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## **From Control to Networks in Academic Publishing: Introduction of an Open Peer Review International Journal**

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### *Abstract*

*The aim of the article is to discuss alternatives to the traditional peer review system and reconstruct the review praxis to include ideas from Mode 2 and the second generation of web solutions, often called Web 2.0. The article starts by discussing the concept of Research 2.0, which basically propose a gentle marriage between the concepts Mode 2 in the researchosphere and Web 2.0 in the webosphere. The following discussion concerns the concept Open Peer Review. Open Peer Review is a young and still quite open concept, used to describe a general transparency in the review process as well as a complete shift in the ideology of peer review. Our preference goes to the later interpretation. The last section before the conclusion describes International Journal of Feminist Technoscience. The journal is a way of realising our ideas in a working praxis.*

### *Keywords*

*Feminist technoscience, innovation system, open peer review, technoscience, transdisciplinary, web 2.0, webosphere, researchosphere, triple helix, non linear processes, Richard Stallman, Elisabeth Gulbrandsen*

## **Introduction/abstract**

The aim of the article is to discuss alternatives to the traditional peer review system and reconstruct the review praxis to include ideas from Mode 2 and the second generation of web solutions, often called Web 2.0. The article starts by discussing the concept of Research 2.0 which basically proposes a gentle marriage between the concepts Mode 2 in the researchosphere and Web 2.0 in the webosphere. The following discussion concerns the concept Open Peer Review. Open Peer Review is a young and still quite open concept, used to describe a general transparency in the review process as well as a complete shift in the ideology of peer review. Our preference goes to the later interpretation. The last section before the conclusion describes International Journal of Feminist Technoscience. The journal is a way of realising our ideas in a working praxis. <1.>

## **Research 2.0**

In the last century and a half, scientific development has been breathtaking, but the understanding of this progress has dramatically changed. It is characterized by the transition from the culture of "science" to the culture of "research." Science is certainty; research is uncertainty. Science is supposed to be cold, straight, and detached; research is warm, involving, and risky. Science puts an end to the vagaries of human disputes; research creates controversies. Science produces objectivity by escaping as much as possible from the shackles of ideology, passions, and emotions; research feeds on all of those to render objects of inquiry familiar. (Latour, 1998)

In our project of launching an open peer review journal we want to encounter these tendencies in knowledge production. As a starting point we emphasize that we are walking on certain epistemological floors. The floorboards originate from concepts like mode 2<sup>1</sup>, feminist technoscience<sup>2</sup>, innovation systems<sup>3</sup> and triple helix<sup>4</sup>. These concepts indicate that information and knowledge flows within research ought to be altered from control and guarding behaviours to participation and sharing. The development of knowledge production ought to be directed from different kinds of "control rooms" to creation of legitimacy in network construction where collaboration is fostered. <2.>

A number of important and central questions about new challenges related to collaboration must be dealt with when participating in an open system for knowledge production and development of activities. As discussed by Elisabeth Gulbrandsen (2006) the main challenge probably is realising that we are taking part in *non-linear processes*. 'Innovation system' was one of the first concepts put forward as an interactive alternative to the linear model. The term is in widespread use in the Nordic countries. Finland is usually held up as the paradigmatic case because of its use of the term 'national innovation system' (NIS). Reijo Miettinen's analysis of how views on the NIS have developed in Finland can also be called paradigmatic because of his focus on the role of the NIS as a mobilising metaphor. Miettinen talks about a double development in that it has become a scientific term and a political term (Miettinen 2002). He introduces and develops: "...an epistemology of transdiscursive terms that are simultaneously and interactively used both by scientific communities and in policymaking". We believe that this is a perspective that can provide us with better tools to process changes in the relationship between research and society or science and politics, to produce more substantial, complex and integrated understandings and images of this relationship. <3.>

Miettinen argues persuasively for a more modest way of relating by emphasising reflexivity, learning processes and contextual knowledge production. This is an echo of Haraway's situated

knowledges and Jasanoff's technologies of humility. Rather than seeking mastery and control, we should focus on collaboration with ambitions of developing modulations in the diminishing gap between variation and selection or between support and control (Rip 2002). Situated knowledge is a cornerstone concept in feminist technoscience studies (Haraway 1988, 1997). The significance of the local, the situated, is also expressed by Reijo Miettinen (2002) in the following: "... innovation is about adapting to changing circumstances and making new things in new ways. New ways to do things always emerge locally". <4.>

Sheila Jasanoff comments on the spread of co-evolution and interactive models (Jasanoff 2003). Co-evolution of science and society has led to a greater degree of complexity, unpredictability and irregularity in both spheres. Jasanoff broadens the discussion further by claiming a need to develop a set of technologies of humility in order to be able to assess the unknown, unspecific and uncontrollable, the ambiguous and uncertain aspects of the development of science and technology. Technologies of humility require different capacities and forms of engagement between researchers, experts, political decision-makers and the general public, differentiating them from the regulating, predicative 'technologies of hubris'. Jasanoff is not alone in addressing questions of complexity and uncertainty in relation to science and political decisions. In some extremely interesting and rather provocative suggestions, Brian Wynne (2003) and Jerry Ravetz (2000) have recently placed the partial ignorance of science at the heart of the discussion about how we should understand, differentiate, express and communicate complexity and uncertainty. All in all, we believe that 'situated knowledges' and 'technologies of humility' cast light on some of the central preconditions for effective and innovative knowledge production and its diffusion processes. <5.>

Coming closer to the core issues of this paper, namely preferred practices of knowledge and information flow, Richard Stallman in 1990 said "I believe that all generally useful information should be free. By 'free' we are not referring to price, but rather to the freedom to copy the information and to adapt it to one's own uses" (Denning, 1990). Stallman's statement is a more balanced version of Stewart Brand's poetic words "Information wants to be free" from 1984 (Clark, 1999). It is self-evident that all information cannot be free. Stewart Brand's poetic words might be true, if information would be counted as organisms with free will. We suppose every entity with free will wants to be free. The problem here is how we categorize and group things. Is it really possible to create a group called information and give it a common set of properties? We do not think so. Commercial information cannot be free in every sense of the word. It would, for example, not exist, if all information the company is housing would be free – at least not in a substantial form. It is also a fact that Amazon.com<sup>5</sup> probably would not be the icon, as it truly is, if they did not understand the poetry of Stewart Brand's words. It is a truism that collective intelligence would not work, if we had to pay for it. The rise and fall of Web companies will to a great deal depend on their ability to create a balance between commercial and free information. Free information is an asset for all commercial organizations and an absolute must for some of them. In the future a substantial part of this free information will be about user participation. <6.>

There are some forms of information corresponding especially well with Stewart Brand's and Richard Stallman's word – academic information. With academic information and knowledge, we mean information and knowledge produced in research by government financed resources. To this category we count most information and knowledge produced by universities and other forms of higher education institutions. We do not count information and knowledge produced by private companies. The form of information and knowledge produced by companies such as Microsoft and Sony belongs to another discussion. <7.>

Before the digital era, before Web 1.0, publishing companies had a substantial role since those kinds of resources were needed to select, distribute and spread information about the information created in research institutions around the world. In the Web 1.0 era there has been a growing resistance against the very nature of research publishing companies. Most of these voices are based on the notion that “information wants to be free”. Many universities have built their own publishing environments. The reason is not only because they want the information to be free. It is because they have realised that the business model in the academic publishing industry is out of date. A university produces large amounts of high quality information and knowledge and much of that information and knowledge is collected by publishing companies, printed on paper and/or locked in expensive digital suites and sold back to the university in the form of very expensive Journals and database subscriptions. The only reason this business model still works is because the academic norm is very conservative. The model is strongly linked to academic quality and ranking system. We do not think most researchers are so conservative though. The conservation mechanism mostly lies with the research funding and career system in the academic society. That system is still extensively focused on how many articles or books a certain researcher has published in a defined set of well known academic journals or by academic publishers. <8.>

The first point to make for a research 2.0 concept would be to free the academic information and knowledge from commercial slavery - if you publish an article in a journal, or likewise, always keep the right of reasonable usage, like a creative common license. In a connected research environment, we cannot make valuable information invisible. <9.>

### **Open Peer Review**

What is the nature of intellectual work in the peer review process? Reviewing a submission involves drawing on certain criteria (e.g. theoretical content; empirical content; presentation quality; appropriateness for the publication) to evaluate the quality of reasoning and evidence provided, to probe for weaknesses, acknowledge strengths, and question background assumptions. In effect, reviewing is an argumentative process where reviewers are engaging in an imaginary debate with distant authors who are not present to respond to their analysis. This paper-based review model has shortcomings in questions go unanswered; confusions go unclarified; criticisms go undefended. The dynamic cut-and-thrust of debate normally found in face-to-face contexts such as workshops or conferences is not supported by the paper-based review processes, nor is it yet being realised in the new electronic media.

We are currently rethinking the review process to use new technologies in order to recapture the best features of a dynamic scholarly debate. This rethinking is guided by existing research into hypertext-based, computer-supported collaborative argumentation. Argumentation research is concerned with developing notations and tools to facilitate public debate and negotiation. (Sumner, 1996)

The text above was written 1996 by Tamara Sumner and Simon Buckingham Shum of the Knowledge Media Institute of the Open University. If we would try to analyse the Open Peer Review discourse, the result would not be so flattering for the academic society (from our viewpoint). A search on the Internet for sources of “open peer review” articles resulted in the fact that the open peer review discourse seemed to have had its peak around 1996. Since then Open Peer Review has had a steady stream of voices, such as João Pedro de Magalhães (2004) and Richard Smith (1999). <10.>

The problems with the traditional peer review system are linked to the question of how authority is created and distributed. This question is raised by Elisabeth Gulbrandsen, Albert

Nsengiyumva, Birgitta Rydhagen and Lena Trojer in *ICT, innovation systems and the role of universities in societal development - a (post)colonial strain?* (Gulbrandsen et al., 2004):

One important aspect of informal knowledge is the notion of authority or lack of authority in a text. The ability to recognize such authority is hard to make explicit and thus difficult to achieve. "Very few scientists can answer questions about why certain texts give an impression of 'competence' while other texts don't" (op. cit., p. 25, my translation). Gerholm and Gerholm describe this ability as a feeling for how authority is created in a text or a lecture, for what counts as an argument, for the common attitude towards the surrounding world and for the personal style accepted by colleagues. What we want to leave behind as outdated conceptual models may live on as cultural frameworks, showing itself spontaneously in practice as a "theory-in-use".

This is not a call for any old or new liberalism, but we think Wendy Hollway makes a point by stating that: "Science as we know it could only become dominant because it was preferred" (Hollway, 1989, p. 11). <11.>

This text questions the idea of formal authority as valid judge for knowledge claims. In the Open Peer Review discourse, the word *open* is a key word, but open can, and does, mean different things. Most often it means *transparent* as opposed to *hidden or closed*: "The primary argument against closed peer review is that it seems wrong for somebody making an important judgment on the work of others to do so in secret. A court with an unidentified judge makes us think immediately of totalitarian states and the world of Franz Kafka" (Smith, 1999). As Magalhães says "Anonymity is based on the principle that anonymous reviewers will be more honest and objective. For example, open peer review may hinder junior scientists from rejecting works by more senior colleagues. This cowardly behaviour is nearly exclusive of science. In the arts and even in politics criticism is open and serves an important role in making ideas stronger" (2004). Most voices in the Open Peer Review discourse want to have a transparent peer review process. Starting from a Web 2.0 perspective, *open* should mean Open in the words every sense. The peer review process should not only be transparent, it should also be open for participation. <12.>

Why willingly create borders at all in the review process? For a transdisciplinary mind, this is really hard to understand. In more closed and highly specialised disciplines, such as medicine or physics, the walls are kept to keep the ignorant people out. We all know these explicit walls are unnecessary, because most of us ignorant people would never think of the idea of making a contribution to the discussion, since we know we are ignorant, and we would not want it to be otherwise. But the walls also stop possible critique regarding research methods. <13.>

Open Peer Review in the spirit of Web 2.0 would mean complete openness in the research process. No researcher has to be hesitant of "The cult of the amateur" in the researchosphere. In 9 cases of 10, the amateur does not have the right words to understand a research discourse and even less to make a contribution. When an amateur raises his or her voice it is most often wise words worthy of attention. We are fools if we do not take them / us seriously, and still more fools if we try to stop them / us from entering the conversation. We are all amateurs when it comes to most issues, and we are all experts when it comes to some issues. <14.>

An Open Peer Review research facility could be realised in many different ways. We are going to sketch a Web 2.0 inspired publishing environment for the transdisciplinary field of Technoscience Studies. <15.>

The website would of course be developed on top of an open source environment. The interface would preferably be ajaxian lightweight with instant responses when a link or button is clicked. Anyone could join this community. You would not have to join just to read texts, only to write, but the point is that the communication would be bidirectional so hopefully most of the users

would register with the community. The community would have to be open for reading so the search engines could index the site. Your identifier in this community would be your real name, not an avatar or something like that. Your identity is connected to an “about-page”, where you are requested to write about your context. This context is very important, since the context is integrated in everything you write, both your own texts and your comments of other texts. <16.>

Everyone has the same right to write articles and comment on other participant’s texts. Both writing texts and making comments are viewed as valuable kinds of participation. An important fact is that commenting on other author’s texts has the same potential value as writing your own. The Web of comments in which a user has participated should be collected by the system and displayed in the same obvious way as the articles of the person in question. The network of a person’s articles and comments is a person’s Web of participation. <17.>

Every participated item can be valued by everyone. In practice, this evaluation might be realised by putting an evaluation box in connection to all articles and comments. In this box you could give a quick response to the text, and also see an aggregated view of how other readers have evaluated this article or comment. <18.>

With all this user participation the CI machine<sup>6</sup> could be created to do several interesting tasks. You could, for example, let the CI machine work out the most useful users and mark their name with an icon separating them from the others. This kind of hierarchy creation would simulate how hierarchies are created in real academic situations – in the best of all worlds. In real academic life it is not only the value of your texts that places you in the hierarchy. It could for example be more difficult to gain recognition if you are a woman (Wennerås and Wold, 1995 & 1997), or belonging to some kind of minority. It is also an advantage if you know people in strategic positions. Open peer review and collective intelligence could create a more text related hierarchy – research democracy. Open Peer Review is the obvious review system for research 2.0, and for future development of research communication. <19.>

The Open Peer Review system we have sketched out very briefly above relies heavily on the kind of hybrid intelligence called collective intelligence. Researchers have always communicated at seminars, conferences and staff meetings, and technology has been involved for a long time now. Technology mediated conversations have been extensive with tools such as phone, email and Usenet. Technology mediated Collective Intelligence is hybrid intelligence. The CI machine and all the voices create the intelligence together. Most research environments would probably gain by moving some of the interaction to the Web - such as in the form we sketched above. It is important, though, that the design of the CI machine includes other researchers than hard core mathematicians and programmers, such as psychologists and gender researchers. <20.>

Thinking about the Web as a native environment for research will lead to more information within reach for the CI machines. Let us say, for example, that you prepare a PowerPoint presentation for a lecture series. You probably want your students to be able to download the presentation instead of splitting their attention by writing notes. Perhaps you do not want to “publish” your presentation for a wider audience. Perhaps you do not think your presentation is good enough to be published. This line of thinking belongs to the time before the Web. We have to move away from thinking about research texts as “paper sheets with thousands of well grounded and thoroughly researched thoughts”. Publishing is everything from making a bookmark in Delicious to commenting on a blog article to writing long articles or books. That insight is the heart of thinking about the web as platform for every kind of publishing and participation, including academic. <21.>

Journals published only in paper format do not belong to this time. Academic knowledge in this time wants to be found and integrated. This time belongs to search engines, CI machines and researchers with an urge to participate. Google Book Search has shown that it is possible to gain a semi transparent view of commercial information (you can perform full text searches of books even though they are not accessible for reading in their complete form). A problem in the academic sphere is that the act of searching in itself is commercial and it is (partly) the companies hosting the information that perform the search. Their business model focuses on finding and getting the information as a package. <22.>

### **IJFT - a situated open peer review**

Our research interests and practices approached a point, where we felt it necessary to go from theory, reflection and frustration to practice. We started a parallel process of developing knowledge as well as content and technically develop a web-based open peer review journal. We were benchmarking our initiative with initiatives in young generation new media and with a colleague from Hamburg, who later were included in the development work. The journal aims to realise the publishing environment sketched above. <23.>

International Journal of Feminist Technoscience (IJFT) is a forum for articles in the area of Feminist Technoscience as well as general Technoscience. The exceptional added value for this journal is its Open Peer Review Process. The journal is attractive to researchers, who want to

- be published within a future oriented theme as of IJFT
- go in dialogue with the international research community in a much faster way than what is the case when publishing in traditional, closed peer review journals
- use this journal for bringing her / his manuscript from draft to final version by the help of the open peer review process
- publish both / either in this journal and/or some other journal or book. The authors are free to publish their manuscript anywhere after using the facilities of IJFT. <24.>

This journal has two missions.

#### **Mission 1:**

Open Access and Open Peer Review for research publication is an intervention into present knowledge production in order to secure

- Quality
- Relevance
- Efficiency
- Democracy <25.>

#### **Mission 2:**

Feminist technoscience and Technoscience in general are dynamic and reality producing fields of knowledges, technologies and politics. A vibrant and continuous dialogue between actors in these fields can be fostered by the offers of this journal. <26.>

The publishing environment is built on top of a publishing system called Wordpress. Wordpress is one of the biggest publishing systems in the world, counting users and developers. It is open source and licensed under GPL [7]. Even though Wordpress is widely recognized as a blog environment, it is highly customizable and can easily be reconstructed to function as an open peer review environment. <27.>

There are three steps in the publishing process. An article is sent to us attached in an email and:

1. We perform a very basic selection to decide, if the article follow the basic idea of IJFT and our guide lines.
2. We publish the article in the review process.
3. We might include the article in an issue. Every issue is based on a certain theme. <28.>

#### 1. The basic selection

Since International Journal of Feminist Technoscience is a conceptual publishing forum we obviously do not accept any type of article, but our aim is to be as open as possible. If we reject an article we have judged it to fall outside the journals area of interest. The basic selection process is the process that renders the journals core of identity. <29.>

#### 2. The review process

When an article is placed in the review process, it is considered to be published under review in IJFT. Our role here is not only to take part in the review process but also to work actively to get other researchers to participate. The author might withdraw the article from the review process at any time. This is important since the review process is viewed as an agora for "work in progress", a place for discussion. When the article is considered "finished" by the author, we just remove it from the review process. After the review process the article can either be published in an issue in IJFT or elsewhere. IJFT does not have any owner right to the articles in the review process. <30.>

The structure of the article post is the same as a blog post. This means that no one can make changes directly in the document. All review comments are appended after the main post. Article posts contain the article reference with basic information as title, author and abstract. The article is attached in a PDF file. The review comments are thus appended to the article reference post, which means comments either regard the whole article or a quoted part of the article. In a later version of the journal we might integrate a wiki system, which means it will be easier to comment directly in the article itself. <31.>

#### 3. Issues

The editorial staff use the articles in the review process to get thematic ideas for an Issue. Issues represent the periodic feature making IJFT a journal and not just some kind of review community. The issuing interval depends on the number of articles active in the review process. <32.>

#### Subscription

It is possible to subscribe to rss feeds for articles in the review process as well as issues. Articles in the review process generate a feed for both new articles and new review comments. It is also possible to subscribe to review comments for separate articles. <33.>

#### Conclusion

“Like Jacques Derrida, Luce Irigaray, Lyotard, and others, Haraway calls for a conception of writing (“cyborg writing,” in her terms) that resists authoritative, phallogocentric writing practices, that foregrounds the writer’s own situatedness in history and in his or her writing practice, and that makes visible the very “apparatus of the production of authority” that all writers tend to submerge in their discourse. This is not to say that writers must “eschew” authority, but that in a truly ethical and postmodern stance they must reveal how authority is

implicated in discourse." (Olson, 1996). Writing has been the main point of this paper and particularly writing in a manner that tries to avoid some of the negative consequences of closed, authoritative systems. The scientific paradigm we contextualise ourselves in is going from a sense of certainty, to a sense of instability. More and more of us is beginning to disbelieve the authoritative transfigurations in conservative research politics. The traditional peer review system is counterproductive in a time where complex information systems have become the nerve of society. <34.>

We are launching a system which is more credible in times where institutional walls is transfigured into innovation systems in a triple helix society. In IJFT, ideas can co-evolve between researchers and between researchers and other participants. Open Peer Review in the shape we laid out above was difficult until recently. The rise of Internet and especially the communicative web of participation, often called web 2.0, has laid out a path for change. Inexpensive, lightweight systems is ours to use, if we can get the research politics right. Of course, since IJFT is just to be launched, we cannot be *certain* it will work as expected. An open peer review system is more vulnerable than a peer review system since it is more contextualised, more dependent on participation. A traditional peer review system is an economic institution. If there is money, there are those, who are willing to participate. An open peer review system built on co-evolution and mutual interest strategies rises and falls with the will to participate. <35.>

## Notes

1. In the *New Production of Knowledge* (1994), Michael Gibbons et al. created the concept mode-2 to describe a change in the research society. Mode-2 is not to replace mode-1 (traditional research). Mode-2 is different in most aspects. Problems are not set within a disciplinary framework, but operate in the context of application. It is transdisciplinary rather than mono- or multi-disciplinary, and carried out in non-hierarchical, transient, heterogeneously forms. Mode-2 is not carried out primarily within university structures. It involves close interaction of many actors, which means that knowledge production is becoming distributed and more socially accountable. In *The Potential of Transdisciplinarity* Helga Nowotny place transdisciplinarity in the context of mode-2 (2003). She identifies an array of attributes for mode 2, of which transdisciplinarity as a key actor:

"The third attribute of Mode-2 is transdisciplinarity. If we had intended to use the term 'multi-disciplinarity or pluri-disciplinarity, we would have done so. Rather, we have chosen transdisciplinarity for a reason. What we were trying to convey by the notion of transdisciplinarity is that, in Mode-2, a forum or platform is generated and it provides a distinctive focus for intellectual endeavour, and it may be quite different from the traditional disciplinary structure. In a Mode-1 system, the focus of intellectual endeavour, the source of the intellectually challenging problems, arises largely within disciplines. This may still go on, but other frameworks of intellectual activity are emerging which may not always be reducible to elements of the disciplinary structure. Rather, it is in the context of application that new lines of intellectual endeavour emerge and develop, so that one set of conversations and instrumentation in the context of application leads to another, and another, again and again."(Nowotny, 2003) <36.>

2. Within international feminist research strongly linked to the dominant technical fields of our era: information technology, biotechnology and material technology, there is a widespread understanding of the production of knowledge and technology as processes that take place in complex and distributed systems. In other words, in this late modern time knowledge is

generated in overlapping contexts of universities, companies and other regional, national and international actors. The term technoscience connotes this understanding of the production of knowledge and technology. The way in which technoscience is defined by internationally leading feminist researchers such as Donna Haraway raises interesting questions about transgression of boundaries between science, technology, politics and society, and between humans and non-humans, the processes of hybridisation between people and machines (cyborg theories), etc. <37.>

3. An innovation system is the flow of technology and information among people, enterprises and institutions, which is a key to an innovative process. It contains the interaction between the actors who are needed in order to turn an idea into a process, product or service on the market. According to innovation system theory, innovation and technology development are results of a complex set of relationships among actors in the system, which includes enterprises, universities and research institutes. <38.>

The concept of a 'system of innovation' was introduced by Lundvall in 1985. Freeman coined the expression "National Innovation System" in his 1988 study of the success of the Japanese economy. The concept was later applied to regions and sectors. There is no consensus on the exact definition of an innovation system, and the concept is still emerging. Innovation is often the result of the interaction among an ecology of actors, and the term 'innovation ecosystem' is occasionally used to emphasize this. For some, the expression 'innovation ecosystem' is a subset or synonym of 'innovation system'. Others separate between the expressions, using the expression "innovation system" for labelling a planned innovation environment, and "innovation ecosystem" for an ecological innovation environment. <39.>

Lundvall B.-Å. (1985) 'Product innovation and user-producer interaction, industrial development', Research Series 31, Aalborg: Aalborg University Press.

Freeman, C. (1988) 'Japan: A new national innovation system?', in G. Dosi, C. Freeman, R. R. Nelson, G. Silverberg and L. Soete (eds.) *Technology and economy theory*, London: Pinter. (Wikipedia, the free encyclopedia, 2006)

John de la Mothe (2003) emphasizes that innovation and innovation policy are to be seen as not simply bodies of practice but also as bodies or cultures of understanding the nature of learning, evaluating and selecting. This understanding gets increasingly complex and it is undesirable to approach complexity with a centralized mind-set, when systems require the capacity to adapt. One impact of these arguments stresses the innovation policy and organizational learning to be understood as a co-evolutionary process. That process certainly involves organisations like universities, its ability to transform into societal relevant role(s). <40.>

4. Uhlin and Johansen (2001) states that "three institutional spheres (university, industry and government) formerly operated at arms' length now are increasingly working together, with a spiral pattern of linkages emerging at various stages of the innovation process, to form a 'triple helix'. The complexity of the reality that the Triple Helix model indicates is envisaged by four dimensions in which these linkages are said to emerge in innovation processes. First, there are internal transformations in each of the helices, e.g. universities more and more (are forced to) behave in an entrepreneurial way in order to finance education and research. Second, each one of the helices influences the others, e.g. university industry strategic alliances. Third, there are "spin-off s" of trilateral networks and organisations from the interactions among the three helices in order, for instance, to promote local and regional development. Fourth, there is a recursive effect on these exchanges among institutional spheres, both on the spirals from which they

emerge and on the wider society. Etzkowitz and Leydesdorff (1997) summarise this spiral-like mode of knowledge production by saying that "knowledge is no longer transferred, but co-developed" (Uhlin and Johansen, 2001, p. 15). <41.>

5. Amazon.com is the worlds largest web book store, <http://www.amazon.com> <42.>

6. The algorithmic process of Collective Intelligence. <43.>

7. General Public Licence. <http://www.gnu.org/copyleft/gpl.html> <44.>

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