The Application of Sustainability Criteria at the Built Environment. Starting or Finishing Point?

Irina V. Drăgulanescu
University of Messina, Faculty of Economics, Italy
E-mail: dragulanescu@unime.it
Angelina De Pascale
University of Messina, Faculty of Economics, Italy
E-mail: adepascale@unime.it

Abstract

In the last years, a different number of public and private organizations have given increased attention to the problems of excessive natural resource consumption and depletion; waste generation and accumulation; and environmental impact and degradation. Since the construction industry is a major contributor to these problems, it now faces increasingly restrictive environmental conservation and protection laws and regulations, the emergence of international standards to address environmental quality and performance. In this context, quality represents a key factor for the efficiency and competitiveness of economy and welfare of whole community. It can be acknowledged as a set of characteristics and attributes of a product or a service able to confer it the capability to satisfy a number of needs connected with manufacturing processes and use of same product or service.

As a result, private and public sector face new, complex, and rapidly changing challenges imposed by these laws, regulations, standards, and pressures at all life cycle stages of a capital project, from initial planning, design, construction, and operation/maintenance, to ultimate rehabilitation, decommissioning and/or disposal. Moreover, traditional approaches to capital projects of mere environmental regulatory conformity or reactive corrective actions such as mitigation or remediation have proven to be consistently costly, inefficient, and many times ineffective.

There are strong incentives for the development of a sustainable approach to capital projects. Such an approach goes beyond the traditional focus on cost, time, and quality performance to include the goals of minimal natural resource use, depletion and degradation, waste generation and accumulation, and environmental impact and degradation, all within the contextual satisfaction of human needs and aspirations. These goals are clearly and systematically integrated within the decision-making process at all stages of the life cycle of a capital project, particularly the early funding allocation. In this context, most stakeholders have to face a complex task when attempting to implement a sustainable approach. First of all to face challenges imposed by increasingly limited resources on the effective and efficient delivery of capital projects and then taking in account a lack of awareness and understanding of the actual or potential impact and/or implications of environmental regulations and standards on capital projects; a lack of

awareness and understanding of the opportunities and potential benefits to an organization created by a sustainable approach to its capital projects; and finally, a lack of credible and reliable quantitative indicators, metrics, and/or data on the actual benefits and associated costs.

A sustainable approach to capital projects would allow the construction industry to take a more aggressive role in finding both short-term and long-term solutions for a more effective and efficient use of its increasingly limited and fixed capital resources.

Keywords: sustainability, built environment, closed cycle approach.
J.E.L. Classification: Q56

1. Through a Sustainable Development

The development path that humans have taken, particularly since the industrial revolution, has proven to be detrimental to the health of ecological context of the world. In the last few years there has been a growing understanding of the world and its inhabitants as a single system, and of the need to combine two key global aims in the development of human activities: to accelerate human development, particularly in the poorest countries, and to remove the gross inequities present in the world today; while at the same time avoiding the depletion of the resources and biological systems of the planet to such an extent that future generations will be impoverished.

From this point of view, sustainable development offers a new way of thinking which reconciles the human drive to improve quality of life with the limitations imposed by the global context. It requires unique solutions for improving welfare that do not come at the cost of degrading the environment or impinging on the well-being of other people. Although there is no general agreement regarding the precise meaning of the term *sustainability* beyond respect for the quality of life for future generations, most interpretations and definitions of the term "sustainable" refer to the viability of natural resources and ecosystems over time, and to the maintenance of human living standards and economic development. Thus, sustainability is a relationship or balancing act among many factors (economic, social, and environmental) which are constantly changing. As by many authors it is defined "… a process of change in organizing and regulating human activities so that humans can meet their needs and exact their aspirations for current generations without foreclosing the possibilities for future generations to meet their own needs and exact their own aspirations" (Weston, 1995). Because sustainability is a dynamic concept rather than a static state, it requires decision makers to be flexible and willing to modify their approaches according to changes in human needs and aspirations, the environment, or technological advances.

However, in order to understand the necessary changes to achieve sustainability, it is useful to look at the paradigm which is currently being employed. Despite a wide range of positions and opinions on the subject, there is a general agreement that describe the current paradigm of development as unsustainable. This paradigm, which has prevailed over the last few centuries, is based on an unsustainable linear approach to development that begins with the extraction and use of primary (renewable and non-

renewable)natural resources and it finishes whit the production of an manufacturing product eventually transported and commercialized, and ultimately used and consumed.

Figure 1. - The unsustainable linear development approach

The explained process is linear because from an initial extraction of resources, all inputs and outputs move in one direction until disposed, going through the system only once without recovery of materials. Aggravating this situation even more is a continuous increase in the demand, use, and consumption of products and services, which creates pressures for further extraction of natural resources, and for continued expansion of energy production, resource processing, and manufacturing capabilities. This unsustainable growth has created a series of problems, particularly:

- excessive natural resource consumption, depletion, and degradation;
- waste generation and accumulation;
- environmental impact and degradation.

These are the challenges that must be overcome to achieve sustainability.

2. Sustainability and the Built Environment

The built environment includes all buildings and living spaces that are created, or modified, by people. In addition to the buildings and spaces themselves, it also includes the infrastructural elements such as waste management, transportation and utility transmission systems put in place to serve this building space. When evaluating the built environment, it is important to take a broad view incorporating broader stakeholders and communities, beyond immediate investors or building users. The intergenerational aspect of sustainability is even more pertinent in the built environment since the structures are typically influencing the needs and requirements of future generations. Sustainable construction is an emerging field of science that aims at incorporating the general sustainable development concepts into conventional construction practices.

At all, one of the problems in relation to sustainable development and more specifically, sustainable building, is how to define these terms. In many parts of the world, the concept of sustainable building is interpreted differently. In general, it may be said that balanced resource-use on a global scale is one of the aspects involved (e.g. energy, resource, water, land and so on). These physical elements are the most tangible: availability is limited, negative environmental impacts are well-known and there are strategies to reduce resource use (although these have so far been only very partially implemented). Next come the human scale aspects: healthy living conditions, comfort, and social and cultural adjustment to people's perceptions of what life is, with its needs and desires. All this has to be established within the national political context, with the

economy as a regulating system. These three scales are sometimes summarized as "*ecology, sociology and economy*", or as "*people, planet, profit*". This suggests the same level of importance for all three. However, the physically available resources (energy, materials, clean water, clean air, land, etc.) set the limit on the material framework within which people can create their welfare, while the economic system (with profit as a part of it) has to facilitate this, and is not a goal in itself.

For the construction industry specifically, achieving true sustainability will require a paradigm shift, similar to the one facing the manufacturing industry, that strives toward a sustainable approach to development by integrating sustainable strategies at all phases of a facility's total life cycle. First, instead of thinking of the built environment as an object separate from the natural environment, it should be viewed as part of the flow and exchange of matter and energy which occurs naturally within the biosphere. In addition to the non-living components which make up the built environment, planners, designers, and constructors of sustainable facilities must also consider the living components of the built environment (flora, fauna, and people) which operate together as a whole system in the context of other ecosystems in the biosphere (Yeang 1995). Furthermore, people who make project decisions with sustainability as an objective will need to evaluate the long-term as well as short-term impacts of those decisions to the local and global environments. And those who take a sustainability approach to planning, design, and construction will be rewarded with reduced liability, new markets, and an earth-friendlier construction process, which will help future and current generations to achieve a better quality of life (Kinlaw 1992, Liddle 1994).

Sustainable buildings need an approach focused on the entire life cycle of the facility, not just the initial capital investment. Life cycle considerations are particularly important because each phase builds upon, and is constrained by the decisions made on the preceding one.

3. The "Trias Ecologica"

The "Trias Ecologica" has proven to be a useful strategy in developing sustainable and environmental concepts. This principle states that the first step is to reduce the need for or use of anything. The next step is to use renewable sources to meet the need. And if the first and second steps are not sufficient to cover the activity, step 3 can be applied: supply the remaining needs as efficiently as possible. Applied to energy this leads to a major reduction in demand (through insulation, efficient ventilation, daylight optimization, etc.), the introduction of renewable energy sources (e.g. solar collectors, passive solar gains by design, solar electricity, etc.) and highly efficient use of fossil fuels to meet the remaining need. These steps need to be applied in that order. The same approach can be used for materials, water consumption, and even for maintenance or installations.

4. The sustainable development as a closed cyclical system

By natural progression, the "Trias Ecologica" approach leads to a closed cycle approach in which all needs are taken care of in the first and second steps, and the third can

be eliminated. At that point, non-renewable resources are no longer needed, and there will be a balanced situation for the activity. It will not be possible to reach this optimum situation with an "adding measures" approach; innovative and creative concepts are needed. Of course, this cannot be implemented in a day or a year, at least not on a wide scale. Nevertheless, the concept should be clear, and any decision to establish part of the concept should be made, in such a way it does not compromise the total concept at a later stage.

In this view, a sustainable approach to development must not be imagined as a linear process, but rather as a closed cyclical system. The total integrated system includes the same elements that describe a linear approach. But, in addiction it include other important elements, such as:

- natural resource management addresses to pay attention in managing the extraction of renewable natural resources from the environment; in a way that ensures that the supply will always exceed the demand, and at the same time, monitors and controls the use of non-renewable natural resources to prevent their total depletion;
- resource recovery addresses the need to reduce the amount of waste that requires disposal by recovering selected resources and products from waste, including direct reuse, remanufacture of reusable components, reprocessing of recycled material, and monomer/raw material generation;
- waste disposal recognizes that a certain amount of waste is inevitable, and thus will require disposal in ways that are not detrimental to the environment;
- environmental technologies address the need to incorporate proactively, within every element of the system, strategies and mechanisms that mitigate environmental impacts at the origin, before the impact happens, through the application of preservation, pollution prevention, avoidance, monitoring, assessment and control strategies and mechanisms and also to implement corrective actions such as remediation or restoration when some damage to the environment already has been done.

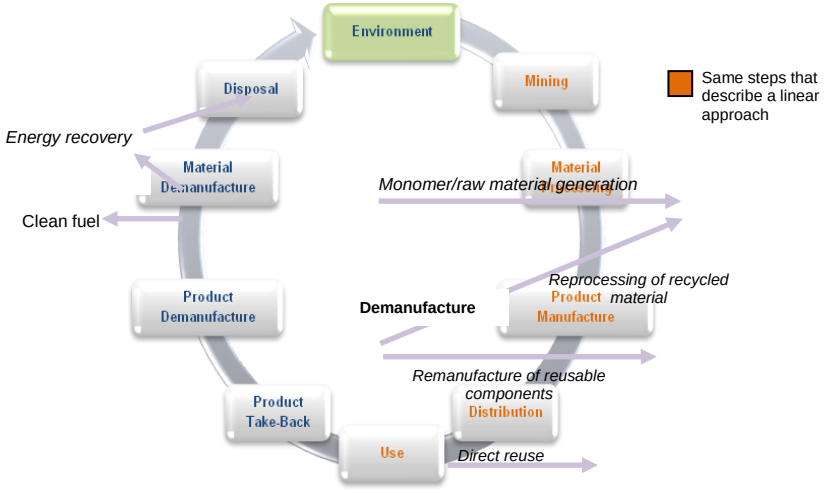

Figure 2. The sustainable development as a closed cyclical system
Source: adapted from Vanegas et al. (1996)

5. Paradigm shift from traditional to sustainable construction

The model of the new sustainability paradigm incorporates explicitly and proactively within the decision-making process, the goals of minimal natural resource consumption, depletion and degradation; minimal waste generation and accumulation; and minimal environmental impact and degradation. At the base of this new paradigm is the contextual satisfaction of human needs and aspirations. Within this new paradigm, specific strategies emerge to support each of the four goals described above. Taking into account both environmental and economic considerations, such us, integrating the built environment into ecological systems: designing resource and energy flows into and out of the built environment to fit within the yield and assimilative capacities of its ecological context creates a symbiotic relationship between the two, which can be mutually beneficial to humans and nature, provided that humans do not exceed the assimilative capacity of natural systems. And from an economic point of view, revising economic valuation of projects: developing better tools for cost-benefit analysis, financial forecasting, and long term prediction, and also revised economic valuation schemes which assign meaningful values to reserves of natural resources and ecological habitats can prove essential to assess the economic viability of sustainable projects.

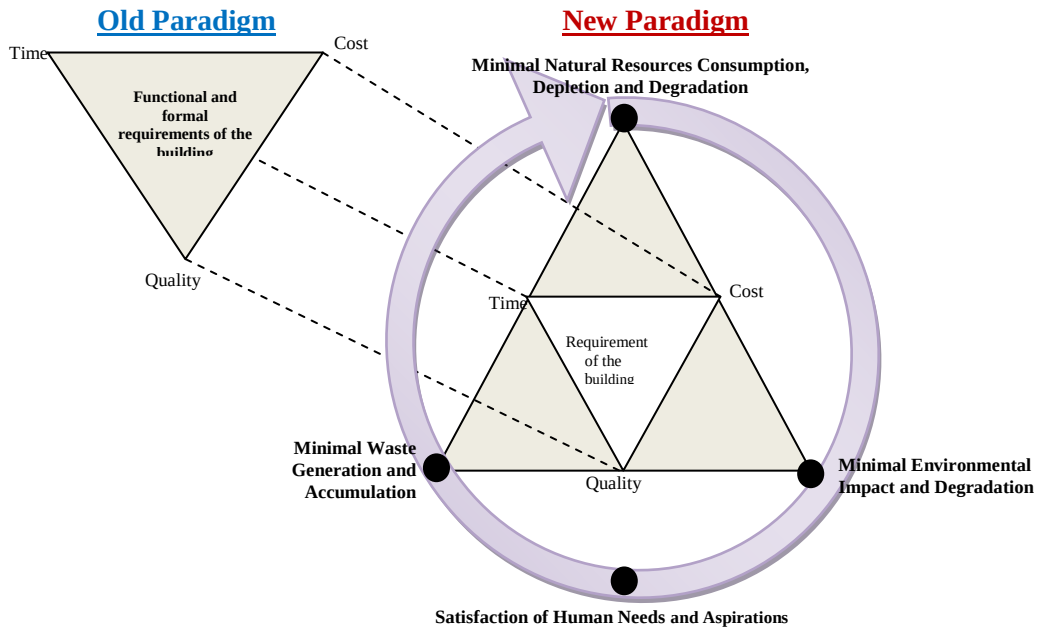

Figure 3. - Paradigm Shift from Traditional to Sustainable Construction
Source: adapted from Vanegas et al. (1996)

6. Conclusions

The principal conclusion of this paper is that the area of sustainable strategies for the built environment is one of increasing interest which has many levels and complex dimensions. It showed that built environment is quite important from the general economic, environmental and social sustainability perspectives. For example, the life cycle of products that emerge from built environment processes are typically intergenerational. That is, future generations will be influenced by decisions made today in terms of buildings and supporting infrastructure related to the built environment processes and products. Thus, more than most products and industries this one has a direct relationship to the intergenerational management philosophy associated with sustainability. This paper tries to underline the importance of adopting a new paradigm for development which goes beyond the traditional focus on cost, time, and quality performance. Goals of minimal natural resource consumption, depletion, and degradation, waste generation and accumulation, and environmental impact and degradation, need to be explicitly addressed and incorporated at all stages of the life cycle of a product or project, ensuring the contextual satisfaction of human needs and aspirations.

References

Kinlaw, D., (1992), *Competitive and Green: Sustainable Performance in the Environmental Age*, Pfeiffer & Co., San Diego, CA

Liddle, B.,T., (1994), *Construction for Sustainability and the Sustainability of the Construction Industry*, Proceedings of the First International Conference on Sustainable Construction, CIB TG 16, C.J. Kibert, ed., Tampa, FL, November 6-9.

Porter, M., Van Der Linde, C., (1995), Toward a New Conception of the Environment-Competitiveness Relationship, *Journal of Economic Perspectives*, 9(4): 97-118.

Pujari, D., (2006), *Eco-innovation and new product development: understanding the influences on market performance*", Technovation, 26: 76-85.

Rennings, K., (2000), *Redefining Innovation - Eco-Innovation Research and the Contribution from Ecological Economics*, Ecological Economics, 32: 319-332.

Tidd, J., Bessant, J., Pavitt, K., (2005), *Managing Innovation*, (3rd Ed.), Chichester: Wiley.

Vanegas, J., Dubose, J., Pearce, A., (1995), *Sustainable Technologies for the Building Construction Industry*, Proceedings of the 1995 Symposium on Design for the Global Environment, Atlanta, GA, November 2-3.

Weston, R., (1995), *Sustainable Development: Integration of Free Market and Natural Economic Systems*, Proceedings of the AAES/Engineering Foundation conference on Sustainable Development: Creating Agents of Change, J. DuBose and J. Vanegas, eds., Snowbird, UT. August 4-8.

Yeang, K., (1995), *Designing with Nature*, McGraw Hill, New York, NY.