Multifunctional Concrete Material: Construction Management Point of View

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Received: 11/12/2016                Accepted: 19/02/2017 Published: 30/03/2017

Abstract

In this short note, the authors are highlighting the extreme lack of matured consideration of experimental decision science as well as constructability studies in multifunctional concrete materials research. Having experience in research on self-healing, waterproof, anti-algae, and antifungal, thermal diode, and heat conductive concrete [1-17], with construction management background, the authors are proposing the taxonomy of multifunctional concrete material from a perspective of “outsider (construction manager) in the house (of concrete designers).” Recently, there is extensive attention by the research community on multifunctional materials applicable to the construction industry. This attention, as a traditional downstream engineering subject, has been emerged in multifunctional concrete materials as a demand-driven solution. It is while the outcome of this venture never assessed with construction managers. To this end, “Decision science of experimental design” and “Constructability of findings” are two major research shortcomings in multifunctional concrete design and development.

Keywords: Multifunctional Concrete; Multifunctional Material; Construction Management; Constructability; Decision Science

1 Multifunctional Concrete Definition and Shortcomings

In general term, “Multifunctionality” shall be defined as an objective, given to material “to have or to fulfill several functions” [18]. Records at Scopus indexed databases are showing earliest multifunctional material titled whitepaper backs to 1980s, and there are several streams taken to venture the multifunctional concrete world. By definition, it should be based on the development of new active derivative function or improvement of the existing attribute to an additional service function. Existent of every newly developed function in parallel to default functions concluded to the novel introduction of multifunctional concrete mix design. Concurrently, concrete has historical limitations that in some cases addressing that can also conclude to a new function. It is while, equally modern area and its fashion of economic, environmental, and social friendly demands are persuading to the introduction of concrete’s new function as well. However, there are shortcomings to multifunctional concrete associated with “Decision science of experimental design” and “Constructability of findings,” which the following presents, in details.

2 Decision Science of Experimental Design

It is well understood that “Decision science” is not that matured as a mathematical science, chemical science, or other fundamental core sciences. Indeed, the existing development of decision science body of knowledge is not well in practice by concrete researchers. The following are some examples supporting this statement:

- Majority of researches in multifunctional concrete material is shortsighted to lab condition outputs under extreme control variables. This is while non-measured casual and control variables are other missing points.
- Dependent and independent variables are measured, but measurable variables of the same variable are not comprehensive or not well investigated.
- Experimental process of evaluating different functions is being conducted per the requirement of “Dominant decision making,” in discrete form, while it is not necessarily a valid approach, since “Non-dominant decision making” processes rarely focused by researchers.

All the above come under the scope of decision process analysis of multifunctional concrete research where it is part of constructability study in construction management, as well.
3 Constructability of Findings

O’Connor [19] research on constructability is one of fundamental effort to this knowledge. Based on this work, “...Constructability improvement impacts are most often modifications in resource utilization and usually involve a tradeoff between engineering and construction resources. Constructability improvements seldom benefit a project without requiring some additional effort to be expended in some manner.” This in mind, economic analysis, supply change, contractor capacity, labors skill, end-user acceptance, and other downstream requirements rarely studied in multifunctional concrete material research. Analysis of upstream requirements of constructability can be another major future research concern; including, availability of resources, dynamic, and complexity of expanding material input, change order process, etc.

4 Conclusion

This short note is to highlight the major and main shortcomings of global research in multifunctional concrete materials. It indicated inadequacies associated with “Decision science of experimental design” and “Constructability of findings” in multifunctional concrete materials research. The commitment of editors, reviewers, authors, and researchers is needed to reconsider standards and proper experimental decision science as well as constructability analysis in multifunctional concrete research publication. As such development will shorten the shelf life of research for the ultimate benefit of construction stakeholders, as well as, public communities.

Acknowledgments

The authors are grateful to the Ministry of Higher Education, Malaysia (MOHE) and Research Management Centre (RMC), Universiti Teknologi Malaysia (UTM) for financial support under grant FRGS R.J130000.7822.4F762 and GUP Tier 1 Q.J13000.2522.13H02.

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