

**SOCIO-CYBERNETICS AND BUSINESS CYBERNETICS AS APPROACHES
IN DEALING WITH THE RELATION BETWEEN TECHNOLOGY AND
SOCIAL COMPLEXITY IN INVENTION-INNOVATION PROCESSES**

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Abstract

The aim is to start discussion about similarities and dissimilarities of Business Cybernetic and Socio-cybernetic concerning invention-innovation processes. Both of them deal with human aspects of life in a (requisitely) systemic style, although from slightly and essentially different viewpoints – business and social sciences, respectively. Both of them are relatively new sciences concerned with complexity of the contemporary life and controlling – managing – influencing it. What ever is the level of modernization of tools by technological innovation, they are always tools under control of humans. These humans can differ in knowledge, values, circumstances and socially beneficial use of tools. Thus, it might belong to roles of socio-cybernetic to help humans develop their subjective attributes toward more social responsibility in general; business cybernetic should do the same inside humans' business life. The critical point seems to be much more in the cultural innovation of the contemporary humans than in the technological innovation. Such conclusion emerges also from a study about opinions of the world-top managers, again. But its findings are in danger of oversight because culture-related invention-innovation processes might endanger the power positions of the power holders, who are not requisitely holistic to see the crucial danger resulting from their own oversights leaving culture aside.

0 The selected problem and viewpoints

Invention-innovation processes (IIP) are very complex and under crucial impact of humans and their organizations, as business systems (BS). Technology is the oldest admitted IIP topic, but in recent empirical literature innovation of business models, including the management style, is found even more crucial for success. (Collins, Porras, 1994; Collins, 2001; Chesbrough, 2003; Competition, 2004; Lester, Piore, 2004; Hippel, 2005; Nussbaum et al, 2005; Rooke, Torbert, 2005; Basadur, Gelade, 2006; Chesbrough, Vanhaverbeke, West, 2006; Davila et al., 2006; Gloor, 2006; Huston, Sakkab, 2006; IBM, 2006; Jaruzelski et al., 2006; McGregor, 2006; Daghfous, 2007; Jantschgi, 2007; Leydesdorff, 2006; Levitt, Dubner, 2006; Schwartz, 2006; Tapscott, Williams, 2006; The Economist, 2006, 2006a, 2006b, 2006c; Likar, Fatur, 2007; Mulej, 2007). This new insight, which smaller economies and companies have experienced for longer times than the bigger ones, might offer a new way out of the current very poor success of the big companies' innovation projects: under five percent on average (Nussbaum, 2005). Except

Leydesdorff, the cited authors do not explicitly mention either socio-cybernetics (CoS) or business cybernetics (BuC). Implicitly, they might be close to one or both of them; we will not analyze this issue here. We will rather try to start a discussion what BuC and SoC share or differ in, when IIP is at stake.

1 Briefly about the invention-innovation process (IIP)

In Jangtschi's collection (2007) the following simple model of the technological IIP is presented – Figure 1. All four phases need a good care for innovation to result, which means the new benefit of the users (EU, 1995):

1. Pre-development	2. Development of new options	3. Operational work	4. Elimination and replacement
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Figure 1: Four phases of the invention-innovation process

The model in Figure 1 exposes the early IIP phases very much. Some other authors do so as well (for some references see e.g.: Likar, Fatur, 2007). In all these IIP phases Mulej's equation of preconditions for an idea to become innovation matters (Mulej, 1997):

Innovation = (invention X entrepreneurship and entrepreneurial spirit X requisite holism X management X co-workers X innovation friendly culture X customers X competitors X suppliers X natural environment X socio-economic environment and other outer, i.e. objective conditions X random factors, such as luck)
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Figure 2: Equation of preconditions of innovation

What also matters is content, scale of consequences and duty of BS members – Figure 3:

Three networked criteria of inv., suggestions, potential innovations, and innovations	(2) Consequences of innovations		(3) On-job-duty to create inv., sugg., potent. innov., and innovations	
(1) Content of inventions, suggestions, potential innovations, and innovations	1. Radical	2. Incremental	1. Duty exists	2. No duty
1. Business program items	1.1.	1.2.	1.3.	1.4.
2. Technology (products, processes)	2.1.	2.2.	2.3.	2.4.
3. Organization	3.1.	3.2.	3.3.	3.4.
4. Managerial style	4.1.	4.2.	4.3.	4.4.
5. Methods of leading, working and co-working	5.1.	5.2.	5.3.	5.4.

Figure 3: 20 basic types of inventions, suggestions, potential innovation and innovations

Nussbaum et al (2005) suggest two steps to be used to improve IIP results:

1. 'Change the Game': stop considering the technological inventions and innovations only and tackle the following ten types, at least, instead:

1. Business model	2. Partners networking
3. Support processes and collaboration	4. Basic processes
5. Efficient equipment	6. Linking of products in systems
7. Services	8. Channels
9. Trade mark	10. Customer experience

Figure 4: Ten basic types of innovation in the ‘open innovation’ model

The basic processes are found not a technological issue only, but based on culture and talent of coworkers inside and outside the given organization.

2. Knowledge of attributes of the market in which you compete with innovation, especially from the viewpoints of issues such as:

- 'Which attributes did you miss and did not invest in them, but they matter?' and
- 'In which of the ten types in Figure 4 can you differ from competitors?'

The most frequent mistakes in IIP management resulting from mixing up of:

- Research and development with IIP;
- Consumer marketing with understanding of consumers;
- Design with Design strategy;
- Innovation with technology;
- Creativity with innovation.

In other words, what ever is the type of IIP and its outcome they depends on humans and their organizations, which makes IIP a topic of both SoC and BuC.

2 Our understanding of Cybernetics

Cybernetics introduced complexity to science/practice concerning making an influence and attracting attention to relations, impacts and information, which opened human insight into the previously overseen attributes of reality. It helps humans control their own conditions of life a lot more efficiently and, hopefully, more holistically, too (See development of Cybernetics: Wiener, 1948, and later; Ashby, 1956, and later; Beer, 1959, and later; Zadeh, 1965, and later; Foerster, 1974, and later; Checkland, 1981, and later; Trappl, 1983, and later; Clemson, 1984; Umpleby, 1990; Delgado, Banathy, 1993; Francois, 1999; Wood, 2000; Vallée, 2003; etc).

On such a basis, one may conclude that Cybernetics is a science and practice of influencing / controlling / managing features, events and processes that:

1. Are complex or very complex, i.e. have multiple relations, internally and externally, and specific attributes resulting from these relations.
2. Are open, i.e. have relations, especially interdependencies, with their environment/s, including the ones between different viewpoints.
3. Are dynamic, i.e. able to change, including the observers, decision-makers and impacting actors, as well as the observation process.

4. Take inputs as well as produce outputs = impacts by information rather than by material/energy flows only.
5. Support these flows by feedback loops, e.g. stabilize and simplify them by negative ones, and reinforce them by the positive ones.
6. Are mentally, explicitly or implicitly, modeled from the selected (set or system, or dialectical system, of) viewpoint/s.

Cybernetics cannot be reduced to feedback loops or modeling alone, it takes all six attributes mentioned above as one synergetic whole, a dialectical system. The point of cybernetics is to help optimize the human impact over the human life and its circumstances, conditions and preconditions.

Thus, cybernetics is one of many specialized disciplines that need to be requisitely holistic, and can hardly be so, if left alone rather than acting in interdisciplinary cooperation with other specialized disciplines. In addition, there is a number of cybernetics applying the same basic ideas to different traditional fields of science and practice. Among them, we see BuC and SoC – Figure 5 (Potocan, Mulej, Kajzer, 2005).

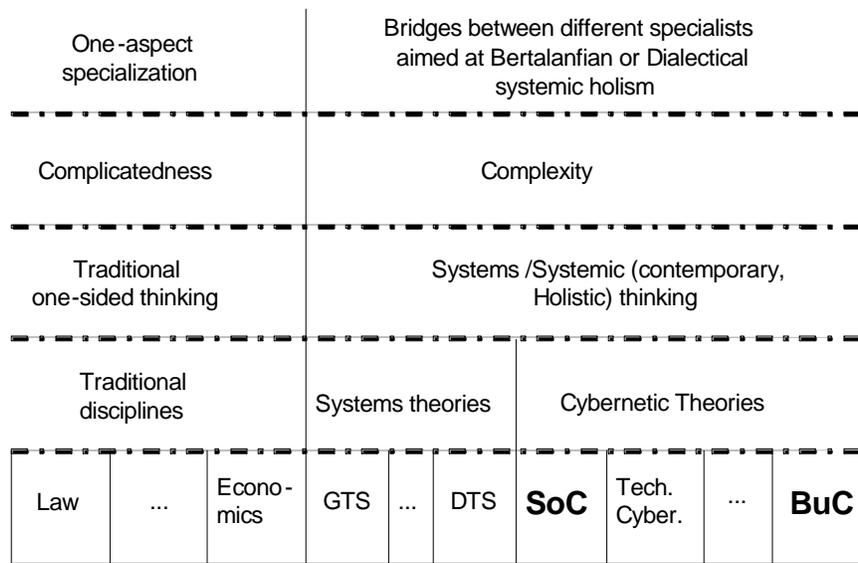


Figure 5: The area of BuC and SoC among other sciences

3 Cybernetics and / of business systems

Four sets of ideas are specifically stressed when one tries to understand the role of organizations or humans as BSs and their characteristics in terms of cybernetics (See Potocan, 2003; Potocan, 2004):

1. A BS is a communication network in which its components, individuals and groups mutually exchange information (which stresses the importance of informatics and of building the information systems as partial systems rather than systems or subsystems).
2. A BS is a system / network of activities in which the sources (matter, energy and information) are transformed into outcomes (which is the topic of the modern operations research, decision support systems, and expert systems), when talking about organizations as BSs and humans in the role of BSs (trying to get employed, retire, contract out one's capabilities).
3. A BS is a societal system having certain societal tasks and responsibilities. As such, both a human and an organization as a BS is a society's subsystem (rather than a system of its own only) characterized by a network of roles and interactions, which are to be performed skillfully. Special attention is to be paid to ecological problems.
4. A human being, if considered and/or behaving as a BS, demonstrates more or less the same attributes as an organization as a BS, although in a different way.

In general, we can establish, that each phenomenon should be examined as cybernetic systems through the network of all the important viewpoints. Certainly, within the treatment, we should consider the specific starting points and characteristics of particular groups of phenomena (and the systems introduced to represent them as mental pictures of the selected parts of attributes). Therefore, different viewpoints, networks of viewpoints or dialectical systems / systems of treatment are unavoidably highlighted for different phenomena. The differences in the selection of viewpoints and their interdependence depend on the subjective selections of the authors of definitions (this is also true for the engineering / scientific laboratory experiments). The subject of our examination, here, is a BS, which represents characteristics of societal systems, illustrates social processes and events from the viewpoint of (systemic) business viewpoints.

See the important characteristics of three basic viewpoints of cybernetic treatment of phenomena selected on such basis (For details of each viewpoint of cybernetic treatment see: Umpleby, 1990; Potocan, 2004):

- An engineering observation tries to study natural events from the viewpoint of their usability for tools.
- A biological observation tries to study natural events from the viewpoint of their given attributes with no attempt to influence them.
- A social observation tries to study social events from the viewpoint of the given attributes or from the viewpoint of influencing them.

We will present our view of dealing with the said dilemma on the case of cybernetics in business.

4 Business Cybernetics

The dialectical classification (Figure 6) into the interdependent general, special, and individual parts (subsystems) means that any version of systems theory or cybernetics is

useful and makes sense more or perhaps less than another one; the point is only in the difference of fields of applicability and usefulness.

(1) The general part or subsystem of interdependent attributes					
(2) Group specific subsystem (1)		(2) Group specific subsystem (n-1)		(2) Group specific subsystem (n)	
(3) Individual subsystem (1)	(3) Individual subsystem (2)	(3) Individual subsystem (3)	(3) Individual subsystem (m-2)	(3) Individual subsystem (m-1)	(3) Individual subsystem (m)

Figure 6: Interdependence of the general, group specific and individual part of attributes

Individuals, organizations, and countries can also be seen as BSs. Doing business can namely be seen as a way toward viability in complex conditions (see: Beer, 1959, and later). Business is not the only way toward viability in complex conditions, but it differs e.g. from medical care, healthy life style, innovations to be applied in production and elsewhere, leisure, sport, culture, etc. In BuC we do not mean market in other outer relations only, but also the internal ones, such as organizing, management, work processes, structures.

According to our suggestion, the difference of BuC from the viable systems model in general lies therefore in the level of specific and individual details and depth of consideration of BSs. These details might be equally crucial as the general attributes. BuC, hence, may be considered as a next step into research and application of the general cybernetics and of viable system model in the specific, rather narrow but important, area of business.

Every topic under consideration can be seen on different levels of holism along the following lines. It takes into account the human capacity not to see the objective reality, but its selected part/s of attributes only, and to do so, on three basic levels of the unavoidable simplification (Figure 6). Thus, the attained level of holism differs a lot.

Years ago there quite some discussion about holism (see: Ashby, 1956; Bertalanffy, 1968), but less so lately (Trappl, 1983). Concepts are rather different, ours is in Figure 6. Our warning resulting from Figure 6: very rarely the requisite holism can be attained without dialectical systems, requiring interdisciplinary creative co-operation.

By limiting the topic and adapting the principles of cybernetics, the term BuC can be applied to the cybernetic treatment of the operation (and behavior) of people and organizations as BSs. BuC represents a special form of cybernetics, which can be (and should be) defined holistically based on the identification of its purpose, contents, methodology, and circumstances of use, needs and possibilities, as well as of the users. The latter can utilize it as the cybernetics of the 0, 1st, 2nd or 3rd order or as the cybernetics of conceptual systems – dependent on their selected system of viewpoints, preferably the dialectical system and requisite holism. (Mulej et al, 2000).

BuC is designated for the identification, definition, analysis of BSs and the influence on them. However, the question arises as to what business/BS is and how to define it.

Business is an old term. In modern economic literature, a number of different definitions of the term business may be found, still (See: www.pangaro.com/published/cyber-mcmillan.html). For example, Webster Dictionary (Gove, 2002) gives 17 different definitions for business. At least nine of them are related to economic treatment and / or the definition of economic viewpoints of cybernetics.

In order to define BuC, the definitions of business may be classified into two basic groups: 1) business as an activity (acting and behaving) and 2) business as an interest. Therefore, BuC may be understood and requisitely holistically defined on the basis of an adequate (synergetic) understanding and use of both content definitions mentioned above.

A more detailed definition of the term BuC depends on the selection and use of the methodology for its treatment (the approaches taken to the treatment, methods, and methodologies). Why? Business is an elaborate (complex and complicated), dynamic and comprehensive phenomenon, which can, in our opinion, be adequately conceived and defined only in a requisite holistic systemic treatment. It makes sense to analyze it within this framework as a network of all selected significant viewpoints, levels and areas of activity.

In the case of BuC, we attempt to treat the activity and behavior of a (specific) group of (profit-oriented) organizations (and/or people) from a network of all the selected viewpoints (organizational, management, economic, business) holistically, which enable the requisite holism of the treatment (considering its purpose and goals) of activity and behavior. Based on the above starting points, BuC can be best defined in broadest terms as follows: BuC (in our definition) (Potocan, 2003; Potocan, Mulej, Kajzer, 2005) is specializing in organizations and individuals as so-called BSs emphasizing the so-called business viewpoints rather than the natural and/or technical / technological viewpoints of consideration of features, events and processes in real life.

Calling humans and organizations BSs rather than “features, events, and processes considered from the viewpoint/s of business sciences/practice,” may mean that the requisite holism of consideration and action is consciously or subconsciously limited to the selected viewpoint/s, and therefore (rather) one-sided, although the expression “system” suggests holism. In this case, like in all other cases when one uses the word system, one should describe quite explicitly what viewpoint/s and content/s does one have in mind – in order to avoid mutual misunderstanding and the resulting lack of capacity and possibility to cooperate creatively on an interdisciplinary basis.

When we speak about the role and importance of Cybernetics (and/or BuC) in business (Ashby, 1956, and later; Beer, 1959, and later; Trappl, 1983; Clemson, 1984, and later, we must take into account that the idea of BuC is close to uniting the cybernetics of the 2nd and 3rd order and cybernetics of conceptual systems into a dialectical system in order to provide for the requisite holism of management in the BSs. Thus, this concept adds a

new (meaning of) relation of cybernetics of conceptual systems and of cybernetics of the observation, decision-making and impacting as the phases of the same process (Mulej, 2007).

In order to implement the mentioned cognitions about BSs we also need an appropriate methodological approach to understand the BuC aspect of considering humans and their tools producing benefits for customers and themselves by three interdependent processes (basic, management, information). However, if we try to create a new requisitely holistic solution, we also need a new (requisitely holistic) approach in order to apply the exposed relation between BuC and Systems Theory: the concept of interdependence. Of course, different relations cause interdependencies of different types and vice versa.

The Ludwig von Bertalanffy's concept of interdependence (Bertalanffy, 1979) expresses the finding / reality that all parts of the universe, in one way or another, directly or less directly, influence each other. This is so because they depend on each other due to their mutual differences; they are mutually complementary. Later this finding was expressed well and documented in Gaia, when it comes to nature in general. Today, it is expressed well in literature on systems, chaos and complexity theories (Checkland, 1981; Mulej et al., 2000; Wood, 2000). Interdependence may not be seen only as a relation of elements inside a whole alone, but also as a relation between different viewpoints (which is not discussed in Bertalanffy, 1979).

Interdependence of specialists is expressed and used by interdisciplinary cooperation. Thus, the relation between Business, BuC, Cybernetics and Systems Theory can be defined as one of several parts of a whole / entity in a systemic consideration of the object at stake such as a BS. These parts exist and participate in different relations (internal, external), which make them create and realize a number of synergies. Hence, relation itself may be seen as a source of synergy/ies. These synergies may be used by cybernetics / cyberneticians aiming at a requisitely holistic application of the 2nd and / or 3rd order cybernetics and cybernetics of conceptual systems.

In relation between BuC and the Viable System Model it can be clear now, that BuC specializes in a way of attainment of viability, which is typical of humans and organizations as BSs.

5 Socio-Cybernetics of Business Systems

Socio-cybernetics is, in the framework in Figure 5, specializing in the so called social systems emphasizing the so called social sciences' viewpoints rather than the natural and/or technical or technological viewpoints of consideration of features, events, and processes making the real life (Hornung, 2006). Therefore usually the interdisciplinary approach is needed in socio-cybernetics as well. Socio-cybernetics is about systemic, i.e. holistic thinking about complex social topics. Innovation belongs to them, once the selected viewpoint does not address the engineering part of attributes of innovations as processes and their outcomes. Here, we will consider innovation from social, psychological, managerial and economic viewpoints. Humankind is namely entering the

period in which innovation and the creative-class society prevail, at least in the advanced countries, to which the less innovative countries and people/s are practically subordinated as neo-colonies (See: Florida, 2005). SoC should, on these terms help the 3T to prevail, meaning: Tolerance (for diversity of people in the same area) attracts Talents (to create new IIP and innovations) using Technology (to make IIP and innovation efficient and effective). Hence, innovation of management might be a crucial topic of SoC, today even more than in the old times.

Schmidt (1993) showed clearly that innovation of management had been taking place throughout the known human history, including its millennia old phase in which the said distinction in the thinking tank/class and the working tank/class has perhaps been helpful. Then, access to education was very limited. Routine was prevailing in technology and most jobs required no creativity. Thus, the distinction as well as the exclusion of anything but technology from the innovation mattered, but resulted in poor life for more or less all people except the nobles in the roles of the civilian and religious authorities and abusing their positions.

The industrial revolution made in the 19th century the impression that the way out of the poor life depends on the technological innovation, which is true, but not all the truth. A case: what ever is the quality of a gun, it depends on human decisions and action whether a gun is used to shoot in a target for sports or to kill an innocent person. Besides, every gun is a human product. And a human consumes it.

Then, a new way of life resulted from the society management innovation, called the end of the feudal era and move of social power from castles to cities. Urbanization, industrialization, political democracy (later on, other types of democracy were added, of course, gradually), education of all population, market rather than guilds as the method of matching supply and demand, separation of government and church ending the monopoly of the latter over thinking, etc. – all of them were managerial rather than technological innovations and become a normal beneficial routine over time. (Reich, 1984; Rosenberg, Birdzell, 1986). Human relations and human resources were concepts in the management and organization theory that could be called innovations of management in 1930s and after the 2nd World War (Potocan, 2003). According to Reich (1984) innovation of management contributed to the U.S. progress more than the technological innovation: it made room for the latter. Still, the human creative capacity is badly underused (Ackoff, 2003). This is why the ‘rise of the creative class’ matters so much today (Florida, 2005).

6 Conclusions

Cognitions that a more holistic application of cybernetics and systems theory is possible might enable more of the necessary requisite holism in consideration of BSs. This need requires consideration of interdependence and synergetic working of: (1) the business reality (i.e. working and behavior of BSs); (2) systems thinking (i.e. the methodological approach enabling the requisite holism of understanding of the business practice), and (3) cybernetics (i.e. methodology of impacting the business reality). This makes the general room for BuC and SoC that can, on this basis, provide more depth and specification to the

application of the 20 types of innovation in Fig. 3 and 10 types of innovation in Fig. 4. – if bosses accept it as a novelty that does not endanger their commanding positions.

In management of IIP both BuC and SoC make necessary backgrounds of improving its quality toward excellence rather than failure in more than 95% of so far:

- BuC can improve IIP by helping owners, governors, investors, managers and their co-workers perceive, think, reflect, decide, and act along with the Law of requisite holism. The current stressing on the open innovation model by authors about IIP and by organizations they are reflecting about, says that the innovation of business models is even more crucial than the technological one; this can be found to be in line with BuC. This does not mean, that all BuC concepts are fully used today. The internal processes (Fig. 1 and related activities) used to be covered in the ‘closed innovation’ model more narrow-mindedly, and hence with more oversights and resulting failures, than the modern ‘open innovation’ model is promising to provide.
- SoC can improve IIP by equally oriented impacts. The SoC’s contribution differs from BuC in its background of sociology, psychology, anthropology and similar social sciences. The ‘open innovation’ model stresses in several cases, that the current global market trends require BSs to offer their customers an extraordinary experience rather than a products or service as a technological product only. Organizations that understand this trend, are replacing e.g. the Six Sigma model with insights of designers, as creative authors, and anthropologists etc. into the emotions and thoughts of customers, which the customers are not yet (fully) aware of: these insights might make a new market.

Thus, BuC and SoC are complementary in terms of the issue in the title of this paper. They can add to social responsibility and to human happiness (Hornung, 2006).

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