What is Info?

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Abstract

When agricultural projects are analyzed using emergy methodology, the systems diagram recognizes an external energy source called INFO, a short expression for the word information, which until now has not been calculated. However, it seems that for soybeans production systems in Brazil, information is the main emergy source (the external force that defines the system). It is a paradox! The study of soybean agriculture models in Brazil revealed the existence of four different types of agricultural production: (a) family managed ecological small farms, (b) medium size organic enterprises, (c) chemical inputs-machinery farms, and (d) biotechnological and no-tilling farms. The ecological small farm option showed the best values in emergy indices as well as the greatest economic profit per unit of land and greater value for labor per hectare. Then, why isn't it the model adopted in Brazil for Soybean Agriculture? In order to discover the INFO emergy flow it was necessary to study the Brazilian political, financial and law systems and also to understand the logistics and the dynamics of technological trends imposed by multinational enterprises and the International Monetary Fund. Moreover, it was necessary to review the scientific literature about negative externalities and environmental services produced by agricultural systems in Brazil and other countries. As a result of this effort, a new generic systems diagram of agricultural projects that includes new inputs and outputs is offered for discussion, as well as new emergy indicators that take into consideration natural contributions and internal flows that do not occur in agrochemical systems operated with urban manpower and inputs derived from fossil fuel. This new model and its accompanying emergy indices may be of interest for those interested in a Prosperous Way Down.

Keywords: Soybean, Agriculture, Brazil, Emergy, GMO, Ecological farming.

Introduction

As it can be seen in Figure 1, information is identified as an external force that contributes to the transformation processes that occur within an economic system.

In the Emergy literature, there are several valuable works written about Information (Odum, 1977; 1988, 1996, 1999, Odum & Odum 2001; Brown, 2004); but even if it is recognized as a force and it is represented in systems diagrams, until now, as far as we know, its influence in agricultural systems has not been explained and measured. A reference for an emergy calculation of agricultural systems (Folio 4 prepared by Brandt-Williams, 2001), does not include the symbol of external Information (Figure 2) and does not discuss this issue. In the case of soybean production in Brazil, previous research (Ortega et al, 2005) points out that external information could be the force that defines public policy and the behavior of a great number of soybean farmers.

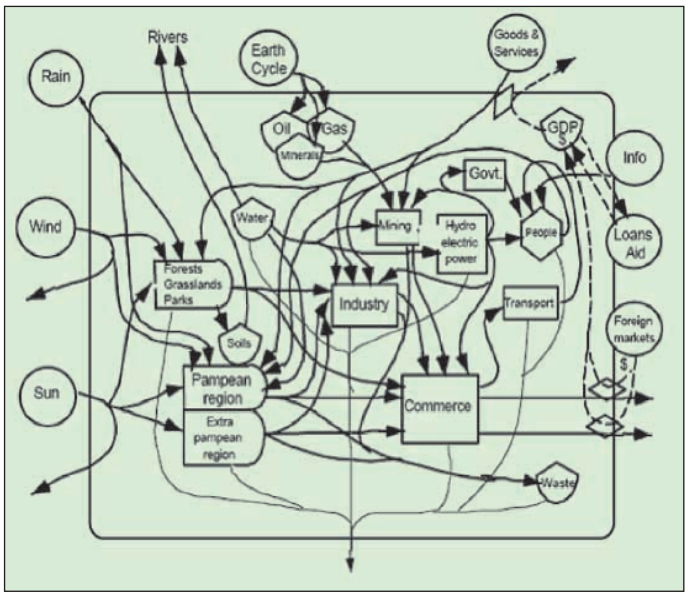

Fig. 1 - Emergy diagram of Argentina (Ferreyra, 2001).

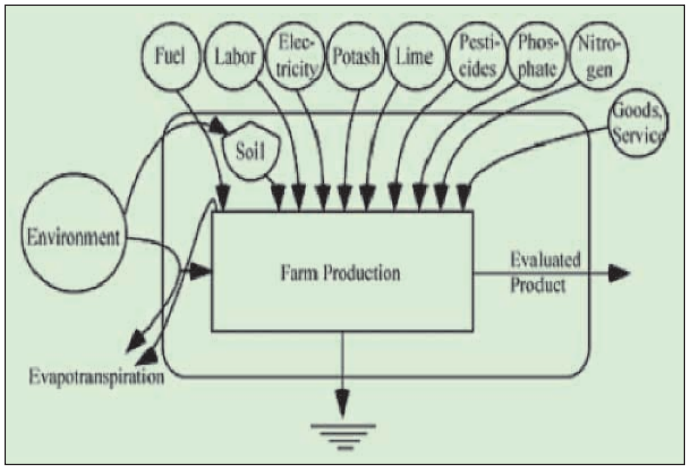

Fig. 2 - Emergy diagram of inputs evaluated for products of Florida Agriculture (Brandt-Williams, 2001).

Therefore, some effort is needed to understand the concept of information and information processing and also to discuss the possibilities of how to measure this flow.

The concept of information

Human information can be defined as stocks and flows of signals, links, data, codes, symbols, ideas, concepts, images, emotions, feelings, smells, memories, knowledge structures and life-style or culture produced by a system that can be interpreted and used by others. The sequence of processes through which raw data become information, knowledge, science, technology, know-how, local public policy, foreign policy and finally norms and laws is visualized in Figure 3.

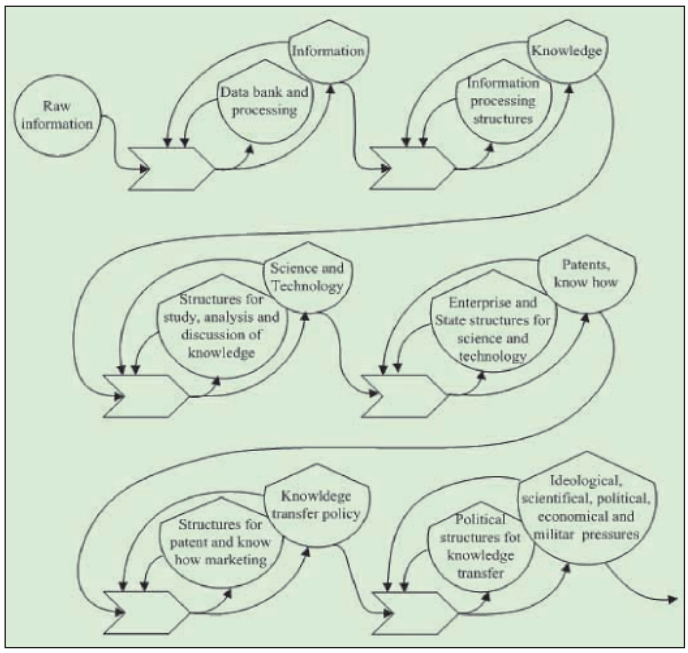

Fig. 3 - Systems diagram of the transformation of information into knowledge.

The force of information (INFO) is not neutral; it is linked to the ethical and moral values of the scientific-economic frame where it is created. The force of knowledge does not always have positive effects on the system that receives it. For example, under present circumstances in Brazil, it often has a negative impact because it transfers most of the benefits to the system that generates and controls the information. Within the Capitalism paradigm, INFO is usually understood just as new technology, but behind that neutral image there is the ideology of maximizing the return on investment, exclusion of social and environmental costs as well as strong military forces used for its proliferation all over the world.

The diagram in Figure 3 does not show explicitly the force of human values acting along the pathway of information flow, but that force is implicit. INFO can incorporate a clear perception of how the ecosystems work, and then it could be beneficial to the whole. In practice, two paradigms define it: "dominium" (ownership and exploitation) and "convivium" (working together for the common good). Figure 4 compares knowledge used for domination or for convivial interactions.

The information concept applied to soybean farming

As it is shown in Figure 5, in capitalist agriculture, INFO is basically an external force used to control an agricultural system for the benefit of the chemical and biotechnological industries of highly industrialized countries. But, in Brazil there are "local ecological agricultural traditions" and also organic farms that demand other kinds of information.

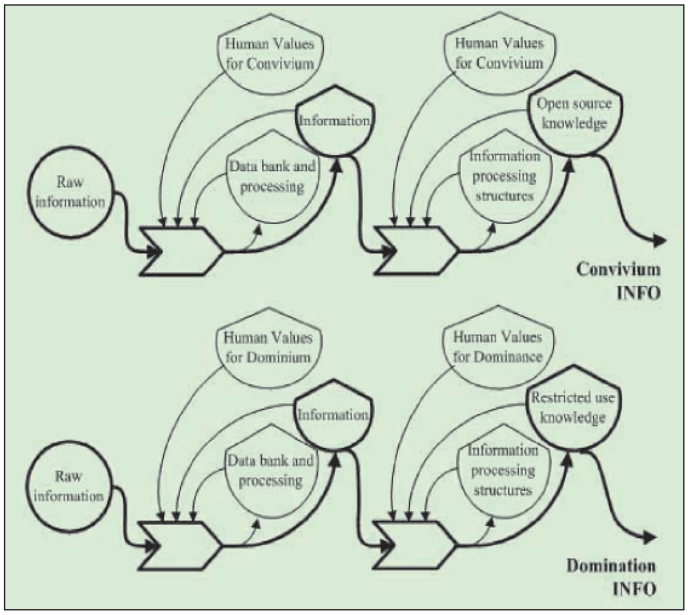

Fig. 4 - Two kinds of information and knowledge configured by human values.

Table 1 - Type of farm, number of farmers, size of farm and supporting INFO.

Biological systems		
Ecological family-managed small farm (25 000)	10 to 30 ha	Agroecology and forestry integrated with cattle hubandry; Local markets; Environmental services. Permaculture and Slow Food Movement
Organic producer (500)	300 ha	Organic Agriculture, Organic foreign markets.
Chemical systems		
Chemical inputs small farm (500000)	5-30 ha	Agro-chemistry; Local markets.
Biotechnological systems		
Chemical inputs medium farm (20000)	300 ha	Agro-chemistry and Biotechnology; Commodities foreign markets.
Chemical inputs big farm (5000)	3000 ha or more	Agro-chemistry and Biotechnology; Commodities foreign markets.

Table 1 was built to show the link between each type of farming and the INFO that supports it.
Recently the Brazilian Congress had audiences concerning the use of transgenic soybean seeds but only the chemical and biotechnological farming options were taken in consideration, the biological farming options were completely ignored. The main concern of the government was to obtain economic resources from soybean exports to pay external debt, and in that sense the more "practical" attitude was to support the big biotechnological farmers even though the small and medium biological farmers are responsible for almost 20 % of production and provide sustenance for much of the population.

The results of emergy and economic analyses

Emergy analysis of agricultural systems can be improved substantially if the systems diagrams show the complexity of information processing and its effects on the system see for example Figure 6.

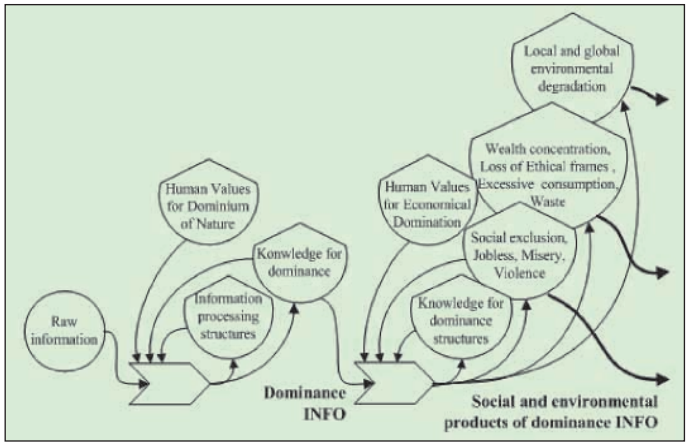

Fig. 5 - Social and environmental impact of knowledge prepared for dominance. This diagram was adapted from a flow diagram prepared by Freire (2002).

In the USA, soybean farmers can receive direct subsidies in the form of money deposited in the farmer's bank account. Both in the USA and in Brazil, farmers also receive indirect subsidies: the positive effects of government research and infra-structure; and no summons or repercussions are assessed for ecosystem destruction (ecological debt), rural exodus (social debt), climate change (atmosphere debt) and destruction of human heritage (ethical debt). What is the cost to society of these uncounted impacts?
The Emergy complete evaluation table will have to consider the effects of regional biodiversity, nitrogen captured from the atmosphere by bacteria, soil minerals dissolved by soil biota, increased ultra-violet radiation, excess carbon dioxide, climatic change, acid deposition and water percolation. In addition, the specific renewability of each input should be considered. Finally, INFO should be identified and measured. This is not an easy thing to do, as it can produce a positive or a negative effect on the receiving system, as shown in Figure 7.

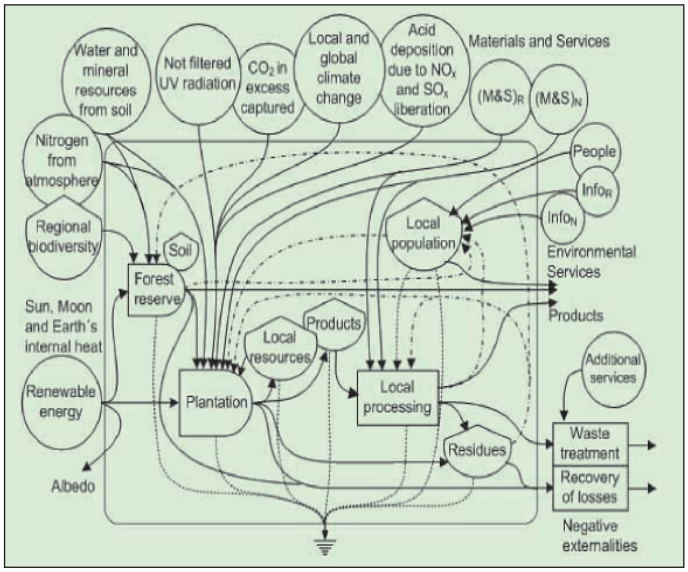

Fig. 6 - A more complete systems diagram for an agricultural system.

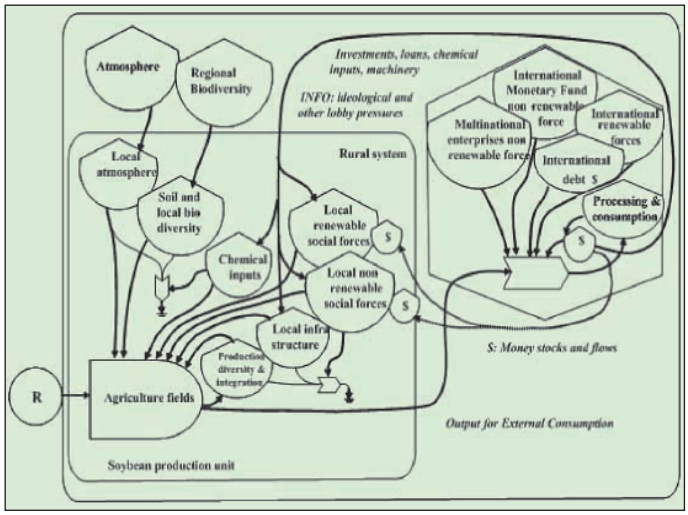

Fig. 7 - A more complete systems diagram for agricultural systems.

A brief description of the information process:

The transformation processes through which raw data become information, knowledge and finally technology transferred to other systems must be studied to discover how to measure the INFO flow and understand how it acts on the receiver. Figure 8 shows the information process at the creator and receiver sides. The world exists in a time of strong competition between human systems. In order to overcome competitors social systems organize themselves to use the natural resources that deliver maximum net energy, as fast as possible. There is no concern about fairness in trade, social impacts, biosphere health or recovery efforts, it is analogous to predation, the strong devouring the weak.

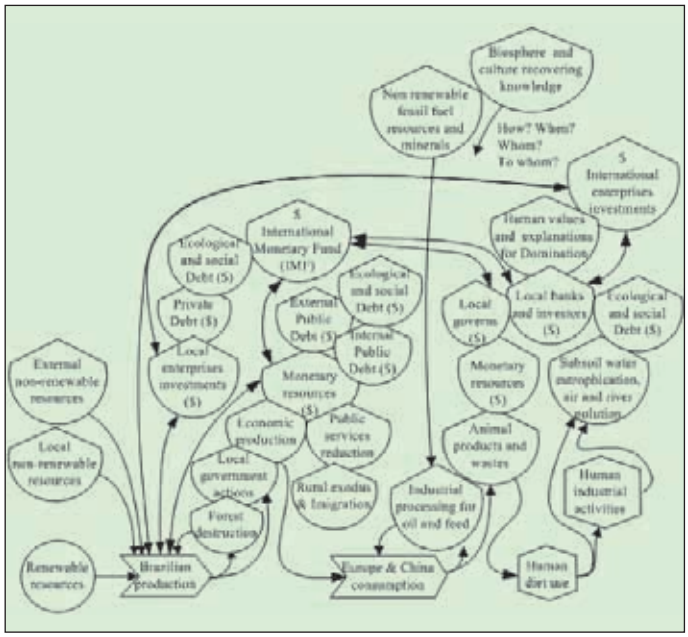

Fig. 8 - Information creation at donor side and information actions at the receiver.

Most industrialized countries have depleted their energy resources and now are expanding their influences on other countries; exploiting the remaining natural resources, such as, low priced agricultural raw materials and fuel oil. The less developed surrounding states become dependent and try to replicate the development process of the central more industrialized countries.

To survive, the peripheral countries mimic the countries with central roles in the global economy. They borrow money to install infrastructure, to induce investors to produce raw materials for export, and to set-up industries to process some raw materials into products. These investments create monetary debts and later their payment becomes the basis of an extortion mechanism to subjugate the peripheral countries to transnational enterprises and define their public policy in favor these corporations. This process is oblivious to the real needs of the peripheral countries and their people.

It is necessary to explain that interest rate on the debt is changed by the lender countries; as a result the debt increases and becomes practically eternal even if it is regularly paid by the borrowers. On the other side of the balance, the capital lenders create an ecological debt, a social debt, and an ethical and cultural debt that can be even bigger than the economic debt that is owed, but these liabilities are never recorded in an accountant's ledger and thus never have to be paid.

As can be seen in Figure 9, INFO becomes at the receiver side: corruption, omission in the application of laws,

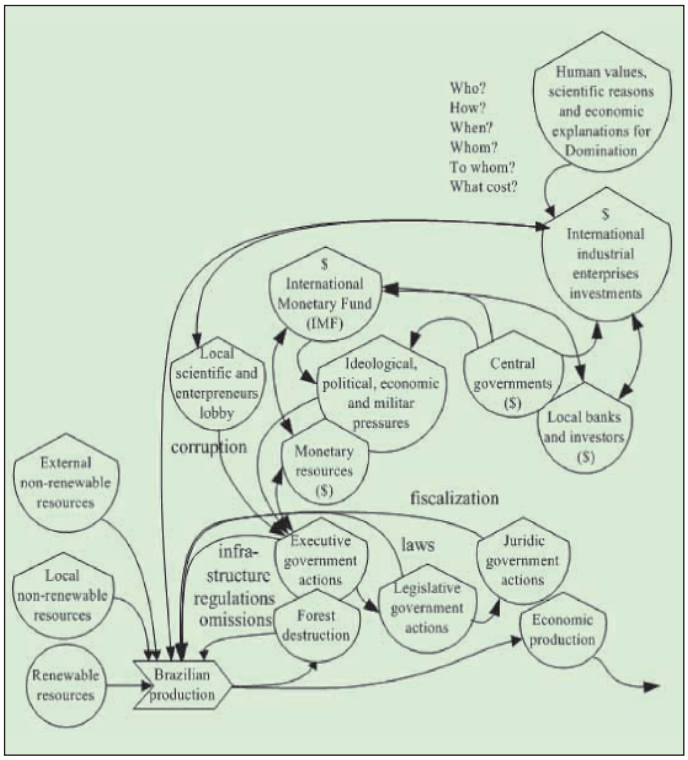

Fig. 9 - How debt payment controls agricultural planning in Brazil.

rapid change of internal regulations, modification of laws, the creation of infrastructure to benefit only part of population, destruction of ecosystems, reduction of welfare, reduction of autonomy and risks to the sovereignty of the nation. As a result detrimental INFO establishes the possibility of an environmental and social collapse, both at local and global scale.

Preliminary conclusions

This work is still in progress. After the identification of information mechanisms the next step is to measure the value of destructive INFO. A first guess can be obtained by considering the yearly expenses of the US military corps divided by the total number of countries affected by the US. This coercion pressure in Brazil is used to force the payment of the external debt (interests and principal) and a great part of the revenue from soybean exports is used for that purpose. Soybean farming spreads over 18 x 10^6 ha with a yield of 2930 kg per ha, at a price of 186 USD/ton. 38% of production is exported (Alice Web, 2006).

Info pressure: (720 E9 USD/150 countries) / 20 E6 ha = 300 USD /ha/year.

We think that the current INFO input to the Brazilian agricultural system is an indirect subsidy that benefits biotechnological farmers because it creates unfavorable conditions for the growth of ecological farmers.

For a more complete analysis, it is necessary to include the negative externalities and consider environmental services. A recent research (Ortega et al., 2005) and also work in progress reveal great values for these items:

Chemical agriculture:

Negative externalities: 360 USD/ha/year (greater cost due to additional services).

Environmental services: 0 USD/ha/year (less ecological products).

Ecological agriculture:

Negative externalities: 0 USD/ha/year (no external costs).

Environmental services: 400 USD/ha/year (currently unpaid ecological services).

In other words, an ecological farmer should receive 400 dollars per hectare per year due to environmental services transferred to society and nature (water percolated, temperature reduction, carbon fixation, biodiversity maintenance and human culture preservation). On the other side, a chemical farmer should pay 360 USD for destruction of local native vegetation, pollution of soil and water, carbon dioxide emissions during fertilizer production, human exodus in rural areas (urban problems) and health hazards to workers and consumers.

Recommendations:

The inclusion of externalities in emergy and economic analyses can improve our perception of benefit/cost ratio and social and environmental performance of soybean systems. It could be argued that biotechnological systems have positive externalities in urban areas but these benefits are unsustainable as they are dependent on fossil fuels. It probably would be more beneficial for any developing country to develop ecological farming methods and to focus on providing land, jobs, richness and environmental services for the people of their own country. Another paper will describe the sustainable INFO mechanisms and their energy-emergy values.

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