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## Rural - urban co-development - challenges to post-industrial society

**Jan Holm Ingemann**

Agricultural Economics

Department of Economics, Politics and Public Administration

Aalborg University

Fibigerstraede 1

DK 9220 Aalborg East

Phone (+45) 96 35 81 85

E-mail: [ingeman@socsci.auc.dk](mailto:ingeman@socsci.auc.dk)

The World Commission (1987) pointed out that sustainable development in general is a prerequisite to alleviate fatal threats to human future. In this note<sup>1</sup> it is stated that it is necessary to return to basic concepts and reflections to ensure that the aim, means, and context are remembered when radical changes to gain sustainability are designed. In particular this is the case when humanity's social interplay (i.e., technology) with natural life support systems is in focus. Thus, the note is founded on a restatement of basics linked to the essential challenge facing post-industrial societies. In that light it is revealed that the current reactions to the challenge are insufficient because sustainability implies radical rather than marginal changes and that the radical changes *inter alia* imply a new design of rural - urban co-development.

### 1. Basic statements as points of departure

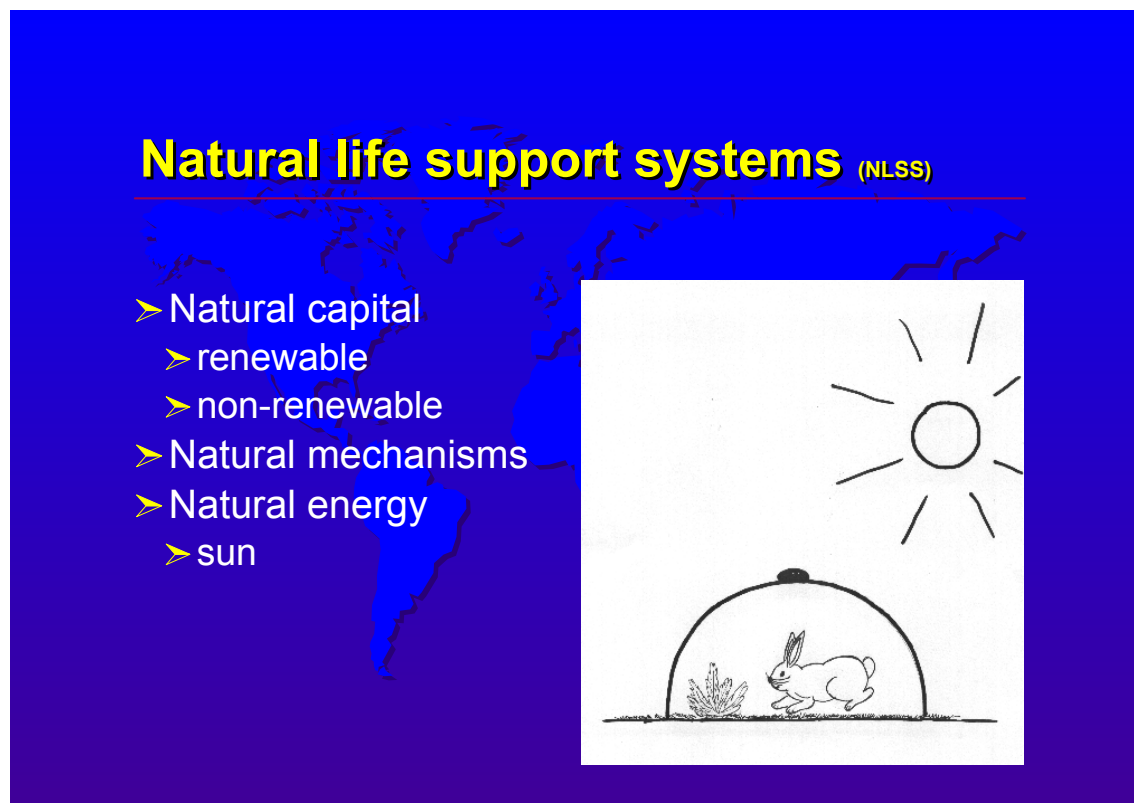
The basic challenge facing post-industrial societies is not rural-urban co-development but sustainable development. In this perspective sustainability is the aim and rural-urban co-development one of the necessary ways. Thus, the point of departure for this note will be the connection between ecology and sustainability, followed by an introduction of society into that connection.

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<sup>1</sup> The present note only includes a limited number of references. However, the author owes a debt of gratitude to the colleagues in the transdisciplinary network concerning EEA (re Ingemann, 2001b) for shaping the transdisciplinary reflections.

The World Commission emphasised the concept of sustainability in 1987. The term *sustainable development* was reshaped to describe a solution to current threats to the global society: unequal distribution of resources in time (inter-generational) and space (developing versus developed nations) implying overuse of non-renewable resources besides pollution that damage natural mechanisms. Both overuse and pollution represent a fatal threat upon the future prospects of the human species and imply the need of radical changes. Sustainable development was then introduced as the headline of the necessary radical changes. In the meantime sustainability has been interpreted and used in a widespread range of contexts that infer the necessity to state the basics.

*Fig. 1*



Sustainability is clearly related to the basic principles of ecology. Food and gas are the basic cyclical elements of ecology while energy provided by means of sunshine make the system work, as illustrated in Figure 1 with the rabbit and lettuce under an airtight dish cover; alone they would die, brought together they form a living system with two cycles. In the gas cycle, the plant and the rabbit are symmetric and equal; both are recipient technologies able to transform waste (oxygen and carbon dioxide) to resource (carbon dioxide and oxygen). In the nutrient cycle, however, the plant is autotroph and the animal heterotroph; thus, only the plant is able to reprocess nutrients from waste. The elements and relations in that system constitute the foundation of understanding and assessing sustainability. Resting for a moment by the simple picture of ecology, there are no problems of sustainability when the species are left alone in their ecological cycles and evolution. That is so, because the basic mechanisms

of nature are then exclusively in power. In that case the ecosystems will ensure that basic mechanisms will function and that the totals of living organisms automatically are balanced out to ensure that no organism extend the limited capabilities of the system regardless whether the perspective is local or global. This system can be labelled as a natural life support system.

In relation to natural life support systems sustainability presumes two crucial points. One, actions that involve hazardous damage to the basic cyclical mechanisms must be avoided. Two, balance between the number of organisms - i.e., number of rabbits and amount of lettuce - must be ensured. So, we have to consider both function and capacity.

In nature, food is nothing but a biological input and the system is outbalanced by its own means. Problems do arise when one of the species (i.e., mankind) evolves and applicates skills (i.e., technology) to offset or modify the function, or to go beyond the bounds of the system's carrying capacity for instance due to overuse of resources. When so, mankind incurs responsibility in relation to *sine qua non* for fellow men in both time and space.

When human beings have entered the picture, it is also necessary to consider sustainability and natural life support systems from a social point of view and then ask: Does present social organisation support or counteract damage according to function and balance according to capacity?

Related to the latter questions complex difficulties emerge, as food in the modern world is not only a biological input but a commodity too. Then supplementary food is a source of revenue to farmers, industries, distributors, scientists, bureaucrats, etc. Besides, these actors are gathered in social institutions and are parts of societal structures. These complex structures and institutions - producing and reproducing social experience and knowledge - can support or counteract sustainability. From a social scientific point of view structures and institutions in which technology is adapted and evolved are then important analytical concepts when sustainability is studied. Structures are the material and institutions the immaterial framings of society. (Ingemann, 2001a)

## **Technology**

Now focus is turned to human production and a couple of statements about technology are needed.

It is a basic function of any society to provide and ensure means by which the members can comply their reproductive needs. These imply productive activities; technology then becomes a crucial affair from a social point of view and a sphere by which a society might be characterised.

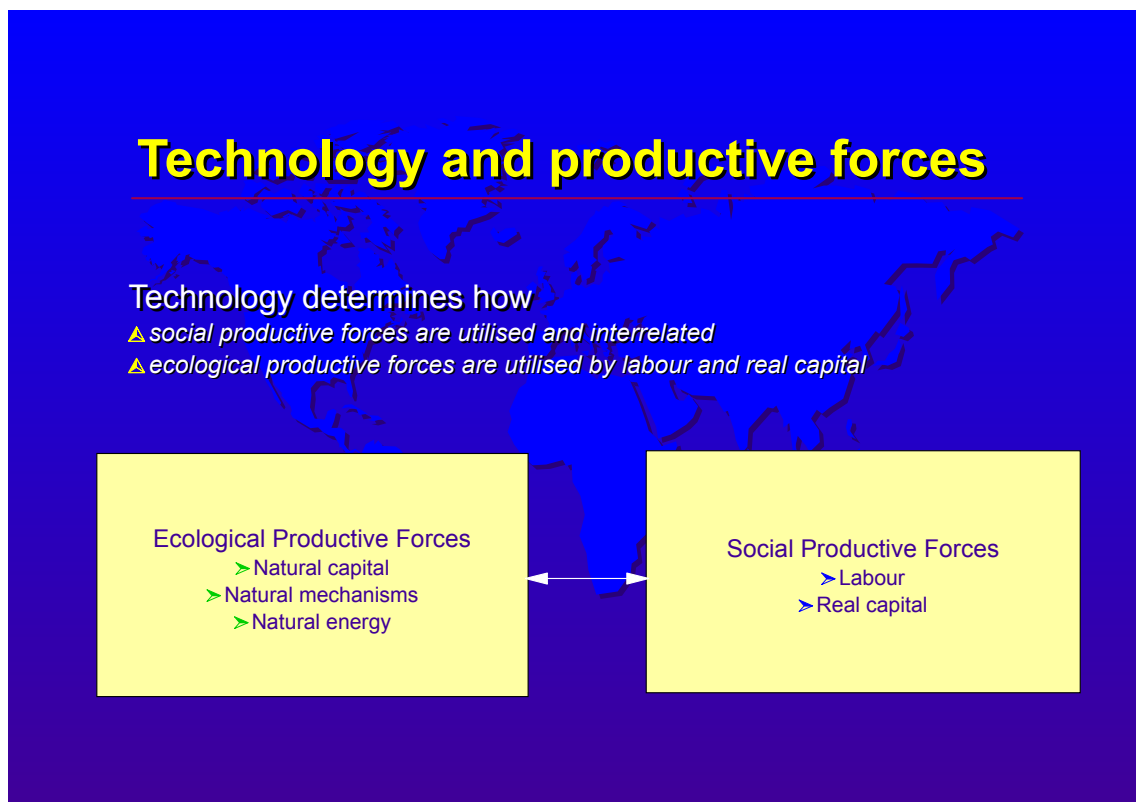
'Technology' is in everyday comprehension most often interpreted as similarly to technical devices and matters. This implies an inadequate limitation of the conceptual meaning where crucial social dimensions are cut off. In the Greek origin the concept consist of two parts, *techne* and *logos*. *Techne* is art and craft while *logos* is knowledge.

Combining *techne* and *logos* we face productive and reproductive activities, the tools, the labour with certain skills and knowledge, and the way in which the activities are organised. Tools are technical devices as machinery, hand tools, buildings, etc. - equipment that in economics are labelled as real capital. The labour is not only the physical power of human beings but particularly their skills and knowledge provided by their individual and social experience and by research and development. Skills and knowledge pertain to the ways in which the tools are effectively used in correspondence with material and labour. Organisation of the activities, however, pertain to the social framings in which the productive activities are carried out besides the relations between the elements included in the productive activities. Putting this into an actual approach seen from a social point of view implies the necessity to understand technology as consisting of three elements:

- Technical devices,
- skills/knowledge, and
- social organisation.

So, technology is related to technical matters considered in the social context; the latter being the social framings in which techniques and tools are applied and organised. In this sense technology is dealing with social organisation of productive activities and the inclusion of nature in these. In this sphere it is also determined whether the productive activities are sustainable. That is so because it is in the social organisation that the interplay between human activities and natural life support systems is determined. Just one step further is needed in the investigation of technology to underline that point.

*Fig. 2*



The material structure in which the productive activities are carried out consists of two main parts: those made by nature and those moderated by man. Both are necessary conditions to carry out social production; for that reason social production must be based on two kinds of productive forces, i.e., the ecological and the social (re Figure 2). The ecological productive forces should here cover natural capital and natural mechanisms that in unity provides the fundamental basis for human life - so ecological productive forces are the forces embedded in natural life support systems. The social productive forces - embedded in societies - should here cover the human performance by means of labour and real capital. It is important to underline that the working capacities involve a physical dimension (the labour of hands) and a mental dimension (the labour of mind) - the latter for instance the ability to co-operate and learn, cognisance, etc. The latter dimension could also be labelled as human resources. Among the two productive forces, the ecological is claimed to take precedence over the social due to the obvious fact that the ecological forces can exist (i.e., produce and be reproduced) independent of the social forces while the opposite situation is impossible. The ability of the social productive forces to produce and reproduce is fatally depending upon the ecological forces regarding both natural capital and natural mechanisms. The human reproduction (for the individual as well as for the species) is for instance only possibly by means of biological mechanisms; simultaneously construction of real capital is only possible by means of natural resources converted by means of human labour. As individuals, society, and species we therefore bear a fatal interest in and responsibility for maintaining the natural capital and avoiding damaging intervention in natural mechanisms when we carry out productive activities. Although the social productive forces rest upon the ecological, we have of course to be careful and bear forethought in our use of social productive forces too. (Ingemann, 2001b)

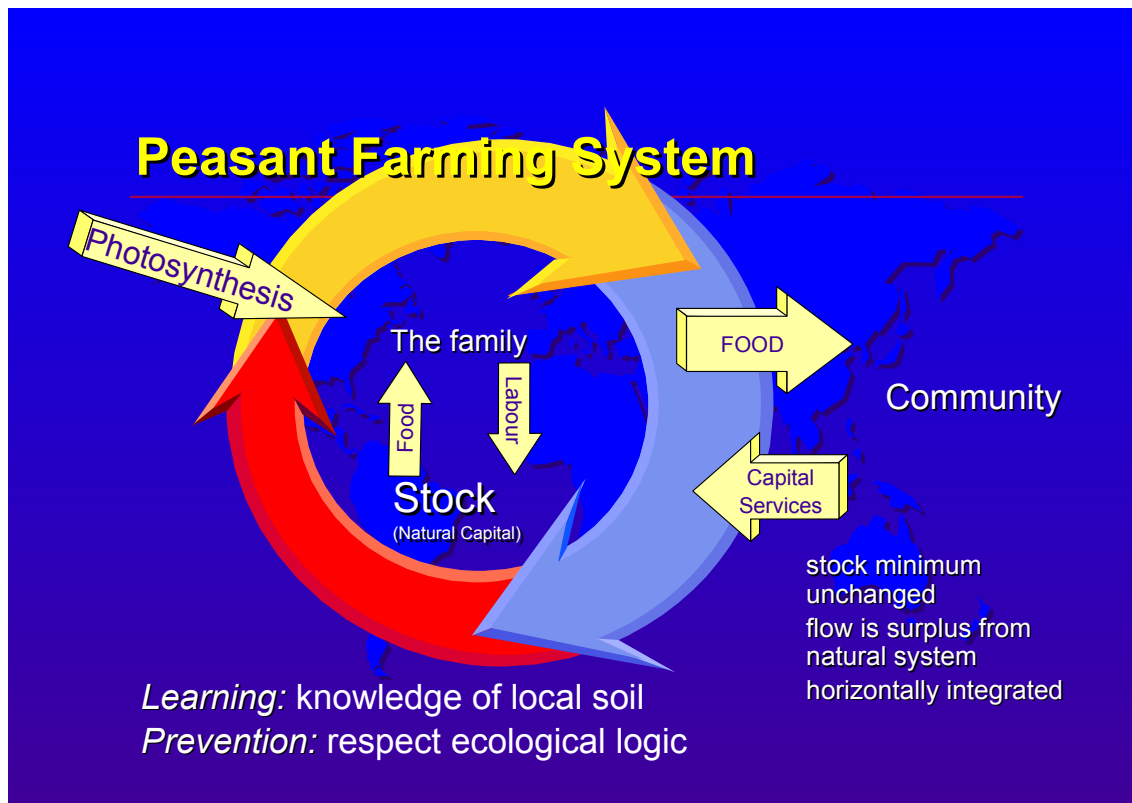
## **2. Agriculture and the environs - a historical illustration**

From the comments above follow that technology (and then human interplay and exchange with natural life support systems) both affect and depend upon social environs. To introduce fundamentally new technologies it is necessary to alter the institutional and structural design of society. When the social design is altered rigidity occur in a new epoch and tend to keep technological evolution locked in the new direction and evaluated against the new rationality. This interdependence between technology and social environs will be illustrated below by means of a brief historical sketch.

The peasant production system went through changes when conversion into livestock production took place in several countries around the year 1900. However, the applied technology was still founded so that the farm constituted an ecological unit part of a local and transparent cycle including livestock and grain production using very limited external inputs. This system (as illustrated in Figure 3) implied a high degree of farm self supply in relation to energy and raw materials. It implied a certain consciousness too. The transparent reliance and dependence upon natural life support systems did provide the foundation for a cyclical common notion of nature as well as of society. This notion was often explicitly stated as a comprehension concerning property rights of future generations: the soil should at least be

passed on to the next generation as fertile as received from the past. Basis for this comprehension was experience and knowledge; if the farmer managed his livestock or soil contrary to the biological logic of ecological cycles he would experience negative productive reactions from both livestock and soil. These negative reactions would further result in negative economic performance and then economic pressure on the family. Shortage of material opportunities could of course force the families to act as short-sighted and then to ignore long term considerations. However, without romanticising the past, one can conclude that in those times farming technology was ecological; and a functional integrity was maintained between labour (often the farmer and his family) and the local natural life support system.

**Fig. 3**

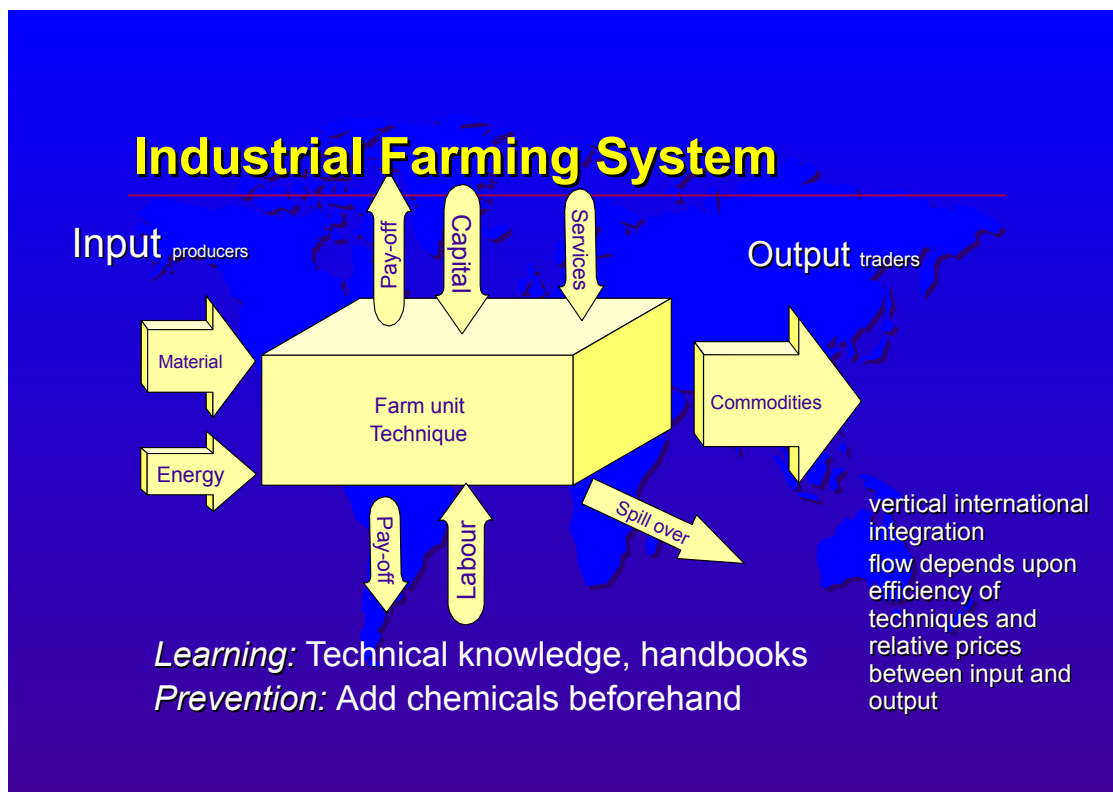


The surplus from the ecological cycle - produced by means of photosynthesis, labour and natural capital (primarily soil) - could be exchanged with the external economy. However, this exchange took for a major part place at the local level implying a relatively close relationship between the producer and the consumer - in other words, the social cycle too was transparent and rather horizontal. This implied that the consumer could personally experience the ecological cycles, while the farmer simultaneously could face the consumer and receive reactions from the latter concerning the food supplied. This user-producer relationship was basis for a mutual understanding and for directly sharing of the responsibilities attached. Similarly the farmer could in general experience how the potential spill over would affect the environs and how the input to his farm was provided. (Ingemann, 2000)

### Industrialisation of farming

After World War II industrialisation of farming was speeded up which in turn implied a rather rapid technological transformation. However, the scientific basis was for a great part already established in the mid-19th century primarily attributed to the German chemist, Justus von Liebig (1803-1873) (Liebig, 1840). He laid down the theoretical foundation for applying chemicals in agriculture stating that the plants should only be supplied with water-soluble nutrients produced in an artificial/industrial way. In his alternative statement Liebig simultaneously and explicitly rejected the common conception of that time which stated that efficiency of the living microbes in soil was the key to adequate and efficient farming. By means of Liebig's alternative approach the dynamic comprehension of natural life support systems - as farming was understood hitherto - could be substituted by a more clinical and industrial notion of an input-output production system. This system was to a high degree designed as decoupled from local natural life support systems and potentially also decoupled from local community.

Fig. 4



In the mid-20th century the theoretical basis as well as an affiliated notion of decoupled relations between man and natural life support systems had thus already been offered for about 100 years. So the agricultural innovation in the mid-20th century did not reflect a new scientific but rather a new social invention. The structural and institutional framework of agriculture became transformed to enable implementation of this alternative technology quite

in line with the view upon technology and in line with the current social experience of that time: the evolution of fordistic industries had prepared a general heavy increase in wealth. A structural and institutional transformation was necessary why industrialisation of agriculture implied increasing amounts produced per farm besides provision of equipment and industrial intermediates. Production and distribution of knowledge had to be altered too in accordance with the alternative technology and its alternative notions.

Introducing industrial technology in farming then involved a distinct break with the up to then practised relation between man and the natural life support systems besides a similar break with attached notions. According to industrial practices and notions the peasant was transformed into a specialised producer organising his production relatively detached from the ecological cycles looking upon soil as dead material re Figure 4. Direct interrelation and interaction with natural capital and biological mechanisms were to a still wider degree substituted by technical approaches enabling an endless reiteration of similar processes on similar objects. This reiteration on similar objects implied a need to adjust the objects - fields and animals - to similarity. Simultaneously the main part of the necessary inputs was reached outside the local ecological cycle and then outside the local natural life support system; for instance energy and industrial raw material. Besides, the application of various chemical inputs, such as pesticides and antibiotics, implied that biological indications of mistreatment were missed. Indications such as crop rotation and livestock diseases were no longer interpreted as symptoms of the farmer's inadequate knowledge and experience but as inevitable parts of production. According to the new approach such symptoms should just be cured through appliance of systematic - most often chemical - treatment. Finally, the detachment involved a new demarcation between crop and livestock production by which manure tended to be interpreted as troublesome waste and not - as hitherto - as a valuable and integrated element in an efficient symbiosis between livestock and soil.

Thus, the cyclic ecological relation between man and nature was substituted by a linear relation where agriculture to a certain extent became detached from living biology and interpreted and organised as an iterative production process; input at one end and output at the other. Nature then became an outdistanced object and the functional integrity between man and nature tended to disappear. The conversion also implied new fields of experience whereafter human learning about agriculture and natural life support systems changed. Where the peasant of the past experienced that actions adverse to basic ecology (knowledge about fundamental principles of cycles in nature) would give a negative pay off, the modern farmer experienced that actions adverse to industrial logic would give a negative pay off - for instance if he avoided pesticides. Certainly, not because the nature or the logic of its fundamental mechanisms was transformed but because the social institutions and structures around agriculture were so.

Supplementary the industrialisation caused a decoupling from the local level, whereafter inputs were provided from industries around the world and the farmer lost the breath of view of the interrelated connections his farm became part of. Thus he lost insight into the production of his inputs and the subsequent dependence on natural life support systems in various parts of the world. Farmers' horizontal integration was then substituted by vertical, international integration where the individual farmer became a tiny part in an international system hard or impossible to take in. This internationalisation also implied that farmers tended to be separated from consumers who became spread all over the world and then



became rather invisible. Governmental institutions took over responsibility for the veterinary quality and thus should secure that consumers did not catch diseases from eating the food - the personal user-producer relationship then disappeared. Similarly spill over - for instance pesticides - from farming seemingly disappeared out in nowhere whether these occurred at the farms providing food to the processing enterprises or at the farms in other parts of the world producing produce as input to the former farm. (Ingemann, 2000)

### **3. Observations about post industrial society and its present capability to redirect the trajectory towards sustainability**

Over the past decades an increasing awareness has been dawning in the so-called developed world that sustainable development is necessary to alleviate local, national and global problems afflicting the natural environment. It is suggested that this acknowledgement can be understood on the background of changes in values (related to mass belief systems) that can be attributed to the transition from an industrial to a post-industrial and post-material epoch in our rich part of the world (Inglehart, 1997). It is further suggested to be seen as a consequence of experiences with the irreversible and fatal environmental effects that modern technologies can result in (e.g., World Commission, 1987; Walter, 1999).

The post-industrial responses to the awareness about human misuse of natural life support systems have so far been of three kinds:

- 1) Several local, national, and global meetings supplemented by an endless stream of documents.
- 2) A marginal number of green consumers and producers trying to do something in delimited sectors like renewable energy and organic food.
- 3) Governmental regulations *after* natural life support systems have been damaged.

To put it polemical the comments on the reactions could be:

- 1) Words do not make a sustainable technology. It is not by means of words but by means of actions we poison our drinking water and damage the ozone layer.
- 2) We do not turn society into a sustainable trajectory by eating an organic roast on Sundays and junk food the rest of the week.
- 3) We do not reach sustainability if we keep on fighting symptoms and leave the fundamental causes unaffected.

This is of course an unfair and derogatory judgement. The efforts made by grass root activists and well-meaning politicians and bureaucrats ought not to be underestimated - they represent essential social actors. However, the polemic characteristic brings forward the crucial point: a more comprehensive and fundamental modification of behaviour towards sustainability has yet to be attained. This is the case although most of us presumably know - and many of us obviously know - that a good deal of our actions are not sustainable; but with the current institutional framework and the social structures within which we act, we can only hardly do otherwise. Of course as an individual I can modify parts of my daily actions and routines; I

can even opt out and move to an uninhabited island and live my life in harmony with nature. However, none of these options fundamentally affect technology because the latter involves *social* organisation and then is a social matter only to be transformed by means of social decisions and collective actions.

The comprehensive modifications of behaviour have fundamental changes in social structures and institutions as a prerequisite. One of these changes is re-establishment of rural-urban co-development founded on a conscious recognition of the basics of natural life support systems; under here it is necessary to recognise that urban areas have evolved as heterotroph without adequate linkages to recipient technologies in rural areas. From a social point of view such points call for a new design of social structures and institutions where regard for function and capacity in natural life support systems is couched in the basis for the social rationale just as is the case with democracy and human rights. By the way, who would for instance seriously calculate whether the monetary benefits in current prices would exceed the monetary costs if we abandon freedom of speech?

#### 4. Concluding remarks

It is asserted above that a new institutional and structural design of post-industrial society is an urgent task if serious threats to human prospects should be avoided. To gain such sustainability, respect for the ecological forces of production is a prerequisite. On the other hand it is also necessary to recognise that the purpose of society's productive efforts is to meet human needs *and* in fulfilling that task, the social forces of production are a prerequisite too. Thus we must consider two productive forces and two allocation systems related to human production and then to technology. An allocation system exists within natural life support systems that is independent of man. Due to technology and the ensuing production, humanity has introduced its own supplementary system of allocation (economy within politically established frames). The human allocation system has implications for the ecological forces of production. Ecology concerns the allocation and circulation of matter in the environment, while economy concern society's allocation and circulation of exchange value between citizens. Both ecology and economy are realities that are necessary for human production and reproduction. So, we cannot abolish ecology nor economy. Conversely we can change the institutional and structural framings for the economy and so politically determine society's trajectory.

Hence, the challenge is to design social institutions and structures so that they escape the current mismatch between the two necessary allocative systems: ecology and economy. This is as far as we can get by now, because we are only equipped with a vague sense of what that design actually should entail when carried out in practice. So it is claimed that no one - for the time being - has a final recipe. Thus, the necessary knowledge and experience must be produced. We can use inspiration from the past - for instance acknowledge lessons from the peasant system as introduced above and as included in the *principles* of organic farming. But we can not turn the clock backwards and return to previous trajectories and if we could why then abandon progress that humanity after all has endeavoured in the time between now and then?

The proper and adequate solution is to carry out social experiments to produce the necessary knowledge and experience concerning institutional and structural design of sustainable technology in a post-industrial society. In this connection it must again be remembered that technology both consists of technique and society's organisation, and that sustainability involves the relationship of technology to the ecological forces of production. Sustainability is therefore not necessarily synonymous with substitution of existing techniques - we do not necessarily have to wait for new inventions and innovations on the technical level. Evolving *organisation* of society, which is the other dimension of technology, can advance more sustainable utilisation of the ecological forces of production, even in the short-term and with the continuing adaptation of existing error-friendly<sup>2</sup> techniques. Here it should also be remembered that organisation of society includes the relation between rural and urban activities.

In Denmark Ecological Experimental Areas (EEA's) are suggested as means to carry out the necessary experiments. EEA are geographically specified areas where communities can conduct experiments concerning the means by which not only delimited sub-sectors but an entirely sustainable society can evolve. It is pointed out that the EEA's must be founded in existing communities because the aim is to explore how present society can evolve institutions and structures supporting sustainable technology as an entire and consistent system able to produce and reproduce. Furthermore, basis in existing communities implies experiments concerning both the process and the substance. The *process* because the findings will indicate how to evolve society from the present stage to a sustainable stage. The *substance* because the findings will indicate how to design social framings that enable a sustainable interplay between the ecological and economic allocative systems. (Ingemann 2000b; Ingemann, 2000c)

If such experiments are to be meaningful then they must naturally have a high degree of freedom to gain experiences via trial and error. Indeed, they must be empowered to extricate from the current social framings that are the cause of present mismatch and social traps (Costanza et.al., 1998). But it must nevertheless be maintained that there is an indispensable objective for the experiments that they must seek a suitable design of society that promotes sustainable technology in a post-industrial society. In the design of institutional and structural framings for zones as EEA it is then of fundamental importance that the ecological forces of production are consciously reintegrated, and that one is deliberate about procuring the necessary empowerment to avoid social traps.

Delimited sub-technologies such as organic agriculture and renewable energy are developed with matching partial conceptions and stand together with historical inspiration available for the experiments. The challenge is to connect these delimited sub-technologies in interaction with, and with the utilisation of, other relevant technological conquests for entire systems of human production and reproduction. In this connection it is also necessary to carry out adaptations, changes, and the further development of these conquests.

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<sup>2</sup> Error-friendly technologies are characterised by reversible and transparent effects on the environment (Weizsäcker and Weizsäcker, 1984).

However, knowledge and experience presented at this seminar will form a mosaic that can be useful to the practitioners who must carry out social experiments on our behalf in an attempt to find the way in which rural-urban co-development can be established as sustainable technology.

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