permanent improvement of the system. DGV ensures the standardization of procedures and the coordination of the operational control. DGV should also ensure a perfect cooperation between the different entities of the national road system.
http://www.dgv.pt

PRP – develop actions in the driver's training and educational arena. Prepare and develop educative actions in schools, as well as designing sensibility campaigns for the road user. Designs and arranges courses to prepare technical professionals in the sector. Designing actions to reduce the adverse impact of vehicles, namely acting in a concerted way in terms of equipments and their security.
http://www.prp.pt

IEP – Portugal Road Institute controls road design, maintenance and traffic sign placement and maintenance.
http://www.iestradas.pt/

- **IRTAD** graphic on traffic deaths per 100,000 populations in 1998, see next page.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Traffic deaths per 100,000 population in 1998