Sustainability Science and the University: Towards Interdisciplinarity

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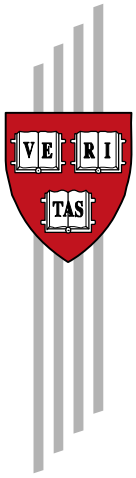

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Abstract

Interdisciplinarity plays a major role in the debate about the crisis and the future of the University. If the 20th century can be identified as an era of specialization in Academia, there is a tendency now to add interdisciplinary spaces to the traditional disciplinary organization of research and training. Non-academic research institutions are showing more flexibility than universities to respond to problem-oriented demands. This article analyzes the present situation in which a rigid disciplinary academic framework prevails and discusses its limitations in facing complex demands, such as sustainable development. Examples from the Brazilian graduate programs in Environmental Sciences are presented to describe some institutional pathologies that usually affect the attempts to achieve interdisciplinarity. Among the main conclusions are the need to more interaction between universities and non-academic research institutions, and to integrate rather than oppose disciplinarity and interdisciplinarity.

Keywords: sustainability, interdisciplinarity, university, science metrics, environment

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The Sustainability Science Program at Harvard's Center for International Development seeks to advance basic understanding of the dynamics of human-environment systems; to facilitate the design, implementation, and evaluation of practical interventions that promote sustainability in particular places and contexts; and to improve linkages between relevant research and innovation communities on the one hand, and relevant policy and management communities on the other. See http://www.cid.harvard.edu/sustsci.

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1 Introduction

Environmental degradation and its impacts on life support systems are among the great challenges mankind has to face. Our creativity and the development of knowledge led us to a paradoxical situation: we are capable of causing major changes to life (such as health conditions), but we are suffering the consequences of our material and existential progress. The more we advance, the more it seems we need to find solutions to the effects of our advancement. The university, as a source of knowledge, plays an important role in this process, as part of the problem, but also as part of the solution. New paths to tackle grand and complex environmental problems are presently being built in different academic institutions. This means rethinking their structure and promoting changes that inevitably cause reactions in their consolidated power structure.

Some important landmarks indicate the relevance of environmental issues and its relation with the need for sustainable development (SD): 35 years since Stockholm's UN Conference on the Human Environment, 20 years since Brundtland's Report introducing the concept of SD, 15 years since Rio's UN Conference on Environment and Development, and 5 years since Johannesburg's Rio+5 UN Conference.

The first experiences in environmental studies programs in universities (both by introducing its issues as disciplines in traditional courses and by creating new interdisciplinary programs—IPs) are now consolidated (Soule and Press 1998; Bursztyn 2007). They have in common the contradictory situation of achieving more legitimacy outside the universities than inside them. A new debate is now on the academic agenda: instead of operating just as a melting pot of disciplines, Sustainability tends to claim a status of a science in itself (Clark and Dickson 2003; Clark 2007). As this does not mean becoming a discipline, but rather an interdisciplinary field, the issue is still far from being understood or accepted.

As an institution, the University has evolved and changed substantially its profile. But since the student rebellions of 1968 and the reforms that it inspired (both opening and creating defenses), very little has changed.

In many countries, under various institutional conditions, there is now a movement toward adapting the University to the new challenges of the world (Lubchenco 1998). A crisis of legitimacy is shaking self-confidence about the certainty of the provision of public funds to universities (Delanty 2002). Unless some changes are made, the gap between the demands of societies for solutions and the low capacity of the University to provide them will increase. In the meantime, part of the research usually conducted by universities is being conducted in non-academic institutions. The latter, unlike the University, are showing themselves to be more flexible and rapidly adaptable to new and complex demands. By being problem-oriented, by definition, and for not having rigid segmented structures, non-academic laboratories and research institutes usually operate through task forces, whose members, once the goal is matched, are redeployed in other projects. By mobilizing non-perennial structures instead of consolidating a rigid departmental structure, non-academic institutions are proving to be more responsive to address new complex scientific and technological demands (NAS 2004).

Environmental issues, such as global warming and the degradation of life support systems, are just part of the challenges that the University has to face. In common with other challenged they entail the debate about the need for interdisciplinary approaches and for building bridges that link the University's fragmented structure (Max-Neef 2005).

This article analyzes the recent process of the creation of formal IPs aiming at sustainability as a scientific field in itself. The main idea explored is that although it is not an odd attempt—as interdisciplinary experiences were successfully implemented in the last four decades—the institutional culture of the universities still reacts against such arrangements. The position advocated here is that interdisciplinarity is complementary to—rather than competitive with—disciplinary approaches.

After the introduction, the second section presents elements of a theoretical and epistemological approach to support the discussion, pointing out that unless the University adapts itself to the new complex demands, it will not be able to address all problems of modern society. The third section calls the attention to the experience of the last four decades, when numerous IPs were created. Understanding these experiences is crucial, as they are rich and pioneering cases of adaptation to emerging complex demands made to the University. Section four is based on empirical perceptions of the difficulties faced by interdisciplinary academic initiatives in achieving legitimacy within the University. The Brazilian experience in institutionalizing graduate programs by integrating various disciplinary approaches to sustainability is then analyzed to illustrate the pitfalls faced by such initiatives. Some pathologies that affect these programs are presented to illustrate misunderstandings that are common to other attempts, worldwide. Section five contains a warning about reaching a banal consensus about sustainability as a politically correct issue, a development that attracts *discursive free riders*. The need for an alternative model to build bridges for integrating pieces of the puzzle-game of Sustainability Science (SS) in the University is discussed in section six. As a contribution to the solution of such a challenge, a new institutional framework is proposed—the Star Model—to integrate the disciplinary foci to the growing need for interdisciplinary approaches. Finally, in presenting sustainability as a science, its singularities are recalled in section seven in order to discard the image of a shallow field.

Among other conclusions the article sustains that interdisciplinarity is not to be considered as anti-disciplinary, but rather the contrary: it is an effort to integrate disciplinary approaches. Lessons from other types of organization, such as research institutions, are evoked as alternatives to be considered in order to adapt the University to the challenges of complex demands. Mobility of faculty, scholars, and practitioners, both within the University and from academic programs to non-academic research institutions, industries, governmental agencies, and NGOs, and vice versa, is presented as a key issue that can bring fruitful results to all.

2 Interdisciplinarity—updating an old debate

Interdisciplinarity plays a major role in the debate about the crisis and the future of the University. Although it is not a new issue, it is highly relevant for the present. In the past, trying to find references about the need to integrate different sciences would be going back to the origins of the organization of knowledge, much before the birth of the University. Specialization shaped the academic world over the last century, producing a formidable array of disciplines (Max-Neef 2005) in a growing number of isolated and self-centered fields. This process has been backed by the proliferation of specialized journals and reviews and also by the institutional structure set up

for the accreditation, evaluation, and funding of research projects and courses. In such an environment, interdisciplinarity appears as a claim to integrate parts that seem to evolve away from each other in an irreconcilable way.

Referring to William Whewell's (1840) classic statement, Wilson (1998, 8) evokes the concept of "consilience" as a way to aggregate and/or integrate knowledge, by linking facts and theories related to facts as developed in disciplines, to produce a common base of explanation.

Some intersections of disciplines have emerged as required instruments for the solution of recent interrogations, as is the case of bioethics. This new field is a consequence of the evolution of life sciences (particularly genetic engineering) and of the epistemological and ethical questions raised by scientists from different fields.

The fact that we have reached a threshold in terms of the possibilities of modifying and creating new life forms renews Bronowski's (1972 and 1978) disenchantment and alert about the implications of the human capacity to destroy the Earth, expressed after the bombing of Hiroshima and Nagasaki.[1] The debate about the risks of a planetary cataclysm as a consequence of human actions was an important issue in scientific forums in the 1970s, after the oil crises, the spread of nuclear energy, and the rise of the "environmental question." The implications of the advancement of techniques on life systems is also a core concern that led to the formulation of the precautionary principle, an ethical and philosophical concern that owes much to Jonas' (1984) responsibility principle (Bartholo et al. 2000).

Alerts were also included in the writings of the "rebel authors" who reacted against the lifestyle that emerged from industrialism, particularly in the three decades of the virtuous economic cycle that followed World War II. Consumerism, waste of energy and raw materials, social exclusion of growing numbers of people worldwide, environmental degradation, the need to destroy capital—via wars—as a condition for economic growth, and the increasing obsolescence of knowledge, techniques, and goods, among other aspects, caused a wave of reactions against the role and the dynamics of the evolution of techno-science. One of these rebels, Illich (1976), called attention to the uselessness of accumulating unnecessary knowledge by means of formal education and to the importance of knowledge that is not taught in schools.

Evoking what he called Buddhist economy, Schumacher (1974) addressed his analysis to the fact that science and technology (S&T) was following a track in which humanity was adopting increasingly complex solutions to problems that were often simple, and, in doing so, traditional knowledge could be lost. The University's environment was the arena for this kind of debate during the 1970s and part of the 1980s. The concept of *appropriate technology* became an issue that seduced researchers from different fields. The notion of *ecodevelopment* was a result both of this process and of the major United Nations Conference on the Human Environment, held in Stockholm in 1972 (Sachs 1980).

Edgar Morin made an important contribution to the debate about interdisciplinarity, by presenting his view of *complexity*.[2] His prolific academic production, particularly the series *The*

[1] Jacob Bronowski was a member of the Manhattan Project. He visited Nagasaki in 1945, shortly after the bombing, and was shocked by its effects. He then became a critic of the nuclear bomb and wrote several books about the ethical limits of science.

[2] Complexity is understood here not as just difficulty, but rather ideology, politics, and science (Morin 1980 and 2004) in his attempt to integrate it an epistemological innovation.

Method, seeks to launch new epistemological bases so that science can restore its capacity to deal with complex problems, in an integrated manner, by promoting a dialogue among disciplines (Morin 2000). Such a process should be preceded by a reform in the educational system.

Although many rebel or reformist authors came from the humanities, the debate was not restricted to their fields of science. As mentioned, important ingredients of this debate were produced in the realms of the exact, life, and natural sciences.

In his analysis about the contributions of selected Anglo-Saxon scientists to the environmental sciences, Drummond (2004) identifies in them a concern about the need to caution about the limits of segmented views.[3] The current stigmatization of these authors as biocentrical by social scientists is refuted by the author. Examining the points of view of those scientists, the study reaches the conclusion that there is much from each discipline to be learned and adopted by other fields of science.

From the perspective of evolutionary biology, Wilson (1998) identifies the limits of disciplinary approaches. The image of a totality with some points that appear clearly and are surrounded by blank spaces is used to demonstrate how each of the known subjects cannot perceive the others. His notion of *consilience* focuses on these spaces (*gap analysis*). Wilson lists some of the blanks with more potential to be explored nowadays: physics, the reconstruction of living cells, the organization of ecosystems, the co-evolution of genes and culture, the physical bases of the mind, and the deep origins of ethics and religion.

Wilson presents his idea of *consilience* with caution, as he considers the crossing of the blank spaces as risky and adventurous as was Magellan's trip around the globe. According to the author, several decades will be required to prove which of the two alternatives will be the right one: the circumnavigation of the gaps that separate disciplines or the infinite sea. The epistemological formula predicted by Wilson is clearly biocentrical, with the biological sciences occupying a core position in what he calls "material existence." This is relevant, as it comes from an important life scientist, but it does not help us think in terms of what should be the institutional design of the University in the 21st century. Nonetheless, it serves as an antidote to finalistic theses such as Fukuyama's (1992) *end of history*, Rifkin's (1995) *end of work* and Horgan's (1986) *end of science*. We still have much to learn!

The lesson is that if, on the one hand, we still have much to learn, on the other, we have to learn how to learn. Wilson's analysis can help (re)organize life sciences, with biology in the center. But the challenge for the University is much broader and demands other centralities. This is a matter that deserves careful consideration.

3 We are not reinventing the wheel

Interdisciplinarity in the University is not an issue raised originally by the debate about environmental issues. In fact, despite the overall tendency towards specialization, some important experiences deserve to be mentioned as innovators of the institutional arrangements that provide room for the convergence of different disciplines (Katz 2001).

[3] The study focuses the contributions of seven authors that became references as discoverers or formulators of some of the great environmental issues over the last 70 years: Paul Sears, Aldo Leopold, Rachel Carson, Paul Ehrlich, Donella Meadows, Garrett Hardin, and James Lovelock.

Looking back to the second half of the 20th century, a series of new demands contributed to the shaping of alternative forms of organization within the University. Although not aiming to replace the disciplinary structure materialized in departments, subjects such as planning studies, development studies, urban and regional studies (Bursztyn 2007),[4] energy studies, feminist studies (Friedman 1998), and environmental studies (Soule and Press 1998) started to be focused by multidisciplinary centers. In common, these subjects have a problem-oriented identity and a dependency upon various disciplinary fields. For this reason, they are all "studies," not claiming the status of specific sciences. They all found their ways to acquire legitimacy and are mostly deemed to be necessary and respected in the academic world.

The case of environmental studies deserves to be considered apart from the others. Its emergence as an academic issue in the late 1960s is related to two tendencies: on the one hand, environmental challenges became crystal clear as a societal concern; on the other, different disciplinary views started to call attention to ecological imbalances. Neo-Malthusian alerts and studies arguing about the limits of the industrial paradigm played an important role at that time. This process led to a double movement in the University: the "environmentalization" of disciplines and the "interdisciplinarization" of the environment as a subject. In institutional terms, each one of these movements demands specific arrangements with different levels of complexity.

The first case—the "environmentalization" of disciplines—does not demand any change in the departmental organization of the University. It is, in fact, just an adaptation of the disciplinary approach by means of the introduction of new subjects of research and, in some cases, new contents into the existing courses (Bird 2001). The green wave of the 1990s influenced disciplines, entailing the rise of sub-areas such as: environmental law, environmental economics, environmental engineering, environmental history, environmental education, environmental chemistry, and agro-ecology.

The second case—the "interdisciplinarization" of the environment as a subject—consisted of the creation of new IPs. Although in some cases those experiences were mostly based on research conducted by people from several departments, there was a tendency to create specific graduate courses. As an example, Harvard University established in 2003 a Center for the Environment to pull together activities carried out in several departments. Later, in 2006, the Sustainability Science Program was established. The novelty was that, unlike those previous cases of interdisciplinary *studies*, there was now a clear claim for being admitted as a scientific field in itself.

Due to its originality, the challenges it faces, and its role as a possible institutional model, the "interdisciplinarization" of the environment as a subject deserves to be considered in more detail.

The first consideration is that the University, as a long-living institution, reaches the 21st century having to face deep, unsolved questions. There is a clear and growing gap separating the academic world from social and economic reality. This crisis is more serious in some universities than in others but concerns all of them (Lubchenco 1998). In trying to face such a challenge, European countries defined, in 1999, a bold plan for reforming the University, known as the Bologna Process, that aims to create a Higher Education Area by 2010, on a continental scale.[5] Without disregarding national and regional peculiarities, a central issue in the project is to

[4] In 2007 the MIT celebrated the 75th anniversary of its degree program in City Planning and the 40th anniversary of the Special Program for Urban and Regional Studies.
[5] http://ec.europa.eu/education/policies/educ/bologna/bologna_en.html (10 October 2007).

simplify and unify the university system. Three aspects are in the core of the new structure: mobility, employability, and interdisciplinarity (Arthur and Rousseau 2001).

In most of the agendas for the discussion about the future of the University, we find subjects such as: sources of funding, criteria for assessing and measuring scientific performance, the articulation among disciplines (NAS 2004), the interaction with spheres of the society (Mcmichael 2003), the balance between the production of market-oriented techniques and non-marketable sciences, and how do deal with complex scientific problems (e.g., ethical and environmental ones).

For almost a whole millennium, the University evolved from the general to the particular (Max-Neef 2005). In the beginning, the focus was on a small set of broad subjects: theology, law, philosophy, and medicine. The general movement was towards the definition of clear borders among the disciplines. New fields of science emerged mainly by splitting from existing disciplines, acquiring status of independency and establishing their own rules and codes.

Humboldt's project for the foundation of Berlin University in 1809 is very up to date and can be used as a reference for the debate about the alternatives to be considered nowadays. At that time, the challenge was how to maintain Enlightenment ideals without denying the roots of the national cultural identity (Bartholo 2001).

In contemporary modernity, globalization raises similar challenges. Increasing political and philosophical contents of academic life can be a way to overcome the present crisis of identity and legitimacy. This issue demands interdisciplinarity.

Forgetting that interdisciplinarity is not a new matter in the University may lead us to efforts at the reinvention of the wheel. As most of the previous experiences tended to become independent fields in themselves, as disciplines (multidisciplinary disciplines!), the lesson to be considered is that SS must find a way to remain interdisciplinary. Otherwise, it would amount to the invention of the square wheel. Going back to Wilson's metaphor, SS should be not a isolated point but rather part of the blank area.

4 Traps, tricks, and misunderstandings

Part of the present crisis of the University is due to its ontological dilemma: on the one hand, it is pushed toward a sharpening of its competence and increasing specialization, at the risk of losing the overall view; on the other hand, there is an increasing need of reconciliation with its universal mission and to tackle complex interrogations that demand more than specialties (NAS 2004).

The emergence of environmental issues and the way they were internalized in the University can be viewed as a *leitmotif* for the discussion about reforming or reshaping academia. The question is: how to advance at the same time in particularity and in generality?

One limitation to the solution of this question is related to the nature of the University itself. As a place that gathers intelligence and rewards it in accordance with strict rules and metrics, there tends to be more room for developing knowledge within given paradigms than for creativity to break those paradigms. This causes a gap between the need to produce innovations and the ability to innovate and renew itself. This contradiction can be summarized as scientific imagination vs. institutional conservatism (Bird 2001).

To this aversion to change we must add a corporatist reaction against the entrance of newcomers. This can be explained by at least two arguments. The first is related to academic legitimization based on a system that tends to place value on what is older.[6] The second is a pragmatic one: new areas mean dividing existing resources among more people. If this is already a problem in itself, it becomes more striking in situations of diminishing resources (Katz 2001). In the competition for resources, scientific veto to newcomers can be just a pretext. The image of the behavioral sink (Calhoun 1958) seems to fit to this context.[7]

However, if there is a tacit veto from old and consolidated disciplines to the emergence of new fields, there is also a considerable attraction for positive and negative participants. On the positive side are those concerned with complex problems and the limitation of unilateral approaches to solving certain challenges. On the negative one, we can mention opportunists (seeking profitable windows of opportunity without necessarily being committed to the field itself), incompetent members of academia (trying to hide behind the curtain of generality), and folkloric mystical characters attempting to find their herd among a heterodox audience.

Traps, tricks, and misunderstandings can be illustrated by the analysis of the case of the formal configuration of environmental sciences as an interdisciplinary field in the Brazilian University. Following the international trend, but also motivated by its particular environmental challenges, Brazil created, since the early 1990s, an expanding system of graduate programs dealing with SD. Part of this experience was due to the incentive of a national project led by the Ministry of Science and Technology and partially financed by the World Bank.[8] In a rather short period of time, there was a proliferation of programs: only one existed before the Rio-92 UN Conference on Environment and Development; 30 were active in 2004; and around 60 are accredited in 2007. All these programs have been approved by a strict national accreditation system and are regularly evaluated and ranked.[9] In 2000 a national association of graduate programs focused on SD was created, gathering 45 institutions by 2007.[10]

The analysis of the process of institution building and trajectories of those programs unveils interesting features that can serve as reference to compare with other experiences and as lessons to be considered. Each one of the programs analyzed (Bursztyn 2005a, 2007) is a *sui generis* case, but some "pathologies" are common to all of them with different degrees of intensity.

- The *stigma of generality*

By definition, interdisciplinarity consists of linking disciplines that are structured and coded according to particular methods and meta-languages (Bauer 1990). In this sense, researchers from various backgrounds working on interdisciplinary projects must find common tools and languages in order to have a constructive dialogic relation. As interdisciplinarity is not just a comprehensive sum of all disciplines, but simply a logical *ad hoc* bridge among fields that converges to the resolution of a given problem, the degree of representation of each discipline can

[6] For example, older scientific journals are more likely to have a higher impact factor. For this reason, new fields tend to create their own sources of publication, with low impact, falling into a vicious circle.
[7] Essentially, this is a study of behavior of rats in a cage under conditions of overcrowding. Abnormal attitudes under stress include hyper-aggression, failure to breed and nurture the young normally, infant cannibalism, increased mortality at all ages, and degeneration of sexual patterns.
[8] The component Environmental Sciences of the PADCT (Program for Supporting Scientific and Technological Development).
[9] http://www.capes.gov.br (10 October 2007).
[10] http://www.anppas.org.br (10 October 2007).

vary from one case to another. Hence, there is not a meta-language unique to subjects such as SD, but a set of terms, some of them imported from different disciplines and used in a way to enable communication among researchers form different backgrounds. The result is, unlike in specialized disciplines, a language easy to be understood. For those used to hermetic codes of communication, this gives an image of superficiality, as if one should not be intelligible for the non-initiated to be serious or deep and to be considered as scientific.

- The syndrome of *ruined noblesse*

Although this is not a syndrome that affects all universities, it is rather common in those supported by governmental resources and used to not having to search for funding. In such cases, there is an institutional culture in which the more consolidated departments tend to get used to the certainty of receiving resources that are not necessarily abundant. The emergence of new units—such as the interdisciplinary ones—takes place in an environment of scarcity of funds, as universities have grown faster than the allocation of governmental funds in their activities. As a result, conflicts within and between departments became frequent.

New fields have arisen as a response to new demands coming from outside the University. Hence, they can interact with market and external partners and tend to depend less on the basic budget provided by universities. Such interaction is sometimes considered as heretical and as an abnormal procedure by members of departments whose practices are not directly applicable to market demands (although they are equally necessary for the advancement of knowledge). The conflict can reach extremes within the decision-making bodies of universities, in which some accuse others of deviating from independence and self-sufficiency. Such a discussion is reminiscent of the behavior of the old noblesse, who, even after being ruined, still lived as if it was in the glorious days of power and fortune.

- The syndrome of *refusing alterity*[11]

This institutional pathology can be explained by the use of the above mentioned metaphor of many rats confined in a limited space, as studied in behavioral psychology. The financial crisis that affects public universities maintained by governmental funds tends to cause corporatist and selfish reactions within the older and more consolidated units that somehow feel threatened by having to share their resources with newcomers. In these institutions, the space for the rise of new units is rather narrow.

In the decision-making bodies of universities there is a tendency to reject innovative initiatives aiming at the creation of new academic units, unless they can assure their own funding. But even in those cases, two kinds of arguments are frequently used to justify rejection: disqualification, from the scientific point of view, under the pretext of weakness or inconsistency; and willingness of a disciplinary department to absorb such activities (normally when there are secure sources of financing involved).

Refusing to accept the “other” as something new is, in this case, a reaction in defense of the old.

[11] Alterity means “otherness” (Levinas 1999).

- The syndrome of the *bastard*

This is a typical case of identity crisis. IPs by definition emerge from gathering scholars from various disciplinary fields and usually linked to different departments. Hence, there is a clear difficulty in framing their academic outputs, both within their universities and in their relation with funding agencies and external evaluation agencies. In the first case, conflicts arise over which unit should receive the credit for scientific output: the disciplinary department or the interdisciplinary program? In the second case, the problem is essentially related to the gap between the creation of new IPs and the slow adaptation of existing disciplinary structures, based on a growing range of splitting specializations, rather than on the integration of those parts.

In such a context, the existential dilemma of individuals belonging to interdisciplinary teams is somehow socratic: Who am I? What is my address? To what do I belong? To whom shall I report?

- The syndrome of *non-peer evaluation*

Since the 1970s, all graduate programs in Brazil have been centrally accredited and are also centrally ranked under a system meant to produce a distribution similar to a Gauss curve: each program is compared to the others, by 45 evaluation committees (representing different areas of knowledge) formed by peer members recruited within the academic community. Programs must send annual reports, in increasingly complex and detailed softwares, to allow a hopefully unified process of evaluation; every three years programs are ranked. In late 2007, 2,226 Brazilian graduate programs (1,182 offering Ph.D.s and the rest only masters degrees) were evaluated.

In 1999, following the growing demand for the accreditation of interdisciplinary programs, a specific evaluation committee was created for this group of programs.[12] It was named "multidisciplinary." All combinations that could not fit into the traditional subdivision—such as gerontology, bioethics, materials science, agribusiness, and SD—were bundled together and placed in this new slot. Nevertheless, unlike the committees of the disciplinary fields, this committee is formed essentially by members chosen among participants of disciplinary programs, i. e., the ones evaluated by the other 44 disciplinary committees.

Hence, if this was an innovation in terms of opening a window to new initiatives, it also broke the basic rule of peer evaluation: the identity and the sense of belonging to what Foucault called an *epistemic community* (Howse 2002).

Some of the characteristics of the committee that evaluates interdisciplinarity deserve to be considered. The first one is the fact that the committee always works beyond its installed capacity, due to the fast growth in number and in size of the programs self-identified as interdisciplinary. As a result, there is a tendency to consider some of the proponent programs as not being interdisciplinary. In this case, they are sent to other committees, to be evaluated as disciplinary, facing the high risk of not being admitted as such and thus falling into a "no man's land." As an example, from 140 programs that demanded to be accredited as multidisciplinary until 2003, more than 30 were sent to other areas, more than 60 were plainly denied accreditation,

[12] In 1999, 44 programs were evaluated under the criteria of interdisciplinarity. In 2000, this number rose to 57; in 2001, to 70; in 2002, to 85; and in 2007, to 140. In Brazil's rapidly growing graduate studies system as a whole, IPs have grown twice as fast as the general average. http://www.capes.gov.br (10 October 2007).

and only 40 were approved. The rate of success, under 30%, is rather strict considering the system's standards.

The second aspect to be stressed is the feeling of those working as evaluators of IPs. In general, a view of the committee as an incubator of new (and immature) initiatives prevails. Not committed with the objects of their evaluation, because they do not work in similar programs, committee members do not admit (or do not feel secure) to consider those programs as serious and solid ones. Thus, far from being a peer evaluation, it is a non-peer trial.

- The syndrome of *external metrics*

As a consequence of the evaluation made by non-peers, the criteria used for measuring performance and results of IPs have been strongly influenced by the idiosyncrasies of the fields of each of the evaluators. For not being understood as pertaining to any particular fields, IPs end up being considered as an amalgam of the expectations of various members of the committee.

This view reflects directly on the way not only the curricula and the syllabi but also the journals are classified. Evaluators tend to consider the most worthy aspects of a program those that have interfaces with their own fields. In such a process, important results can be neglected by the metrics of academic performance. Inevitably, there is an overvaluation of some aspects but also an underestimation of others. The classical opposition between humanities and natural sciences about what or how to measure academic productivity is particularly present in this case.

The idea of treating IPs as infant experiences leads inevitably to a sense of stewardship. As immature institutions, these programs are treated as demanding special care and, therefore, are not seen as eligible for self-sufficiency. The consequence of such a view is that the normal curve of the ranking of IPs is substantially slanted to the left: unlike the 44 disciplinary committees, in this case there in not a single program in the upper classification. Clearly, IPs are compared not to each other but to the universe of reference of each evaluator. And as such, they are always considered both incomplete (for not having the full shape of a program belonging to each one's background) and exceeding (or even eccentric), for containing aspects that do not fit to a specific disciplinary view. In other words, these programs end up being evaluated not according to what they aim to be but according to what they are not.

- The syndrome of *The Birdcage*[13]

The University is an appropriate environment for imagination and boldness. Creative initiatives are (or should be) part of the daily academic life. Nonetheless, there is also space for eccentricities and for achieving useless or doubtful outcomes. The Ig Nobel Prize—a good humored distinction for academic inutilities awarded annually at Harvard University—shows the degrees of liberty enjoyed by researchers.[14]

Due to their heterodox institutional situation in universities, IPs are often taken as the possible refuges for "deviating" scholars. The positive aspect of such a characteristic is the existence of alternative spaces for genuinely innovative experiences. But the negative aspect is that those spaces can become a kind of "no man's land." Once formally admitted as part of universities, there is a risk that IPs become depositories for confining problematic personalities. This image reinforces the stigma of lack of seriousness.

[13] From the French play *La Cage aux Folles*.
[14] http://www.improb.com/.

- The syndrome of *NOAA (none of the other answers above)*

As a consequence of the syndromes exposed above, there is a tendency to send all doubtful cases to IPs and to its evaluation committee. Everything that is not understood as belonging to a certain discipline is deemed to be interdisciplinary. In this case, there is a clear risk of becoming a sort of trash bin, or the alternative answer to complex questions, as in multiple choice questionnaires. As such, IPs can become a kind of self-fulfilled prophecy: they turn out to be not what they intend to be but what they are seen and treated as.

5 A commonplace

As part of its mission and identity, the University is a fertile field for innovation (Van Vught 1989). New concepts and theories, as well as new techniques, are usual outcomes. Following the acceleration of the life cycle of market goods, knowledge acquired the status of a tradable and immaterial commodity (Passet 2000; Gorz 2003). As such, it must follow strict standards (concepts and technical norms) and be universally accepted. As new concepts are launched in the academic market, they need to be consumed, once validated. Validation, in this case, is a combination of two intrinsically related elements: citations and obtaining grants and funding.

As a science, sustainability has already traveled a long road, since it was sanctioned in Brundtland's Report in 1987. Its initial stigma of utopian or alarmist activism has been replaced by an image of being *politically correct*. This becomes more evident as environmental issues ceased to be remote and vague warnings and became daily life concerns. Agreeing with the relevance of environmental management and protection is in fact a mainstream attitude in the University (as it is in society as a whole) nowadays.

Such a condition, unexpected a few years ago, brings a new challenge to the academic scene. As a consensus, sustainability is at the brink of becoming a fad. And, then, more important than being pro-sustainability or acting in accordance with its principles, just pretending to be sustainable can be enough. The logics of the discourse can become more important than the practice, in terms of validating one's commitment. As in Olson's (1965) analysis of *collective action*, the academic environment is now favorable to the rise of free riders (Leiserowitz et al. 2006): discursive free riders, by simply declaring their agreement, feel as if they do not need to act in accordance. As all are "in favor," nobody will argue about the distance between praxis and discourse. Such a paradox can be sociologically explained by Goffman's (1974) notion of stigma.

The changing image of sustainability—from a black-sheep issue to a common-sense middle ground—causes a paradoxical situation: everybody is in favor of it, so nobody has to change. This is equally valid for the institutional structure of universities and for the relations among disciplines.

6 Building bridges

The present crisis of the University can be compared to the crisis of the State: too much energy spent in bureaucratic procedure; too little energy focused on finalistic outputs; fragmentation; internal controversies; looking more and more at itself and less and less at the rest of the society; and fading legitimacy. Nonetheless, in spite of the present bottlenecks, its role is understood as necessary. As is the case of the State (Osborn and Gaebler 1992), the solution is not just abolishing the University but rather reinventing it (Crow 2006)

Disciplinary fragmentation led to institutional fragmentation in the University. Some social capital has been formed within departments, as many groups tend to carry out autonomous and self-centered activities.[15]

Interdisciplinarity can contribute to solve the problem of how to integrate or enable a dialogue among parts (Kates et al. 2001; Clark et al. 2004; Leiserowitz et al. 2006). First, as it is naturally a point of convergence of disciplines, it is a good environment for the gathering of dispersed activities. Second, because of its focus on complex problems, such as SD, it tends to converge its activities with those of other sectors of society, increasing the legitimacy and usefulness of University output. Third, due to the fact that its practice and outputs tend to contain a high density of creativity, IPs become an important forum to foster a culture of innovation throughout the whole institution.

In his analysis of multicultural and multiracial societies, Putnam (2000; 2007) identifies two processes for building social capital: bonding and bridging. In the University, the first process is usual within thematic groups that bring together people with the same disciplinary identities. The second process, that could be associated to Wilson's aformentioned idea of filling blank spaces among disciplines, tends to be harder to be achieved. In the academic environment, bonding means a kind of *sprit de corps* involving peers, whereas bridging demands willingness and legitimacy to connect differentiated entities. In these terms, bridging demands an opening of the minds, in order to accept *the others* as they are, and not as what *we* think they should be or as *we* are.

The lost link among the splitting parts of University can be provided by the adoption of a structure in which a synergy could be provided, instead of wasting energy in intra-group struggles. The formula proposed to reach such synergy is adopting an institutional framework in the University to enable both fostering of disciplinary issues (bonding) and the operation of IPs (bridging). The Star Model (see Figure 1) shows this structure (Bursztyn 2005b).

[15] "The aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition" (Bourdieu 1986, 248).

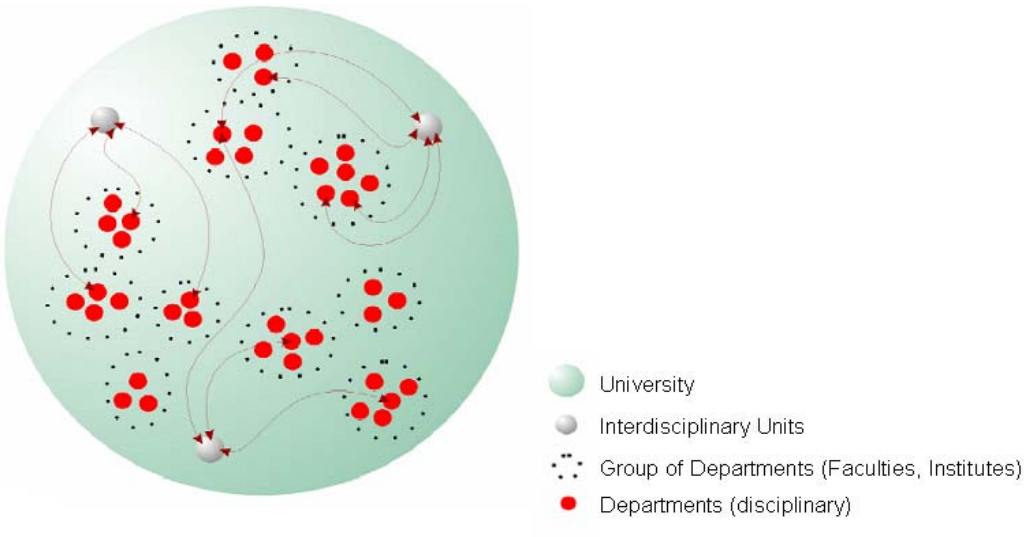

Figure 1: The Star Model

There are some challenging questions linked to the proposal of reinventing the University by adopting a structure such as the one proposed in the Star Model. The first one is: which activities are to be considered as nuclear in a new institutional design? To answer this question we must take into account an important, but rather forgotten, mission of the University: to extend its activities to the society as a whole. The fact that SS (as an interdisciplinary field) has an intrinsic relation with extension activities can also contribute to building social capital, by bridging. The process described previously in this article about the two-fold evolution of environmental issues within the University (by *environmentalizing disciplines* and *interdisciplinarizing environmental issues*) can be a clue to finding a good path. Scholars dealing with different ingredients necessary to SD, in various units of the University, can find a fruitful environment as they gather around common subjects. This does not mean that they should all leave their departments to join an inter-departmental unit or program. It is important to state that interdisciplinarity does not compete with disciplines, but rather the contrary: it is just a way to integrate them

The next question derives from the previous one: who should be the members of the nuclear units, as proposed by the Star Model? Figure 2 illustrates a situation in which scholars and faculty could be distributed in three different levels within the University: some are located in disciplinary departments; others play a role of bridging, by having joint appointments in departments and in an IP; a third group, normally formed by those with interests and skills in interdisciplinary methods and practices, form the “resident” core of the integrating structure.

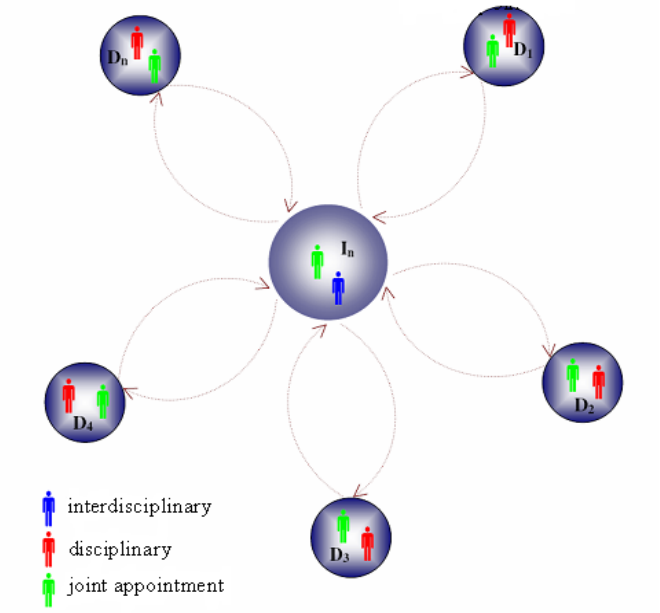

Figure 2: The Star Model - faculty

Redesigning the University according to new demands for interdisciplinary units is not a recent issue. Jantsch (1972) called attention to the need and the possibilities of structuring the higher education system in different levels, including intedisciplinarity. McNeill (1999), in analyzing the experience of Scandinavian universities, focused on the field of environment and development and pointed out the divide between natural sciences, on the one hand, and social sciences and humanities, on the other.

The challenge to be faced by SS is to build bridges among disciplines without becoming a discipline itself (Bammer 2005).

7 Interdisciplinarity is not shallowness!

The growing number of IPs—particularly those converging on the new field of SS—brings to the academic debate the issue of whether its results are deep or shallow. The association of broadness or non-specialization with superficiality is not rare. In fact, if it is to be measured by how hermetic it is, the result will probably be an opposition between *deep* specialization and *shallow* interdisciplinarity. But if the measure shifts to the degree of complexity of the object, then fields such as SS become deep.

A close look at an universe of just under 400 masters thesis and doctoral dissertations defended since 1999 at the Center for Sustainable Development (University of Brasilia) can be a good gauge to measure how deep such an output can be. When the effort was primarily to be comprehensive (in trying to be transdisciplinary), rather than problem-oriented, the result was inevitably *shallow*. But when the main drive was just facing a complex problem and then searching for the various disciplinary contents to have it solved—no matter the amount of

disciplines involved and the hierarchy of its utilization—the outcomes became substantially deep. The lesson learned in this process is that there is no inter- (and even less trans-) disciplinary person. Therefore, each one, working as an individual (as in a dissertation) must stick to his/her disciplinary background as a scientific anchor, and then, once he/she has built solid bases, search for the contributions from other fields (McNeill and García-Godos 2005). Such an experience enables, now, a clarification of the many uses of the concept of discipline, when preceded by different prefixes (see Figure 3):

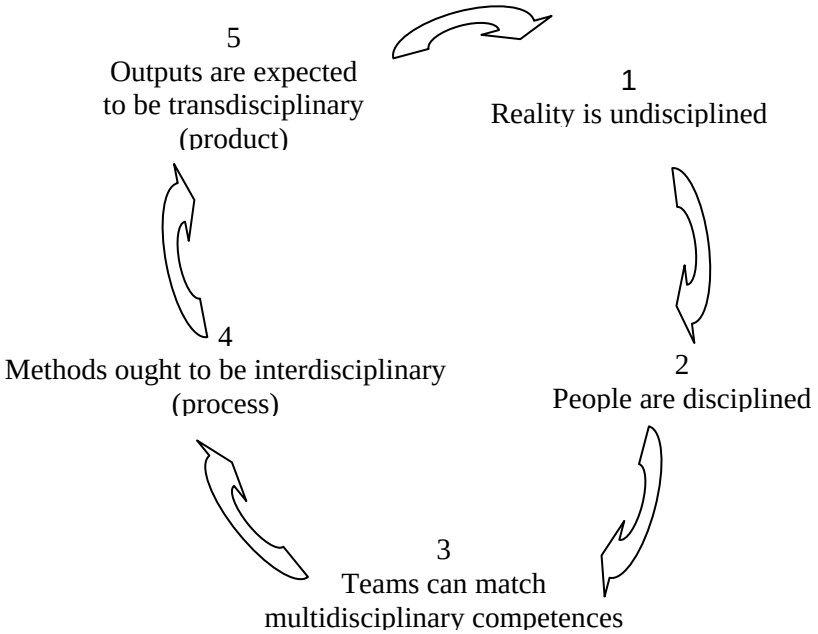

Figure 3: The Disciplinarity Chain

Hence, the effort of graduate programs in the field of SS should aim at developing methods (Bammer 2005) based on an epistemology that enables building interdisciplinary practices. This is a challenge to which the Star Model can be a contribution.

8 Conclusion

This article shows that in spite of the difficulties in being assimilated by the University structures as *normal* fields, there is a growing concern about the importance of IPs. A claim for integrating disciplines (without denying their importance and need) is voiced by prominent scientists but often following a tendency to overestimate a kind of self-centered aggregation: there are biologists who intend to be the core of such a new synthesis, neoclassical economists who propose that all sustainability problems can be addressed by using economic instruments, and there are sociologists blaming the others for not giving a central role to society.

Among the main findings of this text, some of them already stated in the previous items, I wish to emphasize those that are especially relevant to the present stage of consolidation of SS.

One of them is that universities have much to learn from non-academic research institutions. The growing complexity of scientific and technological challenges, together with the acceleration in the demand for knowledge in general, cannot be faced alone by departments in rigid institutional frameworks, as is the case in universities. Not being able to communicate

among themselves, departments tend more to deepen their activities into narrower views that to broaden its practices. And when the latter is the case, a new department is usually created.

In research institutions (public or private), a more pragmatic approach, based on a problem-oriented practice, enables a rapid re-adaptation to new demands. Teams are rearranged once a project is finished. Task forces, instead of departments, are proving to be more adaptive and responsive (NAS 2004). New procedures should be adopted in order not only to interchange capabilities but also to internalize in Academia a culture endowed with more flexibility. This could be reached by creating incentives to the mobility of faculty, scholars, and practitioners, from academic programs to non-academic research institutions, businesses, governmental agencies, and NGOs, and vice versa. Although it is not a problem in all universities, mobility from departments to IPs—both of faculty and students—must be seen as a positive rather than negative practice.

As interdisciplinary practices are not yet supported by solid integrating methodologies, there is a great need for developing such skills. The question is: who is capable to link different contributions, coming from various fields that are necessary to solve complex problems? This question is a commonplace in IPs. One idea could be Bammer's (2005) proposition of a new instrumental discipline: Integration and Implementation Sciences. Such a discipline, like for instance Statistics, could help organizing skills to be mobilized into problem-oriented activities. But in itself it is not sufficient to solve the challenges faced by interdiciplinarity.

Another major question of interdisciplinary issues, as is the case of SS, is to establish its own metrics; otherwise, misunderstandings will remain. Complex interdisciplinary research and academic programs must be evaluated considering how they are and not as they are seen by non-peers. The first step in this process is to organize those who are involved in interdisciplinary activities as epistemic communities, according to their specific thematic foci and not to their disciplinary backgrounds (e.g., climate changes or biofuels). In addition, scientific periodicals should become adapted to peer-reviewing such issues. New journals are likely to be created to cover those new fields, but they will not be ranked among the most cited ones in the short run. A transition, therefore, is to be expected, while the outputs will be shared between traditional periodicals and the new ones. Anyway, and according to the proposed Star Model, if interdisciplinary knowledge is to avoid becoming new disciplines, it should never be confined only to a narrow circle of readers.

According to the characteristics of the issues addressed by SS, its metrics have to be conceived as to be in constant change. This aspect makes a difference in relation to the disciplines that form what Kuhn (1962) calls *normal sciences*: here, changing paradigm is not something unusual (and to be rejected), but rather part of the daily life. Actually, paradigms are always changing in SS, as its focus falls upon ever changing problems.

Finally, interdisciplinarity is not to be seen as anti-disciplinarity. The way universities evolved, by seeking specialization, led to a vicious circle of segmentation of disciplines, increasing the gaps that separate them. SS comes as a reaction to the need to solve problems related to life support systems by integrating natural and social sciences (Kates et al. 2001; Clark and Dickson 2003; Naveh 2000). As so, it is stepping into the academic world (Clark 2007) with an original institutional arrangement: by aggregating instead of by segregating. Considering the need for creativity, especially in the present context, this can be a relevant contribution to a reinvention of the University.

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