

**Niranji Satanarachchi, 076962, Graduate Program in Sustainability Science (GPSS),  
The University of Tokyo  
e-mail: [niranji.satanarachchi@gmail.com](mailto:niranji.satanarachchi@gmail.com)**

**Completed on August 2009**

**Primary Advisor: Professor MINO Takashi**

## **Conceptualizing Sustainability Dynamics**

### **Abstract**

The universe we know today is a highly complex system with many different subsystems interacting with one another to form incredibly diverse patterns and relationships<sup>1</sup>. Anyone who would be interested to see beyond the boundaries of a village, country, the earth, or the whole solar system may start to identify these numerous viable interactions. Over the years the man, one of the most intelligent creatures on earth has understood this reality and tried to give interpretations for what he has seen around him, to answer many puzzles, and more importantly to face the challenges continuously faced by the hardships the surrounding induced upon him. Sustainability is a concept which has surfaced and stands upon many of such realities. Even though it's well recognized milestone in 20<sup>th</sup> century, with the related concept of sustainable development, is much known and cited in sustainability literature, the essence of facing the challenge of survival, the suitable way of existence, the sense of noble path has been a question always hovered in the background and surfaced from time to time in many eras of human history at many different parts of the world. These have taken the form of beliefs or perceptions which sometimes evolved in to ideologies, philosophies or even religions. Stressing on such hard

---

<sup>1</sup> We use the term system to mean an interdependent group of items forming a unified pattern

conceptual side in modern discussions on sustainability is now often regarded as perceptions of strong sustainability. Such terminologies have emerged with the complexity today we face with the highly interrelate but contextually diverse dimensions of what we understand as sustainability. These dimensions would vary from, economical, technological, ecological, social aspects, even to integrate ethics or what one perceive as values. In addition any form of sustainability that is talked of today, often carries the desperation of reaching tangible or physical grounds, so that goals can be set easily within existing structures of research, policies, engineering etc. This strong inclination to frame the concept has lead to interpret sustainability from many view points, in the way to suit a particular application, goal or a target. Such efforts have been challenged but not completely stopped by the existing vagueness and ambiguity in the definitions. However linked with the unavoidable confusion made by highly spectral approach to integrate this conceptual value in to policies, research, actions etc., instead of basing a foundation in holistic viewpoints, very often sustainability is implied as a future state or a target, which is not quite clearly defied, yet since known as good, to be followed or even raced to reached through different means. For instance, nowadays, terminologies such as reaching, achieving, future state, are quite abandon in the scattered literature. Whatever the exact reason, the end result is that sustainability tends to carry much implication on maintenance, sustenance of either conditions, resources, systems or even relationships, in other words perceiving the concept as an end state or a goal.

Hence based on the proposition that sustainability, instead of a past, present or future state is a continuous process which evolves over time, the thesis aims to understand what the perception of dynamics would specifically mean in relation to sustainability, hence the dissertation illustrates a logical process of conceptualizing what we call as *sustainability dynamics*, to reach a

conceptual model which has the potential to frame the concept within firm scientific grounds. Through evaluating various complex socio-environmental systems on one hand from the viewpoint of their natural evolutionary patterns, and on the other hand, through the lens sustainability/unsustainability principles, concepts of sustainability sphere, sustainability path, patterns of movements along the path and finally dimensions which form the sustainability sphere and determine the path movements within, are developed in various stages. The basic model of sustainability sphere and sustainability path is defined reaching from the internal dynamical forces and external dynamical forces. Internal forces are identified as the ones, which govern the functional movements or dynamics within the system despite whether they generate sustainable conditions, or not. The external forces are identified as straight away linked with sustainability characteristics or principles inherent or concerned with a certain system. In addition, with the support of few contextually different cases the movement patterns that are created by these forces, path dynamics are characterized in to two main forms, namely Horizontal Process Dynamics (HPD) and Vertical Process Dynamics (VPD). Finally integrating the two approaches together a model is introduced which explains Sustainability Dynamics in relation to movements and forces, while in the latter part of the thesis ways to further improve and strengthen the proposed conceptual model to be successfully utilized in research are discussed in detail.

**Key words: Sustainability Dynamics, Sustainability Path, Sustainability Sphere, Path Dynamics, Dimensions of Sustainability Dynamics**