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Editorial

Technology and Management for Sustainable Buildings and Infrastructures

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According to a report published in 2019 by the United Nations Environment Program (UNEP), the building sector accounts for 38% of all energy-related CO_2 emissions when adding building construction industry emissions [1]. Yudelson (2008) argued that the building sector accounted for 45% to 65% of landfill waste [2].

Given this fact, the building sector must be one of the major causes of global warming and the resulting climate catastrophe. Therefore, research on the technology and management of the entire process including design, construction, O&M, and decommissioning is urgently needed for sustainable buildings and infrastructure that minimize energy use throughout their life cycle. At this point, it is judged that it was timely to hold a Special Issue under the topic of "Technology and Management for Sustainable Buildings and Infrastructures".

At the time that the world is struggling with the COVID-19 pandemic, this special issue has been published in 27 research papers [3–29], 1 review paper [30], and 2 technical notes [31,32], and with the help of many research colleagues and reviewers. A total of 30 papers were published. A total of 104 authors from 9 countries including Korea [3,5,6,8,12–15,17,19,20,22,23,25–28,30–32], Spain [11,18,21], Taiwan [4,24], USA [16,17,25], Finland [10], China [29], Slovenia [9], the Netherlands [7], and Germany [21] participated in writing and submitting very excellent papers that were finally published after the review process had been conducted according to very strict standards.

Among the published papers, 13 papers directly addressed words such as sustainable, life cycle assessment (LCA) and CO_2 [5–7,11,12,14,16,19,20,22,25,27,28], and 17 papers indirectly dealt with energy and CO_2 reduction effects [3,4,8–10,13,15,17,18,21,23,24,26,29–32]. Sustainability research related to CO_2 and the resulting climate change started in the construction field more than 20 years ago. Although life cycle cost analysis (LCCA) has dealt with the energy use of buildings for more than 40 years, it focuses on cost rather than CO_2 reduction. In the 21st century, research on net zero or near zero energy use of buildings has been conducted, but research on embodied CO_2 resulting from the design and construction stage has been excluded because it is limited to the operation and maintenance stage. Until recently, many design and construction studies focused on maximizing economic benefits, and rarely focused on carbon neutrality or CO_2 emission minimization. As a result, there are not yet many papers directly dealing with energy and CO_2 reduction throughout the construction project life cycle.

Among the published papers, there are 6 papers [4,6,9,18,29,32] dealing with construction technology, but a majority, 24 papers [3,5,7,8,10–17,19–28,30,31] deal with management techniques. The reason is that construction management can be approached more easily than construction technology when considering research cost, time, and effort. Among all the papers, 15 studies focused on buildings [7,8,10,12,14–16,18,19,22,25–27,31,32], 9 studies on infrastructures [6,9,11,13,17,20,24,28,29], and 6 papers could apply to both [3–5,21,23,30]. With the development of science and technology, there is a tendency for buildings to become taller, larger, and more luxurious, and the energy use tends to increase rapidly. In particular, this trend is conspicuous in the developed countries where most of the papers

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have been submitted. In addition, in the developed countries, infrastructures such as roads, bridges, seaports, airports, and power plants are sufficiently established. Therefore, it is presumed that there are more papers on sustainable buildings than on sustainable infrastructures.

The authors of the published papers used various analysis techniques to obtain the suggested solutions for each topic. Listed by key techniques, various techniques such as Analytic Hierarchy Process (AHP) [3,12], the Taguchi method [4], machine learning including Artificial Neural Networks (ANNs) [5,28], Life Cycle Assessment (LCA) [6,7], regression analysis [13,17,19,25,28], Strength–Weakness–Opportunity–Threat (SWOT) [11], system dynamics [16,26], simulation and modeling [10,19,22–24,29,31,32], Building Information Model (BIM) with schedule [21,24,27], and graph and data analysis after experiments and observations [8,9,14,15,18,20,27,29–32] are identified.

As mentioned above, although the construction sector is a key influencer that harms the global environment, many studies have been focused on cost, time, quality, and safety. However, future research should be conducted on the basis of carbon neutrality or CO_2 emission reduction. For example, previous cost minimization studies should be conducted as cost optimization studies based on CO_2 emission reduction or minimization. As such, if all research is conducted in the direction of pursuing sustainable buildings and infrastructures, the global environment will be gradually improved.

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