

Future prospects of Industrial Ecology as a Set of Tools for Sustainable Development

Perspektywy ekologii przemysłowej jako zestawu narzędzi wspierających rozwój zrównoważony

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Abstract

From thought to action, ideas to implementation... that is the way to go. Industrial ecology as a set of tools and strategies to shape the world of the future and enable it to develop sustainably, needs to adjust and evolve over time. There is often a risk of having to *rob Peter to pay Paul* which must be minimized. The *wheels-within-wheels* nature of sustainable development needs to be appreciated and accepted in advance, even if one may agree that it would be difficult to please everyone equally. *Something's gotta give*, as they say, for something else to stay.

Industrial ecology as a field of education and research is in its teens now, raring to go. In the days to come, even as it entrenches itself as a mature discipline in university campuses across the world, it is vital and extremely necessary to ensure that the links to society, government and industry are strengthened and researchers in this discipline do not become ivory-tower idealists dishing out theories ad infinitum, which do not have any relevance to ground realities.

Key words: sustainable development, social, economic, environmental, Triple Bottom Line, life-cycle thinking, government, society, industry, science, thought, deed, ideas, policies, practice

Streszczenie

Od myśli do działania, od idei do wdrażania w życie... tak właśnie funkcjonujemy. Ekologia przemysłowa jako zestaw narzędzi i strategii pozwalających kształtować świat przyszłości umożliwiając jego zrównoważony rozwój dostosowuje się i zmienia w czasie. Zawsze istnieje zagrożenie, że nasz cel będzie realizowany czymś kosztem, co należy zminimalizować. W każdej sytuacji należy jednak zaakceptować ideę rozwoju zrównoważonego w całej swej złożoności, nawet gdy spełnienie w równym stopniu potrzeb wszystkich okaże się problematyczne. Jak głosi popularne powiedzenie: Aby coś osiągnąć, z czegoś trzeba zrezygnować.

Ekologia przemysłowa jest wyzwaniem edukacyjnym i polem badań naukowych. To dyscyplina, która dopiero zaczyna się rozwijać. Ważne jest, aby wraz ze wzrostem jej popularności pozostała ona dyscypliną praktyczną, służącą społeczeństwu, władzom i przemysłowi, a także aby uprawiający ją naukowcy nie stali się oderwanymi od rzeczywistości teoretykami mnożącymi swoje teorie w nieskończoność, zapominając o świecie rzeczywistym.

Słowa kluczowe: Rozwój zrównoważony, społeczny, ekonomiczny, środowiskowy, trojakić podejście do zrównoważoności, cykl życia LCA, rząd, społeczeństwo, przemysł, nauka, myśl, czyny, idee, polityka, praktyka

This journal is called the *Problems of Sustainable Development*, which means in sooth, the *Problems to be encountered to achieve sustainable development*. It can be noted at this juncture that *Problems* has a negative connotation; and one could as well

replace this word with *Challenges*. Problems are encountered and challenges are overcome. This paper is based on a trial lecture delivered by this writer on the 24th of March, 2011 at the Norwegian University of Science and Technology in Trond-

heim, as part and parcel of his PhD thesis defence. The title of this lecture was – *Industrial Ecology: Current Realities and Future Prospects*.

Industrial Ecology, as defined by Robert White of the US Academy of Engineering, is the study of the flows of materials and energy in industrial and consumer activities, of the effect of these flows on the environment, and of the influence of economic, social, political and regulatory factors on the flow, use and transformation of resources. In a nutshell, it is a set of tools and strategies, ways and means, to chart the way ahead to sustainable development. The *Current Realities* point to challenges which need to be surmounted, and the *Future Prospects* refer to the possibilities of surmounting these challenges and also what lies in store when these challenges are surmounted.

With that backdrop, it is apt now to focus on the *Current Realities*. In other words, where we are poised at the moment and how we understand industrial ecology in the year 2011.

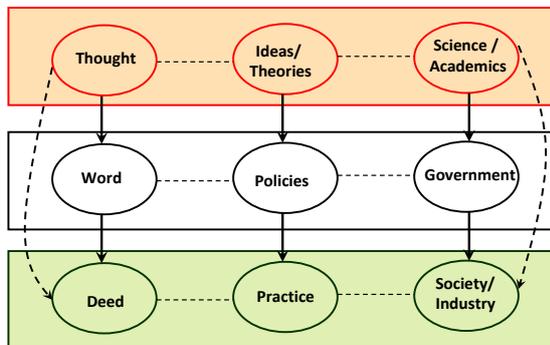


Figure 1. Layers in Industrial Ecology development Author's own work.

Figure 1 depicts graphically the layers in industrial ecology – thought, precept and practice. The origin of any field of endeavour is in ideas and theories which are developed at the *thought* level. The minds in the scientific and academic communities around the world conceive ideas and principles. These can, of course, just remain at thought level, and not be converted to word or deed. However, ideas need to be converted into concrete action. This is indicated by the dotted arrows linking up thought with deed and the Science/Academics oval with the Society/Industry oval. Oftentimes, academia-industry and academia-society interactions enable a translation of ideas to practice. However, this is not often possible, and where it is not possible, the ideas need to seek the aid of policies. Governments and public agencies would then act as intermediaries to break any impasse that may exist. In some cases, this would take longer than anticipated. In some cases, ideas need not be converted to policies before being implemented. They have the power and the strength to directly influence the society/industry. A case of actions speaking louder than words.

The question now arises: Why should ideas and theories related to industrial ecology be implemented? What is the basis on which the scientists and academicians can inspire and convince policy-makers and people in general about the need for a change in the way things are done? It follows that industrial ecology is an approach which we need to adopt in our journey towards the elusive goal of sustainability. The industrial ecology approach in other words is synonymous with sustainable development – the integration of the economic, social and the environmental aspects of development in decision-making. The priorities vary from time to time and from place to place. Even within a country, no two provinces or states or cities or towns would have the same priorities. A one-size-fits-all approach is thus not what is advocated. While it would be irrational to expect everyone everywhere to assign the same importance to the social, economic, environmental at all times, as a matter of principle, one may say, that one should try to strike a balance by optimizing the use of resources, ensuring a reasonable degree of social welfare and keeping the economy healthy enough. As things stand on date, however, in most parts of the world – be it the developing world or the developed world, the economic aspect often is given the first priority – not necessarily at the expense of the social and the environmental though. Everything gets monetized. When options are to be compared, everything is reduced to monetary terms. Even human lives! Sample these viewpoints from the industry: *As with all business, the economic factors must be given priority as an economically unsustainable business will not be in business long enough to impact the social and environmental aspects* (Evan Puzey, the CEO of the Asia-Pacific operations of Kewill, in: Venkatesh, 2011a). *A company must be profitable to stay in business and no one must question this* (Onno Boots, Regional Managing Director, South East Asia and the Pacific, TNT, in: (Venkatesh, 2011a). Economists and businessmen these days often swear by Milton Friedman, the American economist – Corporate officials must focus on making money for their stockholders. Expecting them to accept any other social responsibility undermines the foundations of free society. Well, Friedman may still be right, if stockholders are interpreted as stakeholders and not just as people owning monetary shares in the operation of an enterprise. Then, it may be said that the environment and society also are rightful stakeholders in the enterprise.

While pleasing everyone is impossible and should never be the starting point of any endeavour, it is good to know about the viewpoints and opinions of people (Keitsh, 2011).

We know that integration is complex. Systems have now become very complex and pleasing everyone is impossible. Technology is not a silver bullet and

technology-optimism is naive to say the least. So, where do we go from here onwards?

Figure 2 borrowed from Venkatesh (2010) maps the individual onto the earth – the microcosm onto the macrocosm. Each of the three levels in Figure is composed of human beings and it is essential that human beings in general – be they scientists, policymakers or engineers in the industry or even housewives, understand the three levels of human existence *apropos* the earth as a whole. The physical which is the grossest can be likened to the economic aspect. Men work to fulfill their material needs, comforts and luxuries. They earn, save (invest) and pay (taxes and expenses to procure their material needs), and thus keep the economy chugging along. Mental, emotional and intellectual development enables the members of the human race to interact on a subtler level. Cooperation, collaboration and helping each other in need, is vital for the sustenance of societies; and social development. Even subtler is the spiritual level. This is very much akin to what the environment is to societies and industries. One would fan out to understand the macrocosm, and delve in to understand oneself and one’s relation to this macrocosm.

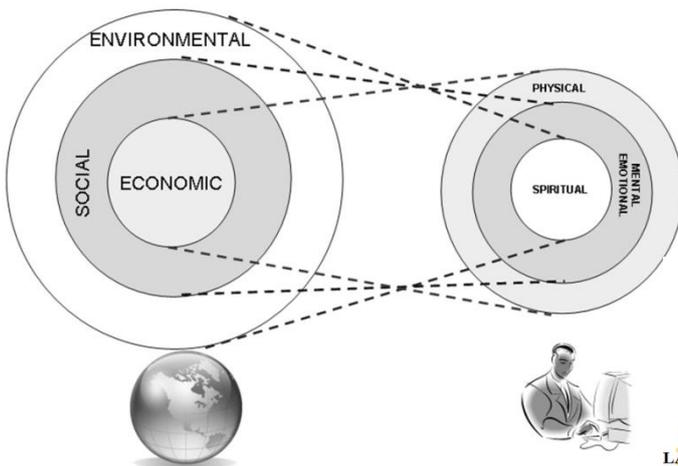


Figure 2. Mapping individual holistic development to global sustainable development. Author’s own work.

Having said that, the complexity within the *social*, *economic* and the *environmental* need to be addressed (Pawłowski, 2009). These are true challenges! The *social* for instance, encompasses the cultural, religious, ethical, moral, as well as health and educational aspects, in addition to employment and earnings, thus linking it to economic growth. An old monument may be much more than a mere tourist attraction in a country. The government may be spending a lot of money on its upkeep though the return on investment may be sluggish. It would be stark and clear that demolishing it and building a hospital or school or a factory on the site would contribute to the economy and satisfy some other social needs. Yet, decision-making cannot ignore the role heritage and culture plays in the lives of the people. The economic aspect once again entails the

development of the primary, secondary and the tertiary sectors of the economy – not one growing rapidly at the expense of the others, as has been the case in many African countries where economies are so heavily dependent on mining and agriculture. And when the environmental aspect is considered, you have the air, water and the soil/land to care about. One notes that environmental impacts are often weighted, and one is often given a higher priority over the others. Global warming for instance seems to be more important than eutrophication, acidification etc for example.

Trade-offs and compromises are inevitable, but not well-defined. How much and how much of which? These questions constantly befuddle decision-makers and captains of industry. Further, when we consider the fact that we are not moving towards a static, well-defined equilibrium, but a dynamic, ever-changing one, and when we also realize that sustainability is an emergent property – one realizes after implementing a set of strategies, that the state one has reached is not sustainable after all. External factors keep changing, and with them, what one defines as a state of sustainability. Change being the only constant, to quote Heraclitus, sustainability is to be constantly pursued. However, whenever there are changes, and conflicts among the different aspects of sustainable development arise, the law needs to step in, as symbolized in Figure 3 by the lubricating oil can, with the much-needed course corrections. Further, it is also a known fact that policies, once in place, are very difficult and cumbersome to change. This also applies to human behavioural patterns.

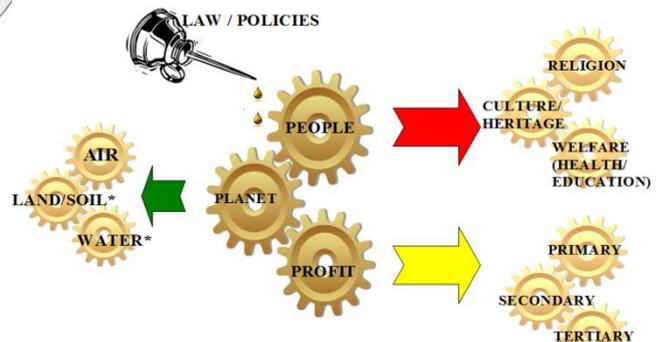


Figure 3. ‘The-wheels-within-wheels’ nature of sustainable development. Author’s own work.

All this entails knowing the various sub-systems well, and also the correlations between them. This calls for an efficient system of data gathering, and also an understanding of the correlations between discrete events in sub-systems. The more complex the systems are, the greater the uncertainty in the effect (type, timing and magnitude) an event would have on the others. We are verily entering an age of information revolution. For industrial ecology to entrench itself and be instrumental in enabling the journey towards sustainability, the infosphere needs to grow.

Table 1 sums up in a nutshell how industrial ecology has to restructure itself in order to be effectively able to overcome the challenges and make its future prospects stronger and brighter – or evolve in other words – over the next few years (Graedel & Allenby, 2003).

Table 1. Desired evolution of industrial ecology into the future. Source: Graedel & Allenby, 2003.

From	To
Looking to the past	Thinking about the future
Fragmented	Systemic
Gross insults	Micro-toxicity
Environmental improvements	Sustainability
Local	Global
Pastoral	Urban
More technology	Better technology and social engineering
Developed world	Developing world
Isolated	Connected
Regulation	Cooperation
Low-hanging fruit	More difficult-to-attain goals

Conclusions

In conclusion, it would be apt to dwell in brief, on the knowledge gained from trying to understand the current realities on the one hand, and the desired changes in the industrial ecology approach on the other. These are presented as bulleted points hereunder:

- ✓ The most difficult barriers, on date, to industrial ecology implementation, are cultural and psychological; not technological or economic. It is high time one realises that technology is not a panacea, it is necessary but not sufficient.
- ✓ Life-cycle thinking is fine enough. It should be understood that this is not the same as systems-thinking. The former without the latter does not accomplish much.
- ✓ Industrial ecology is all about doing things differently, not necessarily different things.
- ✓ History has it that trendsetters were always scoffed at, to begin with. One cannot please everyone when one starts off with a new trend. People and things fall in place, gradually.
- ✓ Every system is essentially a complex system from the point of view of industrial ecology. It does not mean that one ought to be deterred by this complexity for that is very much in the nature of things.
- ✓ Given the conservative nature of the Law in general – the difficulty (often impossibility) of amending the Constitution – resolving conflicts is often very tardy and acrimonious to boot.
- ✓ Impetus need not always be top-down, bottom-up community initiatives to exert pressure on policy-makers, wherever and whenever needed can often be very effective.

- ✓ Science without religion is lame; religion without science is blind (attributed to Albert Einstein, Nobel Laureate (Physics)).
- ✓ Austerity or spirituality should not be confused with retrogression. What we consider progressive today may actually be dragging us down and under (from a book review of Prof. Tim Jackson's book – *Prosperity without Growth*).
- ✓ Dynamic decision-making (advocated by industrial ecology), is particularly difficult when decisions have indirect, delayed, multiple and non-linear effects (attributed to Senge, PM and Sterman, JD, MIT Sloan School of Management and sourced from Allenby, 1999)
- ✓ Sustainability is not *Utopia* (as in an imaginary place). It is *Eutopia* (as in *good place*). Continued pursuit is better than no pursuit at all (attributed to Ramchandra Guha, eminent Indian historian, Guha, 1992).

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