PROBLEMY EKOROZWOJU – PROBLEMS OF SUSTAINABLE DEVELOPMENT
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Environment, Economy and Society – the *Body*, *Mind* and *Soul* of Sustainable Design of Buildings

Środowisko, Gospodarka i Społeczeństwo – *Ciało*, *Umysł* i *Dusza* zrównoważonego projektowania budynków

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Abstract
The design process in general, and the one for buildings in particular has evolved and become increasingly intricate, with additional layers and factors becoming relevant, as the drive towards sustainability (the Sustainable development goals defined by the United Nations in 2015) has gathered steam. This short chapter focuses on the diversity of issues which sustainable building design is likely to be influenced by, in the years ahead.

Key words: design, sustainability, buildings, sustainable design, Life-cycle thinking

Streszczenie
Proces projektowania ogólnie, a w szczególności ten dotyczący budynków, ewoluował i stawał się coraz bardziej skomplikowany, a dodatkowe warstwy i czynniki nabrały znaczenia, ponieważ dążenie do zrównoważonego rozwoju (Cele zrównoważonego rozwoju określone przez Organizację Narodów Zjednoczonych w 2015 r.) nabrało tempa. W tym krótkim opracowaniu skupiono się na różnorodności zagadnień, które w nadchodzących latach prawdopodobnie wpłyną na projektowanie zrównoważonych budynków.

Słowa kluczowe: projektowanie, zrównoważony rozwój, budynki, zrównoważony projekt, kontekst Cyklu Życia

Introduction

In Figure 1, the three tools which will be useful to *sustainability-engineers*, be they a part of the building sector or otherwise, in the future have been shown – Environmental Life-Cycle Analysis (E-LCA) (Baumann, Tillmann, 2004) Life-Cycle Costing Analysis (LCCA) (Dong, Ng, 2016) and Social Life-Cycle Analysis (S-LCA) (Hosseinijou, 2014; New Buildings Institute, 2022). These three aspects of sustainability – environmental, economic and social – can be looked upon as the *body, mind* and *soul* of the paradigm; and needless to add, must march shoulder to shoulder. The *soul* which is the paramount of the three (philosophically and metaphysically) is the social aspect in this case. Sustainability is for the people, by the people, of the people. We would not bother about the environment, if we were not concerned about ourselves and the generations to come!
These three tools, when used as standalone tools, are used to analyse and make decisions about environmental sustainability, economic sustainability/feasibility and the preservation of social welfare, respectively. They are more often than not, in conflict with each other, if one blindly pursues any one at the expense of the other two (Dong, Ng, 2016). This is analogous to people pandering to materialism, at the expense of intellectual development; or satisfying their senses, to the detriment of spiritual growth. A double-bottom-line approach is still better than a standalone, biased one. Eco-environmental analysis is one where one tries to optimise economic feasibility and environmental impacts. Likewise, there are socio-economic analysis and socio-environmental analysis, where

the aspects of dimensions of sustainability one seeks to optimise are different. In these double-bottom line analyses,

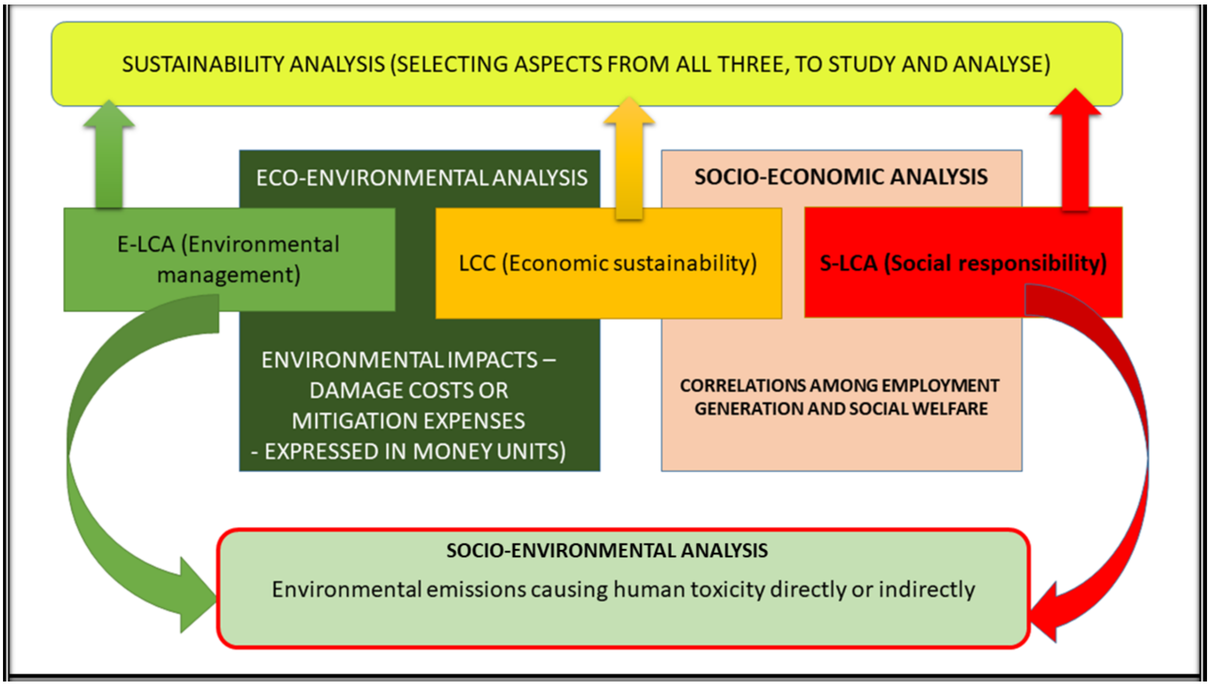

Figure 1. Understanding the *body, mind and soul* of sustainability, source: (Dong, Ng, 2016)

one conveniently ignores the third aspect on the grounds of irrelevance to the case or country or region, or beyond the scope of the decision-making at that given instant of time. Then, there is the highest level of sustainability analysis – the triple bottom line analysis or the triple-P analysis (Planet, standing for the Environment, People for Society and Profit for the Economy). Once one understands the rudiments of each of these three tools (and remembers that they are evolving continuously), one is well-equipped to embark on design, production/manufacturing, or life-cycle management practices in general, from a double bottom-line or, more preferably, a triple bottom-line perspective.

Money often rules the roost

When it comes to designing and planning in the construction sector – be that buildings, roads, airports, highways, dams, sports stadiums, shopping complexes etc. – there has often been (and may still be so in many parts of the developing world) a proclivity towards selecting from available design alternatives, on the basis of the lowest initial cost. For a design which is cheap at the outset, hidden costs will be uncovered slowly but surely, over the lifetime of the structure. Evidently, this would be a case of a *Design for Low Initial Cost to Purchaser*, and thereby haphazardly done, with a lot of oversight and bungling. That approach ends up being totally unsustainable in the medium-term, despite having created a feeling of *satisfaction* for the purchaser in the initial months. Figure 2 depicts nine different combinations of Initial Cost-Operation & Maintenance Cost, over lifetimes of buildings (or constructions in general). As reported in Venkatesh (2019b), the operation expenditure of a hospital building for instance during the first 3-5 years of its functioning is much more than its initial cost – and this can be explained by the expenses incurred regularly on heating, ventilation, refrigeration and electricity, efficient waste management, water treatment and wastewater handling, among other items of expenditure. A hospital building would exist and function for a few decades, and thereby an energy-efficient structure would enable a possible truncation in the so-called total cost of ownership (TCO) or life-cycle cost (LCC). However, to *design for energy efficiency* (resource-efficiency, lower life-cycle environmental impacts, recyclability and durability), greater initial costs would be incurred – energy-efficient devices, water-saving appliances, captive solar power units, captive biogas generation and utilization units, material resource recovery units for reuse within the facility (Renstrom et al., 2013) or for sale in the marketplace, etc.

Aesthetics is recommended in good design

It is the function that matters, not so much the form, unless of course the form is necessary for the function. Engineers focus primarily on function, artists, architects and designers focus a little more on form (Dong, Ng, 2016). While yours sincerely will opt to sit on the fence and moderate this debate and not be partisan, it will suffice

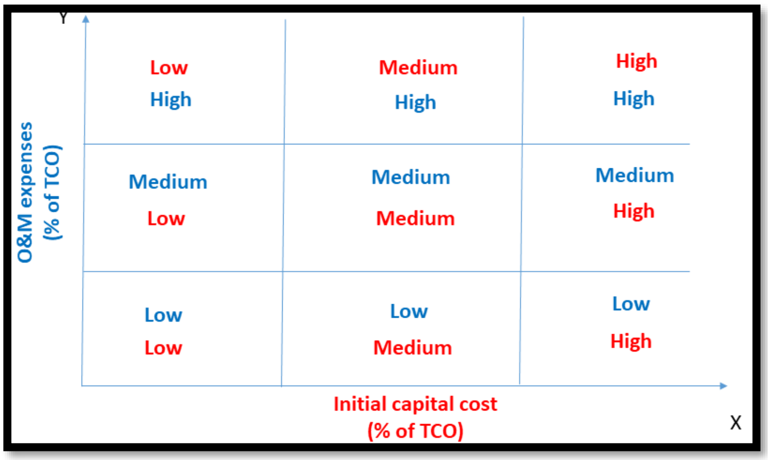

Figure 2. Designing must take into account the optimisation of the TCO (Total Cost of Ownership), source: Venkatesh (2019b)

to say, that if form is very much necessary for the function (the practical function that is), then a collaboration among the two groups is necessary. We however know that *sustainability* and thereby *sustainable design* includes the socio-psychological dimension, and if people like colour for instance, you cannot force them to use *black-and-white* just because it is cheaper and eco-friendly, without trying to determine the willingness to give up the former for the latter! *Design for aesthetic and cultural values* combined with a *Design for Functionality* makes one remember the versatile Leonardo da Vinci, more than that other genius, Galileo Galilei.

Design with a conscience

A life-cycle approach must not preclude the human factor which influences and is influenced by the design-to-dismantling journey of buildings. There are the workers on the upstream – be that in the mines which provide the raw materials for the production of building materials, or those in the factories around the world, which produce components and sub-structures used in buildings (Venkatesh, 2019a). Readers are referred to Hosseinijou et al. (2014) (a paper cited by Hosseinijou, 2014), in which the authors have concluded that steel as a building material, emerged as the better overall alternative with a lower social footprint, vis-à-vis concrete. The authors however recommend that working conditions (accidents, low wages and absence of job security) in the steel sector need a lot to be desired. Concrete production on the other hand was seen to have a more adverse impact on living conditions (noise pollution, destruction of natural habitats, etc.), for people in the local community.

Dong and Ng (2016), cited in Venkatesh (2019a), have written about the strength of quantitative and semi-quantitative indicators over the qualitative ones when it comes to the effectiveness of communicating the results to stakeholders, and subsequently informing the design process as well, in their paper which presents a social impact model for construction (SMoC). Of course, the designer cannot bring about improvement in worker welfare around the world, directly, but if the design approach factors in the social-footprint and emphasizes on a full understanding of the upstream entities in the long value-chain, the designer would have played his part!

Design to influence user-behaviour

The variability, diversity and the fickleness of user behaviour needs to be understood by the designer. There is a so-called Design for Sustainable Behaviour approach (Venkatesh, 2019c), to promote a more sustainable use of products, sub-systems and systems. This brings one to the realm of behavioural psychology, which designers keen on promoting sustainability along the lifetimes of the structures they design, must take into account (Venkatesh, 2019c). This approach would work hand in hand (and reinforce in the process) with the design approaches focusing on energy efficiency, resource efficiency, durability, recyclability and lowering life-cycle environmental impacts.

Designing for lowering embodied carbon

Talking of durability which was mentioned in the previous paragraph, it will be apt to quote Walter Stahel, Founder-Director of the Product-Life Institute, Geneva, from his post on LinkedIn (Stahel, 2022) *Doubling the service life of an office building (750 people) could save approximately 10000 tonnes of embodied carbon*. This calls for *Design for upgradability*, which would enable one to renovate (small fixes here and there). Stahel emphasizes the indispensability of extending the service life of buildings (and structures in general), in a robust, well-functioning circular economy (Renstrom, 2013). While the use phase dominates the life-cycles of buildings and usually accounts for the lion's share of the energy consumption and GHG emissions, researchers are advocating the importance of a whole-life carbon approach, analogous to Total Cost of Ownership in an LCC, and stressing on the importance of achieving practically-possible reduction in the environmental (specifically greenhouse-gas) footprints of construction materials – in other words, promoting the use of what could be termed as *lower GHG-embodied* materials (Venkatesh, 2021a).

Designing the design process

Worth citing in this sub-section is another LinkedIn post, this time from Stefanie Blank (2022), in which she lists 8 different characteristics of a truly sustainable building (and thereby the design for one) – Fossil-free and renewable energy in the use phase, social aspects along the production chain to the user, Efficient use of healthy and climate positive materials, Preservation of biodiversity, circular land use and management, Flexible design and shared spaces, Design for repurposing and recycling, Densification: inner before outer, and Renovation of building stock. Figure 3 presents the diversity of aspects a designer ideally ought to bear in mind to have a perfectly sustainable design as the output – a design not merely for Green Buildings or Zero-Emission buildings, but something far superior to and beyond them. The criteria have also been linked to the Sustainable Development Goals (Venkatesh 2021a, 2021b) they address. Thirteen criteria have been categorised under the three pillars of sustainable development. The design process itself has to be thought through carefully, designed and structured before one can embark on it. This may be labelled as meta-designing.

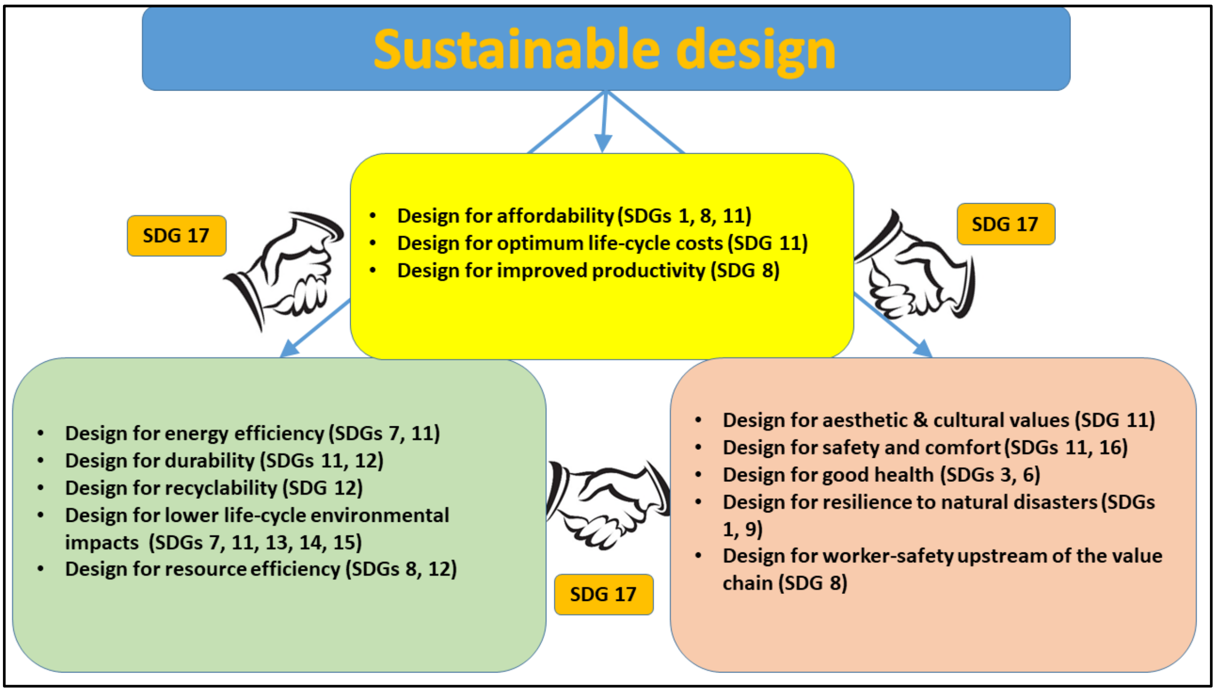

Figure 3. Designing the design process (SDG#s 1: No Poverty, 3: Good health and well-being; 6: Clean water and sanitation; 7: Affordable and clean energy; 8: Decent Work and Economic Growth; 9: Industry, Innovation and Infrastructure; 11: Sustainable Cities and Communities; 13: Climate action; 14: Life below water; 15: Life on land; 17: Partnerships for the goals), source: own composition

Conclusions: Nothing called a perfect design

A sustainable building design which may seem optimum today (never perfect), may not be so tomorrow, as the influencing factors keep changing. Sustainability itself is a moving target, and what may not be of concern or relevance today, may emerge to be important tomorrow. That would make one revisit the 'design of the design

process' so to say, and re-design it. The author thereby would desist from outlining rules and guidelines for sustainable building design, fully aware of the fact that a designer may wish not to consider all the factors mentioned in Figure 3, for a host of reasons. That would mean, the output of any so-called sustainable building design will still leave something (if not a lot) to be desired.
Just as perfection does not exist, sustainability is also perhaps elusive. If anything, it keeps changing. It is never the same, from this day to the next! But that is certainly a good thing – as designers, engineers, researchers, scientists and administrators will always be on their feet, re-evaluating, rethinking, overhauling, being dissatisfied and discontent… and redesigning, again and again.

Acknowledgements

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