IMPACT OF SUSTAINABLE FEATURES ON LIFE CYCLE COST (LCC) OF GREEN BUILDINGS IN SRI LANKA

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Degree of Master of Science by Research

Department of Building Economics

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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DEDICATION

To My Beloved Parents……

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JOURNAL PAPERS

- Weerasinghe, A.S. and Ramachandra, T., Economic sustainability of green buildings: life cycle cost analysis, BEPAM Special Issue on "Built Environment Sustainability: What's New and what's Next?" (Accepted with minor comments)

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ABSTRACT

Recently, the focus to green buildings has fore-fronted in countries like Sri Lanka. However, in the context of Sri Lanka, the number of green certified buildings is still at a minimal level and the reason could be attributed to green investors who continue to perceive that green buildings are costly with a 20 to 25% of green premium. They fail to appreciate the benefits that could be absorbed in the long run in terms of operation and maintenance costs. Further, in the global context, there are contradictory views with regards to green cost premium. However, in both context, only a little information is available on the status of operation and maintenance costs reduction. Further, quantitative evidence of running cost reduction in green buildings compared to conventional buildings, would enable green investors in their decision making. Therefore, this study establishes the economic sustainability of green buildings followed by a comparison of life cycle cost of green certified and that of conventional industrial manufacturing buildings in Sri Lanka and an assessment of the impact of each sustainable feature on life cycle cost of green buildings.

First, a preliminary study was conducted using the already published data on LEED certified buildings in Sri Lanka to identify the level of sustainability achievement in terms of variable sustainable features and the reasons for the level of achievement of those sustainable features. Afterwards, two green buildings and a conventional building with similar physical and performance characteristics were selected with due considerations to year of construction, Net Internal Area, and occupancy rate. The quantitative data on construction, operation, maintenance and end of life cycle costs of the selected green and conventional buildings were collected referring to green building construction budget, operation and maintenance expenditure budget records and analysed using Net Present Value and sensitivity analysis.

The analysis shows that the construction cost of green building is 37% higher than that of a conventional building while the green building offers a saving of 28%, 22% and 11% in terms of operation, maintenance and end of life cycle costs respectively. Overall the green buildings offer an economic sustainability of 21% over its life time. According to the sensitivity analysis, the changes in variables do not affect the economic sustainability of green buildings, still the life cycle cost of green building is less than that of a conventional building. Further, the sustainable features: Energy and Atmosphere and Indoor Environmental Quality contribute more to life cycle cost of green buildings due to the implementation of energy metering and sub metering, Building Management System, CO_2 and airflow measurement equipment, high-performance glazing, building commissioning and 3D energy modelling.

Therefore, the study recommends the green building investors to select suitable green strategies and technologies to reduce the life cycle cost of green industrial manufacturing buildings.

Keywords: Green Buildings, Green Rating Systems, LCC, Sustainable Features, Sri Lanka.