PROBABILISTIC COST-BENEFIT ANALYSIS OF INSTALLING EXTENSIVE GREEN ROOF IN MALAYSIA

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To my beloved mother, father, sister and
dear Sanaz

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ABSTRACT

Green roofs have been known as an environmentally friendly application and a sustainable approach in the developed countries such as: Germany, United States and Canada. Although environmental cost-benefits related issues of green roofs are already proven by many researchers in developed countries, it is not used widely in developing countries like Malaysia. It is estimated that the market at first focuses on extensive green roof due to the lower initial and maintenance costs; as a result, a probabilistic cost-benefit analysis for extensive green roof is conducted in this study. Installation, maintenance, and disposal costs of extensive green roof system are compared with the related private and social benefits (increase of property value, savings for air conditioning, longevity, air quality improvement, carbon reduction, etc.), determining two indicators: the Net Present Value (NPV) and the Pay Back Period (PBP), using Monte Carlo simulation. The analysis demonstrated that green roofs are not long-term investments in terms of net returns. In general, installing extensive green roof is a low risk investment. Furthermore, the probability of profits out of this application is much higher than the potential financial losses.

ABSTRAK

Bumbung hijau telah dikenali sebagai satu aplikasi yang mesra alam, dan sebuah pendekatan yang mapan di Negara – Negara maju seperti : Jerman, Amerika Syarikat dan Kanada. Walaupun isu berkaitan kos faedah persekitaran bagi bumbung hijau telahpun dibuktikan oleh ramai penyelidik di Negara maju, ianya masih belum digunakan secara meluas di Negara membangun seperti Malaysia. Adalah dianggarkan bahawa matlamat utama pasaran untuk bumbung hijau sepenuhnya hanya menumpukan kepada kos permulaan dan penyelengaraan yang rendah; hasilnya, satu analisis kos-faedah kebarangkalian untuk bumbung hijau sepenuhnya telah dijalankan dalam penyelidikan ini. Kos pemasangan, penyelengaraan dan pelupusan bagi bumbung hijau sepenuhnya dibuat perbandingan dengan faedah berkaitan swasta dan sosial (peningkatan nilai hartanah, penjimatan penyaman udara, ketahanan lama, peningkatan kualiti udara, pengurangan karbon, dan lain –lain), menentukan dua penunjuk: Net Present Value (NPV) dan Pay Back Period (PBP), dengan menggunakan simulasi Monte Carlo. Analisis menunjukkan bahawa bumbung hijau bukan satu pelaburan jangka-panjang dari segi jumlah pulangan bersih. Secara umum, pemasangan bumbung hijau sepenuhnya ialah satu pelaburan risiko rendah. Tambahan pula, kebarangkalian keuntungan daripada aplikasi ini lebih tinggi daripada potensi kerugian perbelanjaan.