

## I. INTRODUCTION

Economic growth is considered to be a prerequisite for meeting the basic needs of a society. Nevertheless, economic growth alone is not sufficient to enhance well-being, although it plays a pivotal role in increasing the purchasing power of people and thus provides greater opportunity to raise their standard of living. Economic growth depends not only on human capital, but also on environment or natural capital.<sup>1</sup> Continuous economic expansion may lead to a loss of the services provided by natural capital, which in turn may place a limit on growth. However, economists, until recently, held the view that the environment is a subset of the economy and the economy can grow forever. The only role that nature plays in economic growth processes is as a source of raw materials and as a sink to absorb the waste products of economic activities. This narrow view of environment has led to the depletion of natural resources at a rate faster than the replenishment rate, generating pollution beyond the assimilative capacity of nature.

Discussions on the impact of human-led economic activities on the environment started to gain popularity in the 1960s with the works of certain scholars from interdisciplinary fields (Carson, 1962; Boulding, 1966; Daly, 1968; Ayres and Kneese, 1969; Georgescu-Roegen, 1971). Although diverse in nature, all these works suggested an interaction between the economy and the environment. Boulding (1966) pointed out that it is not possible to have limitless growth in a finite world. This is because the economy is part or a subsystem of a whole ecosystem, namely that of the environment (Daly and Farley, 1994; Getzner, 1999). Therefore, the economy cannot grow forever, as growth is limited by the availability of natural resources or the environment (Daly and Farley, 1994; Lawn and Clarke, 2010; Asici, 2013).

These studies have shown that there is reason to be concerned about the future of humankind and a need to put constraints on economic activities that stem from both human and physical interactions of the economy and the environment (Stern, 1997). Hence, sustainable development is concerned with development not only for the present generation, but also for future generations. In other words, this definition of sustainable development emphasizes that for development to be sustainable intergenerational equity is achieved when each following generation has at least as much capital at its disposal as the preceding generation (Figge, 2005). Though this idea has been widely accepted, there is a great deal of debate concerning the question of whether one form of capital (e.g. natural capital) can be substituted for

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<sup>1</sup> Natural capital is the range of functions that the natural environment provides for humans and for itself. Traditional economists have defined capital as a produced means of production, where the term "produced" implies "produced by humans" (Costanza and Daly, 1992). Ecological economists have broadened the definition of capital to include the means of production provided by nature.

another form of capital (e.g. human-made capital). Based on this capital approach, two schools of thoughts have emerged: weak sustainability and strong sustainability. Weak sustainability, which stems from the prevailing environmental-economic theories, assumes that the total capital stock is an aggregate stock of man-made and natural capital and so there are no natural resources that cannot be replaced by other forms of capital (Stern, 1997). That is, the theory of weak sustainability is based on the market economy and the whole concept is human centric. This school is strongly opposed and challenged by the strong sustainability school of thought. This school of thought belongs to ecological economics, which does not support the concept of perfect substitutability among capitals. The school believes that substitutability among capitals, especially between natural capital and man-made capital is restricted (Daly, 1990; Gowdy, 2000).

Until now, most studies have analysed one or several countries at one point in time, taking either the weak sustainability indicator or the strong sustainability indicator. For example, Galli and others (2012) have taken the ecological footprint as a strong sustainability indicator for India and China. Lawn and Clarke (2010) used the genuine progress indicator as a weak sustainability indicator to gauge countries' sustainability. You (2011) considered genuine savings as a weak sustainability indicator to measure China's sustainability in terms of energy consumption. In this paper we concentrate on studying the sustainability of a few selected developing Asian economies by considering both weak sustainability and strong sustainability indicators. The reason for choosing both indicators is to enable us to understand the path of development followed by emerging economies. We have used adjusted net savings, also known as genuine savings, as a weak sustainability indicator and the ecological footprint as a strong sustainability indicator to understand which path the selected Asian economies are on. By conducting a trend analysis of the growth patterns using time-series data from 1990 to 2010 for the selected Asian economies, the paper seeks to understand if economic growth is putting pressure on the natural resources of those countries and if resource utilization is related to the increasing size of the economy and population.

The paper is structured as follows: section II discusses the concept of sustainable development; section III describes the study region, data and methodology used to analyse the data; section IV presents the results; and section V concludes with a discussion of the findings.

## II. SUSTAINABLE DEVELOPMENT: WEAK AND STRONG

The concept of sustainable development explains the evolution of society from a new perspective. Although the concept took shape in the 1980s, its origin predates that. Natural resources were always considered the primary elements of production and for maintaining a given level of population. However, when population increases, there is an impact on the natural resources themselves, due to increasing demand. In 1798, Thomas Malthus, discussed the effect of population increase on land in his famous book *An Essay on the Principle of Population*. He believed that an uncontrolled increase in population might hamper the development of society (Brander, 2007; Rogers, Jalal and Boyd, 2008). This belief of Malthus can be regarded as the first important step towards the concept of sustainable development. Although current discussions on sustainability are more scientific and include much more important phenomena than Malthus could have included. However, both the present concept of sustainable development and Malthus's view of population growth emphasized the fact that the economy cannot grow forever. The linkage between these two concepts is still relevant for increasing quality of life. Brander, in 2007, revisited this theory in a very scientific way while considering three important elements: the stock of environmental capital; the human use of environmental capital; and population growth. With the help of a formal model of Malthusian demography in the presence of ecological constraints, Brander (2007) concluded that the most fundamental factor in achieving sustainable development was population and the demographic transition to lower fertility.

The next important development was the book entitled *Limits to Growth*, which was commissioned by the Club of Rome and was published in 1972. In its introduction, the authors claimed that if the existing trend continued in the growth of population, industrialization, pollution, food production and resource depletion, then the limits to growth would be reached within 100 years (Meadows and others, 1972). One of the main aims of *Limits to Growth* was to bridge the gap between development and environment. In the same year, the United Nations Conference on the Human Environment was held in Stockholm. This conference turned the environment into a major international issue (Long, 2000). As the result of a recommendation made at that Conference, the United Nations Environment Programme (UNEP) was established in 1972 to focus on environmental action and to coordinate with the United Nations system. Again following the Stockholm Conference, in 1974, a symposium was held in Cocoyoc, Mexico, by UNEP and the United Nations Commission on Trade and Development (UNCTAD) to identify the economic and social factors responsible for environmental deterioration (UNEP, 2003). Right after these seminal works, the first World Climate Conference was held in 1979 in Geneva and in 1980, the World Climate Programme was established to provide a framework for international cooperation on research into important climate issues such as ozone depletion, global warming, etc.

All of the above-mentioned processes increased the need for conservation strategies to incorporate environmental considerations into development planning. In 1980, in an effort to meet one of the objectives of the Stockholm Conference, the World Conservation Strategy was launched by the International Union for Conservation of Nature (IUCN) with the advice, cooperation and financial assistance of UNEP and the World Wildlife Fund (WWF) to address environmental issues where the term “sustainable development” was coined for the first time (Moldan, Janouskova and Hak, 2012). Furthermore, in 1983, the World Commission on Environment and Development (WCED) was formed under the chairmanship of Ms. Brundtland, the then Prime Minister of Norway. The commission published its report in 1987 as *Our Common Future*, which defined sustainable development as “the development that meets the needs of the present generation without compromising the ability of the future generation to meet their needs”(WCED, 1987). It concluded that existing decision-making structures and national-international arrangements could not cope with the demands of sustainable development (WCED, 1987). This definition means that environment<sup>2</sup> is a necessary condition for development. However, how to achieve sustainable development and how to decide whether the present path of development is sustainable or not are still under consideration.

There are many challenges to sustainable development as emphasized by different scholars. *Limits to Growth* identifies population, industrialization, pollution, food production, and resource depletion (Meadows and others, 1972) as some of the challenges to sustainable development. Wackernagel and Rees (1996) argued that the Earth’s ecosystem cannot sustain the current levels of human demand for resources and ecological services and they identified the rising levels of carbon dioxide emissions and resource consumption as challenges to sustainable development. Various studies have established that the scarcity of natural resources poses a real constraint on lasting growth. As discussed in the introduction, sustainable development can be looked at from two different points of view. One way is to view the environment in terms of the natural resources or natural capital that are available for wealth creation, and that future generations should have the same ability to create wealth as we have. In other words, future generations will be adequately compensated for any loss of environmental amenity by having alternative sources of wealth creation (Beder, 2000) and hence growth will not stop. This is referred to as “weak sustainability”. The weak sustainability concept was the extension of neo-classical theory of economic growth to account for non-renewable or exhaustible natural resources based on the assumption that natural capital can be replaced by man-made capital (Getzner, 1999). According to this view, the total stock of capital must not decline and should remain

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<sup>2</sup> Environment refers here to the capacity to supply raw resources and to absorb the end waste products (Daly, 2005).

at least constant for development to be sustainable. The view is based on a belief in technological advancement, which offers the possibility of replacing natural capital with man-made capital. The proponents of weak sustainability looked at environment as a natural resource, which has a monetary value and can be extracted for the benefit of humankind. Economists started looking at sustainable development mostly from the perspective of weak sustainability after the works of some renowned scholars, like Dasgupta and Heal, Hartwick and Solow (see Dietz and Neumayer, 2007). In their works, the authors successfully applied the substitutability assumption of weak sustainability. Furthermore, Hartwick (1978) wrote “no generation short-changes a future generation by depleting the stock of exhaustible resources without providing the future generation with, in some sense, the depleted stock equivalent in the form of reproducible capital”. Up until the 1990s, policy discussions and environmental debates focused on this simplified way of understanding economy-environment interaction, namely, that complete substitutability of natural capital with man-made capital is possible.

However, this view was greatly challenged in the 1990s by certain scholars from divergent fields who viewed the environment as offering more than just economic potential that is not substitutable by man-made wealth. They argue that future generations should not inherit a degraded environment, no matter how many extra sources of wealth are available to them. This is referred to as “strong sustainability”, and is the second view. The proponents of strong sustainability, such as Daly, Georgescu-Roegen, Ekins, Pearce and Atkinson, who are ecological economists, emphasized that environment performs four categories of functions,<sup>3</sup> for which the total economic value is difficult to calculate. For them the economy is only a “part” of the “whole” ecosystem and hence for sustainable development, both natural and man-made capital must be preserved (Figge, 2005). In 1999, Gowdy and McDaniel (1999) established — by taking the case study of Nauru, a small Pacific Island nation — that weak sustainability is a short-run concept. Nauru has achieved good economic growth at the cost of its natural resource, phosphate. However, as a result of its mining activities, 80 per cent of the island is totally devastated, land has become unusable for habitat, many species have become extinct, many more have become endangered and the nation has become dependent on the global economy (Gowdy and McDaniel, 1999). Beforehand, Pearce (1987) had argued that none of the economic forms could guarantee sustainability. Figge (2005) proved that the theory of

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<sup>3</sup> The functions of natural capital can be divided into four categories, namely: (a) a source of raw materials for production and direct consumption, such as food, timber and fossil fuels; (b) a sink to assimilate the waste products of production and consumption; (c) amenity services; and (d) basic life-supporting functions on which human life, as well as the first three categories of functions, depends (Pearce and Turner, 1990; Ekins and others, 2003). Hence, this fourth category is of primary value, whereas the first three categories are of secondary value.