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## **Complexity and Orthodox Economics**

### **Abstract**

Economic paradigm is complex by nature and empirical and theoretical evidence indicate that complexity in economics have increased with the progress in technology and movement of economy through time. The era of information and communication technology has added to the complexity of economic system in a way that simple systems cannot explain economic phenomena any longer. This important issue will be analyzed from the two distinct outlook of reductionism and holism. The dichotomy between the orthodox economics and complex economic theories will be described. Finally, the importance of knowledge and innovation in today's economic system and the work of evolutionary theorists such as, Hayek, Schumpeter, Luhmann, and Clark will be discussed.

### **Introduction**

Complexity has evolved in various fields of scientific knowledge, including mathematics, physics, and biology. It has been advanced in both natural and social science throughout the 20<sup>th</sup> century by several movements with an interdisciplinary approach, including general systems theory, cybernetics, catastrophe theory, chaos and synergetic by scientists such as Rosser (1999). The common view at that time was that natural and social systems have common structures and they can be subject to the same law (Suwailem, 2011). With this analysis, economic paradigm is complex by nature and therefore, analyzing it through a simple system such as classical economics is not appropriate. Empirical and theoretical evidence indicate that complexity in economics have increased

with the progress in technology and movement of economy through time. Thus, the uprising of information and communication technology (ICT) and the aftermath which brought the world together through the inter-connectivity of global economic system has added to the complexity of economic system. The structure of economy has changed from less complex to super complex after the advent of digital industry since mid-1990s and has revolutionized economic structure in all aspects such as: Production, consumption, trade, banking, and role of government, so on, and so forth.

Due to the revolutionary uprising of new technology in the digital industry and growth of international economic systems, the mainstream or traditional economics that adheres to simple systems proved to lack the analytical capacity to handle structural economic changes. On the contrary, it is empirically proved that alternative theoretical approach through the lens of complexity in economic systems, are more capable of solving this problem in a more realistic way. There is little doubt among economists that simple systems cannot explain economic phenomena any more. Subsequently, it is essential that the evolutionary behavior of current complex economic systems be understood and to be considered in the future economic theories. All these have made the role of economists much harder to understand the complexity of the economic system in the new era and move along the theories to match with reality. In this article, I will first explain the two outlooks of reductionism and holism that differentiate all economic theories. Then, I will describe the dichotomy between the traditional or orthodox economics and complex economic theories. Finally, I will describe the importance of knowledge and innovation in today's economic system and the work of

evolutionary theorists such as, Hayek, Schumpeter, Luhmann, and Clark will be discussed.

### **Theoretical Background**

Clark (1990) defined simple systems as a mechanical metaphor with a system like a machine that existed independent of the observer and can be described in terms of deterministic sets of mathematical formulas. With this definition, simple systems are closed systems, isolated, and state-determined. Therefore, the property of determinacy which manifest itself in all closed systems make it possible that the system to be explained as a linear function. Somerhoff has defined the feature of determinacy as a single-valued function of the initial state (Somerhoff, as cited in Clark, 1990). Therefore, in a closed and isolated system such as a market, the system will reach to an equilibrium price and quantity. Historically, the reason for dominance of determinism over economic theories has been the powerful influence of classical physics, specifically the Newtonian cosmology that influenced the science arena since early seventeenth century. Newton viewed the world as units knotted together that would interact due to external pressure. Newtonian mindset and its deterministic mechanistic outlook provided a lens that traditional economists have attempted to explain economic phenomena for years.

On the contrary, complex systems are considered as open systems and are qualitatively different from simple systems. Since complex system are open systems, they share the following features: They adapt to the environmental pressures through feedback, they are hierarchical, they are relatively instable, and they are creative. Clark (1990) in explaining the complex systems replaced the mechanical metaphor with the biological organism which interacts with the environment constantly for both survival and growth.

Since the traditional and mechanistic view of static economy has been repeatedly rejected by empirical evidence, economists have paid much attention to the economics as a complex concept and much research has been done on complexity. These studies indicate that contrary to the traditional perception, the economy is a dynamic phenomenon with capability of being innovative and adaptive to the external pressure as well as being constantly in disequilibrium (Suwailem, 2011). Also, due to the fact that the complex systems metaphor is inductive by nature, it gives an opportunity to economists to analyze economic paradigm with respect to social phenomena and avoid deductive reasoning.

### **Reductionism and Holism**

Economy composed of individuals with heterogeneous needs and preferences, the whole arguments among different economic theorists lie on how they distinguish between the individual interest and the general interest. A general differentiation among economists stem from the two outlooks: Reductionist approach and holistic approach. In reductionist outlook the entity and its components manifest the same properties. On the contrary, in holistic perspective, the entity that is a result of interaction between its parts, manifest completely different features from its constituent components. As an example, Friedman and Lucas's view on the economy was based on reductionist approach and Smith and Hayek had the characteristics of holism.

In economic history the reductionist approach manifest itself in a laissez faire policy prescription; that indicates if individuals follow their interests, the society as a whole will also benefit. Therefore in laissez faire policy, there is no macro prescription for solving economic problems. On the other hand, in the holistic approach, problems are considered as a whole and the prescription to solve economic problems is with the

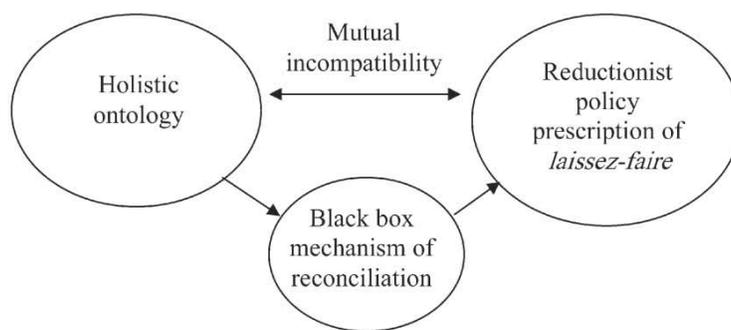
intervention and policies imposed on the economy. Adam Smith tried to reconcile the holistic view with a reductionist policy perspective through the invention of a concept, called a black box. Adam Smith called for divinity to resolve the problem of dichotomy between holism and reductionism (as cited in Denis, 2004). According to Denis, the fundamental rhetorical strategy that would distinguish economists is based on how they resolve the conflict of interest between individuals and the common interest. In other words, how they handle the interaction of microeconomic with macroeconomic.

On the reductionist analysis, a sack of grain as a whole is just the sum of units at lower units and therefore, the properties and behavior of a unit, for example, the whole sack can then be understood in terms of the qualities of the lower-level elements, for example, one grain. In other words, according to reductionists qualities of a phenomenon will be reduced to its constituent parts (Denis, 2004). On the contrary, some economists such as Minsky focused on interrelations between elements and the fact that whole cannot be explained by its constituent elements. For example, the fact that billions of brain cells work separately, this would not explain how the brain works as a whole (Minsky, as cited in Denis, 2004). The holistic reasoning indicate that whole is greater than the sum of its components (Hofstadter, as cited in Denis, 2004)

As a practical matter, the concept of unemployment could be interpreted differently using one of two approaches. In a holistic approach, unemployment is a macro concept and is not a fault by individual workers, whereas, in a reductionist approach, it is regarded as individual agent that decided not to work and preferred leisure to work. Lucas, for example saw unemployment as 'voluntary' and based on choice. Therefore, a connection here can be seen between laissez-faire principle and interpretation of unemployment. Moreover, if unemployment

is an individual matter, no macro-level prescription is needed to solve it. There is a famous phrase by neo- classical economists that they promoted the idea of (PIP) or ‘policy ineffectiveness proposition. On the other side of the spectrum, economists like Keynes stand for a complete holistic view. Keynes’s position to laissez-faire was that the self-seeking behavior of individuals that has unintended consequences might result in undesirable social outcome for the society as a whole. Therefore, it might be necessary to take corrective action in society as a whole to mitigate those outcomes (as cited in Denis, 2004).

It has always been an issue among economists that how they interpreted macro, micro and the relation amongst them. Whereas microeconomics analyzes economic elements on the basis of parts taken in isolation, macroeconomics study the economy as a system as a whole (Denis, 2004). Toynbee differentiates between society which is the total network of relations between human beings and the crowd which is a palpable collection of people (as cited in Denis, 2004). Some economists relied on a holistic view to solve the problem of laissez-faire and they proposed a resolution as a black box. Adam Smith has left the responsibility to divinity (as cited in Dennis 2004, p.351).



“Figure1: “There is a tension between a holistic ontology, which might be expected to lead to interventionism and the reductionist policy prescription of laissez-faire (Dennis 2004, p.351).

Hayek, on the other hand, attempted to resolve this contradiction by proposing an evolutionary theory which he explained in the evolution of institutions. Theory of evolution by Hayek rests on his theory of group selection which was based on social outcomes and not on individuals' behaviors for his selection. He named this natural selection of rules and the theory of evolution that ensures that individuals only select the decisions that reconcile individual interests with group interests. However, according to laissez fair principles, individuals will choose those rules of conduct that serve best their interest. Therefore, unless we can prove that individuals interest are in line with group maximization profit, we cannot assume that individuals' actions are the best selection as Hayek proposed. Hayek's analogy which was referred to as the survival of the successful suggests that evolution is the outcome of more effective practices (Hayek, as cited in Denis, 2004).

### **Economy as a Social System**

Luhmann defined the concept of a system as objects that would maintain the difference between themselves and their environment. Concurrently, he stated that the most important feature of being social is communication and since the economy is a subsystem of a social system then, communications within the economic system is the payment. The important point in Luhmann's theory is that individuals are not considered as the basis for the system's reproduction process, but it is the communication within individuals that is important in forming a social system. Thus, he viewed the economic system as an autonomous social system that is ruled by its own logic and observes, describes, and regulates itself, as well as, responds and adapts to its complex

environment. Hence, evolutionary economics has a holistic approach and views the economy as an autonomous complex system (as cited in Boldrev, 2013).

According to this view, money acts as a means of communication in economy and payments that are produced by the system are an ontological basis for the economic system. Price system that is a sign and a means for delivery of information acts as a self-description of a complex economic system that allows economic agents to obtain information. Market is a mirror that would reflect the firms and their competitors' activities. Then, he concluded that individuals are not rational but the system as a whole is stable and rational. Therefore, it is not the microeconomy that is the foundation of macroeconomy, but the other way round (as cited in Boldrev, 2013).

### **Neo-Classical Economics and Complex Systems**

Neoclassical economics see the world as convex and complex economics view the world as non-convex (Suwailem (2011). Suwailem, on the basis of that assumption suggested that a convex set does not generate novelty, because novelty occurs when combination of two items produce some outcome with properties that none of the components possesses in isolation. For this reason, innovation which has empirically proved to be the main reason for economic growth is absent from neo-classical economics. The same reasoning applies to the concept of entrepreneurship where the firm in neo- classical economics replicates precisely its previous decisions. Henceforth, innovation, creativity and entrepreneurship is absent from neo-classical philosophy and on the contrary, complex economics views the world as dynamic, creative, and constantly novel (Holland, as cited in Suwailem, 2011).

Moreover, the problem with convexity is that it excludes increasing returns to scale and according to neo-classists, economy is subject to decreasing return to scale. This feature of neoclassical economics is inconsistent with one of the most established economic facts of modern times and that is specialization and division of labor. Division of labor that improves productivity and comparative advantage which is the base of international trade have been instrumental for the industrial advancement in the West and production growth in the world. With specialization and division of labor and by using the principle of increasing return to scale, production at the end line is larger than the middle. This is the outcome that can be obtained through the feature of novelty and complexity and novelty and is excluded by convexity in neo- classical paradigm. Furthermore in the era of new economy or knowledge economy, knowledge and information is subject to increasing returns to scale (Romer, Stiglitz, as cited in Suwailem, 2011). However, in neo- classical view there is decreasing return to scale due to ignoring the element of knowledge in their model. In complex systems in which there is non-convexity, however demand and supply functions become discontinued and discontinuities may cause crashes of markets and sudden freeze up of liquidity, as happened in the recent global financial crisis (Baily et al., as cited in Suwailem, 2011). In the era of digital industry innovation creates demand and the network structure creates self-perpetuating effects which is excluded from neo- classical philosophy.

One of the most important parts of any economic theory is choice theory and choice theory can be path dependent, or path independent. In case of path dependent choice, the outcome depends on initial conditions. For example, in neo- classical philosophy choice is based solely on economic factors such as price and income and

other factors that are incorporated into the market. However, in reality with the inclusion of increasing returns to scale and the positive feedback mechanisms as well as the past events and initial conditions the outcome is different and the history matters. Moreover, the feature of indivisibility is not because of physical barriers, but it is due to the fact that the quality of an object changes dramatically when it is divided into its parts.

On the contrary, complexity postulates a non-convex world and the two important features that manifest a complex system are self-organization and emergence. Self-organization order or spontaneous order is the result of interaction between large numbers of units in a system; that is, it is a global order arising from local interactions and it is a decentralized order. A good example of this is when a flock of birds moving together in an ordered manner, they do not have leaders and they are self-organized into flocks through local interactions only.

Emergence occurs when a system is able to perform functions or solve problems that individual parts cannot achieve separately; the typical example in this case is ant colonies. In order for emergence to happen, whole should be greater than the sum and as a self-organized system, whole has to represent qualities that independent parts do not possess. These two terms, self-organization and emergence are also features manifest in complex systems. Whereas, self-organization depends on positive feedback mechanisms, emergence brings about novelty out of the system. However, none of these qualities exists in neo-classical models.

In a complex world choices are hard to select and in many cases problems are unsolvable by individuals and they are solved by inter-relationship between individuals. On the contrary, in neo-classical perspective, the world is quite simple and individuals have ability to read market signals and then decide on choices. As Axel Leijonhufvud

pointed out, neo classists assume “incredibly smart people in unbelievably simple situations, but in reality we find believably simple people with incredibly complex situations” (as cited in Suwailem, 2011, p. 486).

### **Orthodox versus Heterodox Economics**

Clark (1990) made a distinction between the conventional economics and modern economics that looks at the world with the lens of complexity. He proposed that traditional economic is static, it does not pay attention to knowledge, and it looks at the technological change as a productivity tool. As an example, neo- classists assume the rational behavior that abolishes the change through time. These features limit the scope of thoughts, encourage the deductive reasoning, ignore creative thinking, and make policy options for the real world limited.

This mechanical metaphor has been challenged by a number of economists and the reason for its failure has been explained. Marshall, the German Historical School, and the early institutionalists was among the economists who challenged this view. Hodgson pointed out that orthodox economics was mainly concerned with the analysis of allocation of resource, consumer choices, and production function (as cited in Clark, 1990). On the contrary, Clark stated that the complex perspective represents a different view in analyzing economic system and does not follow the deterministic equilibrium paths. Furthermore, he proposed that complex systems behave like natural organisms, their behavior is subject to a dynamic economic system, and it is ruled by the motivation of survival and growth under the condition of a competitive market. As a result, developing the theories along these lines have given more flexibility to economists to deal with the problems of conventional

economic theory that are more in line with the results of empirical research and policy applications.

Potts who shared, the 2000 Joseph A. Schumpeter Nobel Prize, in economics for his book “The New Evolutionary Microeconomics” acclaimed that the key difference between orthodox and heterodox economics is that the former looks at the economy with the simplicity and beauty of mathematics, the latter looks at the economy with complexity outlook (Pott, as cited in Earl and Wakeley, 2010). On the basis of orthodox analysis of economy, focus is on the individuals and the fact that they act in isolation in a way that consumer does not interact with anyone, but the trading partner. On the contrary in institutional or heterodox economy, choices are socially determined, as Galbraith pointed out in his “New Industrial State that major corporations might pursue different choices in response to social attitudes (Galbraith, as cited in Earl and Wakeley, 2010).

Behavioral economists concentrated on the role of society in demand function. The role of demand has been noted in the areas of fashion and visible consumption for sometimes now. It has further been argued that in the modern world of rapid technological change and product novelty, consumers’ preferences are decided by social networks (Earl and Potts, as cited in Earl and Wakeley, 2010). Other economists such as Alfred Marshall noted the importance of enduring connections in the demand function. He proposed the principles of a connectionist vision of the determination of market share in contrast with the focus of orthodox economists that were concentrating on the type of market, Marshall’s analysis concentrated on the need for any supplier in such markets to

build up customer goodwill and grow a reliable clientele (Marshall, as cited in Earl and Wakeley, 2010).

As far as the process of production is concerned, the orthodox economist's view is substitution in terms of continuous production functions and no limits to combining workers to get the optimal mix of workers and outputs. By contrast, heterodox economists see the barriers to connections that is caused by rules that specify jobs as bundles of tasks for which workers with particular skills are required. Therefore in heterodox economies, economy is complex and not all connections are apparent and the nature of connections as opposed to the orthodox approach has to be studied. However, in orthodox economics connections are assumed to be complete and there is no further scope to form new connections and change the structure of the economy from within' (Schumpeter, as cited in Earl and Wakeley, 2010).

### **Growth, Complexity, and Evolutionary Theory**

Economists have challenged for many decades to offer a proper theory of growth that is capable of addressing the historical record of output that is recorded and constructed as time series. The growth theories date back to the 1950s and particularly to the work of Robert Solow for which he was awarded a Nobel Prize. Before that many economists realized that the neoclassical economic principles could not provide a viable base for building economic growth theories (as cited in Foster, 2011). Marshall himself did not offer a viable theory of economic growth except to say that it should be based on some kind of evolutionary thinking.

The historians of economic growth verified growth through time series data and suggested that economic growth has been achieved by the increase of invention,

entrepreneurship, technological and organizational innovation, as well as education, and training. In this process the determining force were considered to be business organizations and entrepreneurs which could be both the facilitator and the hindrance to economic growth (Foster, 2011). The neo-Schumpeterian theory of economic growth was the first inclusive modern theory of growth based on evolutionary hypotheses. Schumpeter, the pioneer in the matter of innovation made a relationship of between profit motivation of entrepreneurs and novelty creative ideas. He stated that entrepreneurs are encouraged to innovate if they benefit from a high margin that temporarily results from a monopoly position. This innovative initiative is rewarded with benefits of monopolistic position for entrepreneurs up to and until the moment when the generic form of the product is allowed to build. In a sense a wave of change is created and then, spread across all levels of the economic activity (Ciote, 2012).

According to the classical view, the principle of laissez-faire makes the selection in the competitive market that is based on the natural mechanism of selection from Darwin's theory. Then, this leads to an efficient allocation of resources in the economy, because the less profitable firms would have to leave the marketplace and the more profitable ones survive and continue with production. According to Ciote (2012) the innovation process affects economic growth through four channels: Invention, innovation, diffusion and imitation. Inventions and innovations create novelty and diffusion and imitation propel the economic development and have the greatest effects on economic growth.

With the same token, Schumpeter defined the complexity and chaos theory as the process of diffusion and imitation when, under certain set of conditions, a novelty is

added to the system. This, under the influence of various factors, leads to major changes, for example a soaring increase in investment and hiring for firms who imitated the novelty and losses for those who did not adapt to the new situation. Moreover, Schumpeter referred to business cycles as “disruptions in the normal flow of activities” and considered non-linear theories for analyzing business cycles. Schumpeter put the entrepreneur at the center of this process of change, because according to him, entrepreneurs are the ones with means and power either to grow the economy or to ruin it. On the contrary, Christopher Freeman and some other economists that followed Schumpeter expanded his idea from microeconomic level to a macroeconomic. These groups of economic researchers led by Christopher Freeman formed the basis for the Neo-Schumpeterian evolutionary outlook. Neo-Schumpeterian economists had a heterodox view and simultaneously followed the evolutionary approach to economic theory and focused on innovation as a proper tool for measuring qualitative changes within an economy (as cited in Ciote, 2012).

Schumpeter’s outlook that influenced and generated decades of economic theories is based on innovation as a drive of economic growth. At the outset, his theory started from the idea that structural changes in society is created by novelties at every level. Then, he developed a comprehensive economic model in which he redefined the concepts as well as he noted the importance of interactions between individuals and he analyzed the process of adaptation to a novelty. The joint efforts of group of economists that call themselves evolutionists have resulted in a whole theory of change or novelty in economies. In fact, the essence of economics dynamics was laid on human’s ability to

continuously generate and adapts new ideas in the long term (Schumpeter, as cited in Ciote, 2012).

This new paradigm, that viewed the economy as an evolutionary phenomenon allowed economists to reorganize the scientific elements of economy at the macroeconomic level and as such gave them the opportunity to provide solutions for new technical economic problems. The evolutionary economics adopted the dynamic analysis and the interpretation of biological concepts. Therefore, it was opposed to the standard economic outlook regarding static equilibrium and put forward the ideas such as a live organism and a living and moving force concepts which were suitable with complexity theory (Ciote, 2012). Then, the Schumpeter's ideas was adopted by many economists and resulted in new theories amongst which the most well-known is Neo-Schumpeterian ideology. This view, based on the idea of innovation from Schumpeter, created a paradigm which is anchored around creation of novelties.

Neo-Schumpeterian economics which is also called 'evolutionary economics' or complexity economics is elaborated on the problem of change and development, enterprise life-cycle theory, and systems theory. Neo-Schumpeterian perspective defined the economy as a process that is grounded by industry, finance, and public sector. Neo-Schumpeterian approach belonged to the heterodox school that concentrated on qualitative changes in the economy that is brought about by innovations such as: electronic technology, the development of internet, and expansion of knowledge. Therefore, business firms have to adopt new inventions if they want to survive, in fact, the era of price competition is replaced by the era of innovation.

Thus, it is apparent that while conventional theories are not creative due to being deterministic, complex systems can evolve through time. Also, in complex theories, information is infused through different agents and causes behavioral change. In respect with the technological change and the process of economic growth, economic concepts will move towards macro and aggregation and therefore, towards more complex systems. However, Clark (1990) proposed that economists, even the evolutionists, have great difficulty in separating themselves from determinism. Nevertheless, the empirical studies on innovation indicated that growth and movement of economy through time fits well with the organic view. In regard with equilibrium, complex analysis does not go well with equilibrium.

Moreover, information that nurtures technology and knowledge are important in growth and the overall health of economy. This is because, much of the decision making in firms is determined by the technological capacity and the information needed to acquire it, rather than access to economic resources. Besides, technological growth comes out of curiosity and creativity and thus, in mechanical metaphor, which acts like a machine, actors cannot function creatively and cannot be a good choice for explaining technological change. The complex systems, on the contrary, constructs models as an inductive, interactive exercise which enables the analyst to engage with a constantly evolving world. There is a difference between scientific and deterministic and the innovative act which is a creative act can only be evolved when circumstances allow creativity to happen (Clark, 1990).

Clark (1990) stated that historically, it takes time and a lot of struggle through time to make an innovation. In addition, knowledge creates innovation, thus, institutions by investing in research and development (R&D) play a vital part in technological

development. In this case, innovation becomes organized and would guide the institutions towards future direction of novelties. Moreover, there is an argument that in order for the economy to move over time and to make progress old style institutions should be replaced with new ones. In a sense, it is true that technological innovation usually requires institutional innovation (Prez, as cited in Clark, 1990).

Nevertheless, evolutionary economics has focused mainly on supply side analysis posited at the firm or industry level and therefore, it is difficult to relate their hypotheses, both analytically and empirically, with macroeconomics. The contention in growth theories is based on the dichotomy between macro and micro economy. Growth is a macro phenomenon, but most economists that offered growth theories have analyzed it in terms of micro-economics. For example, the neo-Schumpeterian, Nelson and Winter offered a growth theory that is based on microeconomics and is built at the firm level (as cited in Foster, 2011). Also, both Schumpeter and evolutionary theorists build their theories on the basis of micro level. Nevertheless, all economists believe that it is difficult to conduct economic analysis such as growth with macroeconomic concepts, on the basis of micro hypotheses (Foster, 2011).

There is also a new discussion that initiated the idea of micro-meso-macro' approach to economic evolution and it is presupposed that this new approach would resolve this dichotomy by offering an analytical framework in which macroeconomic models can be built upon meso foundations, not micro-foundations (Foster, 2011). Given the widespread failure of mainstream macroeconomists to offer warnings of the recent global crisis or any innovative prescriptions to deal with it, the further development of evolutionary macroeconomic analysis would seem to be very necessary. It is necessary to

focus on the process of economic growth and its fluctuations or economic cycles.

Besides, it is a matter of fact that the economic systems and its components are complex adaptive systems and, as such, they have an energetic character that must be dealt with explicitly, particularly if environmental interactions are to be understood.

### **Discussion**

Economic structure has changed a lot since mid- nineteenth century. It started from industrial revolution and the mass production and finally into the most astonishing occurrence of the last decade of the 20<sup>th</sup> century in the USA, technological revolution in information technology. Each mode of production has generated its own underpinning economic paradigm. Classical, neo-classical or what is named as mainstream economics or orthodox economics has had its era, starting from David Ricardo to Adam Smith, Alfred Marshal, so on, and so forth. Orthodox economics that was based on deterministic view of Newton and his followers was very simple and clear cut theory that was generated by science of physics. Thus, in order to apply it to economic phenomena which is by nature a complex and multi- dimensional concept, they had to cut the reality by a lot of pre-suppositions and assumptions to fit that simple theory into reality. On the contrary, since economics is a complex concept by nature, the theories that are based on complexities can better explain and analyze economic matters and propose prescriptions.

The innovation of computer chips in the 1970s that resulted in the internet boom of 1990s has turned into an innovative machine generator by producing almost daily innovations in computer processing power, software technology, multimedia technology, wireless communications, and above all in the internet technology. The extreme information technology innovations have changed the structure of economy in

all aspects. With respect to production, the structure has changed in a way that there is no diminishing return any longer, but there is infinite increasing return to scale, or decreasing cost to scale up to the price of zero for unit cost with the increase in units of production; in other words, the cost curve is not convex anymore.

Therefore, economy has become more complex in this technology driven economy. Firms have to change their structure and adapt the new technology if they are going to survive in this economy. The entrance of new and young innovators by the use of internet has accelerated the growth of the innovative capability in the economy. Globally, cost of international transactions have been reduced, internet brought closeness to people, and the geographical distance has been dissipated. Geographical and cultural differences does not matter anymore and it seems that the world has become united. The internet has changed the way people and corporations live and do business.

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