

# **Systems meeting networks: Applying general systems theory in the industrial network perspective**

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## **Abstract**

This paper aims to examine the industrial network perspective in the context of general systems theory (GST). The elements of GST (focus on subsystem of components, hierarchy, holism, system boundaries, input-output-processes, feedback, internal elaboration, steady state, goal-seeking, equifinality) are compared with network characteristics in order to analyse, how applicable GST properties are in the industrial network context. The study indicates that while many of the GST properties are applicable, it is relevant to develop concepts that distinguish a network from a system, because networks do not share the system property of boundaries and goal directedness. The paper suggests that GST properties could be used in the network perspective for enriching the IMP thinking conceptually.

**Keywords:** General systems theory, Industrial network approach, Open systems view

## Introduction

This paper is concerned with systems. But what is a system? Aristotle's (384-322 BCE) statement "The whole is more than the sum of its parts" is an early remark related to systems and this notion is still valid when discussing systems (Bertalanffy, 1972). According to Bertalanffy a system can be defined "as a complex of interacting elements and interaction means that these elements stand in a certain relation that again is different from their behaviour in another relation" (1950a:143). Another definition of a system states that a system is "a set of interacting units or elements that form an integrated whole intended to perform some function" (Skyttner, 1996: 16).

Systems can be open or closed (Bertalanffy, 1950a) depending on the extent to which systems are in interaction with their environment and receive input and deliver output through their boundaries. Open systems are typical for living systems and they can be both natural, like a human body, or socially constructed (Scott, 1961; Richardson and Lissack, 2001), like organizations and associations. No matter what kind of open systems we are referring to, there are certain similarities between systems.

General Systems Theory (GST) was introduced in the early 1950s in an attempt to define unifying principles ('Gestalten' properties) that can be applied whenever studying living systems (Bertalanffy, 1950a). The principles of GST were originally aimed at studying biological systems, but this open systems view has encouraged the application of GST in e.g. atomic physics, medicine, psychology, economics and social sciences, as well (Bertalanffy, 1950b; 1972).

The principles of GST (focus on subsystem of components, holism, hierarchy, system boundaries, input-output-processes, feedback, internal elaboration, steady state, homeostasis, goal-seeking, equifinality) have also inspired management theorists to study GST elements in the organizational context, even though they have appeared to be a '*partial system approach*', i.e. not all the principles of GST have been studied in the organizational context (Kast and Rosenzweig, 1972; Ashmos and Huber, 1987). The open systems view in general has inspired several authors (e.g. March and Simon, 1958; Scott, 1961; Emery and Trist, 1965; Katz and Kahn, 1966; Thompson, 1967; Kast and Rosenzweig, 1972), and some partial elements are recognized when studying GST in the organizational context: namely input-output processes and feedback (Brown, 1966; Berrien, 1976), system boundaries (Brown, 1966; Adams, 1976; Alderfer, 1976) and the environmental impact on the systems (Dill, 1958; Emery and Trist, 1965; Lawrence and Lorsch, 1967; Terreberry, 1968; Duncan, 1972).

There are a few references to networks as systems in the industrial network approach, e.g. in Hertz (1992: 106), Håkansson and Snehota, (1995:271) and Halinen et al, (1999:792), but all in all the principles of GST seem to be an unexplored area in the IMP contributions. The use of the GST tools peaked in the management studies in 1972, after which the systems paradigm went out of fashion among organization researchers (Ashmos and Huber, 1987). The studies related to the industrial network approach emerged in the mid 1970s, time-wise shortly after the interest towards GST had faded, which may explain the scarce number of references to GST properties in the IMP studies. Ashmos and Huber (Ibid.) argue that organization studies have missed the opportunity to use the properties of GST by determining to which extent the properties are important, or to which degree the properties are variables that could enrich organization theory and vice versa. In accordance with this notion, the aim of this paper is to study industrial network perspective in the context of GST to elucidate to which extent GST properties are applicable, and hence, it is an attempt to develop IMP thinking further, i.e. enrich the theory conceptually.

The structure of the paper is as follows. The next section presents the principles of GST by focusing on the open systems view and by presenting the basic elements of GST. After that GST elements are compared with an industrial network approach. Subsequently conclusions and research implications will follow.

## General Systems Theory

GST was initiated in the 1950s as a unifying attempt to apply general theory within different disciplines. Bertalanffy describes GST as a *logico-mathematical discipline, which is in itself purely formal, but it is applicable to all sciences concerned with systems* (1950a: 139). Therefore, GST can be applied in the different fields of disciplines, as in atomic physics, structural chemistry, biology, medicine, psychology and social sciences e.g. history, philosophy. It is characteristic for these fields that they all are considered systems of interrelated subunits that would work collectively which leads us to a notion that all these systems are characterized by wholeness, or in other words, they are built from interrelated subunits rather than individual ones. The fact that GST aims towards understanding systems within different fields, GST is qualitative and descriptive in nature. Moreover, because of the high abstraction level of GST (Boulding, 1956; Kast and Rosenzweig, 1972; Skyttner, 1996), it can point to similarities between different systems.

Systems can be considered as either closed or open, where open systems exchange information, energy or material with their environment. Biological and social systems are living systems and therefore open, whereas mechanical systems may be open or closed. In other words, a system is closed if no input enters or output leaves it, while it is open if there is import and export, and therefore changes of the components (Bertalanffy, 1950a+b). In Boulding's (1956) study of hierarchy of systems complexity closed and open systems are placed in nine different levels. This classification indicates that the three lowest levels (frameworks, clockworks and cybernetics) are considered as closed, while the remaining six levels (open systems, genetic-societal, animal, human, social organization, transcendental) address the different levels of complexity in open systems. With aid of this classification it is possible to obtain valuable knowledge by applying lower level systems knowledge to higher levels, as each system level incorporates all levels below it (Skyttner, 2005). Furthermore, Boulding's classification implies as well that you cannot grasp higher level system with lower level system concepts. Boulding's hierarchy of systems is explained in table 1.

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Table 1 about here  
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The fundamental idea behind GST is that systems are composed of interacting components and interaction means that these elements stand in a certain relation to each other; there is a functional division and co-ordination among components in a specific context, that again is different from their behaviour in other relations and contexts (Bertalanffy, 1950a; Skyttner, 1996). This implies that a system gets its specific character not by its component elements, but by the way the components are connected or assembled. Miller's (1978) theory of General Living Systems is concerned with all living systems and divides them into eight hierarchical levels. Each level has its typical individual structure and processes which are explained below in table 1.

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Table 2 about here  
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Systems have three main characteristics that have to be fulfilled in order to qualify for the name system (Skyttner, 2005): Organization, continuity and goal directedness. Organization refers to the functional division and co-ordination of labour among the parts, while continuity of identity entails the fact that if something is not able to preserve its structure in the middle of the change, it cannot be recognized as a system. Goal directedness refers to the function a system is carrying out. In this

context it is relevant to point out that living systems in general are *teleonomic*<sup>1</sup>, i.e. they are unconsciously fulfilling a goal (Skyttner, 2005).

### **Properties of GST**

Many authors (e.g. Bertalanffy, 1950a; Katz and Kahn, 1966; Litterer, 1969; Kast and Rosenzweig, 1972; Skyttner, 1996, 2005) have listed the properties of GST:

1. *Subsystems or Components.* All systems are by definition composed of interrelated parts or elements. Every system has at least two elements and they are interconnected. The lowest level elements build subsystems that in turn structure the system which itself is a part of a superior supra-system.
2. *Holism.* The system itself can be explained only as a totality, and therefore the whole is not just a sum of the parts.
3. *Hierarchy.* A system consists of subsystems of a lower order, and the system itself is a part of a supra-system. Thus there is a hierarchy of the components of the system and in this sense the hierarchy exists between different levels. Sometimes, the term *heterarchy* is used to indicate a structure within each level<sup>2</sup>.
4. *System Boundaries.* Systems have boundaries that separate them from their environments. The immediate environment is the next higher system minus the system itself. Closed system has rigid, impenetrable boundaries, whereas the open system has permeable boundaries between itself and a surrounding environment.
5. *Input-transformation-Output Process.* The open system can be viewed as a transformation process, where it receives various inputs in a dynamic relationship with its environment. Thereafter the systems transform these inputs in some way and exports outputs.
6. *Feedback.* The concept of feedback helps in understanding how a system maintains a steady state or homeostasis. In much of GST concern is primarily with the way in which the organism responds to environmentally generated inputs (how a system reacts to external stimuli). Feedback concepts and the maintenance of a steady state or homeostasis are based on internal adaptations to environmental forces (a key perspective in Cybernetic models).
7. *Internal Elaboration.* Open systems appear to move in the direction of greater differentiation, elaboration, and a higher level of organizational complexity to improve or align adaptations to environmental evolutionary or dynamic forces.
8. *Steady State, Dynamic Equilibrium and Homeostasis.* Open system is striving for a state where the system remains in dynamic equilibrium through the continuous inflow of materials, energy and information.
9. *Multiple Goal-Seeking.* Systemic interaction is driven by and leads to some goal, final state or equilibrium point. Multiple goal-seeking systems are capable of choosing from an internal repertoire of actions in response to changed external conditions.
10. *Equifinality.* There are equally valid alternative ways of attaining the same goals (divergence), or, from a given initial state, obtain different goals (convergence).

## **Systems meeting networks**

The IMP Group initiated research activities about 30 years ago, and it is focused on studying, how customers and suppliers interact in B-2-B –markets. IMP research assumes that companies are interdependent rather than independent actors in the economic world, and are therefore parts of a larger network consisting of different actors. Adopting a network approach means that relationships are viewed as parts of a broader network structure, rather than as isolated entities (Håkansson and

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<sup>1</sup> A **telos** (from the Greek word for "end", "purpose", or "goal") is an end or [purpose](#), in a fairly constrained sense used by philosophers such as [Aristotle](#). It is the root of the term "[teleology](#)," roughly the study of purposiveness, or the study of objects with a view to their aims, purposes, or intentions.

<sup>2</sup> Another kind of hierarchic view is expressed in the HOLON concept; a whole that is also a part. Coined by Arthur Koestler (1972: 12) from the Greek 'holos' meaning whole, and 'on' meaning entity, as in proton or neutron; hence a holon is a whole to those parts beneath it in a hierarchy but a part to those wholes above it.

Snehota, 1989). A relationship view is a more nuanced and rich picture of the constraints and opportunities the company is facing in dealing with its suppliers, customers and other relevant counterparts (Håkansson and Snehota, 1995: 3).

The above section has provided an outline of GST. In the next section GST elements will be analysed in the context of the industrial network approach.

### ***Subsystems or components and holism***

As mentioned earlier, a system consists of subcomponents, constituent parts that are interconnected. In network terms this is understood in the way that a network is a supra-structure consisting of subcomponents (activity pattern, web of actors and resource constellation) interrelated and interconnected through relationships. The subcomponents can be further divided into smaller elements, i.e. activity and organizational structures, and resource collection, as addressed in Håkansson and Snehota's (1995: 45) scheme of analysis.

A way of seeing networks as systems is found in Hertz (1992), where clusters of particularly interdependent firms, based on an interdependent structure of industrial activities and resources, form fields of dominance or industrial systems, and the supra-system, namely the network, consists of these industrial systems. Hertz (Ibid.: 106) identifies the industrial systems by distance, density, and exclusiveness *within* the system rather than *between* systems. But what is meant by an industrial *system* in this context? Though, this view does not deal with the key system properties of boundaries and goals, and in that sense it may be more appropriate to talk about units or nets in order not to misplace the term system.

Even though networks are understood as wholes, they emphasize the interconnected and interrelated (or integrated) nature of the subcomponents, i.e. the relationships among subcomponents gains relevance. The substance of the relationships (bonds, links and ties) emphasize the importance of studying relationships (Easton, 1992) in order to understand the overall network.

### ***Hierarchy***

The hierarchy is addressed in two ways in the network perspective, like in GST. First, there is a hierarchy related to the level of analysis (Easton, 1992; Mattsson and Johansson, 1992; Håkansson and Snehota, 1995), meaning that there is the overall network level that e.g. in a specific case study is delimited to a net, thereafter the relationships level (dyad) and lastly the organisational level. Secondly, a hierarchy exists between actors in the networks, and that is recognized as positioning in the network literature. Mattson (1984) defines positions as a role *that the organisation has for other organisations it is related to, directly or indirectly*. A position is not a role that is automatically given, nor is it static. In this context a time factor (Easton, 1992; Ford and Håkansson, 2006) plays a role, as a firm's current position is determined by the history but, on the other hand, the future provides opportunities for repositioning. Moreover, there are preferred and desired positions (Easton, 1992: 21), even though changes in positions are difficult to achieve, sometimes even impossible. As a matter of fact, there can be made a further classification between hierarchy and heterarchy, where hierarchy exists *between* levels referring to the network, dyad, and company levels, while heterarchy refers to a structure (position) *within* a network, dyad or company level.

### ***System boundaries***

The GST property of system boundaries supports the idea that a system is surrounded by a boundary that distinguishes it from its environment and in that way determines what is included within the boundary and what is excluded. When bringing a network approach into this thought, the fundamental question is either dealing with which activities are executed within the boundaries (Dubois, 1998; Gadde and Håkansson, 2001) or what is excluded, or how companies' knowledge defines the boundaries (Dubois, 1998; Gadde and Håkansson, 2001; Araujo et al, 2003).

In principle there is only one network (Mattsson, 1988), and it is in a continuous movement, as actors change positions. This means that some actors may vanish (e.g. bankruptcy, but they are kept in history, in the past, and may influence future ARA of living nodes) or merge, and new actors are also likely appear. Nevertheless, the data related to an entire network is infinite, and therefore it is appropriate to bound a network into a smaller group of companies (a net) based on an empirical data

available based on a case study, or even reducing the sample to cover a triad or a dyad (Easton and Axelsson, 1992). These ideas are also supported by Halinen et al who state that: "...in network studies the term 'system' should be seen to refer to a net or network that has been delimited according to the specific needs of analysis" (1999:792).

The network approach highlights the borderless nature of network boundaries, or it assumes that the boundaries are arbitrary or fuzzy (Johansson and Mattson, 1992; Håkansson and Snehota, 1995; Cova et al, 1998; Halinen et al, 1999; Huemer, 2003) depending on who defines the network, i.e. a focal company considers a network differently than its competitor, or an outsider. This leads us to a notion that networks have socially constructed or phenomenological boundaries that can be subject, object and time-specific (and relying on the content of relationships – that's a tricky part because what's in a tie is often unspecified). Subject-specific boundaries depend on, who defines the boundary i.e. in the eye of the beholder, while object-specific boundaries are focusing to a certain topic under scrutiny. In network terms a topic-based can be activities, actors or resources. Lastly, a time-specific boundary refers to the snapshot or a specified period of a net or a network defined at certain point and the development of the boundary over time. In that sense setting boundaries in network studies is a research strategy. In GST it is given by the research objectives. Boundaries are a property of the observer's volition in delimiting the convenient or appropriate number of nodes into nets or partial networks in order to study an object at certain period of time. In GST objectives are given in the system definition. In NW objectives are determined by the researcher (observer).

### ***Input-transformation-output model***

GST property of input-transformation-output process considers open systems as a transformation model that receives inputs and exports outputs through its boundary in interaction with an (often unspecified) environment. The boundary determines both the kind and rate of flow of inputs and outputs to and from the system (Berrien, 1976: 43).

In a network approach actors (which are actually subsystems) receive inputs from and export outputs to other specified actors, and the network model identifies both transformation and transfer activities (Håkansson and Snehota, 1995). The transformation activities, such as production and administration are considered as internal, while e.g. purchasing and sales (transfer) are considered external. The internal and external activities are understood in terms of inside and outside relationships, and therefore both types are to be considered as 'core activities' in a company (Håkansson and Snehota, *ibid.*).

### ***Feedback***

Feedback, on the other hand, means that some information is returned to the input side and reprocessed through the system. In other words, feedback acts a key mechanism that allows the system to live and preserve their identity, i.e. adapt to the changing environment.

In a network perspective the feedback mechanism refers to the way an actor copes with a relationships on dyadic levels, and how the actors in the relationship take the wider network of connected relationships into consideration. Here, like in the input-transformation-output model, interaction occurs with an identifiable actor (e.g. a specific supplier, customer, competitor) and any adaptations are done through exchange of information (= interaction) in the business relationship of different kind (e.g. transactional vs. deep ones).

### ***Internal elaboration***

GST's property of internal elaboration in the network context can be seen as parallel to routinization and specialization. Routinization refers to process characteristics of business relationships (Håkansson and Snehota, 1995) which implies that, despite the complex and informal nature of the business relationships, they tend to institutionalize over time. This means that certain routines, explicit or implied rules of behaviour may emerge and characterize a firm's relationships with its customers and suppliers. Specialization refers to the use of resources, and as Håkansson and Snehota point out: "*The tendency to specialization becomes manifest within the company in the emphasis on cost efficiency of activities and in relationship to others and in a preferential orientation of a company towards certain types of counterparts*". This means it is not only a question of cost efficiency internal to the (sub)system, but also effectiveness in relationships with specific counterparts

### ***Steady state***

Open systems in GST terms are never in true equilibrium, but in a steady state (Bertalanffy, 1950b). The same applies to networks, as they are in a process of continuous movement and adjustments, like systems in general (Gersick, 1991). The industrial network approach supports the idea that both stability and change co-exist in a network through relationships (Håkansson and Snehota, 1995). The big difference is that in NW there is no hierarchical coordination. Coordination and adaptation take place sequentially and in bilateral mutuality. Stability occurs because resource interdependencies cause rigidity in the networks. Moreover, Turnbull et al (1996) suggest that increasing market concentration; high switching costs and risk-reducing strategies result in stability in the networks, as well. These characteristics cause a deep network structure which tends to remain, and leads to inertia (Halinen et al, 1999).

### ***Multiple goal-seeking and equifinality***

Håkansson and Snehota (1995: 40) identify certain organizational attributes related to the structure of the networks among which the characteristics that a network as such does not have any particular goal is contradictory compared with the GST property of multiple goal-seeking. Nevertheless, this has to be understood in the way that the individual actors in the network do have a goal (or several goals, depending on the stakeholders), and a firm 'uses' and is used by other actors in order to achieve a goal.

According to the systems view an open system, like a human body, is teleonomic (pre-programmed in the organism and largely unconscious) and has a set of goals following a life cycle. As the system is in a continuous interaction with and dependent on its environmental conditions it achieves the final state or objective in different ways (Skyttner, 2005: 71). In network terms, subsystems (relationships) achieve individual results by different resource constellation (Håkansson and Snehota, 1995; Gadde et al 2003), but there may be several goals, depending on the stakeholders. In this context it is relevant to highlight that networks do not have a particular life cycle like the natural open systems do, and a network is in a continuous movement, where activities are executed through a various resource constellations.

## **Conclusions and research implications**

This paper has studied the industrial network approach in a context of GST. If we take a look back to, what is required to conform to a definition of a system, three conditions have to be present: organization, continuity of identity and goal directedness. In broad network terms a network does not qualify because networks as such have no objectives, neither organization (but one can observe rather stable structures and processes). This is not to say that networks do not add value in activity and resource streams, and therefore we may need new concepts to clearly distinguish networks from systems.

Nevertheless, when applying GST properties in the network context, the following conclusions can be depicted. Networks, like systems in general, are composed of interrelated and interconnected subcomponents, and in order to understand networks they have to be studied through their relationships. There can be distinguished between hierarchy and heterarchy in the networks. Hierarchy is applied as a research strategy at different levels (network, dyad, and company). Heterarchy refers to a non-hierarchical modality, i.e. positions within a certain level of analysis. Moreover, GST acknowledges the interaction between an open system and its environment, and argues that the environment exerts a degree of control over the system, but cannot be controlled (but may be partially selected or influenced) by the system. This notion refers to the hierarchy of system levels, but it does not apply to networks, as a lower level (e.g. dyad) may have an influence on a higher level (e.g. network) and vice versa. By definition: networks are connected dyads.

In the GST a boundary distinguishes a system from its environment (next higher level of system minus the system itself) and in the network approach this environment is understood in terms of other identifiable actors. Moreover, when studying boundaries in the network context, three characteristics gain relevance. Firstly, a boundary is dependent on, *who* defines the boundary (subject-specific boundary), *what* is the phenomenon under scrutiny (object-specific boundary), and *when* the observation takes place (time-specific boundary). This leads to a further notion that when studying boundaries in the network context, they become a property of a researcher in delimiting the convenient or appropriate number of nodes into nets or partial networks, and in that sense boundary-setting is a research strategy contingent on research questions.

Table 3 summarises the application of GST properties in the industrial network perspective and research implications.

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Table 3 about here  
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## References

- Adams, Stacy J. (1976) "The Structure and Dynamics of Behavior in Organizational Boundary Roles". In *Handbook of Industrial and Organizational Psychology*. Marvin D. Dunnette, ed. Chicago:Rand McNaly College Publishing Company. 1175-1199.
- Alderfer, Clayton P. (1976) "Change Processes in Organizations". In *Handbook of Industrial and Organizational Psychology*. Marvin D. Dunnette, ed.. Chicago:Rand McNaly College Publishing Company. 1591 – 1638.
- Araujo, Luis; Dubois Anna and Gadde Lars-Erik (2003) "The Multiple Boundaries of a Firm". *Journal of Management Studies*, Vol 40, No. 5. 1255-1277.
- Ashmos, Donde P.; Huber, George P. (1987) "The Systems Paradigm in Organization Theory: Correcting the Record and Suggesting the Future". *Academy of Management Review*, Vol. 12, No. 4 (Oct.) 607-621.
- Berrien, Kenneth F. (1976) "A general Systems Approach to Organizations". In *Handbook of Industrial and Organizational Psychology*. Marvin D. Dunnette, ed.. Chicago:Rand McNaly College Publishing Company. 41 – 62.
- Bertalanffy, Ludwig Von (1972), "The History and Status of General Systems Theory" *Academy of Management Journal*, Vol. 15, No. 4, General Systems Theory (Dec., 1972) 407-426.
- (1950a), "An Outline of General System Theory" *British Journal for the Philosophy of Science*, Vol. 1, No. 2 (Aug., 1950) 134-165.
- (1950b) "The Theory of Open Systems in Physics and Biology", *Science*, Vol. 111 (1950) 23-29.
- Boulding, Kenneth, E. (1956) "General Systems Theory - The Skeleton of Science". *Management Science*, Vol. 2 , No. 3 (Apr.) 197-208.
- Brown, Warren B. (1966) "Systems, Boundaries, and Information Flow". *Academy of Management Journal*, Vol. 9, No. 4 (Dec.) 318-327.
- Dill, William R. (1958) "Environment as an Influence on Managerial Autonomy" *Administrative Science Quarterly*, Vol. 2, No. 4 (Mar.) 409-443.
- Dubois, Anna (1998): *Coordinating Activities across Firm Boundaries*. London: Routledge.

- Duncan, Robert B. (1972) "Characteristics of Organizational Environments and Perceived Environmental Uncertainty". *Administrative Science Quarterly*, Vol. 17, No. 3 (Sep.) 313-327.
- Easton, Geoffrey (1992) "Industrial networks: A Review". In *Industrial Network. A New View of Reality*, Axelsson, Björn and Easton Geoffrey eds. Routledge, London. 1-27.
- Emery, Fred E. and Eric L. Trist (1965) "The causal texture of organizational environments". *Human Relations*, Vol.18. 21-32.
- Ford, David and Håkan Håkansson (2006) "The Idea of Business Interaction". *The IMP Journal*, Vol. 1, No. 1. 4-27.
- Gadde, Lars-Erik; Håkansson, Håkan (2001): *Supply Network Strategies*. Wiley, Chichester.
- ; Huemer Lars; Håkansson, Håkan (2003): Strategizing in Industrial Networks. *Industrial Marketing Management*, Vol. 32. 357-364.
- Gersick, Connie J. G. (1991) "Revolutionary Change Theories: A Multilevel Exploration of the Punctuated Equilibrium Paradigm". *Academy of Management Review*, Vol. 16, No. 1 (Jan.) 10-36.
- Hertz, Susanne (1992) "Towards More Integrated Industrial Systems". In *Industrial Network. A New View of Reality*, Axelsson, Björn and Easton Geoffrey eds. Routledge, London. 105 – 128.
- Huemer, Lars.; Manuel Becerra and Randi Lunnan (2003) "Organisational Identity and Network Identification: Creating and Perceiving Imaginary Boundaries". Paper submitted to the 19<sup>th</sup> IMP-Conference in Oslo, Norway.
- Håkansson, Håkan and Snehota, Ivan (1989): "No Business Is an Island: The Network Concept of Business Strategy". *Scandinavian Journal of Management*, Vol. 5, No. 3, pp. 187-200.
- ; ---- (1995): *Developing Relationships in Business Networks*. London:Routledge.
- Halinen, Aino.; Asta Salmi and Virpi Havila (1999): "From Dyadic Change To Changing Business Networks: An analytical framework". *Journal of Management Studies*, Vol. 36, No. 6., 779-794.
- Johansson, Jan; Mattson, Lars-Gunnar (1992): "Network Positions and Strategic Action – An Analytical Framework". In *Industrial Network. A New View of Reality*, Axelsson, Björn and Easton Geoffrey eds. Routledge, London. 205-217.
- Kast ,Fremont E.; Rosenzweig, James E (1972) "General Systems Theory: Applications for Organization and Management". *Academy of Management Journal*, Vol. 15, No. 4, General Systems Theory (Dec.) 447-465.
- Katz, Daniel and Robert L.Kahn (1966) *The Social Psychology of Organizations*. HR Folks International.
- Koestler, Arthur (1967) *The Roots of Coincidence*. Hutchinson.
- Lawrence, Paul R. and Jay W. Lorsch (1967) "Differentiation and Integration in Complex Organizations". *Administrative Science Quarterly*, Vol. 12, No. 1 (Jun.) 1-47.
- Litterer, (1969) *Organizations Structure and Behaviour*. Bolingbrook, Illinois, United States.
- March, JG; Simon, HA (1958) *Organizations*. New York. Wiley.
- Mattson, Lars-Gunnar (1984) " An Application of a Network Approach to Marketing: defending and Changing Market Positions". In *Changing the Course of Marketing. Alternative Paradigms for Widening Marketing Theory*. N. Dholakia and J. Arndt eds. Greenwich, Conn, JAI Press.

---- (1988) "Interaction Strategies: A Network Approach". AMA Marketing Educator's Conference, San Francisco, California.

Melin, Leif (1989) "The Field-of-Force Metaphor". In: *Advances in International Marketing*, 3. Johansson, Jan, and Lars Hallén eds. 161-179.

Miller, James, G. (1978) *Living Systems*. New York: McGraw-Hill.

Richardson, Kurt; Lissack, Michael R. (2001) "On the Status of Boundaries, both Natural and Organizational". *Emergence*, Vol. 3, No. 4. 32-49.

Scott, William G. (1961) "Organization Theory: An Overview and an Appraisal". *The Journal of the Academy of Management*, Vol. 4, No. 1 (Apr.) 7-26.

Skyttner, Lars (1996) *General Systems Theory – An Introduction*. Anthony Rowe Ltd, Chippenham, Wiltshire.

---- (2005) *General Systems Theory (2<sup>nd</sup> Edition) – Problems, perspectives, practice*. World Scientific Publishing Co. Pte. Ltd, Singapore

Terreberry, Shirley (1968) "The evolution of organizational environments." *Administrative Science Quarterly*, Vol. 12, 590-613.

Thompson, James D. (1967) *Organizations in Action*. Transaction.

Turnbull Peter W. and Jean-Poul Valla (1986) *Strategies in International Industrial Marketing*. London, Croom Helm.

## Appendices

**Table 1: Boulding's (1956) nine levels of hierarchy**

Level	Characteristics
9. Transcendental	<ul style="list-style-type: none"> <li>The level of unknowable.</li> <li>Its structure and relationships can only be speculated</li> <li>This level exhibits systemic structure and relationships</li> </ul>
8. Social organization	<ul style="list-style-type: none"> <li>The units of level are assumed roles that are tied together by the channels of communication</li> </ul>
7. Human	<ul style="list-style-type: none"> <li>The individual is defined as a system</li> <li>In addition to the animal level man possesses self-consciousness</li> </ul>
6. Animal	<ul style="list-style-type: none"> <li>Various degrees of consciousness, teleological behaviour and increased mobility</li> </ul>
5. Plant	<ul style="list-style-type: none"> <li>Identified by genetic/societal processes</li> <li>The main qualities: differentiation and division of labour and mutual dependence</li> </ul>
4. Cell	<ul style="list-style-type: none"> <li>The open system level – life begins and develops here</li> <li>Self-maintaining structure</li> </ul>
3. Cybernetics	<ul style="list-style-type: none"> <li>Control of mechanism</li> <li>Thermostat with its teleological behaviour</li> </ul>
2. Clockworks	<ul style="list-style-type: none"> <li>A simple dynamic system with predetermined motion (e.g. the solar system)</li> </ul>
1. Frameworks	<ul style="list-style-type: none"> <li>The level of static structures and relationships (e.g. atoms in a crystal)</li> </ul>

**Table 2: Miller's (1978) eight levels of living systems (Adopted from Skyttner, 2005: 120 – 121)**

Level	Characteristics	Examples
<b>Cells</b>	<ul style="list-style-type: none"> <li>Composed of non-living molecules and multi-molecular complexes</li> <li>Least Complex system that can support essential life processes</li> </ul>	<ul style="list-style-type: none"> <li>Exists either free living or as specialized components of the organs or tissues of organisms</li> </ul>
<b>Organs</b>	<ul style="list-style-type: none"> <li>Composed of structures of cell aggregates</li> </ul>	<ul style="list-style-type: none"> <li>Liver, lungs</li> </ul>
<b>Organisms</b>	<ul style="list-style-type: none"> <li>Composed of organs</li> </ul>	<ul style="list-style-type: none"> <li>Multi-cellular plants</li> <li>Animals</li> </ul>
<b>Groups</b>	<ul style="list-style-type: none"> <li>Composed of two or more interacting organisms</li> <li>No higher level than this exists among animals</li> </ul>	<ul style="list-style-type: none"> <li>Bees</li> <li>Ants</li> </ul>
<b>Organizations</b>	<ul style="list-style-type: none"> <li>Composed of groups</li> </ul>	<ul style="list-style-type: none"> <li>Business enterprises, churches</li> </ul>
<b>Communities</b>	<ul style="list-style-type: none"> <li>Composed of different interacting organizations</li> </ul>	<ul style="list-style-type: none"> <li>A town with its schools, hospitals and business enterprises</li> </ul>
<b>Societies</b>	<ul style="list-style-type: none"> <li>Composed of various kinds and functions of communities</li> <li><i>Totipotential</i>, contains all the essential capabilities as a self-subsistent system</li> </ul>	<ul style="list-style-type: none"> <li>Nation</li> </ul>
<b>Supranational systems</b>	<ul style="list-style-type: none"> <li>Composed of two or more cooperating societies who submit power to their superordinate</li> </ul>	<ul style="list-style-type: none"> <li>NATO, EU, UN</li> </ul>

**Table 3: Network approach applied in GST context and research implications**

Open systems elements (Bertalanffy, 1950a+b; Katz and Rosenzweig, 1972)	Application in a network (NW) approach	Research implications
<b>Subsystems of Components</b>	<ul style="list-style-type: none"> <li>NW consists of subcomponents (actors) that are interrelated and interconnected via relationships (Håkansson and Snehota, 1995)</li> </ul>	
<b>Holism</b>	<ul style="list-style-type: none"> <li>NW under scrutiny can be explained only as a totality. In order to understand a system or a NW, interconnectedness / relationships have to be studied</li> </ul>	
<b>Hierarchy</b>	<ul style="list-style-type: none"> <li>A system is composed of subsystems of a lower order and is also a part of suprasystem A NW can be divided into three levels: network, relationship (dyad) and organization level</li> <li>Hierarchy in NWs is understood as positions that determine which role a company has in relation to other actors</li> </ul>	<ul style="list-style-type: none"> <li>Hierarchy exists between different levels (network, dyad, company)</li> <li>Heterarchy exists within a level. Position in a network, in a dyad or within a organization</li> <li>Lower levels of hierarchy (e.g. dyad) can affect higher levels (e.g. network) and vice versa, it is the question of an ability to influence and being influenced</li> </ul>
<b>System Boundaries</b>	<ul style="list-style-type: none"> <li>Boundaries distinguish actors from other identifiable actors, while in GST a boundary distinguishes a system from higher levels of systems</li> <li>The level of analysis crucial in NWs: Dyads and triads, The use of nets to determine the actual boundaries, Case study</li> </ul>	<ul style="list-style-type: none"> <li>Boundaries are a property of the observer in delimiting the convenient or appropriate number of nodes into nets or partial networks <ul style="list-style-type: none"> <li>Subject-specific boundaries</li> <li>Object-specific boundaries</li> <li>Time-specific boundaries</li> </ul> </li> </ul>
<b>Input-Transformation-Output Model</b>	<ul style="list-style-type: none"> <li>NWs actors are in interaction with other identifiable actors, from which they receive inputs from and</li> </ul>	

	<p>export outputs to</p> <ul style="list-style-type: none"> <li>NWs identify both transaction and transformation activities referring to the inside and outside nature of the relationships</li> </ul>	
<b>Feedback</b>	<ul style="list-style-type: none"> <li>In NWs feedback is understood in terms of, how an actor copes with relationships and relates to a network</li> </ul>	
<b>Internal Elaboration</b>	<ul style="list-style-type: none"> <li>In systems there is movement toward greater differentiation, elaboration and a higher level of organization. In NWs there are identified specialization and routinizations of relationships.</li> </ul>	
<b>Steady State, Dynamic Equilibrium and Homeostasis</b>	<ul style="list-style-type: none"> <li>NWs are dynamic in nature, thus stability and dynamism coexist</li> </ul>	
<b>Multiple Goal-Seeking</b>	<ul style="list-style-type: none"> <li>Systemic interaction must result in some goal or final state to be reached or some equilibrium point being approached, while NWs do not have any specific goal, while organizations itself may have a goal or several goals</li> </ul>	<ul style="list-style-type: none"> <li>As NWs have no specific goal, it may be relevant to develop concepts that distinguish networks from systems</li> </ul>
<b>Equifinality</b>	<ul style="list-style-type: none"> <li>Certain results may be achieved with different initial conditions and in different ways. In NWs this is done through heterogeneous resources</li> </ul>	