Systems theory: an introduction

Systems theory is a set of theoretical concepts used to describe a wide variety of thing in terms of a model called a system. To give it context lets talk a bit about it's origins. Of cause people have been coming up with abstract theories about how the world work for a long time. Some ancient Greeks thought everything was made of earth, water, fire and air, whilst others came to the conclusion that it was the expression of perfect geometric forms.

Over the years our theoretical systems have grown into large and sophisticated bodies of knowledge such as philosophy, mathematics and the many areas of theoretical science, although these theoretical frameworks are often limited to relatively specific area of interest. During the 20th century Systems theory emerged as a new theory that draws upon many core concepts within these pre-existing methods to develop a more abstract framework that is design to be universally applicable to all domains.

In order to achieve such a general relevance, system theory starts with the abstract concept of a system and then applies this to modeling various different phenomena from biological to social and technical systems.

The model of a system can be loosely defined as a set of parts often called elements that form a whole, which is referred to as the system. A system exists within an environment and has a boundary that differentiated the systems exterior from its interior. An example of this might be a country, interior to which are all the people, institution and other elements that constitutes the nation as an entire system. Whilst exterior to its boundary is the international political environment.

A system can be either open or isolated, isolated systems do not interact with their environment, but most systems are open meaning there is an exchange of energy and resources between the system and its environment. The passing of energy or resources from the exterior of the systems boundary to the interior is termed an input whilst the reverse is termed an output.

Systems develop or function through the input of energy or resources from their environment, they process this energy by transforming it to create an output, if this output is of some value to its environment it can be termed energy. If on the other hand it is of negative value it may be termed entropy, a scientific term for lack of order, disarrangement or in more familiar terms we might call it waste.
An early use of this type of model was during the development of the steam-engine where scientist and engineers were thinking about the amount of fuel inputted to the engine relative to the power out put and heat energy wasted. By using this model they could create a quantifiable ration between them that we would now term the efficiency of the system.

Of cause this same reasoning can be applied to a wide variety of phenomena from the processing of energy within a plant cell to the efficiency of a business organization.

We can model systems on various scales, thus elements can form part of systems that themselves form part of larger systems and so on, this is termed nesting or encapsulation and helps us to analyst a system on various levels whilst hiding away the underlining complexity.

Systems theory explores many other areas such as Emergence that raises key question about the relationship between the parts within a system and the hole, that is how elements can function together or self organize to create some new and emergent structure as an entirety.

Or other areas such as Cybernetics that deals with a systems control mechanism, that allow it adapt and respond to changes within its environment through positive and negative feed back loops.

Systems theory has found application within a wide variety of areas forming the foundation for many new subjects such as systems psychology, systems engineering and systems ecology to name but a few. All of which place an enforces upon a more holistic and contextualization approach to understanding the world around us.