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THE IMPORTANCE OF INNOVATIVE TECHNOLOGIES IN SUSTAINABLE DEVELOPMENT

X. I. Isroilov
Fergana Polytechnic Institute PhD Student
x.isroilov@ferpi.uz

Abstract
Because of concern about the environment in different parts of the world, several concepts such as sustainable development and green growth are emerging. This includes different interpretations of the balance between the ecological, social and economic aspects of our society by different sectors. This article examines the dependence of innovations mainly on natural resources. It will clarify how sustainable development relates to innovative technologies.

Keywords: Sustainable development, economic stability, social stability, sustainable competitiveness, resource efficiency, innovation, Niche technologies, End-of-pipe technologies, resource consumption.

Introduction

The most inclusive levels of technological innovation, the transition level, are crucial for achieving long-term sustainable development, as they have the greatest potential for improvement.

The article contains a literature review on the emergence of technological transitions. Once the transition occurs, the new system is often less efficient. In terms of reducing resource consumption or pollution, its returns should be increased through less inclusive innovation strategies such as system innovation and product optimization.

Sustainable competitiveness requires high R&D capabilities (science-based) and business entrepreneurship. In addition, sustained economic success requires a healthy balance between the service and manufacturing sectors. Overreliance on the service industry sooner or later leads to reduced growth potential and loss of knowledge.[1]

Transitions for sustainable development are often impossible because new systems must compete with fully developed and optimized systems that are much further along the learning curve. Smaller-scale innovations, even those aimed at broader sustainability, can counter transitions that have greater potential for sustainable development by improving competing (sustainable) technology.

The study sheds light on important aspects, including the concept of a sustainable economy, its importance, goals and levels, the need to transition to a sustainable economy as an indicator of the impact of the most important sustainable economy on sustainable development, and the most important obstacles to achieving it. .

The most important goal of the research is to demonstrate the importance of innovative technologies in sustainable development through the optimal use of energy and resources to achieve prosperity for all and increase the economic level from environmental pollution in innovative ways.

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Literature Review

Technological innovation is one of the most necessary factors for sustainable development. This is not a reality created based on the fantasy of scientists, but one of the actual problems of today. Ehrlich and Holdren (1972) developed the following simplified equation:

$$I = P * A * T$$

- I = environmental impact
- P = population
- A = welfare (per capita consumption of services and products)
- T = Technology, (environmental burden per unit of product or service)

In 2050, the world's population will increase from 7.4 to at least 9 billion, and the prosperity of developing countries will increase significantly (probably), the ecological efficiency of technology, T, will be improved by a factor of 4-40.

Recognizing the need for innovation for sustainable development, it is not clear what to do. There are several options to help reduce the environmental burden of human activities. New technologies always require social changes. Therefore, the successful introduction of a new technology is always a matter of socio-technical change. The following sections discuss ways to solve a number of socio-technical environmental problems. These technologies are classified according to the degree of "radicalism", i.e. Based on their level of impact on current technological systems:

- Pre-industrial solutions
- Classical ecological technologies;
- Economic technologies;
- Pipe technologies;
- Adapting to the process and preventing damage;
- Sustainable technologies.

Table 1. **Ecological classification of innovative technologies**

	Type of technology	Function	Resources are mostly used	Source efficiency	Emission	Systems of impact on nature
1	• •Pre-industrial solutions	Provide	Regenerable	For low - high	Low	Some over exploitation is often compensated by low population density
2	• •Classical ecological technologies;	Prevention of harm by the population	Non-renewable	Low	High	ecological destruction outside the settlements
3	• •Economic technologies;	Pollution Mitigation	Non-renewable	Below average	Low to medium	Mitigating environmental damage
4	• • Pipe technologies;	Avoid post-procedural contamination	Non-renewable	Below average	Low	Less pollution through additional resource consumption
5	• •Adapting to the process and preventing damage;	Avoid contamination during the process	non-renewable and renewable	High	Low	Low resource and low pollution
6	Sustainable technologies	Focusing on planetary boundaries	Regenerable	High	No	balance between humanity and the natural environment

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Analyzes and Results

It should be noted that technologies for protecting human society from the dangers of nature, such as voltage barriers and vaccinations, are not called environmental technologies. Likewise, technologies used for measurement and analysis are excluded. Although of great importance, these technologies are generally not specific to environmental problems.

Remedial technologies (for soil treatment, etc.) are included in the definition, but are called "End-of-pipe technologies" and it is this type of environmental technology that we currently refer to.

Historically, the first environmental problems were of a local nature. The easiest way to solve these problems was to use the classic, so-called triple D technologies:

• Dumping (Throwing waste in pits, etc).
• Displacement (pollution with sewage, smoke balls, etc.)
• Dilution (gaseous and liquid waste)

In this category of environmental technologies, pollution is not changed chemically or biologically. [3]

As pollution became a problem, people started thinking about pollution prevention. The first initiatives in this direction are always looking for the easiest pollution minimization options within the limitations of existing production methods. This usually boils down to basic precautions or what today is called good housekeeping or the triple M's:

• Monitoring
• Management
• Maintenance

Remaining emissions reductions can be achieved through End-of-pipe technologies, including in particular:

• Enable
• Pyrolysis
• Separation
• Fermentation
• Chemical transformation
• Catalytic reduction
• Shielding (radiation, noise)

Recycling and reuse technologies that return waste (product) to production processes can be called the last process if the waste in question is from another technological cycle, for example, when it is used as fuel. For example, recycling can be sustainable if waste can be reused in the same production cycle without requiring much additional energy or creating much pollution (eg recycled metals).

End-of-pipe technologies are often criticized as not providing a real solution to the pollution problem. In many cases, these technologies create new problems because the pollution prevented from being released must be contained, cleaned, or disposed of in some other way. For the short-term future, we cannot do without them, as implementing alternatives often requires major efforts.

Recovery technology is a special type of End-of-pipe technology. We have an obligation, at the very least, to clean up the worst pollution of the past and to isolate polluted areas from unpolluted environments. Areas that need restoration include:

• contaminated soils
• polluted lake and river bottoms
• Space debris
• Plastic waste in the oceans
• Nuclear waste
• Types of non-native waste introduced into ecosystems.

However, in many cases, the alternative is to reduce the environmental burden by creating a cleaner production process. Thus, further reduction of pollution and resource consumption can be achieved. A complete redesign of manufacturing processes can both benefit the environment and reduce costs. There are various tools for this:

• Industrial ecology: the integrated design of industrial systems to minimize resource consumption and waste generation through a rational combination of facilities.
• Life cycle assessment: analysis of the overall production chain and identification of key target areas for environmental and resource improvement.
• Pinching technology: minimizing the consumption of resources in production processes by minimizing redundant processes.

Ultimately, we need to develop sustainable production and consumption technologies because none of the above technologies are sufficient to solve the environmental problems we face. Sustainable technologies go beyond environmental technologies. While the latter is concerned with the production of goods and services with minimal pollution, sustainable technologies have a broader goal of enabling the needs of all humanity to be met:

• depletion of non-renewable resources of the earth,
• exceeding its ecological recovery capabilities,
• reinforce or promote inequality.

These technologies must enable humanity to survive in the long term, that is, sustainable technologies are a prerequisite for the continuation of human civilization.

Abernasy and Clark presented the following taxonomy of technological innovation in 1985. [1]

Radical market change Niche innovation Architectural innovation	Radical market change Niche innovation Architectural innovation	Radical market change Niche innovation Architectural innovation
Stepwise change of the market Stepwise technological innovation	Stepwise change of the market Stepwise technological innovation	Stepwise change of the market Stepwise technological innovation
Gradual technological changes Radical technological changes	Gradual technological changes Radical technological changes	Gradual technological changes Radical technological changes

Architectural innovations are rare innovations. The success rate of attempts at architectural innovation is often very low. Mobile phones are one of the most successful architectural innovations.

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Conclusion

Architectural innovation does not improve an existing function, but technology creates a new opportunity for consumer behavior. Once architectural innovations emerge, many options for improvement are available: additional innovations can rapidly reduce costs and/or increase the efficiency of the technology. This ensures rapid growth in the industry as it facilitates further market entry. As incremental innovation meets incremental limits, growth can be fueled by other options, and market gaps are opportunities to create additional demand and higher prices. In addition, as regular innovation becomes more difficult, technologists may begin to work on more radical improvements to the technological system (for example, moving to other frequencies for mobile phones may limit the number of ground stations). All these innovations can contribute to sustainable development. Architectural innovations are difficult to predict in this respect, as they usually change consumer behavior and needs.

They can create additional consumption. It is therefore important to distinguish between innovations, as their impact on sustainability varies significantly. The following conclusions can be drawn about what can be achieved from technological historical analysis:

• Optimum use of existing technology can spread best practices, maintain structures well, reduce environmental load by 5-50%. Existing emissions can be reduced through end-of-pipe technologies. The completion of end-of-pipe technologies can bring significant local benefits to the environment, but often at the expense of additional resources (in particular, energy consumption).

Upgrading technology systems can produce real environmental gains. Avoiding emissions, optimizing energy use (for example, cogeneration of heat and power). These innovations require large investments and are always destructive to the system (parts) they replace.

The telegraph system was almost destroyed by the telex. Later, both technologies were eliminated with the introduction of the fax machine. As a result of this disruptive nature of system innovation, stakeholders attached to existing production systems often resist upgrades. Introducing new systems, people can show risks and the "cannibalizing" effect of innovation. However, as Sony founder Akio Morita has said, it's better for a company to cannibalize its own technology than someone else's.

• Niche innovations can further improve the environmental efficiency of technologies (because the fit between technology and demand can be improved), but can also include new features and create additional consumption.

These technological improvements will probably not be enough. For example, it can be argued that power plants produce CO2 even though they can use almost the entire energy content of fossil fuels.

Mineral and fuel consumption remains very high. For this reason, we also need technological changes that go beyond current products: We need technologies that meet human needs much more efficiently.

We need architectural innovations and technological system upgrades that allow us to make leaps in resource efficiency and environmental performance.

Not all technological system upgrades, architectural innovations or transitions will necessarily lead us to Sustainable Development. First of all, sustainable technology means more than producing products without pollution or environmental destruction. Sustainable technology

means meeting people's needs in such a way that the resilience of the planet, as well as the resilience of local ecosystems, is not exceeded. The goal is to push the use of the world's natural resources to the limits determined by the Earth's regenerative capacity. The need for sustainable development sets the preconditions for these innovations.

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