THEME 02

Sustainable architecture needs technology and tradition

TECHNOLOGY AND INNOVATION | ENERGY AND ENVIRONMENT | OUT OF THE BOX

In recent years, the debate on sustainable buildings has intensified due to the unequivocal impact of the built environment on climate change. The common response to this challenge is to introduce technological fixes to reduce energy consumption, either through insulation or high-efficiency heating or cooling. However, several architects today argue that we should actually rethink modern architecture and construction methods and embrace traditional ways of building to make our built environment more sustainable.

Our observations

- In 2017, the International Energy Agency (IEA) reported that buildings are responsible for 36% of global final energy consumption and emit nearly 40% of global CO2 emissions. After the industrial sector, buildings have the second biggest impact on climate change and, with energy demand from buildings expected to rise at nearly 3% per year, this impact will only intensity if action falls behind.
- The global crisis of climate change triggered the debate around sustainable buildings, with a specific focus on reducing the carbon footprint of the built environment. This has led to a triple response of greening energy production (e.g. wind and solar), improving the insulation of buildings and adding high-tech solutions to further reduce energy demand (e.g. smart thermostats and zonal heating).
- Before the industrial revolution, architecture was mostly vernacular (e.g. use of local materials, climate responsive). During the industrial revolution, steel and concrete were introduced, which allowed for greater freedom to design and build buildings for an advancing society, with a strong focus on cost-efficiency and functionality. From the late 19th century, architecture was further fueled by electric equipment (e.g. electric lights, central heating or air conditioning). As a result, buildings turned into uniform and mostly square shapes that have little concern for air quality, water or energy use. It was only in the last decades that we started documenting the ecological effects of our lifestyle.
- In response to climate change concerns, several sustainable housing initiatives have emerged, such as the zero-carbon house, the passive house. Each of these reflect the tendency of modern architects to turn to high-tech solutions in addition to otherwise conventional, non-sustainable architecture.
- Visionary architects have begun to bridge the gap between architecture and sustainability. Thomas Rau introduced the concept of a materials passport for buildings to reduce the material waste of buildings, Bjarke Ingles talks about the ecomodernist concept of hedonistic sustainability when he claims that sustainable architecture does not imply any compromises in terms of cost or functionality. Finally, and most interestingly, Sandra Piesik argues for a return to vernacular architecture to highlight lessons to be learned from traditional architecture (e.g. natural sun shading or ventilation).

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Connecting the dots

The growing awareness of the vast climate impact of the built environment and the subsequent debate on sustainable buildings, homes and commercial property, has created momentum for the development and implementation of sustainable solutions. However, architects are stuck in an architectural lock-in, characterized by the building of simple, square-shaped buildings, the quality of which is dependent on technology (e.g. electric lights and climate control systems). While these technological advances have the advantage of providing more freedom (e.g. building skyscrapers), they also make for buildings with high energy-consumption. There's great merit to today's common solutions, such as insulation, energy-efficient heating and smart air conditioners, to improve the energy efficiency of existing buildings. When it comes to future homes and offices, we should be careful not to rely too much on these add-ons as they typically address the symptoms of flawed, non-sustainable architecture, rather than the root cause. In other words, the aforementioned technologies can only be one part of the solution. Several architects argue for complementing smart technology with traditional design features. This can include exploiting natural light and ventilation by the specific placement of windows and walls (e.g. mashrabiya, projecting windows that allow cool air to flow in from relatively cool streets, or Iranian wind-catchers). These kinds of traditional ideas do not only relate to single buildings, but may also inform spatial planning. In southern Taiwan, for instance, traditional villages were built on an east-west axis to make use of prevailing winds for ventilation and cooling. Traditional materials can also be used for their intrinsically useful properties (e.g. reed for insulation). One example of a modern building that makes use of such traditional principles is Bjarke Ingles's skyscraper in Shenzhen (tropical climate). It uses 30% less electricity by playing with dress-like facades to block sunlight from the south, while still maximizing daylight. These traditional ideas do not necessarily contradict high-tech solutions and the combination of the two would most likely provide the best results. Today, many of the technological fixes are supposed to right the wrongs of architectural path-dependency, caused by a narrow "architectural equation" made up of esthetics, functionality and cost. By radically rethinking architecture, and bringing sustainability into this equation, we can use technology to much greater effect. For instance, digital modeling techniques can factor in sunlight, prevailing winds, airflow and turbulence and help optimize designs. 3D printing provides unprecedented freedom to build any design while minimizing materials use. As such, high-tech can actually facilitate and optimize the old wisdoms of traditional architecture.

Implications

- Traditional architecture also provides clues for how to deal with ongoing climate change. Ideas about natural shading and ventilation can obviously play a major role in that respect and old wisdoms may also help to deal with extreme weather events. In Tonga, for instance, traditional curved roofs are able to withstand storms and cyclones due to their aerodynamics properties.
- New architectural design principles may have consequences for the architectural supply chain. Materials use can be minimalized and there will be an increasing focus on circular buildings that allow for high-value reuse of materials or even the wholesale reuse of (elements of) constructions.
- Theoretically, building sustainably on the basis of these principles could result in cost-efficient solutions as less additional equipment is necessary. However, this is not a given per se, since these buildings may require more space or material to be realized in the first place. In any case, the construction costs alone don't tell the full story of a building's life cycle and a more comprehensive approach to cost is necessary. More specifically, both architects and project developers will have to take into account the energy costs over the lifetime of a building and adopt a total cost of ownership approach to buildings.
- A total cost of ownership approach to buildings is likely to catch on sooner for commercial properties than for homes. Businesses are more used to thinking in terms of total cost of ownership, as opposed to focusing only on the initial cost price. This is quite similar to the automotive market, where consumers seldom factor in operating costs (e.g. electric vehicles are relatively expensive to buy, but cheap to operate).

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