Editorial

In response to growing global warming issues and the constant increase of energy prices, house-builders and housing manufacturers today are becoming more responsive to the delivery of net zero energy and carbon dioxide (CO_2) emission sustainable homes than ever. Within this context, the sustainability may embrace housing economy and adequacy beyond the legitimacy in which the quality barely coincides with individuals' dynamic various needs, desires and expectations. Nevertheless, the industry's business operation tends to follow routines and the close system mode of operation often hinders the enterprises from adopting unfamiliar innovations which may be inevitable in realising the delivery and operation of socially, economically and environmentally sustainable homes.

In this special issue, the notion of 'mass customisation' was reviewed. This paradoxical concept has been recognised as a means to lessen production costs of end-user products whilst achieving the customisability through economies of scope rather than economies of scale. Housing is no exception. The idea dates back to the 1950s as the gravity became explicit in Walter Gropius' book entitled 'Scope of Total Architecture.' The essence of mass customisation applied to housing was speculated as he emphasized the need for 'standardising and mass-producing not entire houses, but only their component parts which can then be assembled into various types of houses.' In fact, housing is a system of energy and environment, composed of a number of parts and components indeed. The choice of the housing design elements need to be made carefully with due consideration of the project's initial and operational cost, quality, and time. Moreover, the location factor cannot be less of a consideration as it encompasses geographical and topographical conditions and local regulations. Location and orientation of housing help secure the optimum use or prevention of sunlight and wind and this affects the building's operational energy consumption and generation which correlate with CO_2 emissions and utility costs.

Mass Customisation is an oxymoron. The term is composed of two opposite notions: mass production and customization. The notion was anticipated in 1970 by Alvin Toffler in his book entitled 'Future Shock.' In 1987, the term was eventually coined by Stanley M. Davis in his book entitled 'Future Perfect.' Furthermore, in 1993, Joseph B. Pine II profoundly systematized the general methods of mass-customizing products and services in his book entitled 'Mass Customization.' In 2009, Frank T. Piller and Mitchell M. Tseng edited a 'Handbook of Research in Mass Customization and Personalization' and compiled the R&D activities and outputs delivered by a variety of industries across the globe. The handbook also includes one of the successful mass customization approaches being applied to the housing industry—i.e. modularization of building components. The total number of possible ordered pairs (or combination) of given standard housing components can be quantified. In the approach, the mass customization (MC) has been systematised and visualised simply by making use of a conceptual analogue model as follows: $MC = f(PS)$. In this model, the service sub-system (S) concerns communication platforms that lead the users to participate in customizing their design output while the product sub-system (P) covers production techniques that aim to encourage the standardization of housing components for mass production and dissemination. Standardisation of building components seems to be a limited hindrance to design customisation if communication platforms are well developed. Design-consulting staff and appropriate communication interface are required to facilitate user choice of standard design components. These fundamental design service factors can also be integrated into a comprehensive model: $S = f(l, p, t)$. In this model, the service sub-system (S) is supported by the existence of the location (l), personnel (p) and tool (t) factors and they are necessarily interrelated. Basically, building components can be divided into three categories: volume, exterior and interior. These can be considered the main elements of the product sub-system (P) which can be explained by the following conceptual model: $P = f(v, e, i, o)$. The volume (v) components are used to configure the building's internal space that determines the size and location of each room while the interior (i) and exterior (e) components serve to co-ordinate decorative and functional elements that customize a building. In addition, 'o' denotes other optional features such as building amenity and security systems, inclusive design components and renewable energy technologies. In general, fabric and ventilation heat losses are associated with building volume and envelop exposures whilst thermal transmittance links up with materials applied to exterior and interior components.

Most of the net zero-utility-cost housing manufacturers typically in Japan have begun to install a number of renewable energy technologies as standard features rather than options based on their value-added, high cost-performance marketing strategy. The strategy itself is far from new having been applied to a variety of end user products around the world. For instance, although today's automobiles can be produced with lower production costs than those in the past, their selling price does not seem to be affected dramatically by higher productivity. New cars are still generally regarded as expensive; nevertheless, the list of items now offered as standard in new cars, such as air conditioning, a stereo set, airbags, remote-control keys, power steering, power windows and adjustable mirrors, were offered only as expensive options in older models. Clearly, the quality of newer models is much higher than that of older models. The same is true for the housing industry. Quality-oriented production contributes towards the delivery of high cost-performance housing in which high-tech modern conveniences that are installed as options in conventional homes are available as standard equipment (Se). In this context, the product subsystem (P) can further be modified into the following conceptual model: $P = f(v, e, i, o) + Se$. In fact, Japanese housing manufacturers mass-produce net zero-utility-cost customizable homes in which a variety of housing amenities and renewable energy and environmental technologies (e.g. PV, air source heat pump, micro combined heat and power systems, and energy monitoring and control equipment linked to a large-scale lithium-ion battery) tend to be installed as standard features rather than options. Despite the reduction of equipment choices, volumetric, exterior and interior design components still remain substantial options from which the users can choose so as to customize the end product.

In order to deliver a marketable and replicable zero energy/emission mass custom home, or ZEMCH, the strategic balance between the optional and standard features seems to be critical. The optional features may be provided with the aim to enhance design quality (or customizability) that helps contribute to satisfying desires and expectations of individual stakeholders. The standard equipment, on the other hand, needs to be installed in buildings as it aims to exceed product quality whose levels can be adjusted in conjunction with societal demands and requirements. This edition encompasses a wide spectrum of hopes and fears around the design, production and marketing approaches to the ZEMCH delivery and operation, and showcases some exemplars budding out in different climates around the globe. This issue is developed in collaboration with ZEMCH Network and the International Energy Agency (IEA) Solar Heating and Cooling (SHC) Task 40 & Energy Conservation in Buildings and Community Systems (ECBCS) Annex 52 joint implementing programme experts with the aim to solidify today's diverse expertise in the realm as elicited research paradigms for further exploration and delivery of the homes that meet the wants and needs of individuals and society.

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