RETHINKING ELECTRONIC JOURNALS: EXPLORING THE FLEXIBILITY AND DUALITY OF TECHNOLOGY

SUELY GOMES[1]; SUZANA PINHEIRO MACHADO MUELLER[2]

Faculdade de Comunicação e Biblioteconomia, Universidade Federal de Goiás
Campus Samambaia, Goiás, Brazil
sgomes@facomb.ufg.br
Departamento de Ciência da Informação e Documentação, Universidade de Brasília
Brasília, Brazil
muller@unb.br

This study analyses the appropriation process of electronic journals by academics at three Brazilian post graduation research programs (Master and Doctoral). The objective is to understand the internal structure of technological practices in the context of potential users, exploring two main characteristics of the appropriation process: the duality and the flexibility of technology. The technological structuring model, proposed by Orlikowsky was expanded to verify the relationship between electronic journals and scientific communities. Results reveal electronic journals as both product of and medium for human action. As a product, technology only comes into existence through creative human action. It has no meaning until given meaning through manipulation; as a medium, technology promotes certain types of work and constrains others (duality). When interacting with electronic journals, academics showed to be influenced by the institutional properties of their setting. They based their action on existing stocks of knowledge and resources and norms to perform their work. As such, electronic journals are products of the organisational context, and will reflect the knowledge, materials, interest, and conditions present at a given locus. Electronic journals are flexible in the sense that they allow more than one interpretation. i.e., their concept vary according to the individual conditions of interaction.

Keywords: scientific communication; electronic journals; technology structuring

INTRODUCTION

As electronic networks, such as the Internet, grew more and more pervasive, new forms of communication became available, which were promptly seized by a growing group of academic researchers from different areas. They use the net to communicate with colleagues geographically distant, discuss ideas and share the results of their research [1].

But, in spite of all the advantages and technological superiority over traditional ways, and contrasting with the prompt and wide acceptance of the e-mail, the adoption of electronic channels for formal scientific communication was slow and complex.

This study was motivated by the fact that some questions on the process of legitimisation and institutionalisation of electronic periodicals for scientific communication are not yet completely or satisfactorily answered. The same motivation led to the choice of the theoretical methodological framework.

As we bring the discussion to Brazil, a developing country which has invested to improve its scientific capabilities, we hope to contribute to the comprehension of this phenomenon.

TECHNOLOGICAL INNOVATION -THEORETICAL FOUNDATION

Since we couldn't find a good model in the literature for the intended study of technological innovation, we established as theoretical framework the work of Orlikowsky [2], to which we added the theory of sense making proposed by Weick [3] and Latour [4]. As a result, we got a model that emphasizes the equal importance of four elements present in the process of technological structuring, which are relatively autonomous: the individual, the organization, the scientific field, and technology. These four elements are recursive and dynamic, for they are neither static nor self-explanatory. The individual is at the centre because the structuring process begins within his social cognitive sphere. It is on the individual's knowledge that the structuring of norms, proceedings and routines will be based. The synthesis of all individuals' knowledge, achieved through continuous dialoguing, results in social or organisational knowledge. Harris[5] suggests that it is through this continuous dialoguing that the leaders exert their leadership, stimulating towards a rethinking of individual reality. This is quite different from the idea of the individual as a singular entity, ontologically invariable, who acts arbitrarily, autonomously and never changes his ways.

Actions related to the appropriation of electronic periodicals by researchers occur within the context of their research activities. These activities have an institutional aim. Therefore we cannot search for an explanation in the individual alone; on the contrary, we should confront those actions with a set of rules and resources originated both in technology and in the scientific field - the network of interactions - as well as in the organisation. The latter concretely defined as the university or research institute. The existing binding social structure present during those actions do not allow for random behaviour. Thus, the conditions that allow us to consider electronic periodicals as part of research activities stem from the relationship between human actions and the social - cognitive structures present in the model's elements.

The model recognises the *systemic and automatic character of technology, proper to its instrumental rationality* (Trigueiro[6]). On the other hand, technological contents result from disputes, vested interests and social, economic and cognitive needs and limitations.

The model of technological structuring, adapted and expanded, is based on the following presuppositions:

· Electronic periodicals are the product of human action. *"technology only comes into existence through creative human action. […] It has no meaning until given meaning through manipulation". So, electronic journals are interpretively flexible, i.e. the meaning constructed vary according to the conditions (special and temporal) of interaction and the identity of the individual assumed during interaction"*[7]. The degree of flexibility to interpret those structures which resulted from the consolidation of or engagement with certain practices will depend on its irreversibility, i.e., the degree of difficulty to remove these practices from a social system after they have been inserted in it and on the degree of influence they exert on the modelling an determination of subsequent interpretations.

· The structuring of human action is based on social structures brought into the process. The conditions for human interaction, i.e., the conditions of each individual as social subject, imply recognising that his actions are always developed within a social system. When interacting with electronic journals, academics are influenced by the institutional properties of their setting. They based their action on existing stocks of knowledge, resources and norms to perform their work[8]. As such, electronic journals will reflect the knowledge, materials, interest, and conditions at a give locus.

· Electronic periodicals are instruments for human action. Since human actions are shaped by social organisations, human actions are made possible or are inhibited by structures stemming

from these same actions (technology duality). Those structures are then not only the product but also the means for human action.

METHODOLOGICAL APPROACH

This study is based on an wider exploratory research. Data were collected in two steps, to validate the proposed model. First, a questionnaire was applied, which aimed at identifying the elements used in the structuring of the individual's positions in relation to electronic periodicals. Then, a semi-structured interview was used to explore the dual character of electronic periodicals.

The population for the questionnaires were academic professors formally employed by Brazilian universities or research institutes, who taught in master or doctorate level courses, in Physics, Biology and Information Science. The total population was 1,471 academic professors, geographically distributed among Brazils' five regions.

In this paper, only part of the wider research will be described. The first corresponds to two open questions included in that questionnaire, and the second to interviews, as will be described bellow.

The fist part refers to two open questions included in the questionnaire, which asked:

a) Would you change from a print periodicals subscription to an electronic one? Why?

b) Would you consider publishing your next article in an electronic periodical? Why?

A total of 301 researchers answered the questions.

The respondents for second phase of this study were selected from among the members of committees which represent each scientific field (and post-graduate courses) at CAPES, a federal agency for graduate courses financing, subordinated to the Federal Ministry of Education. This choice was inspired in the theory of social representation, as presented by Moscovici[9], since the members of these committees are in a position that allow them to know their areas' needs and aims. The interviews, semi-structured, lasted one to two hours, approximately, and touched the following issues: research activities: conceptualisation and essential elements; publication: conceptualisation and reasons for publishing; internet: how did they used it, and what they thought it represented for their fields; electronic periodicals; appropriation. A total of eleven researchers were interviewed, in the beginning of 1999.

THE PROCESS OF APPROPRIATION
ELECTRONIC PERIODICALS AS PRODUCTS OF HUMAN ACTION

Content analysis of the answers presented by the respondents concerning possibility of substituting the electronic for the print version of periodicals identified six types of action needed to technology appropriation.

At the individual level, a cognitive action was identified, based on the following terms present in the respondents' answers: learning, practising, handling, using, training, dominating, getting familiar with, knowing. These topics were grouped in a nucleus denominated *technological apprehension* corresponding to the following stages: perception (know that it exists), "*circunspection*" (building tacit knowledge) and *understanding* (get familiar with, domination) [10].

This nucleus *technological apprehension* tells us that electronic periodicals are products of individual action geared to the cognitive structuring of technology. The stage of apprehension must be dimensioned in relation to other structures also present in the process, such as ideology,

beliefs, habits, preferences and values. The ideology structure brings into the process the cultural dimension of the structuring actions of technology.

Besides cognitive actions, there are two more sets of organisational actions needed to introduce or implement technology into the researcher daily life. Topics such as the need to guarantee access to resources, reform rules for promotion or for the utilisation of institutional resources, and training of human resources for technology were grouped in a nucleus called **adoption of technology.** Adoption of technology is based on actions typified as capability and maintenance of technology[11]. The first category is composed of:

· Administrative actions - based on hierarchical and formalising structures, they aim at co-ordination, planning and control of institutional actions (*"periodicals are financed by the institution. The institution should decide as an integrated body")*

· Administrative support actions - aiming at the improvement of human resources capabilities to reinforce administrative actions (*"libraries are not capable to handle this type of material").*

· Integration actions - based on the formal organisation of the institution, they relate to norms and rules (*"presently, there are no rules").*

The second category of organisational actions correspond to those actions aimed at the distribution or granting of financial resources to make possible the implementation of an adequate infrastructure, and for the redefinition of criteria for promoting, training and rewarding users. (*"It depends on technological resources, software and hardware, and the financial resources available for that"; "we need access to the internet from the laboratory"; "depends on guarantees of continuity and regularity"; "the institution does not recognise it for career advancement"*) .

The guarantees demanded by respondents go beyond the mere allocation of funds. They demand serious engagement, responsibility, seriousness and continuity in actions.

Another set of actions were also identified, which go beyond the organisational frontiers and into the scientific field[12]. The first nucleus here, denominated **legitimisation**, gathers topics on the need to create a pattern of attitudes and behaviour for social actors involved in electronic periodicals (grant agencies, scientific societies, scientific communities, publishers), as can be perceived in the following comment: *"all actors should agree on this type of publication".* That is, to recognise the electronic periodical as a legitimate form of scientific knowledge dissemination.

Yet another nucleus was formed, **democratisation,** which relates to the respondents' perception of the menace inherent to technology as instrument of exclusion, and the need to adopt measures to popularise access to it. (*"electronic publications may become even more exclusive"* and this may make *"growing impossible for small centres which have no adequate equipment").*

Actions resulting in legitimisation of electronic periodicals and equity of access to adequate infrastructure (democratisation) go beyond the competency of organisations or isolated individuals, and are better placed in governmental policies for C&T and telecommunications. Such actions have a social and political nature.

From a technological point of view, some actions were identified, intended to translate the social actors' demands into functional structures. These actions materialise into the technological apparatus which is expected to direct researchers' actions in relation to: the handling of the text (copying, printing, underlining, making notations); the usability of the system (accessing, consulting,

selecting, visualising, transporting, reading simultaneously); the integrity of contents (adoption of proceedings to guarantee quality of articles and security).

There is also need for actions dedicated to maintain a certain consistency in the system performance, such as *"quality of connections"; "quality of pictures"; "optimisation of the data flux when importing bigger archives".*

TECHNOLOGICAL FLEXIBILITY

In order to discuss technological flexibility, we need to identify the different interpretations and instrumental uses present in the social ground. As for the latter, social ground, there have been different reactions to the possibility of going from print to electronic media. Some respondents favoured the idea, others were in doubt, while still others declared themselves against it.

Some respondents argued in favour of both media, print and electronic, one complementing the other, but each one having a different sphere of influence and use. Electronic periodicals were seen by those respondents as a complementary tool to print, usually as an online version of traditional periodicals. Their function would then be to shorten waiting time for the dissemination of articles already accepted to be published in the print version. These answers show a conciliatory position, in which the respondents act rationally, accepting the efficiency of electronic media, but also act emotionally, based on tradition, as shown in the following statement: *"print and electronic do not exclude each other, for while the former makes access to new production more efficient, the latter allows for the very pleasant contact with print - touch, smell, handling, personal markings".*

When talking as authors, some respondents pointed to alternative uses for each media (how would they use them and to which end). Thus, they would publish in electronic periodicals those *"papers of a general character"* or *"only preliminary or peripheral results"* or yet *"only if attempts to publish in traditional media failed".* There is yet another group of respondents who would only publish in electronic media if there was a print version to it.

All answers reveal a behaviour already known in scientific publishing, which is the search for a vehicle adequate to the quality perceived in the work to be published. They also show the notion of an enterprise economy versus bazaar economy, as put by Davenport[13].

Among those respondents who were against or undecided in relation to substituting electronic for print, the prevailing idea about the former is:

1) non adequate for reading, organising, or fit to the field's tradition

2) a still premature technology

3) a communication channel which:

a) is immature or not yet complete in terms of audience and functionality (functions, performance, quality control)

b) contents do not have as yet credibility or are representative of the field's production;

c) is illegitimate and excluding;

d) audience is not known

e) is polemic

4) not safe for registering knowledge or for preservation

5)   is a commodity of uncertain monetary or social value

6)   lacks a selective or efficient tool for controlling quality

Those who would be willing to substitute subscriptions of electronic periodicals for print periodicals, there seems to prevail the idea of electronic periodicals as:

a)   a practical, agile an inevitable media

b)   a much cheaper commodity than the print version

c)   a solution to organisational problems such as information storage and the acquisition of missing issues.

DUALITY OF ELECTRONIC PERIODICALS

In order to perceive the duality of electronic periodicals, we need to understand how university professors and researchers conceive research activities, identify which elements are essential to develop them, how do publications relate to these activities, and then verify where and how electronic periodicals fit into this picture.

RESEARCH ACTIVITIES

The respondents perceived research as a search process and an information production process, and also a process for building human resources, aiming at expanding theory, uncovering new relations, offering solutions to problems or promoting better understanding of nature, i.e., the production of pure and applied knowledge.

Research activity occurs within an organisation empirically defined, the university, which is usually seen as supported by a tripod - teaching, research, extension. Research makes possible the other two legs. As one respondent put it, *"nobody is able to teach or overreach society without researching. One can inform, promote crashing short courses, but there is no real education or extension if there is no research"*. On the other hand, respondents find it possible to do research and not to teach or take part in extension activities: *"I imagine, and know it is possible, to do research with any involvement with students"*. However, there is a consensus among the respondents that a researcher should not only produce knowledge, but also educate people to continue researching.

RESEARCH ACTIVITIES: ESSENTIAL ELEMENTS

Respondents expressed the preoccupation that training for research should, as much as possible, conciliate theory and practice: *you got to learn how to research as you actually do it. Research manuals are no use, even if you read it from the first to the last page, if you don't know how to apply all that. Therefore, a researcher got to get himself integrated, become a member of the group, in the laboratory. There, the more experienced will guide the novice, and so forth.* Under this point of view, they attribute importance to the daily contact between the seniors and the novices, believing that scientific culture can not be restricted to written knowledge or publication: *" it is also acquired in classrooms and outside them"*.

Research should be intentional, that is, *"without clear objectives, new relations or knowledge will not be produced"*. Clarity and internal consistency if intentions minimise

"*possibilities to arrive nowhere*". Additionally, research activities have their instruments, such as epistemology, paradigms and laboratories (which could also be understood as contexts conducive to research). Each area rely on its own set of instruments.

When referring to research activities, information is more than just a cognitive instrument. It is a strategic element to specify objectives or identify the space for action. The achievement of the intended objectives "*depends on access to material representative of the main advances that have been made in this direction, be it in terms of methodology or in theory and paradigms.*"

Respondents cited many channels they use for searching information (books, periodicals, proceedings, bibliographies, colleagues, the Internet).

To some respondents, deficiencies in information infrastructure go beyond organisations, involving national macro aspects, such as *the inefficiency of mail services* and *culture that does not favour the development of libraries*. A physicist argued that "*if there was serious concern for science and technology, then ... library stocks would be properly maintained and developed. But since the researcher cannot count on good libraries, he suffers. This deficiency cannot be ignored*".

As for the Internet, it was considered an agile and practical means to contact people, receive information, access electronic versions of print periodicals, get visibility for one's work in progress, complement the library holdings, buy books. However, the Internet "*may substitute for the telephone and conventional mail when discussing concepts, but is no substitute for the library*". The internet was described by one of the respondents as "*a mess fed by all of us*". Another respondent suggested that the Internet tends "*to clog a person with information and clogging with information will not solve the problem because it is difficult to evaluate the importance of each item retrieved.*"

Scientific environment, sufficient number of researchers, people, colleagues to talk to, and research groups were terms mentioned which indicate that research activity is seen as a process involving interaction among people. In the words of one respondent, "*as in any other activity, there should be more than one person doing it*". Isolation breeds insecurity for not providing enough feedback, which is needed for correcting the orientation of research (the game), leaving the researcher without parameters to evaluate errors, findings, the importance or quality of his contribution.

Research activities can not survive without institutional support, for the continuous provision of human and material resources, facilities, financing. There are two instances for institutional support, the organisational (university) and governmental (agencies for the development of research and scientific policies).

Dissemination, interchange, sharing and the socialisation of knowledge are terms that lead to the conceptualisation of publications as channels for the circulation of knowledge. Through the circulation of ideas contained in publications that "*the adding to the body of knowledge of an area*" occurs. Knowledge acquires value when made available to other people, i.e., "*knowledge which is shut up within one person, in one brain only, is lost knowledge. He knows, but knows only to himself. That is very little. It has no value for society, for to have some value, knowledge must bring society benefits, be shared. The greater the number of people who share that knowledge, the more valuable for society it will be.*"

The notion that different communication channel aim at different communities seems to be consolidated among the academics interviewed. As one biologist put it:" *audience depends on*

channel used. The scientific periodical has a scientific audience; the media has the masses as audience. If you publish in the internet, you are offering knowledge for a different public, international."

The process of socialisation of scientific knowledge, therefore, implies in shaping a communication context where channels and languages used are non compatible with the language used by intended users.

The connotation of judgement, criticism, selection and editorial body, are inherent to scientific publications. Under this perspective, scientific publication is like a quality *affidavit*. But publication in the Internet does not imply necessarily evaluation by peers, since *"it is a fast media, acting in another tempo, in a different level of compromise with truth, veracity or truthfulness with fact […] Truthfulness in the Internet may be so just for your imagination, with no need to verify facts, that is why it acts in another tempo. In science, you will have to wait for one or two years - this is the time required for maturation, dedication, suffering"*.

The credibility of a scientific periodical depends on how rigorous is the refereeing process for manuscript selection, which in turn depends on the composition of its editorial board. The choice of members for this board should take into consideration technical and political aspects, as one of the respondents explained:

> *You should start with someone who is respected within the community, otherwise the job gets difficult ... and this person should also have experience. Should be someone who is not going to favour any one, but will consider all submitted papers equally. Members are also chosen for their visibility. If someone has visibility, national and internationally, that is, if he is a well known person, than that is going to be beneficial for the periodical.*

Publications are also seen as a requisite or institutional demand on researchers, for the allocation of resources as well as for supplying the necessary support for research activities. As one respondent put it: *"Publish or perish, because that is what every grant agency demand of us, anywhere. The criteria that is used, based on the number of publications cause this situation and whether we want it or not we have to accept it."*.

For one researcher, his publications were considered as the only way to guarantee that *"his contributions would be noted by his peers."* International publications were compared to *"a big window"* which, if not all, many will have the opportunity to look at what is being shown. The quest for visibility is associated to an *"intellectual vanity"*, to *"a plight for recognition"*. There is a distinction between technical visibility (citation or technical recognition) and social visibility (to get known in the area through contacts established in congresses, talks, notes in the media, meetings and informal occasions). Prestige, authority and recognition among peers are associates to technical visibility. They are the outcome of the necessary interaction for the effective contribution to other researchers' work and for the improvement of ideas.

Publications are means to register knowledge. As on physicist put it: "*there has to be a notary for registering knowledge*". The main periodicals in each area would perform such role, those which are the most prestigious and therefore promote a wide circulation of knowledge. By consulting these periodicals, a researcher would " *be informed of all important things that have been done in his field"*. The concept of publication as public register of knowledge and as means to circulate ideas, has also the connotation of preservation, of legal property and quality. The register would offer a means to circulate knowledge preserving intellectual rights.

RESEARCH ACTIVITIES AND ELECTRONIC PERIODICALS.

Under the point of view of the respondents, electronic periodicals offer a potentially efficient channel to circulate information, "*a huge qualitative jump*" for the speed, diversity and quantity of information which *"soon will be available"*. Concerning library stocks and access provided to literature, they are seen as a mechanism to help overcome limitations imposed by geographical location and institutional budgets.

However, wider access or circulation depends on human action and will only happen if *"people will be interested in making it happen. If someone, somehow, decide to copy and scan a book and make it available in some site. But the problem is, who is willing to do that… to make available a book that is not his? He may be sued, may he not? And even condemned, isn't it? So that is the point"*. Therefore, a better circulation of knowledge is not just a question of technology, but actions of a political nature. To be achieved there should be a convergence of the different interests of all the groups involved in producing scientific publications.

The lack of guarantee of protection of ideas published in the electronic media causes researchers to use it only for "*lesser articles - not the best of their production, because they are afraid that there will be no respect for intellectual property, […] stealing of ideas, of research"*. Electronic periodicals are then not seen as the "*safe notary that keeps the register of knowledge*" for there are no regulations to guarantee intellectual property nor the same level of engagement found in print periodicals: "*people put information there as easily as they take them off"*. To the respondents, the sense of unchangeable permanence that is perceived in print publications is not present in electronic media.

Easy access also depends on cost. If, on one hand, the majority of the respondents consider that Internet reduces costs, on the other hand, they also worry that some day this will change: "*someone owns that thing (*the Internet*) , someday he may want to charge, and who will pay? Who will own knowledge?"*

The observations and remarks made by the respondents on easiness of access, intellectual property and costs reveal a certain fear of a society based on knowledge as a product or commodity. Decisions involving these issues may result in new power structures based on the concentration of information in some centres. The opinions expressed by the respondents reveal a political dimension involved in the availability and control of knowledge and suggests that, according to the interests involved, electronic media may intensify domination by the countries where knowledge and technology are produced over the rest of the world, limiting access to information.

Considering the filtering process that makes scientific periodicals a refined product, the respondents expect electronic periodicals to adopt similar quality control mechanisms. The absence of such mechanisms leave authors without the needed feedback to correct their works' course. The interruption of the mechanism for controlling quality has as consequence the break down of criteria adopted for the identification of an elite of researchers in the field, as well as criteria to guide the allocation of resources. According to Kuhn[14] the absence of an elite is a characteristic of an early stage in the development of a scientific field. The elite would have the responsibility to direct the area. Without such guidance, totality of research does not form a coherent body of knowledge, there is no *common unity* represented by the paradigm which gives cohesion to the scientific production.

If electronic periodicals developed mechanisms for quality control, they would become a *weapon* which could be used either to promote equality among scientists or to exert power over them. Print version of electronic periodicals could then be used to make possible integration of less favoured and geographically isolated centres with no access to electronic media.

Prestige, which is a consequence of technical visibility, is attributed to a researcher by an audience able to make criticism and utilise research results to produce more new knowledge. Electronic media, however, does not have a well defined knowledge, *"you don't know whom you are writing to" or "who is criticising you"*. As one researcher said: *" you are not sure to what extent the public you intend is reached, or if those who want to read your work will find them."* Such lack of information about the audience, according to Peck (1994) makes impossible to legitimise knowledge at the information market level, as well as to gain technical visibility desired by researchers. These opinions suggest a circular relationship among author and reader - the reader's actions are mutually conditioned.

CONCLUSIONS

The study revealed that the appropriation process of electronic periodicals occurs in at least four levels: the individual, the organisation, technology, and the scientific field. In each level, individuals go through different processes which imply the utilisation of different resources and perform different actions aimed at apprehending, adopting, legitimising, democratising, and making technology adaptations. Thus, we have perceived that the most evident characteristic in the appropriation process is its hierarchical character, which allows results obtained in one level to impose limits to action at the other levels.

Another interesting point relates to actions inherent to the nature of technology, which are not restricted to those actions vested with a technological and instrumental rationale. Besides actions of cultural or technological nature, which leads to an instrumental rationale, technology seems to be a product of cultural actions, expressed in structures based on values, (such as habits, beliefs or preferences). These structures are related to social, economic and political aspects present in the context in which those individuals act. It is through deliberate collective actions that technology may be legitimised.

The results pointed out that when interacting with technology, individuals are influenced by different institutional aspects of their work. They based their actions on existing stock of knowledge,

resources and norms to evaluate the technology. As such, electronic are flexible in the sense that they allow more than one interpretation and instrumental use.

Some technology characteristics seem to influence individuals as they evaluate relations between costs and benefits of change. Criteria such as functional trustworthiness, comfort, relevance, functionality, performance, compatibility with the groups' habits, who are those involved in developing and maintenance of technology, supply arguments for each individual's decision to invest time and effort in technology apprehension, for despite costs, there may be well worthy gains. These criteria refer to technical aspects but also to the human and cultural character of technology (habits, values, attitudes, social influences).

Some attributes of produced knowledge seem to exert influence on individual's motivation to engage in actions for changes and structuring the informational field. Quality, target population and the universal quality of knowledge were attributes used to justify structuring action related to electronic periodicals. These attributes, in a way, are related to the intended change.

If, on the one side technology is the product of collective action, on the other, it is an instrument for action based on a dual structure. As an instrument for action, technology affects social structures created to support individual action. In the specific case of electronic periodicals, the aspects affected represent interruptions in the social dynamics involved in scientific knowledge creation, the scientific field power structures and the very identity of the group.

REFERENCES

1 WALSH, John P & BAYMA, Todd (1996). Computer networks and scientific work. *Social Studies of Science*, vol 26(3): 661-703

2 ORLIKOWSKY, Wanda J (1992). The duality of technology: rethinking the concept of technology in organizations. *Organization Science*, vol 3(3): 398 – 427

3 WEICK, Karl E.(1995). *Sensemaking in organizations*. Thousand Oaks/ California: Sage Publications.

4 LATOUR, Bruno (1997). Actor network and after. Workshop. Keynote speech. *On recalling ANT*. Keel University, July, 1997. Home.

5 HARRIS, Stanley G (1994). Organisational culture an individual sensemaking: a schema-based perspective. *Organization Science*, vol 5(3): 592-608.

6 TRIGUEIRO, M.G.S (1987). *Estrutura da prática tecnológica:* a pesquisa e a sociedade agropecuária brasileira. Dissertação de Mestrado. Brasília: Universidade de Brasília.

7 ORLIKOWSKY, op. cit.

8 WEICK, op. cit.

9 MOSCOVICI, S. (1984) The phenomenon of social representations**.** In: ____. *Social*

Representations. Cambridge: Cambridge University Press, 1984.

10 see CIBORRA, Cláudio U. (imported in march/1999). *De profunndis?* Deconstruction of the concept of strategic alignment. Http://www.ifi.uio.no

11 TRIGUEIRO, op.cit

12 as defined by KNOOR-CETINA, K (1982), in Scientific Communities or Transepistemic Arenas of Research? A Critique of Quasi-Economic Model of Science. *Social Studies of Science*, vol. 12(1): 101-130, Feb. 1982 .

13 DAVENPORT, Elisabeth (1993). Risks and rewards and eletronic publishing: a case study of Information Science in the United Kingdom using a qualitative methodology. PhD Dissertation: Univesity of Strathclyde.

14 KUHN, T.S. *A Estrutura das revoluções científicas*. São Paulo, Perspectiva. 1975.