



“Summary of article by Jesse H. Ausubel: Industrial Ecology: Reflections on a Colloquium” in Frontier Issues in Economic Thought, Volume 1: A Survey of Ecological Economics. Island Press: Washington DC, 1995. pp. 77-79

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## **“Summary of article by Jesse H. Ausubel: Industrial Ecology: Reflections on a Colloquium”**

Industrial ecology can be defined as "the network of all industrial processes as they may interact with each other and live off each other, not only in the economic sense but also in the sense of direct use of each other's material and energy wastes."(879) This paper discusses ten fundamental questions that should shape the field of industrial ecology, spanning the fields of philosophy of nature, history of technology, science, engineering, economics and management.

### **1) Do Sociotechnical Systems Have Long-Range Environmental Goals?**

While societies set broad goals such as poverty reduction, universal education and health care, other sociotechnical systems such as agriculture, transport, energy and production seem to evolve without a long-range purpose. This evolution results from the interactions among strict rules of choice at the micro level. Economic systems are inherently short-sighted and do not help direct sociotechnical systems towards long-range goals. Industrial ecology can provide direction towards a better environment by aiding in the coordination and creative design of the economy. This field can promote reduction of pollution and throughput, and it can help determine which technologies, products and enterprises should survive.

### **2) How is the Concept of Industrial Ecology Useful and Timely?**

Three fields - ecology, economics and chemical engineering - lay claim to an understanding of the dynamic flows of energy, resources and information. Industrial ecology should synthesize the perspectives of all of these fields to incorporate what is valued in economics, to expand the domain of engineering design, and to integrate our understandings of ecology and of the man-made world. The role of industrial ecology is especially important given the scale and rate of growth of the economy and the resulting emissions, pollution and waste. An understanding of the complex interactions between different systems will help us identify methods to make waste products useful.

### **3) What are Environmental Technologies?**

There are still no definite criteria for identifying environmental technologies. At present there are many definitions. Some include technologies that improve the environment relative to present practices, while others focus on technologies that prevent pollution, provide remedies, or conserve resources.

#### **4) Is There a Systematic Way to Choose Among Alternatives for Improving the Ecology of Technologies?**

The crux of industrial ecology lies in the search for technologies that reduce throughput in the production process in an efficient manner. This involves both the use of materials with suitable properties at the outset, as well as consideration of the end-of-life recyclability. Industrial ecology needs to explore whether there are systematic ways of transforming present technologies to achieve these desired results, and also whether potential pollution problems can be foreseen when technologies are being developed.

#### **5) What are Ways to Measure Performance with Respect to Industrial Ecology?**

Performance with respect to industrial ecology can be measured by identifying major transitions expected in the relevant processes, and using these as a base. This is similar to the way in which transitions are used in other fields - e.g., the demographic transition identified when fertility rates start to decrease, or the labor force transition signified by a decline in agricultural workers. One transition that can be used as an indicator for industrial ecology is the shift from materialization to dematerialization, i.e., to a decrease over time in the weight of materials or "embedded energy" in industrial products. Another transition could be the shift to decarbonization of the energy system, i.e., a shift from an increasing to a decreasing ratio of carbon to total energy used for economic activity. Industrial ecology should move towards both hastening and analyzing these transitions. Moral and aesthetic criteria should also be included in the evaluation of industrial ecology processes.

#### **6) What are the Sources and Rates of Innovation in Environmental Technologies?**

Industrial ecology should also explore how environmental innovations come about and how they get diffused. How much can one rely on markets and entrepreneurs? What role should targeting and planning play in the development of environmental innovations?

#### **7) How is the Market Economy Performing with Respect to Industrial Ecology?**

Environmental concerns have not been well served by the market, primarily because social environmental costs are not easily internalized in market transactions. Industrial ecology should consider five aspects of the interactions between industrial processes and the economy:

- a) **information structures** that transmit information between the economy, the environment and economic agents;
- b) **incentive structures**, i.e., the social and economic rewards and penalties for decisions that are faced by individuals and organizations;
- c) **learning mechanisms** within and between technologies and markets;

d) **selection processes**, i.e., how consumers and producers can make better choices of products and technologies; and

e) **control and power structures** that monitor performance and limit the range of acceptable behaviors in the economy.

### **8) What will be the Effect of the Ecological Modernization of the Developed Nations of the North on the Developing Countries of the South?**

The South is an exporter of energy and natural products to the North, so increased environmental efficiency in the North may lead to a widening of the economic gap between the North and South. The effects of the integration of world markets on the environment also need to be analyzed. So far there has only been speculation about what these effects might be, and no real insight has been gained.

### **9) How Can Creative Interaction on Environmental Issues be Fostered Among Diverse Social Groups?**

Different social groups have different views on a number of issues that have an impact on the environment, including myths of nature, views of resources, scales of activity, aesthetics, notions of fairness, risk, etc. All of these views must be considered and discussed to build a consensus on the environment.

### **10) How Must Research and Education Change?**

There is a general feeling that the science and education that brought us to our present state are inadequate to solve our problems. Science and education must move in the direction of an holistic ecological perspective.