Rethinking Systems Movement:

A Proposal for Reshaping it as an Academic Discipline Named 'Systems Studies'

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ABSTRACT

- In this work, in an effort to critically analyze the systems movement, its nature and scope have been discussed, achievements and failures have been examined, potentials to become an academic discipline has been explored and finally suggestions have been made to forge an academic discipline out of systems movement named Systems Studies. Systems movement is centered upon General Systems Theory (GST) that appears to be extremely broad, diverse, fluid and obscure. There is no precise definition of GST. Unlike many other theories, GST cannot be expressed exhaustively in one or several sentences. A number of phrases widely used in systems literature, such as 'general systems theory', 'systems approach', 'systems perspective', 'systems research', 'systems movement', 'systems thinking', 'systems methodology', 'systemics', 'systemology', 'systems science', etc. take us to the same area. The systems movement has gathered ideas from many fields, each of those has become strand of GST. Yi Lin (1999: 10-14) mentions classical systems theory, catastrophe theory, compartment theory, cybernetics, fuzzy mathematics, game theory, genetic algorithms, graph theory, information theory, Navier-Stokes equation and chaos, networks, set theory, simulation, statistics, theory of automata etc. as several strands of GST. The systems ideas have become so fluid that those can reach in any area of intellectual endeavor without any remarkable success. Therefore, the question arises what systems movement really is? The need arises to conceptualize its philosophy, delineate its area, specify objectives, work out methodology and finally put it into practice. It is advisable to replace the above various expressions by a single phrase 'Systems Studies'. Thus, many ambiguities, sterile controversies and even inflated claims can be minimized. Von Bertalanffy – the originator of GST organized a general systems movement in the 1950s with the objectives of searching for isomorphy of concepts, laws and models of various fields, and useful transfers of those from one field to another; developing adequate theoretical models in fields which lack them; minimizing the duplication of theoretical efforts in different fields and promoting unity of science by improving communication among specialists (Kuper and Kuper, 1985: 330). Those objectives have not yet been achieved. During the last fifty years of its existence, the achievements of systems movement are not significant. In fact, systems movement has been reduced today to seminars, conferences, journals, books and courses undertaken by a small number of scholars and institutions of a variety of disciplines with little practical implications. We do not yet have a comprehensive theory of systems, standard textbook of fundamentals and definitive workbook of techniques and applications. So, it requires a

consensus among the scholars how to redirect the movement to specific objectives. Establishment of a link among research, teaching and application is an imperative. Development of an academic discipline can serve these objectives. An academic discipline promotes inquiry and conserves knowledge by educating undergraduates, training graduates, producing texts, announcing discoveries, criticizing works and maintaining a community of mutually attentive scholars with common intellectual interests. The systems movement needs to be reshaped in this line. The next ISSS annual conference theme is proposed to be – Systems Studies: An Emerging Academic Discipline.

Key Words: Systems movement, General Systems Theory, Systems Studies.

Introduction

- Borrowing from biological sciences in the early twentieth century, General Systems Theory (GST) is being used in the analysis of social science phenomena. Since then, some social science scholars increasingly found same laws in the functioning of living organisms, machines and conceptual systems. Thus, the philosophy 'reductionism' emerged. Opposed to the reductionists, the vitalists maintained that the laws governing physical environment cannot be generalized into living organisms because life is characterized by birth, survival, development, reproduction, behavior, senescence, death etc. – those are unique and cannot be equated with non-living beings (Rapoport, 1972: 452). This debate between reductionists and vitalists continued. Added to the debate later, the apparent failure of systems movement in achieving it's stated objectives. Thus, a critique of GST developed. The viability of a theory is determined by its usefulness in explanation, success in prediction or retrodiction, fruitfulness in raising new research questions etc. (LaLone, 1999: 297). The systems approach met with criticisms on all these points – again, responded by the systems scholars. A critical analysis of GST on these points and others is presented below. The discussion is divided into four parts: the nature and scope of systems movement; it's achievements and failures; it's potentials as an academic discipline and finally Systems Studies as an academic discipline. It examines the process of the formation of academic disciplines, explains the status of Systems Studies and suggests ways of building a new academic discipline named Systems Studies. The paper concludes with the assertion that forging an academic discipline out of systems movement, better services can be rendered to mankind.

Systems Movement: Nature and Scope

- Systems notion assumes that everywhere there are systems in the real world. The world is filled with ecological, biological, social, economic, political, cultural and many other types of systems. A system consists of some elements. The interactions among these elements keep the system functioning. Looking at anything with such view is called a systemic outlook. A number of phrases widely used in systems literature take us to the area of systems movement. Those are '**general systems theory**', '**systems approach**', '**systems perspective**', '**systems research**', '**systems movement**', '**systems thinking**', '**systems methodology**', '**systemics**', '**systemology**', '**systems science**', etc. Sometimes,

those are used synonymously. Therefore, the question arises what systems movement really is? What are its nature and scope? We need to have a discussion on those concepts.

- **General Systems Theory** (GST) appears to be conceptually extremely broad, diverse, fluid and obscure. There is no precise definition of GST. Unlike many other theories, GST cannot be expressed exhaustively in one or several sentences. GST cannot be called a 'theory' in the strictest sense of the term. A theory is composed of a statement or a set of statements stating a pattern of the real world that has been tested and found to be true. GST is not a statement or a set of statements, rather it is an assemblage of literature transcending the scope of many academic disciplines. To verify whether GST is a theory, we need to have a discussion on theory.
- **Theory**: - 'A theory is a set of logically connected statements, either deductively derived from abstract general axioms or assumptions; or inductively formulated from facts or data, including law-like assumptions or statements, at least part of which is capable of empirical test' (Halim, 2005: 150). According to Clarence Schrag, 'Any given theory is comprised largely of three different but closely related sets of statement. One set defines the concepts of the theory. A second expresses prescribed relationships among the defined concepts. The third provides an empirical interpretation of the theory by relating some of the concepts to observable phenomena' (ibid.). A theory consists of a coherent set of ideas expressing generalization about observations. In his book *A Brief History of Time*, Stephen Hawking said that a theory is a good theory if it satisfies two requirements: (1) it must accurately describe a large class of observations on the basis of a model that contains only a few arbitrary elements; and (2) it must make definite predictions about future observations (ibid.).
- In science, if a knowledge is empirically based with the following traits, it is called theory:
  - Consistent with pre-existing theory to the extent that the pre-existing theory was experimentally verified.
  - Supported by enough evidences, justifying that it is a better approximation of reality.
  - Survived many critical real world tests.
  - Made predictions those some day might be used to disprove the theory, and
  - It is the best from a variety of explanations derived from the same data (ibid.).
- In physics, theory generally means a mathematical framework derived from a set of basic principles, capable of producing experimental predictions for a category of physical objects. An example is electromagnetic theory (http://en.wikipedia.org/wiki/Theory) that is concerned with magnetic forces produced by electricity and electric effects produced by magnetic fields (Hartmann-Petersen and Pigford: 90).
- In mathematics, 'theory' refers to a body of knowledge consisting of axioms, definitions, theorems and computational techniques, for instance, group theory, set theory, field theory etc. Here, a theory presents certain axioms and rules, corresponding to an abstraction and then derive non-obvious theorems from those axioms. The resulting theorem provides solutions to real-world problems, which correspond to the original abstraction. Examples are arithmetic that abstracts number, geometry that abstracts space, probability that abstracts randomness (http://en.wikipedia.org/wiki/Theory).
- **Types**:- L. Mjoset (2001: 15641-15647) views theory in terms of several notions. Firstly, the deductive-nomological notion of theory that was the major trend in the post-war ideal of theory. Secondly, the law-oriented notion of theory emphasizes upon 'law-like

regularities' or 'quasi-laws'. Thirdly, the idealizing notion of theory that focuses on the conditions those establish the ideal situation where human interaction can be understood via mathematical modeling of parametric and strategic rational action. Fourthly, the constructivist notion of theory, where a separation is made between scientific knowledge and everyday knowledge. Fifthly and lastly, the critical theory, that points that social science laws can never be universal is not regretted, but given an 'offensive' meaning. Some examples of theory are the theory of evolution in biology; global warming theory in climatology; algorithmic information theory in computer science; continental drift theory in geology; axiomatic set theory in mathematics; grand unification theory in physics and critical social theory in sociology and philosophy.

- Theories are accepted if they are able to explain and predict real world objects and events. Simpler and more mathematically elegant theories are accepted over complex ones. Theories are accepted if they connect a wide range of empirical phenomena. "The greater the array of facts subsumed, the more general the theory and the better the understanding of the causal nature of whatever phenomena are being discussed" (Froman, 1972, Vol. 13: 206). In the opinion of R. Hilsman (1990: 32) a theory, conceptual model or mode of analysis describes if and then relationship. It says that if certain conditions exist and certain factors are at work, then there will be certain results. Following are some theories drawn from various disciplines of physical and social sciences to have an overview regarding theory.

- **The Theory of relativity**: - Albert Einstein's theory of relativity is a set of two theories of physics: special relativity and general relativity. The core idea of both dimensions of relativity theory is that two observers who move relative to each other will often measure different time and space intervals for the same event, but the content of physical law will be the same for both. The following are the premises of special relativity:

  - Observation of physical phenomena by more than one inertial observer must result in agreement between the observers as to the nature of reality. Or, the nature of the universe must not change for an observer if their inertial state changes.

  - The speed of light in vacuum, is the same to all inertial observers, is the same in all directions, and does not depend on the velocity of the object emitting the light. When combined with the first postulate, this second postulate is equivalent to stating that light does not require any medium such as aether (http://en.wikipedia.org/wiki/Special_relativity).

- General relativity gave an introduction of an equation that replaced Newton's law of gravity. It uses the mathematics of differential geometry and tensors in order to describe gravity. This theory considers all observers to the equivalent, not only those moving at a uniform speed. The laws of general relativity are the same for all observers, even if they are accelerated with respect to each other. In general relativity, gravity is no longer a force as it was in Newton's law of gravity but it is a consequence of the curvature of space-time. General relativity is a geometric theory, which postulates that the presence of mass and energy "curves" space-time, and this curvature affects the path of free particles and even the path of light (http://en.wikipedia.org/wiki/Theory_of_relativity).

- **The Quantity Theory of Money**: - In economics, there is a theory called the Quantity Theory of Money, which states that the value of money depends upon its quantity in circulation. This theory asserts that "any given percentage increase or decrease in the quantity of money will lead to the same percentage of increase or decrease in the general level of prices" if other things remain the same. Those other things are velocity of

circulation of money; the volume of credit; barter and volume of trade (Dewett and Varma, 1999: 399). This theory stipulates a nature or behavior of money, which generally remains the same in similar circumstances.

- **Theories in Social Sciences**: - In political science we deal with phenomena like state, government, public policy etc. regarding which there are theories. Regarding the origin of state, there have been a good number of theories. Of them, the theory of evolution attempts to explain the origin of the state as a result of historical growth. This theory stipulates that the state is neither the result of an artificial creation nor it originated at a particular period of time. In this regard Garner said, "The state is neither the handiwork of God, nor the result of superior physical force, nor the creation of resolution or convention, nor a mere expansion of the family. The state is not a mere artificial mechanical creation but an institution or natural growth of historical evolution" (Garner, cited in Agarwal, 2001: 143-144). Leacock also added to this view saying, "The state is a growth, an evolution, the result of a gradual process, running throughout all the known history of man and receding into remote and unknown past" (Leacock, cited in Agarwal, 2001: 144). According to Burgess, "State is a continuous development of human society out of a grossly imperfect beginning through crude but improving forms of manifestations towards a perfect and universal organization of mankind" (Burgess, cited in Agarwal, 2001: 144). Thus, theories – tested, non-tested; empirical, normative and many other kinds have developed in all academic disciplines.

- From the above discussion it can be concluded that GST is not a theory. It is not a set of logically connected statements deductively or inductively arrived at. It is not an abstraction of empirical reality that could produce experimental prediction, rather it is a wide array of literature regarding different aspects of systems of every nature.

- **Systems approach** is another term in the area. We have the causal analysis approach that searches the causes and predicts the possible consequences of any event/phenomenon. Making a difference with causal analysis approach, the systems approach tries to explain, on the one hand, the input-output relationship, i.e., what inputs had been given inside the system, how was it processed and finally what outputs were produced. On the other, how a system functions and maintains its stability, and how a change in any part of the system affects in other parts of the system and outside the system in the environment. Thus, systems approach is a new way of looking at things. **Systems perspective** is similar to systems approach. It is the broad bedrock upon which anything can be put and examined. Any phenomenon can be seen from systems perspective, i.e., seeing it as a system and comparing it with a standard system. As in Marxism, things are seen as the outcome of economic causes and class struggle, so in systems perspective, things are explained viewing them as systems. **Systems thinking** denotes seeing everything as system. To understand and analyze a social problem; a problem facing government; an upheaval in share market – the society, government and share market can be seen as systems to find out problems therewith.

- **Systems research** is quest for knowledge in systems area. For application of systems knowledge in practical affairs, we need to know the basic principles, behaviors and tendency of systems. Referring from Blauberg et al. (1977: 88), Charles Francois (2004: 609) lists the logic and methodology of systems research as follows:
  - Construction of conceptual models for the expression of corresponding objects of systems nature in the real world;

- Description of characteristics of the objects of systems nature, their connections, typology, interrelations of system and environment, hierarchical structure of systems, problems of control etc.
- Construction of formalized systems for the description of systems objects and formulation of rules of inference.

- **Systems movement** is a worldwide intellectual endeavor to resolve problems and issues facing mankind with the knowledge of systems. There are organizations in many countries gathering systems thinkers of various fields. The International Federation of Systems Research (IFSR) is the apex body coordinating functions of these national, regional and international organizations dealing with systems. The systems thinkers believe that all or most of the problems facing mankind today can be resolved if the people concerned think systematically. They initiated systems movement to reach this message to the people and make them engaged in systems thinking and practice. Referring from George Klir (1991: 19), Charles Francois (2004: 608-609) cites the definition of systems movement as 'A loose association on worldwide scale of people from different disciplines of science, engineering, philosophy, and other areas, who share a common interest in ideas (concepts, principles, methods, etc....) that are applicable to all systems and that, consequently, transcend the boundaries of traditional disciplines'.

- **Systems methodology** is the way or steps of systematic thinking. There are different methodologies of studying: quantitative, qualitative, heuristic, causal analysis etc. Systems methodology is a new addition to these. There are various systems methodologies, according to their respective aims and uses. Some of those follow hereinafter. According to Rodriguez (1999) 'hard systems methodology' also known as 'systems-based methodology' or 'systems engineering' is for tackling real world problems in which an objective or an end is to be achieved (Francois, 2004: 608). Peter Checkland and his followers said about 'soft systems methodology' applicable to ill-structured problems (ibid.). According to Herbert Simon, another systems methodology is 'architecture of complexity' that is applied to the study of internal structures of complex systems (ibid.). George Klir says about 'reconstruct ability analysis'and 'general systems problem solver' those create more adequate models of complex systems and the ways to manage them (ibid.). Bela Banathy and Fuschl group believe systems methodology as 'coparticipative design' aiming at a better integration of human groups (ibid.). Russel L. Ackoff and his Pennsylvania University team describe systems methodology as a 'management science' developed principally along metadisciplinary concepts and corresponding practical methods (ibid.). S. Beer describes systems methodology as 'viable system modeling' aimed at defining the basic parameters of complex systems (ibid.). 'Global design and interactive management', 'systems dynamics', 'expert systems', 'systems analysis' etc. are some other forms of systems methodology (ibid.).

- **Systemics** is the study of systems. Like economics or semantics, systemics is an emerging academic discipline dealing with nature, scope and principles of systems. It teaches how systems thinking can be put into practice to resolve the issues facing mankind. According to Charles Francois, systemics is a general integrated language of concepts and models. He elaborates systemics as 'An open set of concepts, models and practical tools useful for a better understanding and eventual management of complex situations or entities of any type' (2004: 598). H. Praehofer (1991: 290) mentions systemics as '.....an interdisciplinary discipline that tries to provide general concepts for model building and problem solving' (Francois, 2004: 598). M. C. Le Duc (1992: 917) proposes the following axioms for systemics:

- There is a *concrete* world around us that is accessible to our *mental world* only by the mental **structures** already in the mental world.
- New mental **structures** are **constructed** from existing ones to enhance the *fit* between the mental world and the concrete world (PIAGET)
- Mental **structures** are organized into **levels**, some of which have **emergent** properties' (Francois, 2004: 598).

- The science of systems or their formation is called **systemology** (Blanchard, 1998: 9). D. Mc Neil describes systemology as a reformulation of so-called system sciences (Francois, 2004: 600). Russel L. Ackoff has the credit of proposing the term systemology in 1973. He says: 'As the problem complexes with which we concern ourselves increase in complexity, the need for bringing the interdisciplines together increases. What we need may be called metadisciplines, and what they are needed for may be called systemology' (ibid.).

- **Systems science** is an emerging academic discipline. Being a science, its laws are universal in similar circumstances. George Klir (1993: 27) defines systems science as 'That field of scientific inquiry whose objects of study are systems' (Francois, 2004: 609). He emphasizes upon the need for systems scientists in the service of humanity. He says (1991:23), 'The role of developing and applying the systemhood expertise must be undertaken by a scientist of a different kind, a systems scientist, whose specialization is this very expertise' (Francois, 2004: 610). However, he opines (1991: 352), 'In spite of all its science-like characteristics, I argue.....that systems science is not a science in the ordinary sense, but rather a *new dimension in science*' (Francois, 2004: 610). Systems science is a meta or trans-discipline and should not be reduced to a discipline status (ibid.). The meaning of the term 'system' remains abstract. Therefore, the hard scientists pose serious resistance to the use of the term 'science' in the study of systems (ibid.: 609). However, the term 'systems science' has accommodated a large array of scientists from different specialities within an umbrella of system. By whatever the name we call it, it deals with systems from different fields and their complexity. Systems from different fields together form one discipline that can be most advantageously called 'systems science'. According to F. Heylighen (1990: 423), 'Systems science (including cybernetics) is not a traditional discipline concerned with the study of a particular domain, but a meta-discipline, concerned with the domain-independent modeling of general systems. (van Gigch). As such, it does not aim to find the one true representation for a given type of systems (e.g., physical, chemical or biological systems) but to formulate general principles about how different representations of different systems can be constructed so as to be effective in problem solving' (Francois, 2004: 610).

- **Operations Research, Action Research, Systematics, systemography, systems inquiry, systems philosophy, systems teaching** are some related concepts regarding systems.

- GST is also bedeviled with other problems of multitude of strands and dimensions. In any field, thinking systematically has so far been appreciated that generated multitude of dimensions in the area of systems. Such multitudeness has made GST a blunt-edged tool. A discussion on multitudeness of GST follows.

Strands of General Systems Theory

- The systems ideas emerged out of developments in many fields– those have become strands of GST. Yi Lin (1999: 10-14) mentions classical systems theory, catastrophe theory, compartment theory, cybernetics, fuzzy mathematics, game theory, genetic

algorithms, graph theory, information theory, Navier-Stokes equation and chaos, networks, set theory, simulation, statistics, theory of automata etc. as several research directions in the area of GST. Classical systems theory is a mathematical theory based on calculus. It studies principles of structures (ibid.: 10). Catastrophe theory was initiated by Newton and Leibniz three centuries ago that studies sudden and discontinuous changes in a course of events, shape of objects or behavior of systems; for instance, collapse of a bridge, downfall of an empire etc. (ibid.: 10-11). Compartment theory was developed by Rescigno and Segre. Its basic idea is that a problem or a structure can be described as a whole consisting of parts with boundaries between which there are processes of transportation (ibid.: 11). Cybernetics is a theory of systems and their environments, internal information transportation of systems and impacts on the environment of controlled systems. In many areas including hydraulics, electricity, ecology, markets it found applications (ibid.). Fuzzy mathematics is a theory dealing with relations between precision of classical mathematics and imprecision of the real world. It accepts fuzziness as an all-pervasive reality. It finds applications in psychology, sociology, political science, philosophy, physiology, economics, linguistics, operations research, management science, and other fields (ibid.). Game theory deals with the behaviors of players with the ability of reason and make decisions who wants to win more than lose (ibid.: 12). Genetic algorithms are search procedures based on the mechanics of natural selection and natural genetics. There are two goals of this research (a) to abstract and explain adaptive processes of natural systems; and (b) to design artificial systems software that retains important features of natural systems. Genetic algorithms are applied to many areas including economics, political science, psychology, linguistics, biology, computer science etc. (ibid.). Graph theory describes the construction of relations between systems. Besides the quantitative study of structures, many problems deal with organization and topological structures of systems. Graph theory is one such method. It has applications in biology and mathematics. It is similar to compartment theory (ibid.). Information theory is established on the concept of information that is an expression similar to one with negative entropy in thermodynamics. Information can be considered as a measure of the structure of organization. It has applications in engineering of communication (ibid.). Navier-Stokes equation and chaos is either an illusion of a concept of a higher dimension or a misunderstanding in computer-aided calculation. It is close to Chaos Theory. It has been applied in short-term weather forecasting (ibid.: 12-13). Network theory deals with structures of systems. It can be considered as part of set theory or graph theory or compartment theory. It has applications in neural networks (ibid.: 13). Set theory provides all the general definitions and properties of structures (ibid.). Simulation is required when there is non-linear equations. Specific experiments in laboratories can be replaced by computer simulations. In the study of markets and populations, this method is often used (ibid.). Statistics is a mathematical theory that teaches how to comprehend and predict the reality of whole based on a study of the part. Applications of statistics can be found in almost all applied fields (ibid.: 14). Theory of automata concerns an ideal automation with input and output. An example is the Turing machine (ibid.). Enrique G. Herrscher (ISSS, 2005) mentions the following strands of GST: the original GST, its latest version close to Complexity Theory, applied GST, systemic thinking, system dynamics, organizational cybernetics, living systems, viable systems, hard systems, soft systems, critical systems and emancipatory systems.

- The International Society for the Systems Sciences (ISSS) has as many as 26 Special Integration Groups (SIGs) each dealing with a particular type or aspect of systems. Each of them can be called a strand of GST. Some of those are Business and Industrial Systems Application, Systems Philosophy and Systems Ethics, Informatics and Communication

Systems, Futurism and Systems Change, Medical and Health Systems, Spirituality and Systems, Evolution and Complexity, Ecosystem Approach, Women and Children, Organizational Transformation and Social Change etc.

- Understandably, there is no such theory in any field of science and humanities that has so many strands. Therefore, the very generality of GST has made it vague and imprecise. It does not have any specific application to derive direct benefit. It has now become the area of demagoguery bearing less practical benefit for mankind.
- Thus developed a set of jargons of systems, those appear to be vague in terms of theory and unassembled in terms of application. Enrique G. Herrscher (ISSS, 2005) opines that during the initiation of systems approach in the 50's and 60's, the world needed it as a counterpart to the technological development (mostly informatics) that was taking place. He expresses concern about the future of ISSS and systems approach. He suggests shifting of the whole perspective to another angle or be viewed from another logic (ibid.). Thus, there are various concepts, ideas and opinions regarding systems. So, the critics of systems find those vague and imprecise. The apparent failure of systems approach to bring desired welfare to the mankind is due to its vagueness and the state of unassemblage. So, enough works need to be undertaken by the systems scholars to make systems thought precise and fruitful. A look on all the above aspects of GST shows that apart from its vagueness and unassemblage, some concepts look like academic discipline; for instance: systemics, systemology and systems science. This author holds the opinion that systems scholars should put their efforts to make it an academic discipline called systems studies - not systems science or systemics or systemology.

Systems Movement: Achievements and Failures

Achievements

- An examination is due with regard to what extent systems movement came to the service of mankind. Although the achievements of systems movement are not so significant, those are not complete failures. Had it been so, it could not have survived half a century of intellectual test. GST can explain many aspects of the real world those cannot be conveniently explained with other theories or frameworks of analysis. So, GST continues till today as an important approach to understand the dynamics of social phenomena. In fact, GST can explain a wide variety of things of many disciplines including physical, biological, technological and social sciences substantiating its efficacy as a tool for analysis. With further work towards modification and specification of GST – it has the potential to be used as a better tool for research and analysis. A good number of universities, institutions and schools are offering courses on systems. Although GST encompasses a wide variety of fields of physical and social sciences; the systems community in the world till today is small in size, unable to make an impact on a worldwide scale. It is evident that knowingly or unknowingly, we use systems thinking in all areas of activities ranging from household affairs to statesmanship. More systematization of systems: identifying general laws, principles governing systems and their applications can immensely help in promoting peace, progress and welfare to the mankind.

- Von Bertalanffy – the originator of GST organized systems movement by the Society for General Systems Research (established in 1954, under the name - Society for the Advancement of General Systems Theory) with the following objectives:
  - To search for isomorphy of concepts, laws and models of various fields, and useful transfers of those from one field to another.
  - To develop adequate theoretical models in fields which lack them.
  - To minimize the duplication of theoretical efforts in different fields.
  - To promote unity of science by improving communication among specialists (Kuper and Kuper, 1985: 330).
- While examining the achievements of systems movement, it can be assessed to what extent those objectives have been achieved. As to the first objective, various inter-disciplines have developed those have met the above objective to some extent. The systems movement could not contribute much towards the achievement of second objective. Systems movement till today does not have any mechanism to coordinate theoretical efforts in different fields in an effort to avoid duplication. Communication among specialists has not been improved to the extent that can promote unity of science. Therefore, Bertalanffy's dream largely remains unfulfilled.
- In fact, systems movement has been reduced today to seminars, conferences, journals, books, courses etc. undertaken by a small number of scholars and institutes from a wide variety of disciplines. It is sometimes being used as an approach to management. So, it requires a consensus among the scholars how to redirect the movement to one or several specific objectives. Establishment of a link through research, teaching and application is an imperative. Development of an academic discipline can be a focus of the movement.
- Systems thinking has sprouted in various fields. As everyone needs to know basic computing, everyday science, primary medicare, general courtesy etc. so, systems science has to be taken in such a level that everybody will need to know the basics of systems science or primary systems science. To reach this knowledge to everyone of the world, there could be a systems movement like human rights movement. But prior to that those basic knowledge is to be acquired. So, it needs intense intellectual discourse to gather knowledge regarding systems.

Institutions and Associations Studying and Practising Systems

- The Centre for Systems Studies of the University of Hull works on information systems, evaluation, logistics, supply chain management and systems thinking. The Centre is a loose connection of teaching staff who have the research interests in the above areas. There is an MSc Program on systems and that is changing to more consultancy oriented for management student (http://www.hull.ac.uk). Saybrook Graduate School and Research Center, San Francisco, California is a multi-disciplinary institution teaching and researching on psychology, organizational systems and human science. The Center emphasizes upon systems thinking in social sciences. Systemic orientation to the search for knowledge got special attention in the Center. Founded in 1971, the Center have so far produced 597 doctoral dissertations and 145 Master's thesis (http://www.saybrook.edu). The International Systems Institute (ISI) is a non-profit, public benefit, scientific, educational agency based in Livermore, California, USA. It is organized as a community of scholars, practitioners and institutions to promote systems thinking in different fields of human knowledge and activity through publications, conferences, conversations etc. A

noted systems thinker Bela H. Banathy launched ISI through its first scholarly gatherings at Fuschl, Austria in 1982 with the objective of harnessing the collective potential of groups. In the community of systems, the ISI is contributing much towards promotion of systems knowledge (http://www.isiconversations.org). In the Open University, South West Region, Bristol, United Kingdom, there is a Systems Group researching on systems. The Group has developed three courses as follows: (1) Managing in Organizations; (2) Working with Systems; and (3) Complexity, Management and Change: applying a systems approach. These courses are related to the analysis of systems failures and catastrophes, organizational decision-making and organizational change (Paton, 1995: 659-665). Systems movement has made a better strides in central and Latin American countries. In many of these countries, there are national associations of systems. In some universities, systems science is being taught as a multi-disciplinary studies. In Mexico, Coahuilia State Autonomous University, Faculty of Systems is taking important role in promoting systems studies in Latin America. Apart from those institutions, there are a good number of national, regional, international associations working on systems. The International Federation of Systems Research (IFSR) based in Vienna coordinates the works of all these associations. Among those the UK-based International Society for the Systems Sciences (ISSS) is a distinguished one which organizes conference every year. There are some other institutions and associations as well. But all those together could not make enough contribution to the welfare of mankind.

Critical Points

- A good number of scholars have put GST under question since its adoption as a tool for analysis of social science phenomena. They opine that systems thinking contributed little towards human welfare. Some other thinkings, for instance; human rights, environment, regional integration etc. have added enough knowledge to mankind's storehouse and improved their living. Though systems thinking has its roots in distant past, we did not inherit enough knowledge from the past systems thinkers, unlike we inherited knowledge in other disciplines for instance; philosophy, political science, medicine, physiology, astronomy etc. Systems thinking reappeared nearly fifty years ago, since then it has advanced but to significantly contribute to human welfare, it has still a long way to go.
- Secondly, GST is not a theory in the strictest sense of the term rather it is an assemblage of theoretical particles. It is developing to become a theory, but can serve as the basis for further investigation in many fields (Bertalanffy, 2003: vii-viii) of physical, biological, engineering and social sciences. Like other scientific theories, for instance; the theory of relativity, the theory of gravity, the theory of demand and supply, the theory of evolution etc. GST has not been able to explain phenomena under investigation to call it a theory. The theories of social sciences are replete with such limitations for obvious reasons of unmanageable variables and near impossibility to obtain close system for observation.
- Thirdly, the input-output concept of system is disputed. Because identification of inputs, exploring relations between inputs and outputs, measuring the effects of multiple inputs on an output and measuring systems loss are extremely difficult and nearly impracticable in social sciences. Those cannot be fairly put under empirical test. The input-output model appears to be too simplistic in the understanding of real world. While applying GST in public policy analysis, Sapru (1998: 36) finds that input-output model ignores fragmentary nature of 'black box' i.e., the political system producing public policy. Policy changes may be attributed more to the political and administrative elite's redefinition of their own interests or other vested interest groups than as a product of

demands and supports from the environment. The GST cannot define the politico-administrative system as a black box and as a closed system and cannot explain how public policy is developed within the system turning inputs into outputs.

- Fourthly, some critics view GST with certain methodological limitations. GST assumes that reality consists of systems but it is not empirically tested. In their opinion, in reality, there may not exist systems. There may exist many isolated events and factors in the real world. For instance, a society consists of individuals and isolated events than systems. The interdependence of society and polity and interactions between system and environment are questioned by the critics of GST (Mitchell, 1972: 477).
- Fifthly, the critics of systems approach maintain that the concept 'boundary' cannot be clearly delineated; so, system cannot be demarcated. If variables that constitute a system are not identified, a system cannot be differentiated from the environment and other neighboring systems. The system theorists argue that the empirical location of the boundaries depend upon the scale of observation chosen by the observer. With one scale of observation the location of boundaries will be somewhere and with another scale of observation the location of boundaries will be anywhere else. According to them, systems in the social world lie in a complex, intertwined manner – those are obscure – boundaries blurred. Mitchell (ibid.) holds that there can be different types of boundaries in terms of their permeability. For instance, Schoeffler has characterized economic systems as (1) mechanically closed; (2) stochastically closed; (3) semiclosed (mechanically and stochastically); (4) conditionally closed; or (5) essentially open. All the above types are based on a scale of probabilities regarding outside influences.
- Sixthly, the concept 'equilibrium' has also been disputed by the critics of GST. They claim that equilibrium cannot be operationally defined. They maintain that the variables, which constitute a system, are not linear and therefore cannot be expressed in the manner that a state of equilibrium could be identified.
- Seventhly, Charles Francios (2004: 608) cites from D. H. Mc Neil ".....there is less **relevance** and less credibility in the systems professions today.....University curricula in systems are now being dismantled or merged with other subjects. Professional societies concerned with the subject matter of systems are weak and philosophically adrift.....The 'systems movement' has failed and its offshoots in the 'environmental movement' will fail also unless some changes are made. **After nearly half a century of fitful efforts, there is no comprehensive theory of systems, no standard textbook of fundamentals and no definitive workbook of techniques and applications. (bold mine)**..... It has utterly failed to define itself and its subject matter and has not established itself as a discipline."

Systems Movement: Potentials of an Academic Discipline

- The GST can serve the mankind better making an academic discipline out of it. A general theory of systems is to be developed, then theory of other sub-disciplines, namely: hard systems, soft systems, concrete system, abstract system, etc. As the basic discipline medicine and surgery divides into many branches so systems studies can be divided. In the following paragraphs, it is discussed how an academic disciplines develops.

Formation and Development of Academic Disciplines

- In this section, it will be discussed how academic discipline forms and develops as independent area of study. Since the start of human activities on earth, there were efforts to gather and disseminate knowledge. In different civilizations, it assumed different dimensions. In some civilizations, gathering and disseminating knowledge had been institutionalized. In the present civilization, with a global society, institutionalization of knowledge started with the formation of universities in Europe at the beginning of the second millennium AD. Since then, the domain of knowledge has been divided; new academic disciplines developed, got split, thus today, there are hundreds of academic disciplines taught in the educational institutions worldwide. Among them, the process of the formation of economics and political science, being social science discipline and neighbor to systems have been discussed below to understand how we can develop systems studies as an academic discipline.

Economics

- Economics is an academic discipline that studies the demand and supply of goods and services. It explains phenomena like money, prices, production, distribution, consumption etc.. Insights of economic phenomena can be found in the works of Plato and Aristotle of ancient Greece and in the medieval commentaries. However, a full-fledged academic discourse emerged from political economy in the later half of nineteenth century (Schabas, 2001: 4152). Nicholas Copernicus, Jean Bodin, Thomas Mun, William Petty and John Locke are some of the prominent figures of sixteenth and seventeenth century, who wrote on money and trade. Richard Cantillon, David Hume, Francois Quesnay, Ferdinando Galiani, James Steuart and Adam Smith are the distinguished writers during eighteenth century (ibid.). Quesnay founded the first school of economics known as Physiocracy. He devised one of the first models in economic analysis that depicted the economy as a circular flow of money and goods among three sectors: the farmers, artisans and landowners (ibid.: 4153). Adam Smith in his book *Wealth of Nations* published in 1776 discussed the field of economics in details, including the theories of value, distribution, trade, development, public finance, economic history and history of economics (ibid.). The Classical political economists namely; Smith articulated cost of production and competing claims of three economic classes: laborers, landowners and capitalists and Ricardo devised the theory of rent. The Classical preoccupation with scarcity and the stationary state were challenged in the 1870s by the Neo-Classical economists with focus of economic agency shifted from that of classes to individuals (ibid.). In this period, the study of economics was expanded and upgraded in university curriculum. The *British Economic Society* and the *Economic Journal* were launched in 1891. Every French university established chair in economics in 1878, and in 1887 the *Revue d' economic politique* was established. *American Economic Association* was founded in 1885 and the *Quarterly Journal of Economics*, the *American Economic Review* and the *Journal of Political Economy* were launched in 1887, 1891 and 1892 respectively (ibid.: 4154).
- The theory of prices by Jevon paved the way for mathematization of economics. The use of mathematics, particularly calculus transformed the literary political economy into a mathematical discipline (ibid.). Being realized that the economic phenomena themselves are quantitative and inspired by new developments in logic, psychology, physics, mechanics, and thermodynamics, the early marginalists developed mathematical theory of

economics. Geometry, algebra, probability theory, calculus, topology, set theory, linear programming were adopted in economic analysis (ibid.: 4155). In the period from 1870 to 1930, many economists tended to estimate key economic variables or arrive at patterns based on data analysis. Statistical investigations of economic variables were commonplace by the mid-nineteenth century. However, systematic application of statistical methods and probability theory that is known as econometrics got underway by the Neo-Classical period (ibid.). The Great Crash of 1929 gave a significant boost to econometric research. With the formation of Econometric Society in 1930 and launching of it's journal *Econometrica* in 1933, the field achieved a full academic standing. Marshall added to the analysis of demand curve, with definitions of elasticity and consumer surplus. Walrus developed the theory of general equilibrium. John Stuart Mill, in his book *System of Logic* published in 1843 argued political economy as a science (ibid.: 4154). Neo-Classical theory became dominant trend in economics by 1930s (ibid.: 4156). The Institutionalists treated economic phenomena as part of the government and legal system. They were a viable force in economics through the 1940s. More recently, they have staged comeback with the brand Neo-Institutionalism - the salient features of which are transaction costs and institutions (ibid.).

- Thus, the academic discipline economics developed. Primarily, there were stray writings explaining economic phenomena followed by the construction of models and frameworks for the explanation of economic phenomena. There developed some concepts of exclusively economic nature. The focus of analysis shifted to new dimensions. Establishment of professional associations and journals followed. It got the shape of an academic discipline. The discipline went for mathematization. In this entire course, there were different schools of thoughts representing different strands of the discipline. Today, economic phenomena and institutions have pervaded all aspects of people's lives. The academic discipline economics dealing with all those phenomena and institutions has become indispensable for mankind.

Political Science

- Political science studies in broader sense government and politics (Polsby, 2001: 11698). Politics affects the lives of people in many different ways, so political science has been developed as an academic discipline to study politics. In early days, the fundamental themes of political science were 'state' and 'government' but today those have been replaced with 'power' synonymized with 'influence' (Johari, 1995: 78). Its scope include – organizational structure, the process of decision-making and actions, the politics of control etc. (ibid.: 79). Harold Lasswell's path-breaking book *Politics: Who Gets What When How* is an important indication to the scope of political science. David Easton's formulation of politics as 'the authoritative allocation of values' in society, entailing the study of authority and its bases, allocation and its modes, and the shaping and sharing of values is another important indication to the scope of political science (Polsby, 2001: 11698-99). The study of social organizations, groups and classes is another aspect of the scope of political science. It studies institutions as large as nation-states and their constituent elements: executives, legislatures, courts, parties, elections, interest groups etc (ibid.). The development of political science took place mainly in the universities of the United States and the United Kingdom. Systematic political study is as old as the time of Greek philosophers of the fourth century BC, notably Plato and Aristotle. The oldest University chair in the subject is at the University of Uppsala which in 1622 established the Johan Skytte chair of Eloquence and Government, from which in the late nineteenth

or early twentieth century, being separated from history, political science emerged as an independent academic discipline offered in the universities of Europe and North America (Polsby, 2001: 11698-99). From the times of Plato and Aristotle through Rousseau, Kant, Hegel and Green, a tradition of rationalism developed in the analysis of political phenomena (Johari, 1995: 79). In 1908, Graham Wallas published his epoch-making book titled *Human Nature in Politics* in which he attacked rationalism laying emphasis upon the socio-psychological foundations of political behavior. He stressed upon the role of irrational forces (habits, sentiments, instincts, emotions and the like) in the sphere of human behavior (ibid.). Lord James Bryce endorsed this view, in addition he emphasized upon facts in the study of politics. The establishment of the *American Political Science Association* in 1903 gave the trend a broad-based organizational shape with the *American Political Science Review* as its torch-bearer starting in 1906. Increasingly more political scientists became critical of the speculative theorists and utopia-makers like natural law and natural rights. Rejecting divine and racial theories of institutions, they searched for more precise causations in politics (ibid.: 80). G. E. G. Catlin urged for integration of politics with other social sciences, thus pioneered the rise of inter-disciplinary studies (ibid.: 79). Charles Merriam of the Chicago University in his book *Primary Elections* published in 1908 emphasized upon empirical political theory – afterwards known as 'behavioral tradition' in political science. He urged for attention on the methods and findings of other disciplines, thus gave political science an inter-disciplinary and scientific character (ibid.: 80-81). The political scientists insisted on the greater use of statistical techniques for ensuring more objectivity.

- The incorporation of the term 'science' has provoked controversy from time to time on the ground of predictive inaccuracy of political science compared to physics or chemistry. But it is seen that the claims for prediction or control of human behavior are being advanced today. Therefore, the discipline's pre-scientific name of 18th century is today no more relevant (Polsby, 2001: 11700). However, scientific or mathematical approach to the study of political science has not advanced much. Meanwhile, various sub-disciplines of inquiry have been developed under political science. In the 1950s 'behavioral revolution' intruded in the area of politics – that also could not wholly supplant traditional modes of inquiry (ibid.). Political science traveled long along with other social sciences for about a hundred years only to see today that many political phenomena do not render themselves susceptible to be explained with present political theory. The political matters like terrorism, imperialism disheveling the world today are the glaring examples.
- From the above discussion, we come to know how an academic discipline develops. It requires literature, basic texts, university curricula, professional organizations, journals and a connection from research through teaching and application. It has certain concepts, specific scope. It's emphasis shifted from time to time. Gradually, statistical techniques intruded into the area of political research.

Systems Studies – an Emerging Academic Discipline

- It is acutely felt that all dimensions of systems need to be restructured and concised into an academic discipline named 'systems studies'. The term 'systems science' could have been preferred for comparatively wide and precise connotation. But system is even above science – not a parallel to science. Science is the study of any phenomenon

systematically. Systems studies is on the other hand, the study of systems that may be scientifically. The knowledge derived from systems studies itself is science. There should be a research group, teaching professionals and teaching curricula in all academic levels from primary to post-graduate regarding systems. There should be a cyclic relation among research, teaching and application. It would be a discipline to study systems of different fields. There should be a demand for systems specialists in organizations (systems) of all types. This appears to be difficult but is possible. Before a couple of years there was no demand for interior designers and decorators, fashion designers etc., but in these days there is a big demand for those professionals because providing proper services they have been able to create demand for them. The same holds true for systems studies. The presence of systems specialists should ensure positive change in organizations (systems) and people have to recognize and appreciate such changes. Only then, organizations will search for systems specialists facing system trouble. First of all, a curriculum has to be developed. It may include courses like Theories of Systems, Methodology of Systems Research, specific systems studies like the economic system of Bangladesh, the decision-making system of the While House etc. It is possible to design a well-charted curriculum within 05-10 years. A group of systems specialists can be assigned with this responsibility. Scholars representing all institutions worldwide, those are now engaged in systems research and teaching can be given the responsibility of making a unified curriculum to be taught throughout the world. Keeping aside all other connotations, (movement, perspective, approach etc.) by making it an academic discipline and creating relations from research, teaching and application, we can derive immense benefit from systems studies in the service of mankind. The next ISSS annual conference theme is proposed to be **'systems studies – an emerging academic discipline'**. Or at least a Plenary Session can be devoted to this proposition. Based on the deliberations of scholars, the next steps should be taken to develop an academic discipline and create cyclic relations from research, teaching and application.

- An academic discipline promotes inquiry and conserves knowledge by educating undergraduates, training graduates, producing texts, announcing discoveries, criticizing works and maintaining a community of mutually attentive scholars with common intellectual interests (Polsby, 2001: 11700). In the area of systems, we have a community of mutually attentive scholars, a good number of professional associations where these scholars gather together. There are journals for publications and criticisms. Discoveries are announced in the conferences and in the publications, undergraduates are educated by different institutions. In spite of having all these elements of being an academic discipline, there is no significant contribution of systems movement towards human welfare. This is because there is no standard textbook to be taught, precise programs to be trained, no discovery that can instantly and conspicuously promote human welfare. There lies the need for reshaping the entire systems movement in the form of an academic discipline.

- On the opinion of D. H. Mc Neil regarding the failure of systems movement to define itself and its subject matter and not being able to establish itself as a discipline, Charles Francois (2004: 608) opines "it will probably forever be difficult - and inappropriate - to transform **systems thinking** or **systems approach** into a discipline". He further says, "It would seemingly be advisable to replace expressions like 'Systems Research', 'General Systems Theory', 'General Theory of Systems', or 'Systems Science(s)' by the word 'Systemics'. In this way many ambiguities, sterile controversies and in some cases, inflated claims could probably be laid to rest" (ibid.: 598). After long fifty years of systems movement, now time is ripe to put those thoughts into practice. Various

expressions need to be concised. Charles Francois' suggestion of 'Systemics' is a good direction. But his opinion regarding difficulty and inappropriateness to try to make it an academic discipline appears pessimistic. If it is inappropriate, then what should the systems movement do? Should we abandon the entire movement or try to look at it in different ways to fit it to human welfare? Certainly, we should do the later.

- Charles Francios (2004: 608) cites from D. H. Mc Neil ".....there is less **relevance** and less credibility in the systems professions today.....University curricula in systems are now being dismantled or merged with other subjects. Professional societies concerned with the subject matter of systems are weak and philosophically adrift.....The 'systems movement' has failed and its offshoots in the 'environmental movement' will fail also unless some changes are made. After nearly half a century of fitful efforts, there is no comprehensive theory of systems, no standard textbook of fundamentals and no definitive workbook of techniques and applications. ..... It has utterly failed to define itself and its subject matter and has not established itself as a discipline." Other than abandoning systems movement, it is wise to develop comprehensive theory of systems, standard textbook of fundamentals and workbook of techniques and applications. In the systems area, there are good number of scholars. United efforts can make the proposition a success.
- Systems Studies has to be taken to such position so that facing a problem in the real world (systems), the systems specialists are called, they study the problem and give solution like interior designers and decorators, like an engineer, like a physician. To be equipped with systems specialists, such knowledge is there in the vast volume of systems literature. Those knowledge has to be dug out and put in a systematic order in the shape of an academic discipline.

Conclusion

- Most of the problems facing mankind today are emanated from systems malfunctioning or failure. Those problems can be properly addressed viewing the things around us with a systemic outlook: identifying right problems with systems, eradicating them and building new systems where necessary. From an atomic particle to the great universe there are tens of millions of systems of different types. Among them, great influences are caused on our lives by the social, economic and political systems – putting them on right order immense benefit can be derived for mankind. Systems Studies can teach us methodologies for studying systems, ways of identifying problems with systems, mastering techniques for eradicating those problems and ways to build new systems where necessary. There lies enough literature scatteredly in the area of systems. We need to put those in right order in the shape of an academic discipline. Systems Studies is supposed to address questions like: What is a system? How systems in the real world can be identified? What are the elements of a system? What are the interactions among those elements? What are the principles of systems functioning? How problems in a system can be traced and most advantageously eliminated? Putting the wide array of systems ideas in right order, answers to those questions can be obtained. The proposed academic discipline Systems Studies can greatly contribute to the welfare of mankind. Therefore, not giving up systems movement, but by reshaping it in the form of an academic discipline, great services can be rendered to mankind.

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