DISCIPLINARY AND HOLISTIC APPROACHES TO KNOWLEDGE

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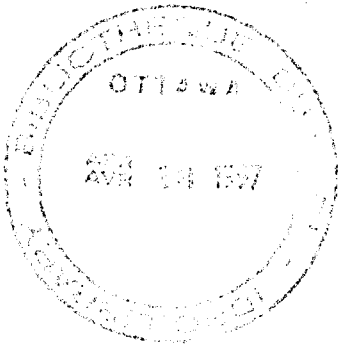

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ABSTRACT

The manner in which scientific knowledge is acquired depends on each specific society: the type of problems that can be formulated, the type of data that can be obtained, the type of hypotheses that can be tested, as well as the people allowed to carry out the scientific pursuits are determined by each specific social environment. One method for systematization of knowledge is through its compartmentalization based on its thematic or disciplinary specificity. In most pre-industrial societies knowledge remained whole often under the control of "priests", "shamans" or aristocratic elites who normally kept a non-disciplinary approach to life and knowledge. The contemporary disciplinary structure of science relates to the growing complexity of industrial production systems and their need for optimum productivity. Priority is given to maximum production at the lowest possible cost. It is in this framework that the fragmentation of "scientific disciplines" took place. The main scientific fields were divided into sub-disciplines, which in turn acquired their own "disciplinary" rank. After some time a large number of scientific fiefdoms were created with a philosophy more based on territoriality than on cooperation. Specialists were trained to think in a unilateral manner, ignoring important facts from "outside" their disciplines. Their thinking freedom was curtailed by the rules of their organizations. Interdisciplinarity was only promoted for operative purposes. In recent times, a technological revolution based on easy access to computers and tele-communications has started. As a result, growing numbers of individuals and groups are successfully breaking the disciplinary walls and the specialized circles are losing their exclusivity to knowledge. This blooming of new avenues for public participation is activating new tools for the recuperation of traditional and popular knowledge and for the development of innovative formats, ensuring their adaptation, utilization and replication. At the same time, the old disciplines are becoming obsolete. Many people now realize, that although they can solve specific problems, their lack of holistic vision can produce enormous long term damage to the societies and the environment. There is growing awareness

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that the disciplinary framework must be reformulated opening the gates for lateral contacts with other disciplines. One way to address these problems is by using systemic approaches based on organized and logical systems better adapted to the complexity of reality. These systems still keep some aspects of disciplinary "epistemology" but are important steps toward a more holistic form of knowledge. In addition, a new holistic approach must also find ways to open communications between all types of knowledge, including relevant traditional, indigenous and popular knowledge without prejudging on the "legitimity" of the sources. Knowledge is power. Therefore, the power groups in any given society will always do their best to keep control of the levers of knowledge. The information age is providing the tools and framework for increased access to information and knowledge and therefore for their democratization worldwide.

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1. Introduction

Industrial societies were based on complex production systems in which individual operators were dedicated to specific tasks allowing a more effective functioning and increased output volumes. The basic principle of the system was that each person would excel in their own field of expertise and that the result would be an optimization of the performance of the system as a whole. In fact, when measured in actual production output, industrial systems worked very well. Many more goods became widely available for a much larger number of people worldwide, populations grew, life expectancy rose and technological knowledge became more complex, sophisticated and effective (effectiveness as measured against industrial society's goals and standards).

Scientific knowledge also became highly specialized; gradually specialists knew more and more about less and less (one could even fear that one day some people would know everything about nothing...). However, this knowledge was unilateral and poorly related with the knowledge of other "specialists". In many cases, technical decisions were made based on very unilateral approaches. For instance, the decision about whether or where to build a bridge was based mainly on engineering criteria. Environmental or social issues were (and in a large measure, still are) less important. Within this framework, decision-makers did not take into account the holistic nature of all (environmental and social) issues. As a result, societies made long term decisions based on insufficient information or skewed points of view. In many situations, the environment was damaged beyond repair, cultural and biological diversities were lost forever and even after their destruction the prevailing ideology praised (and still does) these "accomplishments" in the name of "progress" or "modernity".

As a result of this view of development understood as "economic growth, propelled by intensive technology and fuelled by an excessive exploitation of nature..." (Kothari, 1990) many problems appeared. One of these problems relates to the way in which knowledge was acquired, evaluated and managed. The structures and methods of industrial science tended to

separate nature from society and as a result the selected courses of action were often inappropriate and unsustainable.

2. About the generation and utilization of knowledge

The knowledge of industrial society is often called "scientific knowledge" and the method of its acquisition "scientific method". Scientific method is defined in Webbster (1972) as "a systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment and the formulation and testing of hypotheses".

The manner in which this knowledge is acquired is dependant on each specific society: the type of problems that can be formulated, the type of data that can be obtained, the type of hypotheses that can be formulated and tested, as well as the people that are allowed or possess the means to carry out the scientific pursuits are determined by each specific social environment.

For this reason, it is generally accepted that the ideas about science and scientific knowledge and method are dependant on the given societies and their peculiar historical evolution. In that sense, science can be seen as a dynamic reflection of the knowledge of each culture varying in content and method throughout time. As Morris Berman put it, it is "our consciousness, in the Western industrial nations, uniquely so" (Sterling, 1990).

The concepts of "absolute science", "absolute scientific knowledge" or "absolute scientific methodologies" all fall within the realm of philosophical and religious systems. In fact, it is well known that the differences between science, religion and philosophy were not always so clearly defined, as they are in the contemporary mainstream culture. Still today, from certain points of view, the differentiation between those categories remains rather foggy.

3. Scientific methodologies and disciplinarity

As expressed above "scientific methods" are peculiar forms of obtaining, processing and systematizing knowledge responding to specific social situations, places and timeframes.

One of the methodological tools for systematization of knowledge is disciplinarity. Disciplinary knowledge is compartmentalized in sub-sets based on their thematic specificity. Frequently, in various times and places societies have classified their knowledge, beliefs and traditions by creating disciplinary sets of varied types. However, this never took place to the extent that is happening at present.

In the "classical" Mediterranean societies of Greece or Rome, scientific knowledge was not clearly separated from other elements of the mainstream culture and even at the professional level it was weakly divided. Philosophy, art and theology, the major disciplines, were subdivided into other more specific ones, such as geometry, astronomy and medicine but without clear epistemological borders. In classical times, the members of the intellectual elites often dealt with several or all of these "wide" disciplines at the same time. In these societies the notion of disciplinarity was poorly developed.

In sixteen-century Europe, scientific knowledge was also weakly compartmentalized, the universalist intellectual elite of the time was not composed of people exclusively dedicated to any type or branch of science or culture. It was not unusual that a painter or a physician could be also dedicated to alchemy or military "arts".

The situation was similar in most ancient non-European societies. In China, in India, in the Tahuantisuyu of Peru, in the agro-forestal, pastoral, or hunter-gatherers societies, knowledge was not clearly divided in sub-sets. In most cases it remained whole and generally under the control of "wise men" "priests" or "shamans" who normally kept a non-disciplinary approach to life and knowledge.

4. The process of disciplinarization

The contemporary disciplinary structure of science started developing in relatively recent times. It mainly took place as a result of the appearance of industrialism, especially in European countries and their areas of influence. This new "industrial" society was based on the development of complex production systems with specialized machinery and professional and operative roles and on a political, social and economic organization, generally controlled by capital-holders. The complexity of production systems on the one hand and the need for optimum productivity on the

other, promoted growing processes of technological sophistication and specialization.

In this society, first priority was given to maximum production at the lowest possible cost. For that it was necessary to limit intellectual and professional freedom to the level required for optimization of the production processes.

It was in this framework that the fragmentation of "scientific disciplines" took place. Natural sciences were divided in a large number of sub-disciplines, such as geology, climatology, biology and oceanography, which at a later stage became independent, developing new sub-divisions, which in turn acquired their own "disciplinary" rank. This process continued and in that way many hundreds of highly specialized disciplines were created.

This development took place in a narrow perspective of "scientific and social" progress, in an accepted context of "progress of the civilization" or "historical advancement".

Now it appears that many of these views were refuted by recent history and as a result the role of disciplinarity in societies' progress is being reassessed by many.

5. The specialists and their kingdoms

At the same time that scientific knowledge was becoming more abundant (at least in quantity, not necessarily in quality) more "species" of scientific people and groups were needed to manage it. Once established, these "scientific groups" defined their territories and claimed their jurisdictions. After innumerable "border" conflicts, each discipline defined a "generally accepted" epistemological field, displacing (when necessary and possible) their neighbors, gradually taking control over their own "fiefdom". At the end of the twentieth century this development is becoming very clear. "Modern" science is composed of swarms of disciplines and subdisciplines, well entrenched in their fields, with a philosophy more based on territoriality than on cooperation.

The jurisdiction of each discipline is ensured in various ways: through the establishment of diplomas authorizing work in the respective scientific fields and professions, through the development of a specialized (and often non comprehensible) jargons preventing the access to "disciplinary

foreigners", through the establishment of socially restricted circuits or bibliographic "clubs" under the strict control of the group of specialists or their "authorized" representatives and in many other manners. In each discipline the "purity" of science is "ever more closely guarded by a self-imposed inquisition called the peer review." (Lovelock, 1988).

When the discipline obtained its social recognition, generally as a result of its political or productive importance, this "territoriality" became a "fait accompli" developing policies of exclusion to non-members tending to make still more difficult lateral contacts and interdisciplinary cooperation.

Specialists are trained and forced to think in a unilateral manner. They learn what to see and what to ignore in a particular way. They can read books about "modern agronomic methods" or test productivity of one crop in a "modern" farm, but they are incapable to compare those in holistic terms with the indigenous or traditional communities living in the neighboring village. If they knew how to talk to local people or their medical doctors they would know more about the effects of pesticides they recommend on local health; if they knew how to talk to anthropologists they could know what are the practical reasons of one specific farming ritual; if they knew how to communicate with their colleagues from other disciplines they would be more effective in their profession. However, this is often not so. They see the world through undisciplinary glasses, as Vandana Shiva puts it: they have the habit to think in terms of monoculture: the monocultures of the mind. (Shiva, 1993).

In addition to these limitations of scope, specialists are not "free" to do what they want, not even to think what they wish even if they believe so. However, because they belong to large organizations, governmental departments, transnational companies or universities they must abide by the rules (often very strict of their organizations), including "thinking rules"! In some way "they have traded freedom of thought for good working conditions, a steady income, tenure and a pension". (Lovelock, 1988).

6. Operative complementarity

However, in order to function, industrial societies also required a certain degree of "operative complementarity". Although disciplinary territories allowed little overlapping on common thematic fields, it was necessary for some operative interdisciplinarity to allow coordination between the

various roles. In any case, this interdisciplinarity "by necessity", was always limited by the jurisdictional controls within each discipline.

The "science" of the 1950's was composed of a large number of disciplines with variable degrees of "territorial encroachment" depending, generally, on the recognition received from the social or economical spheres of society. The channels of functional interdisciplinarity were (and still are) generally the minimum necessary for the functioning of the system.

7. The development of post-industrial society and the break-up of disciplinary boundaries

The end of the twentieth century has been characterized by a technological revolution with strong effects on the socio-economic and environmental make-up of the world, which is producing profound changes in the attitude toward science and knowledge acquisition. It has been defined by many as the "Information Age", by Alvin Toffler as the "Third Wave" (Toffler, 1980) and by Daniel Bell as the "Post-industrial Society" (Bell, 1973).

The main two single phenomena, which have allowed the growth of this new historical trend, are the development and spread of computers, which made possible the storage and processing of large volumes of information and the growth of new telecommunications technologies, permitting the transmission of huge quantities of bytes of information over long distances almost instantaneously.

As a result of these changes, storage, processing and movement of information have become much faster, allowing large volumes of data to be sent very far away in a short period of time. Today, sending an encyclopedia from one terminal to another, located at a distance of several thousand kilometers, may take just a few minutes.

In addition, these operations have become very inexpensive, require a minimum amount of energy and human effort and are accessible and easy to utilize for many people throughout the world. Consequently, both the access to and the potential for generation of knowledge are becoming increasingly available to all, making more difficult their control by elite groups.

Specialized disciplines are suffering the impact of these changes. Growing numbers of individuals and groups are successfully breaking the walls of the scientific "inner circles", obtaining new keys to learn or "translate" specialized jargons and opening the gates of restrictive disciplinarity.

In the framework of the planetary neural network there is less room for the exclusivism of the specialist clubs. In that way, the barriers between disciplines are being gradually dismantled and new, more appropriate conditions are created for cooperation and interdisciplinarity.

This process is not easy or straightforward. Some disciplinary groups, mainly those enjoying economical or social benefits, defend their turf enthusiastically. However, gradually, the global trends are opening the gates of exclusivism and allowing a growing democratization of knowledge worldwide.

On the other hand, this blooming of new avenues for public participation is activating new tools for the recuperation of traditional and popular knowledge (usually underestimated by the establishment) and for the development of new and innovative formats, ensuring their adaptation, utilization and replication.

As a result, many traditions that had been eliminated, forgotten or simply discredited by the mainstream culture may now be revived. Some elements of micro and sub-cultures may have now a second chance and finally have a decisive influence in the making up of the new categories and elements of contemporary planetary knowledge.

8. The old and new disciplines

It is becoming increasingly obvious that the old restrictive disciplines are entering into a frank period of obsolescence. The old sciences of industrial society are analytical, with an impressive potential for accurate focusing on specific "minute" subjects but at the same time they have enormous problems to establish horizontal relationships. Many "specialists" only know about their field, know very little about other disciplines or themes and consequently (because reality is not disciplinary but holistic) they know very little even about their own; " a physicist would find it hard to do chemistry and a biologist would find physics well-nigh impossible to do." (Lovelock, 1988).

In a certain way, systemic approaches address this problem through the development and utilization of organized and logical systems adapted much better to the complex nature of environmental and social reality.

9. However, reality cannot be easily structured in disciplines

Unfortunately, neither nature nor society (as a part of nature) are structured in disciplines, it is the human mind that does it. The scientific method of industrialism did not take into account this fact. What at the beginning was simply a method (the method of industrial society) was elevated to the rank of objective and at that point one important element was lost: reality is an integral whole and its parts cannot be easily separated by themes. The elements of nature occur and interrelate in a continuum and when analyzed and fragmented at the intellectual level the applicability of the conclusions decreases accordingly.

These limitations of restrictive specializations are clearly seen in the field of health sciences. Obviously, the human body is a part of nature and as such it must be understood in an integrated manner. However, restrictive specialization promoted the fragmentation of its study and of the interpretation of its dynamics. The diseased human body was (is) separated from its surroundings, located in large hospitals, largely conceived as "factories of medical treatments" and reduced to a simple object within the hospital chain process.

Something similar happened with engineering and the natural ecosystems. The environment was one thing, engineering another. Engineering was a specific disciplinary problem, the environment was the scientific subject (s) of study of a myriad of specialists. The relationships between them were limited or absent. Engineers were respected future-builders while natural science specialists remained in their particular niches studying their little animals or plants without any connection with the engineering works with potential to exterminate them.

According to this vision of development, engineers (generally not even realizing it) were able to kill millions of birds without affecting their reputation. However, nature was affected, and often in unexpected ways. Sometimes the "absent" birds would not eat billions of insects, which in their turn were free to feed on the neighboring crops producing economic

and social disasters. The economy was seriously damaged and nobody was aware of the true cause.

Fragmentation of science did not allow the understanding of the holistic nature of natural phenomena and of their social and economic effects. Now, only a few decades later, the new generation is being presented the bill...

10. Toward a holistic science

During the last years more holistic approaches have been developed in various areas of knowledge. One of them tends to imagine objective reality as a system (Andreewsky, 1991) allowing disciplinary acquisition of knowledge but with very close correlation and coordination. In this approach, the relationships between disciplines are "structured" to better integrate the various aspects of knowledge providing stronger operational effectiveness.

Systemic approaches keep some aspects of disciplinary "epistemology" and in this sense they look like sophisticated versions of industrial operative complementarity. Still, these new methods are important steps toward a more holistic and appropriate knowledge paradigm.

These new scientific methodological models still include specialization and disciplines, but in a much more open context without restricting "fences". In other words, systemic approaches allow us to understand much better what are our neighbors doing in their own scientific fields and how to coordinate that with our own specialized tasks.

11. Reformulation of disciplinary frameworks

These processes of reformulation of disciplinary frameworks have been under consideration for the last few years in many academic or development institutions and agencies. The main preoccupation has been the limited and unsatisfactory impact of many development projects completely out of proportion with the invested funds. In the particular case of research initiatives, there has been a lack of connection between the production of knowledge and their effective utilization in society. Many reports remained in drawers forever and their results unutilized or dormant.

The main reason for that was that in most cases the collected information was mono-thematic and partial and even when reports gathered multi-thematic information, the different chapters remained isolated (and often contradictory). Only exceptionally, there were some integrating attempts in the conclusion chapter or in the executive summaries.

Disciplinary knowledge was presented in disciplinary "islands" because this was the way in which it was developed. The process of generation of knowledge took place in an inappropriate environment due to the absence of lateral contacts with specialists from other disciplines.

As a result the final reports of the projects conceived in that way lacked an effective basis of comprehensive information so necessary in the phases of application and replication.

It is in this framework of questioning of disciplinary structures that new paradigms of development are being rediscussed. However, the walls of disciplinarity are not the only barriers that need to be dismantled in order to reformulate the methods for knowledge acquisition and sharing.

12. Intercultural barriers

Each culture possesses its own ways of approaching knowledge. Although often people situated within the mainstream culture (s) may think that their method is the only legitimate one and the others are wrong, in fact, knowledge can be effectively acquired in many different manners.

Many traditional and indigenous societies have developed extensive oral data bases on their environment and societies which in most cases can be very useful for the particular conditions in which they live. Normally, these valuable data cannot be easily retrieved using the mainstream "Western" scientific methodology, because they are systematized in a completely different logical framework. Many indigenous elements of knowledge can only be accessed through in-depth mastering of their related linguistic, magical, mythical and religious systems. However, because mainstream academicians consider these approaches to knowledge as non-scientific (or simply not deserving the effort), the possibility of intercultural dialogue is reduced or eliminated.

In spite of continuous cultural erosion during the last centuries there are still many thousands of traditional and indigenous societies possessing vast pools of knowledge representing the social experience of billions of human beings during many generations. Although there is more accumulated relevant knowledge in these traditional and indigenous oral networks than in all the libraries of the academic world, this importance has not been properly acknowledged yet by the mainstream establishment.

The loss experienced by humankind during the fire that destroyed the library of Alexandria is a tragedy that is still intensely felt today two thousand years later. However, in the precise moment in which we are writing this sentence, several languages and cultures are disappearing from the face of the earth taking with them a volume of knowledge equivalent to several Alexandria libraries, and few people notice.

This underestimation of the value of traditional and indigenous knowledge is depriving humankind of a valuable source of knowledge very relevant to solve innumerable practical and theoretical problems worldwide.

The new holistic society must also find ways to open communications between all types of relevant traditional, indigenous and "mainstream" knowledge without prejudging on the "legitimity" of the sources.

13. Intrasocial or occupational barriers

Another source of non-communication affecting the soundness and effectiveness of knowledge is caused by the social barriers that are built within the societies themselves. Very often, the monopoly of knowledge generation has been awarded to a specific "recognized" profession. Architects are allowed to design and "build" houses and they have the final say in that regard. However in many cases, experienced builders or bricklayers may know many important facts that could be crucial to obtain a successful design or to implement it properly. Slum dwellers living off the garbage may know a few things that could be very useful to waste-disposal planners or waste-recycling engineers. However, most professional people do not expect that they would obtain any benefit by asking questions to very poor and ignorant people.

Many individuals and groups in all sectors of society are generating useful knowledge everyday but this knowledge remains unused or underutilized.

The underestimation of the worth of "non-academic" people and the non-democratic structure of knowledge generation and utilization are producing great harm and preventing the release of a tremendous potential of knowledge development and growth.

14. Building a new type of knowledge

It is a well known fact that knowledge is power. Therefore, the power-wielding groups in any given society do their best to keep control of whatever tools of knowledge they possess in order to ensure their own power positions. This is true in **all** societies. Knowledge is the power tool of the shamans, of the priests, of the monarchic aristocracies and of contemporary scientific and technological establishments.

The information age is providing a tool and a framework for increased access to information, and therefore, for increased social democratization. As a result of the information revolution, disciplinary, intercultural and intrasocial barriers are becoming less restrictive and the potential for information sharing is growing everyday.

The new knowledge must address in the widest possible manner the processes of knowledge generation and access. New and innovative channels and formats must be developed to ensure that the flux of knowledge is agile in all directions, from traditional communities to the information "gurus" and viceversa, from practically-minded people to the theoretical "elites", from social scientists to hard-science specialists, from left to right and from the top to the bottom.

Obviously, this is not an easy task. It is in fact, a huge challenge. However, if humankind is successful in extricating it, a new beginning, more sustainable and equitable may be possible.

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UNBROKEN KNOWLEDGE

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