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Delphi method of developing environmental well-being indicators for the evaluation of urban sustainability in Malaysia

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Abstract

Urban sustainability is the goal of many cities to improve well-being of urban residents that live in cities. This study sought expert consensus in a 2-round Delphi survey to rate the importance of environmental well-being indicators to assess urban sustainability. A multidisciplinary group of 45 experts rated the importance of 18 indicators with response rates of 75.6% and 91.2% in the rounds. Consensus was reached on 12 indicators with a high level of group agreement (Kendall's W=0.522,$P < 0.001$), and high correlation in rounds rankings (rho:0. 964, p>0.01).

Keywords: Environmenta well-being, sustainability, indicator, urban area, delphi

1. Introduction

Urban environment includes large cities are assuming increasing importance in global environmental health concern[1]. The primary reason is that, more than half population (3.4 billion people) of the world lives in urban areas, and with expected increase (6.3 billion by 2050) into the future [2]. Human population growth has resulted in environmental change in the form of uncontrolled and unplanned urbanization, intensification of agricultural

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production, deforestation, and biodiversity loss [3]. These change impacts the quality of life in the cities; affect human health both directly (air, water pollution) and indirectly (climate change). Cities are faced with environmental health impacts of urban pollution derived from inadequate water, sanitation, solid waste services, poor urban and air pollution (primarily from particulates) cause severe environmental health hazards for urban residents[4,5]. For example, exposure to severe traffic noise in urban environments can cause serious sleep disturbance, hearing impairment, and raised stress levels leading to high blood pressure, related coronary heart disease, stroke, and possibly immune system and birth defects [6] . Also, there are of death from causes related to air pollution in large urban centers each year [7].

Cities are civilization and the engines of economic growth, but the environmental implications of such growth on the well-being of the society are consequential. Rapid urbanization in many developing countries has pressure on the cities and the supporting ecological systems [8]. Thus, there is need for redirection towards sustainability and well-being as an option for further development [9]. Cities are necessary determinants of future sustainability in human health and environmental well-being [10]. Environmental as well as social issues must be addressed in order to move towards sustainability.

The value of linking urban environmental health and wellbeing outcomes is now well recognized [11], but poorly understood not to mention guiding urban environmental planning, policy and governance [12]. The relationships are complex and in many instances; clear and measurable links are not available [13]. Therefore, environmental well-being indicators are required to summaries, understand and monitor the complex relationships to enhance policies on urban sustainability. Many leading democracies and major international institutions around the world are involved in efforts to develop specialized and comprehensive indicator systems to measure societal performance. Indicators are increasingly becoming a useful tool for policy-making and public communication [14]. Different practices use different indicators according to their particular needs, and these have been selected under different methods. The process of urban sustainability require a measurable indicators [15]. Environmental indicators thus, assess the effects of human activities on the environment and the implications for human health, quality of life and the ecosystems. Environmental indicators are usually scientifically based information that describes environmental conditions and trends [16].

Malaysia is currently experiencing rapid economic growth, industrial development, an urbanization process, increasing population and a changing lifestyle [17]. Despite the challenge of urban sustainability practices, the environmental impacts on well-being are yet to be studied. An environmental well-being indicator as a tool can assist in the assessment and monitoring of the impact of sustainable development [18],and transform societies in the direction of environmental sustainability [19]. This study, therefore, develop a valid environmental well-being indicators for urban sustainability in Malaysia, using Delphi consensus.

2. Methods

2.1. Delphi consensus techniques

Delphi consensus techniques have been used in natural resources and environmental management research to facilitates interaction in investigation of variety of local, regional, and global issues among the stakeholders [20]. However, few researchers have used the methods to develop environmental well-being indicators among expert group. A Delphi traditionally involves an anonymous survey using questionnaires with controlled feedback to allow iteration within a panel of experts [21]. It is also understood as a tool for reaching expert consensus through scientific discourse and helping to solve complex situations in which, while scientific knowledge elements are relatively certain, the relations between variables are very complex [22]. The method is found appropriate for developing indicators [23]. The choice of a specific design and the methodological of a Delphi process dependent on the research question defined by the analyst and vary significantly among studies [24]. The Delphi study presented here was devised in a structured format in order to assess a list of pre-defined environmental indicators drawn from the literatures.