

COMPLEXITY AND INNOVATION IN BUSINESS SYSTEMS WITH FOCUS ON TRANSITIONAL COUNTRIES

August Turina*

Faculty of Economics, University of Zagreb
Zagreb, Croatia

Review

Received: 11 December, 2003. Accepted: 30 March, 2004.

SUMMARY

This paper is a review from a business analyst's perspective of innovation and complexity concept and their impact upon the paths of business systems and organisations as wholes. Its task is also to catalyse a broader discussion on innovation segment that is by itself complex and its importance to business in a growing complex environment. The argument is that innovations should be the main driving force of business and other social systems due to their path-dependent and positive feedback features that provide for faster growth. Innovation is not limited solely to businesses and should also be viewed in respect to other social (public) systems whose segment often lack innovative approach. Innovation may be found to possess emergent properties like other events that appear in social systems that influence their change and adaptation. It determines path-dependency of such systems because it is considered an event arising early in the history of the system that determines its ultimate end state. Thus, understanding, managing and accepting innovations and its importance is crucial for recognition of complex processes of path-creation, dependence and emergence of forces that drive social systems. Viewed from aspect of transitional countries, it is crucial for judging the future stability of their social entities striving for development and recognised change.

KEY WORDS

complexity, innovation, business system, path dependence, feedback

CLASSIFICATION

JEL: O31, P27

INNOVATION DEFINED AND SOCIETAL CHANGE

Along with the function of knowledge and technique increases, scientists, engineers and managers have increasingly focused on innovation. Innovation is a powerful weapon in competing with other business enterprises, and pushes the society forward endlessly through positive feedback process. In the past, many scientists have put continued effort to understand questions of defining innovation and conditions under which it is facilitated.

The idea becomes an *innovation* only when it can be replicated reliably on a meaningful scale at practical cost [1; p.6]. In reference to innovation, there are two factors complementary to individual's ability to innovate: (1) the ability to differentiate between objects that seem to be similar and (2) the ability to find similarities between seemingly unrelated matters [2]. Innovation may also be discussed in the general context of learning. In this respect, innovation can be understood as a novel way to solve a problem. Here the word "novel" is understood in a qualitative way: Any type of behaviour can show a large variability and still be categorized into a discrete number of qualitatively different classes of behaviour. A technical innovation involves a qualitative different method of solving problems and is not just an improved way of performing a previously existing process. This definition of innovation can be applied at a multitude of levels and often involves the creation of new, specialized problems that need to be solved in order to improve the solution of a more general problem. The concept of learning as a persistent change of behaviour is more general in the sense that it does not require novelty in the method of problem solving. In most cases learning will lead to a gradual improvement of the performance within the class of one existing strategy or behavioural pattern [3].

Innovation represents scientific, technological, organizational, financial and business activities leading to the commercial introduction of a new (or improved) product or production process. Innovation strategy can be defined as the plan of action that determines the type and magnitude of innovation activity that the organization must undertake to meet its strategic and operational objectives. The innovation strategy links technology and product strategies to the corporate strategy. It is shaped by the organization's dynamically changing knowledge and skill sets embedded within the organization's core competencies.

Significant innovation depends on the "long line": the ability to go beyond cut-and-try recombination of well-known building blocks to the more distant combinatorial horizon. Constraints and bottlenecks set the directions of innovations in sciences. The bottlenecks imposed by technical difficulties (constraints) make some combinations difficult or impossible [4]. If the source of innovation is in the past or even in current technology levels, it is said to be an evolutionary technological innovation since it evolved from what came before. If, however, it does not build on past technologies but represents a significant shift from the past, it can be said to be revolutionary technological innovation. If a company believes that technological innovation will be evolutionary, it will look to the leaders in that technology to develop new products and processes. If a company believes that technological innovation will be revolutionary, however, it may wish to seek out the research efforts of smaller companies, specialized research companies, and university researchers [5]. Just as there are many ways of defining innovation, there are also many ways of describing innovation. Each approach is important because it is

derived from a specific strategy to pursue that innovation path, therefore, requires a different focus of management activity in order to be successful.

Many scientists regard innovation as complex process. It is due to it being a result of interaction of a number of components, or agents according to sets of rules that require them to examine and respond to each other's behavior so as to improve their behavior and thus behavior of the system which they comprise. Many papers and reports introduced experimental programs that utilize knowledge of the creativity process in order to enhance innovation in business organizations.

Various innovation programs have evolved in numerous countries as a response to the growing complexity of the innovation process as a prerequisite for sustained development and progress. Thus, transitional (European) countries, like Croatia, are striving to establish a culture of innovation capable of supporting sustainable economic development, and thus to successfully manage its complexity.

In industrially developed countries innovations are the basis for the economic growth whereas innovations are amongst the main tasks of the bearers of economic policies. The introduction of new manufacturing processes, products and services improvements to them are preconditions for survival on the world market not only for developed countries but also for transitional economies.

The lack of national scientific programs is often a neglect of innovation in the public administration segment. Not only that the innovation acts in a complex environment but it is becoming a growing complex process itself. Innovation process is recognized as a complex process due to involving interactions among many players, including ones not acting in innovative fashion (public segment, city and state administration). In fact, increasingly, the real innovation dilemma is not only the emergence of new knowledge and ideas but also their feasibility in an environment surrounded by complexity of administrative and bureaucratic complexity and complicity (external factors) that suppress the idea of innovation of others in its own backyard. In fact, innovators and innovations in any aspect of social systems are forced to face, in the very process of transfer of knowledge, the very limits of public administration that suppress the very drive for change in any social system.

All too often, well-intentional efforts to solve pressing problems lead to policy resistance, where our policies are delayed, diluted, or defeated by the unforeseen reactions of other people or nature. Many times our best efforts to solve a problem actually make it worse [6; p.3]. Improved access to enormous quantities of data of all kinds is an inherent feature of the information society. But, many companies, especially small and medium-sized enterprises, those emerging in the transitional societies, are simply overwhelmed, and experience information overload. Having access to the right information at the right time is a key factor in a company's ability to integrate change successfully. Managing information overload, social acceptance of new technologies, environmental concerns, and the basic logistics of introducing change often pose a far greater challenge to businesses than the underlying technologies themselves.

Transitional countries should essentially be focused on building innovation support infrastructures such as science parks, and on the promotion of specific transfers of technology. They need to look more carefully at the global context in which innovations take place – at the management of the obstacles and risks imposed by external (administrative) or organizational (internal) factors. Bureaucratic

organizations, in general, which can both be public social institutions as well as private enterprises usually have lots of data and little knowledge. The key knowledge in a bureaucracy is in the systems and procedures used to process data and generate information. There is typically little innovation in bureaucracies. Entrepreneurial organizations, however, reward the spontaneous generation of new knowledge that adds value, and allow their members considerable freedom to innovate [7]. The main issue of transitional countries is still a costly, non-innovative and inefficient public administration that slows the progress of innovative organizations. Also, often income tax incentives in such countries do not provide for positive climate that will encourage people to invest in their own education and learning.

The acceleration of scientific progress, globalization, and the advent of the information society have all contributed to the growing complexity of our societies. Companies' ability to manage this complexity along with public sector that follows it will be a determining factor for future innovation capacity of any society as a whole.

Europe, not just European Union, should be viewed as a whole, systematically. An innovative and open Europe is a prerequisite for its overall long-term global competitiveness. Namely, the transitional, yet non-EU nations should not be left aside from EU (i.e. financial) support to boost innovation processes since the innovation, an event early in the history of the system will determine these nations' ultimate end state. Ultimate end-state may be disappointing if "the early history" (that is, today) is neglected and may thus have negative impacts once these countries are planned to enter European Union. Such uncoordinated action of Europe as a whole today may cause significant time delays and result in Europe slowly lagging behind competitive world markets (i.e., the U.S.A.).

But this goes beyond economic considerations. Technological development is essential for economic growth, but the innovative dynamics which is necessary to make it sustainable must also integrate considerations of social justice and environmental protection. Social awareness is what often lacks in transitional countries overwhelmed by bureaucracies and administration constraints that often work only in favor of interest of individuals indeed employed by public domain but who often act to promote their private speculative interests rather than public ones.

The responsibility exercised by enterprises (and other publicly/socially significant institutions) towards their employees, customers and partners, and towards society in their city or region, makes innovation acceptable. Thus a framework for sharing of knowledge can be created, not only on the scientific content of technology transfer, but also on its relationship with the socio-economic and environmental context. It seems clear that this helps all stakeholders to assume greater responsibility, contributing to the growth of a distinctive innovation culture in transitional countries.

There have always been inadequacies of prevailing ways of managing private and public sectors. Private companies have been building new types of organization – decentralized, nonhierarchical ones – dedicated to the well-being and growth of employees as well as success. Some had crafted radical corporate philosophies based on core values of freedom and responsibility. Others had developed innovative organization design. All shared a commitment and capacity to innovate that was lacking in the public sector. Why business is the focus of innovation in an open society? Business has a freedom to experiment missing in the public sector

and, often, in nonprofit organizations. It also has a clear “bottom line”, so that experiments can be evaluated, at least in principle, by objective criteria [1; p.15].

INNOVATION AND ECONOMIC EVOLUTION

The importance of sharing knowledge, and the need to find solutions based on cooperation and consensus, are becoming increasingly evident. The very concept of sustainable development and development itself in transitional countries, a key factor in the pursuit of long-term economic and social progress, is based on the principle of consensus building. Innovation’s success increasingly relies also on non-technological factors, and businesses are gradually acknowledging the benefits of integrating all the stakeholders in the innovation process. Small and medium-size companies, too, could benefit from greater awareness of the growing importance of social and environmental factors in ensuring long-term competitiveness.

The economy is an adaptive evolving system comprising of multiple agents diverse in abilities and capabilities, interacting, adapting, reacting and constantly modifying the patterns and structures that they help create. And they do so on the basis of sets of internal rules that are modified and refined in the process of interaction. It is believed that this approach offers the promise of new theoretical insights on economic processes, suggests new focus for empirical enquiry and also, new opportunities for the modelling of adaptive processes.

Therefore, first, it is imperative to stress that enterprise is the primary driver of modern capitalist trade economies. To treat enterprise seriously requires the tools and methods of an adaptive, evolutionary approach to economic growth. And, second, it is important to depict innovation as an emergent phenomenon that drives economic growth through positive feedback in which the focus is on the creation of patterns through interaction, with these patterns being created at different levels of interaction.

It is suggested that it is transformation that enables growth and that the process of economic transformation is an evolutionary process. This process is driven by behaviour of innovative agents (often employees aware of importance of learning and adaptive organization), process of selection that transforms diversity into pattern of change and process of development that generates and regenerates that behavioural variation. It is the manner of interdependence between these three elements that defines any particular process of economic transformation.

Economic transformation has qualitative and quantitative dimensions and the interaction between the two is central to the evolutionary endeavour. The qualitative dimension is closely connected with the process of innovation and is reflected in the introduction of novelties and the withdrawal of old economic activities. The quantitative dimension is inseparable from ongoing processes of structural change in the economy.

But evolution and adaptation cannot be reduced simply to a question of variation and selection. Process of development is significant as to have innovation in products and methods of production, and through the selection process, the continual change in the relative importance of the different activities. The link between transformation and growth then depends on whether better ways of satisfying economic needs increase in relative importance over time requiring dynamic monitoring of the process.

Novelty or more precisely the creation of novel economic activities plays a particularly prominent role. The primary dynamic element in economic transformation is the generation of new business conjectures, theories and models of profitable activity that are to be tested in the market place. It raises questions of how creative the product or service is, or, what properties does it have as an experimental (novel) system?

The institutional framework of the economy is extremely important in this approach. The institutions of the market are not given naturally. Markets are costly to establish and operate, they operate by sets of rules in relation to standards and conventions for doing business and they are regulated either by law or informal practice. Most markets reflect the interaction between public and private interest. The growth of knowledge depends on the interaction between organizations in the public and private domains that generate, store and communicate knowledge. These systems reflect the division of labour in the growth and application of knowledge between organizations and disciplines and, within these distributed processes of innovation, firms play the unique combinatorial role of gathering and bringing together multiple kinds of knowledge to practical effect. Competition is essential to this story in terms of the way that institutions are constructed and in terms of the innovation-growth dynamics. But, it is competition as a process of change not competition as a market structure that matters in the evolutionary viewpoint.

DIVERSITY, INNOVATION, COMPLEXITY AND ADAPTIVE STRATEGIES

Diversity is the integral to complexity. The innovation of complex technologies is normally accomplished by accessing or creating new knowledge, decoupling from existing knowledge, and/or reconfiguring knowledge. Innovation occurs in two ways, with the creation of new trajectories and through innovation along those trajectories. In most cases, commercial success comes with innovation along trajectories [8].

Over the past decade a new approach to science, called complexity, has been addressing various kinds of paradoxes in natural systems. What has been learned has useful implications and tools for businesses. The concepts that the scientists concern themselves with have a familiar ring in business: Adaptation, evolution and co-evolution, fitness, interactions of agents, the nature of environments, and the dynamic environment in which such systems adapt or die. We can extend the scientists' understanding of how natural adaptive systems function in comparison to businesses and their unique problems. In that sense our knowledge of adaptive and emergent phenomena in ecosystems is powerfully suggestive about how businesses function.

Concepts and universal principles of complex adaptive systems can be found in a large number of scales and areas of application. One of them is related to evolution and can be interpreted as "innovation" on different hierarchical levels both in natural as well as in artificial, and social systems. Complex systems can provide a general framework for exploring the phenomenon "innovation" and within which innovation in the more traditional sense can be embedded as one specific manifestation.

But that picture is also incomplete and can therefore be dangerously misleading. Businesses are more complex than "natural" systems because of their explicit social and financial goals. Those goals are embodied in ideas. Ideas represent the cognitive frameworks and provide the coherence that allows creative, independent people to

work toward common goals. The cognitive framework is the way to resolve the paradox of consistency and innovation. To manage and lead the business, one must understand that framework. When the framework is muddy, or interpreted in widely differing ways, the business is in trouble. And when a business is successful, it is so because a clear cognitive framework guides people as businesspersons.

Businesses both conduct day-to-day operations and adapt continuously guided by that unifying framework. Today's profits come from finely honed operations; tomorrow's profits will come from innovations. The purpose of business strategy is to fuel innovation (new ideas and new benefit from them), and by that definition strategy must be adaptive and dynamic. The major challenge facing a business today is to create organizational environments in which adaptive strategies can emerge. The spread of rumours and new ideas, the adoption of new technologies, and the growth of new products can all be viewed as "epidemics" spreading by positive feedback as those who have adopted the innovation "infect" those who have not. The concept of positive feedback as a driver of adoption and diffusion is very general and can be applied to many domain of social "contagion" [6; p.323].

In a very general way complex adaptive systems, both natural and social, can be characterized by their capability of evolving in terms of adapting to a changing environment. During evolutionary processes selection mechanisms favour those systems that have a higher rate of survival.

Strategies will emerge naturally in a "well tuned" organization. But how do we know if an organization is well tuned, and how can we tune it better? Our diagnostic processes are built around the relationships among fundamental four elements of any business cognitive framework, which comprise [9]:

- Abstract principles that define it,
- Models for implementing those principles,
- Temporary rules that enable predictable operations and
- Behaviour of the participants.

The achievements of strategic managers with long-established credibility and track records show that sustained strategic success comes neither from process alone, nor from simple checklists or isolated initiatives. Rather, it depends on a deep and thoughtful understanding of exactly how their firm functions, and interacts through time with the industry in which it operates. If strategy methods are to be of any value, then, they must help managers understand and steer this complex system into the future, with some indicators of scale and speed of progress [10].

Our diagnostic process point toward what is possible and effective for a particular company to do, that is, what its cognitive framework will permit and support. The goal of a diagnostic inquiry is to understand and align the company's operations and its fundamental principles. But rarely does a company frame its concerns at that relatively abstract level. Rather, it is likely to focus on patterns of sales, or difficulties with production or suppliers, or a slow pace of innovation, or whether to expand into a new market or to acquire another company.

For example, problems in operations, at the smallest or the largest scale, can almost always be traced to a misalignment among some of those four elements. Very often the problems stem from the way in which different people, or different parts of the organization, interpret the principles. The solution lies in understanding the broader

context, because it is almost always cognitive discrepancies that are at the heart of the perceived problem. This inquiry process is also effective in assessing the viability of new plans that a company is contemplating because it leads to a clear understanding and description of how new activities fit the company's fundamental mindset, or cognitive framework.

These inquiries enable companies to step back and look at themselves in a fresh way. The result is development, by the company, of new processes to provide a sharper cognitive focus and of processes to enhance adaptation of strategy to needs. The process is idiosyncratic for each company and cannot be done by formula. But once done, and once adaptive processes are established, the process for emergent corporate strategy can continue to provide benefits for a long time.

Although there are numerous questions that refer to complex systems, in the sense that a great many independent agents are interacting with each other in a great many ways, in every case, moreover, the very richness of these interactions allows the system as a whole to undergo spontaneous self-organization. Self-organizing complex systems are adaptive, in that they don't just passively respond to events. They actively try to turn whatever happens to their advantage [11; p.11]. Although there is no universally accepted definition of complexity, the following definition is offered by the Santa Fe Group: "Complexity refers to the condition of the universe, which is integrated and yet too rich and varied for us to understand in simple common mechanistic or linear ways. We can understand many parts of the universe in these ways but the larger and more intricately related phenomena can only be understood by principles and patterns – not in detail. Complexity deals with nature of emergence, innovation, learning and adaptation" [12].

Some authors argue that complexity theory has only a limited use as a paradigm against reductionist approaches and that it has a much richer potential as a comparable property and that it is unlikely to have any useful value if applied to "real" objects or systems. Furthermore, some may argue that complexity is usefully differentiated from the concepts of size, ignorance, variety, and minimum description length and order [13].

What sustains organizational continuity and what makes for creative change are central questions, and how we think about these matters is of major significance. It is this conviction that lies behind the desire to explore ways of thinking and complexity related to business systems and how they come to be what they are; that is, how they come to have the identities they have and what the role of managers is in that process. In other words, my key questions are as follows [14; p.6]:

1. What causes a company to take the form it takes and what causes the pattern of its evolution into the future?
2. Can that future be known and therefore predicted?
3. Can that future be chosen in a rational way?
4. Or, is the future under perpetual construction and hence unpredictable to a significant extent? If so, what are the processes of perpetual construction?

Understanding and managing complexity led to systems and matrix ways of thinking. It can be said that in the background of systems thinking lies the complexity itself which appeared as requisite when previous thinking ways were unsuccessful in explaining complex emergent phenomena in company as a whole and relations it has with its environment [15].

This way of thinking makes managers look for the causes that will produce the outcomes they need in order to succeed. It is also a way of thinking that focuses on design. Some thinkers in domain of judging causality suggest that interaction itself has the intrinsic capacity to yield coherent patterns of behaviour. They propose that the entities of which nature is composed interact locally with each other, in the absence of any blueprint, plan or program; and through that interaction they produce coherent patterns themselves.

But, interaction in nature takes place not primarily in order to survive but as the creative expression of identity. It is only when the interaction between entities has a critical degree of diversity, emerging as conflicting constrains on each other, that there arises the internal capacity for spontaneous novelty. In other words, creativity (innovation), and destruction, order and disorder are linked in the creative process. The process is self-referential in the sense that interaction causes patterns in it-self in a way that both sustain continuity in, and potentially transform, those patterns.

Intrinsic properties of connection, interaction and relationship between people would be the cause of emergent coherence and that emergent coherence would be unpredictable. That coherent pattern might be creative or it might be destructive but it would still be a coherent pattern that emerges. People would still be understood to be choosing and acting intentionally, but this would apply to particular, local responses to others in ordinary, everyday organizational life. It would be the interaction itself that has caused the emergent pattern, and plans and procedures would feature in these interactions without determining their pattern. Instead of people interacting selfishly with each other, instead of their organization interacting selfishly with each other simply in order to survive, they would be understood as interacting with each other for the sake of emerging identity and difference in the present living. In this paradigm, an organization comes to be what it is because of intrinsic capacity of human beings, individually and collectively, to express their identities and thereby their differences. Identity and difference emerge through self-organization; that is, relationship of a cooperative and competitive kind. What an organization becomes would be thought of as emerging from the relationships of its members rather than being determined simply by global choices of some individuals [14; pp.7-8].

EVOLUTION OF BUSINESS SYSTEMS FROM STATIC OR DYNAMIC TO ADAPTIVE

Static Organizations can be defined as those having a fixed practice, a fixed size. Like static equations, these organizations have no variables - time does not change them significantly. They persist until some new organization occupies their niche. Dynamic Organizations can be defined as those with fixed practices and variable size. Like dynamic equations, these organizations vary in size over time, even though their underlying practices do not change much. They go through a single life cycle, each growing rapidly as it occupies its niche, then declining as its competitors implement better practices that steal away its clients. Adaptive Organizations can be defined as those having variable practices and variable size. Like complex adaptive systems, these organizations vary their practices, seeking the constant improvement that launches life cycle after life cycle, creating new products, services, and processes that hold on to clients' generation after generation [16].

The capabilities and decisions rules of the agents in complex systems change over time. Evolution leads to selection and proliferation of some agents while others

become extinct. Adaptation also occurs as people learn from experience, especially as they learn new ways to achieve their goals in the face of obstacles [6; p.22]. A key question often asked in business organizations is how do we know if an organization is ready to change? There are several key variables that may have a significant effect on an organization's readiness and ability to change. The variables are as follows [9].

1. Stability – a system that has too much stability will be unable to change, it will need a certain amount of randomness.
2. Connectivity – a stable system can move towards the edge of chaos if its agents are better connected.
3. Diversity – this refers to the diversity in the agents themselves or the nature of the relationships between them.
4. Information Flow – if the amount of information transferred is increased the system moves towards the edge of chaos.
5. Level of contained anxiety – this is particularly relevant for human systems. The readiness for change and creativity are inhibited if the level of contained anxiety within an organization is too high.
6. Power differentials – if there is too much control due to power differentials within the organization, then change is unlikely to occur.

In response to changes in the environment an organization may undergo a process of self-organization so that it may cope with its environment in a better way. New properties (such as new ways of working, new roles and responsibilities) may emerge. Complex systems are said to self-organize onto an attractor. Attractor is a set of points toward which complicated time paths starting in its neighbourhood are attracted. In fact, attractor is used because the system's temporal evolution appears to be consistently "pulled" to identifiable mathematical points [17]. We know that we cannot dictate the attractor, but can organization influence the choice of attractor in some way?

Adaptive organizations will displace dynamic and static organizations in economic competition, so that within a generation, most people will have learned to expect continual improvement in their life experience. The fact that their ancestors once worked at the same job in the same way for an entire lifetime will seem almost as incredible as the fact that people used to stay at jobs they have not thoroughly enjoyed. But, how strong is the impact of the past times?

PATH-DEPENDENCY, RETURNS AND CHAOTICS

Path-dependency represents a pattern of behaviour in which small, random events early in the history of a system determine the ultimate end state, even when all end states are equally likely at the beginning. Path-dependence arises in systems whose dynamics are dominated by positive feedback. Path-dependence is a pattern of behaviour in which the ultimate equilibrium depends on the initial conditions and random shocks as the system evolves. In a path-dependent system, small, unpredictable events early in the history of the system can decisively determine its ultimate fate. Path-dependency can, therefore, be strongly influenced by ability to innovate successfully in an innovative-friendly environment thus providing for a strong driver early in the system's history.

The eventual state of a path-dependent system depends on the starting point and on small, unpredictable perturbations early in the history. Even when all paths are initially

equally attractive, the symmetry is broken down by microscopic noise and external perturbations. Positive feedback processes then amplify these small initial differences until they reach macroscopic significance. Once a dominant design or standard has emerged, the costs of switching become prohibitive, so the equilibrium is self-reinforcing: the system is locked in [6; pp.349-350]. Lock-in persists until an architectural shift of large external shock renders the dominant design obsolete. A wide range of positive feedbacks drives the growth of business systems. The evidence suggests that the profitability of individual firms and the evolutions of the economy as a whole is strongly influenced by these positive loops and exhibits path-dependent behaviour. Successful firms are able to strengthen several of the positive loops that can drive growth to create synergies that lead to cumulative success.

In positive feedback, also referred as reinforcing feedback and process, a small change builds on itself. These processes are defined as engines of growth. Innovation can be considered a small action, a “snowball” with more and more and still more of the same, resembling compounding interest. But, reinforcing (amplifying) processes can also have a character of “vicious cycles”, in which things start off badly and grow worse. If we are in a reinforcing feedback system, we need to be aware of how small actions (i.e. innovation) can grow into large consequences – for better or for worse. Seeing the system often allows us to influence how it works [1; p.81]. It is not intention the oversimplify the definition of positive feedback but rather to provide for an essential understanding of its terminology in context of understanding innovation as an initial step that can grow further into an positive outcome.

Business systems derive their systemic feature precisely from elements that are inter-locking, producing path-dependence. Path-dependence defines historical dependency namely taking one road often precludes taking others and determines where you end up [6; p.22]. Innovation can hardly provide for an initial action that would grow into large negative consequence, but wrong steps, less effective solutions and their social and environmental impacts are essential parts or concerns of every inner, self-organising innovation process. The point is how the system can recognise evolutionary mistakes and at what speed the system can correct them.

Conventional economic theory is built on the assumption of diminishing returns. Economic actions engender a negative feedback that leads to a predictable equilibrium for prices and market shares. Such feedback tends to stabilize the economy because any major changes will be offset by the very reactions they generate [18]. Such an agreeable picture often violates reality. In many parts of the economy, stabilizing forces appear not to operate. Instead, positive feedback magnifies the effects of small economic shifts; the economic models that describe effects differ vastly from the conventional ones. Diminishing returns imply a single equilibrium point for the economy, but positive feedback – increasing return – makes for many possible equilibrium points. There is no guarantee that the particular economic outcome selected from among the many alternatives will be the best one. Furthermore, once random economic events select a particular path, the choice may become locked-in regardless of the advantages of the alternative. If a product or a nation in a competitive marketplace gets ahead by “chance”, it tends to stay ahead and even increase its lead. Predictable, shared markets are no longer guaranteed.

Path-dependency in the economy is common because the growth of business systems and enterprises is driven by a host of positive feedbacks. These feedbacks involve scale economies, learning, network effects, market power, and many other

processes. The most successful companies are able to create synergy by using ensembles of the feedbacks to create a mutually consistent strategy. However, success with one set of these positive loops can lead to inertia and rigidity that prevent a firm that dominates in one regime from maintaining its dominance as the technical, economic, political, or social environment changes [6; p.406].

For a company as a complex adaptive business system, a condition of increasing returns means that bigger is better - it can produce goods at a lower average cost as its own output increases. Increasing returns can also be understood to occur when products become more valuable to each consumer as more consumers use the product. So, for example, in a network like the telephone system, the advantage of having a phone increases as more people get phones. For a given technology, the payoffs to a user may increase as the number of other users of that technology increases. It has been claimed that for typewriter keyboards, videotape recorders, microprocessors, or word processors, the advantage of using a particular design seems to increase with the number of users of that design.

The concept of path-dependency can be used to challenge the widespread view that the corporate governance systems of the major advanced economies are likely to converge towards the economically best system at a rapid pace [19].

The important thing besides studying path-dependent organizations and segmental technologies is to observe the actual living economy as a whole; it is path-dependent, complicated, evolving, open and organic. It is apparent that the economy and thus its business entities are locking themselves in to an unpredictable outcome. If the world can organize itself into many possible patterns, and if the pattern that it finally chooses is a historical accident, then: how can anything be predicted? [11; p.39].

It is essential that the path-dependency and hence increasing returns be understood as the features of the exponentially growing economic environment as a whole, however, predominantly as a derivate of innovation. Innovation may be defined as the “small” starting point or “small random event” early in the history of the system, the initial condition that provides for sustainable and path-dependent growth of business. This innovation in the later phase may grow to the stage of customer brand-dependence, in fact, their locking-in with the innovative product brand. This is a key fact that should seriously be considered in the emerging and developing markets such as the ones of transitional countries. But, how much chaos is linked with path dependency and complexity?

When we look at the changing world that we are living in, we can categorize the types of changes into a few fundamental categories: growth and recession, stagnation, cyclic behaviour and unpredictable, erratic fluctuations. All of these phenomena can be described with very well developed linear mathematical tools. Here linear means that the result of an action is always proportional to its cause: if we double our effort, the outcome will also double. Only recently do we have access to methods and compute power to make significant progress in the field of non-linear systems and understand, for example, seemingly simple things. One whole class of phenomena, which does not exist within the framework of linear theory, has become known under the word of chaos. This fact makes the role of humans and their attitudes crucial. The complexity and chaos theories do not tackle this, but the Dialectical Systems Theory does.

The Dialectical Systems Theory impacts the human attitudes in order to make the starting point of a work process oriented to creativity and cooperation rather than routinism [20, 21]. This starting point may be called subjective (as opposed to material) initial condition that influences future paths of business. However, one does not need to be confirmed evangelist of dialectical materialism to acknowledge that the economic well-being conditions most of our activities, including our intellectual endeavours, and is impacted by them. Usually, the economic well-being measures our actual progress. Following the post-Second World War boom, which lasted for some 30 years, nourished on sustained economic growth, en masse innovation and an information and population explosion, the world has been through nearly two decades of slowdown, stagnation, even regression here and there, amid widespread frustration and scaled-down expectations. The big issue is how to regain the lost momentum, how to get mankind moving forward again and, by the same token, ensure more equitable worldwide sharing of the fruits of expansion and social progress?

For things to improve all around, significantly and durably, it is not too difficult to point out a few prerequisites for success in material terms. Clearly, a first imperative is to produce more, and better-quality, goods while using fewer resources, by recasting some production processes and organisation. This is done by creative, innovation oriented people. The second basic condition is to increase the efficiency of management at both the macro- and microeconomic level, possibly inventing a new managerial culture that will lie upon ideology of systems thinking and approach to battle with the hitherto prevailing reductionism approach. Inasmuch as science and technology are changing more rapidly than ever, there is a pressing need to improve the tools and methods of technology forecasting to avoid costly failures. This, too, is done by creative, innovation driven people, and seen in economics as a material result. Of course, there is a lot of complexity and chaos on the way from the starting points to final results.

It is an interesting phenomenon that the degree of chaos in the environment itself can lead to adaptive changes. Deterministic chaotic dynamics can sometimes be actively used in strategies to simulate stochastic environments: Learning of patterns by neural networks can be accelerated using chaotic learning strategies. The performance of such a strategy can sometimes even be better than the stochastic strategy itself (simulated annealing) if the chaotic dynamics has been adapted to the intrinsic dynamics of the system using the concept of “dynamical key”. In the context of organizational learning strategies including a limited amount of chaos can reduce the degree of predictability for competitors.

CONCLUSIONS

Business is successful because of a clear cognitive framework that guides people as businesspersons. Today's profits come from finely honed operations; tomorrow's profits will come from innovations. The purpose of business strategy is to fuel innovation (new ideas resulting in new benefit), and by that definition strategy must be adaptive and dynamic. The major challenge facing businesses of transitional countries today is to create organizational environments in which adaptive strategies can emerge. Sustained strategic success does not come from process alone, nor from simple checklist or isolated initiatives; it depends on a deep and thoughtful understanding of exactly how their firm functions, and interacts through time with the industry in which it operates. Self-organizing complex systems are

adaptive; they don't just passively respond to events. Hence, complexity deals with nature of emergence, innovation, learning, and adaptation.

The aspect of innovation has a far wider role especially in transitional countries referring to both private and public segment. It means a new innovation culture should be naturalized in the entire social culture of these countries so that the innovation can be activated in the business system too.

A wide range of positive feedbacks drives the growth of business systems. The evidence suggests that the profitability of individual firms and the evolutions of the economy as a whole is strongly influenced by these positive loops and exhibits path-dependent behaviour. It is essential that the path-dependency and increasing returns, too, be understood as the features of the exponentially growing economic environment as a whole. However, predominantly as a derivative of innovation since the innovation may be defined as the "small" starting point or "small random event" early in the history of the system, the initial condition, that provides for sustainable and path-dependent growth of business.

REFERENCES

- [1] Senge, P.M.: *The Fifth Discipline: The Art & Practice of The Learning Organization*. Random House, London, 1990,
- [2] Gharajedaghi, J.: *Systems Thinking: Managing Chaos and Complexity: A Platform for Designing Business Architecture*. Butterworth Heinemann, Boston, 1999, p. 42,
- [3] Mayer-Kress, G.: *Complexity and Innovation*.
<http://www.santafe.edu/~gmk/Pubs/EOLSS>,
- [4] Holland, J.H.: *Emergence: From Chaos to Order*. Perseus Books, Cambridge, 1998, p. 244,
- [5] Montana, P.J. and Charnov, B.H.: *Management*. 3rd Edition. Barron's Educational Series Inc., Hauppauge, 2000, pp. 75-76,
- [6] Sterman, J.D.: *Business Dynamics: Systems Thinking and Modeling for a Complex World*. McGraw-Hill Higher Education, 2000,
- [7] Wood, R.: *Managing Complexity*. Economist Books, 2000, p. 119,
- [8] Kash, D. and Rycroft, R.: *Technology Policy in the 21st Century: How Will We Adapt to Complexity?* American Association for the Advancement of Science, Seattle Washington, 13-18 II., 1997,
- [9] Foss, J.N.: *Understanding Business Systems: An Essay on the Economics and Sociology of Economic Organization*.
<http://web.cbs.dk/departments/ivs/wp/wp97-6.pdf>,
- [10] Warren, K.: *Competitive Strategy Dynamics*. John Wiley & Sons, Baffins Lane, 2002, p. ix,
- [11] Waldrop, M.M.: *Complexity: The Emerging Science at the Edge of Order and Chaos*. Touchstone, New York, 1992,
- [12] Battram, A.: *Navigating Complexity: The Essential Guide to Complexity Theory in Business and Management*. The Industrial Society, London, 1998, p. 12,
- [13] Edmonds, B.: *What is Complexity? – The philosophy of complexity per se with application to some examples in evolution*.
http://bruce.edmonds.name/evolcomp/evolcomp_1.html,

- [14] Stacey, R.D., Griffin, D. and Shaw, P.: *Complexity and Management: Fad or Radical Challenge to Systems Thinking?*
Routledge – Taylor and Francis Group, London & New York, 2002,
- [15] Tintor, J.: *Poslovna analiza: Konceptcija, Metodologija, Metode*. In Croatian.
HIBIS, Zagreb, 2000, p. 4,
- [16] White, M.: *Three Organization Types: Evolving from Static and Dynamic to Adaptive*.
<http://www.gdrc.org/ngo/org-type.html>,
- [17] Kiel, L.D. and Elliott, E., eds.: *Chaos: Theory in The Social Sciences: Foundations and Applications*.
The University of Michigan Press, Michigan, 1996, pp. 26-27,
- [18] Arthur, B.W.: *Increasing Returns and Path Dependence in the Economy*.
The University of Michigan Press, Michigan, 2000, p. 1,
- [19] Schmidt, R.H. and Splinder, G.: *Path Dependence, Corporate Governance and Complementarity*.
International Finance 5(3), 311-333, 2002,
- [20] Mulej, M. and Zenko, Z.: *A Brief Insight into a Selection of Soft Systems Theories*.
Faculty of Economics – University of Zagreb, Zagreb, p. 586,
- [21] Mulej, M. and Zenko, Z.: *Information Management Aspect of Innovative Processes*.
Informing Science 2001 Conference, June 19-22, Krakow, Poland,
<http://ecommerce.lebow.drexel.edu/eli/abstracts/mulejSUMInfo.htm>.
-

KOMPLEKSNOST I INOVACIJE U POSLOVNIM SUSTAVIMA S NAGLASKOM NA ZEMLJE U TRANZICIJI

August Turina

Ekonomski fakultet – Sveučilište u Zagrebu,
Zagreb, Hrvatska

SAŽETAK

Ovaj rad predstavlja pristup konceptu inovacije i kompleksnosti s perspektive poslovnog analitičara te njihov utjecaj na putanju poslovnih sistema i organizacija kao cjeline. Zadatak ovog rada je katalizirati širu raspravu o inovacijskom segmentu koji je sam po sebi kompleksan te naglasiti njegovu važnost za poduzeće u sve kompleksnijem okruženju. Tvrdi se da bi inovacija trebala biti ključni poticaj poduzeća i ostalih društvenih sistema s obzirom na njena obilježja ovisnosti o putanji i pozitivne povratne veze koji potiču brzi rast. Inovacija nije ograničena samo na poduzeće te ju treba sagledati i u odnosu na ostale društvene (javne) sisteme kojima često nedostaje inovativnog pristupa. Može se reći da inovacija posjeduje pojavna (emergenta) obilježja poput ostalih događaja koja se javljaju u društvenim sistemima a koji utječu na promjenu takvog sistema odnosno njegovu adaptaciju. Inovacija određuje ovisnost o putanji takvih sistema upravo stoga što se ona smatra događajem koji je emergentan rano u povijesti samog sistema te utječe na njegovo konačno stanje. Stoga je razumijevanje, upravljanje te prihvaćanje inovacije i njena važnost ključna za prepoznavanje kompleksnih procesa stvaranja putanje, ovisnosti i pojavnosti sila koji vode društvene sisteme. Promatrano pak s aspekta tranzicijskih zemalja, to je važno upravo radi adekvatne prosudbe buduće stabilnosti njihovih društvenih entiteta koji teže razvoju i prepoznatljivim promjenama.

KLJUČNE RIJEČI

kompleksnost, inovacija, poslovni sustav, ovisnost o putu, povratna veza