

Revising and Improving National Innovation System of Countries

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Abstract – Advanced and successful countries have founded their economies aimed at competition in intensive technological and scientific sectors by creating, revising and permanently improving national innovation systems. An innovation system is a network of economical factors, whose activities and interactions provide new products, new processes and new forms of organization for economical usage. The key factors in this network include organizations, universities and research centers, government and other supportive institutes such as industrial associations, consumer groups, business supporting organizations and financial administrations. Continuous interaction among these agents besides creation of instructional opportunities makes us to reach the conclusion that it is important to have capability of understanding, mastering and deploying new technologies along with applying a framework for innovation.

Keywords – National Innovation; Innovation levels; economical policies; Growth of innovation.

1. Introduction

Management plays a significant role in constructing innovation in a way that it encourages all personnel to participate in this process, which leads to consistency of organizational values through motivating and notifying them. The tools for this purpose are establishing specialized teams and groups, implementing suitable instructional programs, arranging the awarding system, introducing efficient employees and so on. Long-term and stable successes require deployment of various innovations in the organizational hierarchy in a way that a chain of successive innovations emerges in the organization. The management is supposed to establish such an organization that simultaneously pursues minor innovations as well as unprecedented and revolutionary initiatives (fifth level).

Result of final test on innovation can be assessed by level of welcoming in consumption market. Small and progressive innovations can be implemented under the same current structure but revolutionary innovations need to be accompanied with organizational transformation. Accomplishment of innovation requires a systematic treatment in a way that innovations turn into norms. Managers will have effective role in creating and implementing appropriate innovation by: having familiarity with technology cycle and merging it with scientific principles- fundamental and radical renovation in organizational structure – having an open and wide attitude towards opportunities – employing and benefitting from creative and innovative persons who deploy their capacities in viable and client-driven environments- appropriate comprehension of innovation selection process, etc.

2. Innovation Levels

According to studies by the Russian researcher, Genich Altshuller, “Innovation levels vary in different organizations and are divided in five categories as follows (this categorization shall be taken into account in revising and improving national innovation system):

2.1. Level-1, Innovations:

Include those innovations which cause slight improvements via presenting a specified solution out of several selected options in systems with no identity changes. Normally, a certain feature of system is revised or improved in this level of innovation (for example double-walling of building windows for better thermal insulation). Studies show that 32% of innovations are positioned in this level.

2.2. Level-2, Innovations:

This level of innovations suggests minor improvements through achieving a technological field; the solutions in this level are obtained after hundreds times of trial and error (such as hydraulic-making of the steering wheel of automobiles). The studies show that 45% of innovations belong to this level.

2.3. Level-3, Innovations:

The contradictions of system are resolved by introducing some completely novel elements in this level of innovation. Usually, the technologies of other resources are used for this type of innovation (like making the automobiles hydro-static and eliminating differential and gearbox from car system). The research results indicate that 18% of innovations are in this level.

2.4. Level-4, innovations:

In this level of innovation, problems in the field of technology (instead of science) are solved in a manner

that the solutions of the respective technology are beyond the ordinary patterns, and, absolutely different approaches are followed for achieving them. In other words, the physical effects and phenomena, about which there had been less knowledge before, are used in level 4 of innovation (like using ultrasonic waves for cleaning surfaces, which is an extraordinary method).

2.5. Level-5 innovations:

This level of innovation is beyond the boundaries of contemporary knowledge, and, new phenomenon is discovered therein. In order to attain this level, tens of thousands of ideas are required (such as discovery of laser waves and manufacturing of transistors that in turn have led to generation of new industries). The research results show that only 1 percent of innovations belong to this level.

3. Necessity for reinforcing innovative activities in industry sector

In societies with widespread poverty, the governments are obliged to control prices and this situation affects government's general policies in industry sector. The governments take some indirect measures in developing countries to help industries, mainly aimed at providing infrastructures and expanding the education. For instance, establishing steel industries is supported by government despite being usually unprofitable. However, when budget deficit is encountered, the government does not take such infrastructural actions or carry them out only in limited scale. This declining trend will ultimately leave its impact on industry, and industrial sector will be damaged as well.

Some part of lags in technical texture of industries usually originates from this problem. It must be noted that the foundation of society's industrialization is based on two plans; the first mechanism pertains to how to acquire knowledge and science, and the second mechanism is associated with how to transfer knowledge and science. Although all human societies have had knowledge and sciences by themselves but the two aforementioned mechanisms are important for industrialization of societies. In other statement, industrial and non-industrial cultures have each a specific and different condition in terms of these two mechanisms. The mechanism of knowledge and science acquisition is slow and prolonged in non-industrial culture and these targets are acquired through trial and error (experientially). Knowledge transfer in such societies is also via teacher-and-pupil mechanism, which is again very slow, prolonged and time-consuming. In industrial world, science and knowledge proceed through controlled experiments and library studies and nobody seeks for trial and error in its traditional sense. Regarding education, teacher-and-pupil style is not the fundamental mechanism but instead the education system goes ahead via pre-codified programs. A society will possess a cultural industry if it reaches to the belief that novel mechanisms shall be employed in its scientific-industrial activities. As

an example, appointing non-specialized individuals (merely because they are very good people) to managerial positions of some industrial sectors is a non-industrial culture even if they gradually learn the management skills. One might be compelled to appoint such person to a managerial position for some reasons but this selection proves the fact that we are not still living in an industrial society and industrial culture is not currently governing in our society.

In non-industrial culture, education is not existent in its modern sense. Research investments is more considered as luxurious and pretentious acts, researches and studies are expected to have rapid and instantaneous achievements, wastage of human force is very high in the forms of immigration of specialists and experts to abroad (brain drain) or staying and dissipation of their abilities. Today, we require innovative thinkers in the society. Such people are key players of society's industrial transformations and their number is very limited. Out of a one-million generation who start education since childhood, only few perfectly trained, skilled and innovative forces would remain after passing procedures in elementary and secondary schools, high-school, university and factory. In fact, one generation is lost by missing these individuals. As a result, the impacts are revealed in industries, facing the society with difficulties. This issue is thoroughly perceived in industrial culture and such resource dissipation is not easily permitted.

Economical development essentially signifies transformation of non-industrial culture into industrial culture and this requires the government to fully pay attention to research and educational system. Major economical problems will not be solvable unless researches and innovations are institutionalized in the educational system of country. However, some problems could be solved through short term plans, and for instance, some commodities can be temporarily imported to the country but principal problems and pitfalls will not be resolved as long as such circumstance is prevailing, unless the time when industrial culture dominates the society and everybody realizes that the society shall move in the direction of having a developmental culture. Thus, fundamental studies should be primarily conducted along with making suitable cultural grounds in order to conduct substantial and proper planning for reaching to economical development. The experience of global economical development is indicative of the fact that industrial culture and industrial development have not been realized in any country without governmental support. No society has developed without effective endorsement of government. Only form of support differs in different societies.

If industries of undeveloped countries are not supported, all demands will be attracted to products of developed countries because all people seek for purchasing better and cheaper goods. In developing countries, there would be no demand for the products since the available technologies often fail to enable suitable production due to low quality level and higher

cost of commodities. Foreign goods are imported to the country under such circumstances, and if all required amount cannot be supplied from imports, the government will resort to domestic industry to produce the remaining demand at lower qualities. Also, in the latter case, the grounds are provided for further dependence of country's economy; this dependence includes both foreign exchange and raw material requirements.

Of course, it is vivid that governmental support shall be accompanied with terms and conditions. In other words, the government has to take steps in a direction that provides the conditions for industrial transformation regarding technology and human force so that certain industries can become independent economically. And also, the government should not allow the industries and production structure to deteriorate in an unreasonable competition. It means that many of these industrial units will shut down and change their businesses to other trades if not supported by government. This support shall continue to the extent that levels of society's science, technology and industrial culture are modified. Yet, the economy shall not be left alone unless the time that such developments are achieved. Technological advance currently is so greatly remarkable that countries like Japan are not thinking of constructing factories anymore, but instead, are planning to export "thoughts and ideas". They intend to pass the work in factories to robots or labor forces from other countries where the needed scientific and technical developments have not yet been achieved. They are looking for the goal to deal more with intellectual activities and export their thoughts and ideas. However, the issues are different in developing world. In these countries, if a factory can be inaugurated, the involved people will celebrate because they have been able to create jobs. Therefore, if the government does not support domestic production, it will not be possible for the industry to flourish in the country. And as long as this process resumes, it will be very unlikely to make investment in industries because every rational man would prefer selling parts instead of investing in production of parts. Accordingly, reaching to these supports requires transformation in government's macro-policies.

4. Main duties for reinforcing innovation in industries

The objective of this section is to investigate duties that can reinforce innovation in industries. All economies are able to overcome structural problems (including high inflation rate, unemployment, reliance on single-product exports, dependence of budget structure and governmental revenues on non-renewable resources, etc) and also take steps for enhancing competitive strength in the realm of domestic and international economy on the other hand. The main duties that can strengthen innovation in industries are listed below:

4.1 Increasing research and development activities

Research and development activities in any country are the essential factor for growth and reinforcement of innovation, bringing about quality improvement, reduction in production costs, and diversity of commodities and services. In other word, promotion of research and development activities (domestic and foreign) and ultimately increase in the number of registered patents in country leads to enhancement of innovation, and as a result, improvement of economical growth. Consequently, considerable progress in innovations of industries and ultimately high economical growth could be attained by concentrating on research and development.

4.2. High social capital creates a suitable environment for innovation

S.AKCOMAK & W.BASTER in a research evaluated mutual effects of social capital, innovation and growth of per-capita income in European Union countries. The empirical result of this study is suggestive of a direct relationship between social capital and innovation in 102 regions of 14 European countries. This research has focused on differences of social investment in different regions and concludes that increase in social capital leads to a suitable environment for innovation because innovation is a risky and dangerous sort of activity.

4.3. Increase in domestic patents leads to improvement of innovation

C.H.YANG (2006) in his paper entitled "is innovation the story of Taiwan economical growth?" proves that increase in registered domestic patents leads to improvement of innovation in economical growth. However, importing and learning from foreign technologies and then localizing them might result in lower levels of innovation.

4.4. Investment for proportional reinforcement of components of national innovation system:

In a research, GHAHREMAN ABDOLI (2007) investigated role of each component of national system of innovations and inventions; he proposed necessary solutions for promoting productivity. Using an economy-scaling model, it was shown that economical growth (growth of per-capita product) is proportional to increase in production of inventions i.e. economical growth of countries is strongly influenced by growth of their national innovation systems.

4.5. Growth and development of innovation requires a systematic attitude

The theoretical model proposed in 2007 introduces the grounds for creating, developing and finally exploiting from an idea in an economical system, as well as, the major effective factors for constructing and publishing innovation and also interactions of these factors with each other. This theoretical pattern is founded on one of the most important features of innovation, i.e. its systematic characteristic. The analytical model illustrated in the

current research provides a suitable framework for designing science and technology policies in a country. This model shows that innovation is not formed in a linear process but is the result of numerous feedbacks and interactions occurring in different economical activities as well as various scientific areas. It is demonstrated in the analytical framework that no innovation is independent of other innovations happened in different fields. The analytical model presented in the current research introduces a convenient framework for designing science and technology policies in the country. It asserts that those science and technology policies which cause reinforcement of connections of national innovation system are more suitable for the country so that competitive strength of national economy can be promoted. In other words, ultimate goal of science and technology policies is encouraging innovations in any country and applying them in economical activities. In fact, performance of firms in a free economy is not merely resulting from the strategies taken by their managers but also largely affected by other economical agents including government and producing institutes of science and technology; therefore, these agents shall be coordinated for improvement and spurring of innovation.

4.6. Legal support and protection from creativities leads to further innovations

According to Robert Solo's theory, invention is the engine of economical growth in any country. For having growth, number of novel ideas shall increase in the length of time. On the other hand, in many cases technology is formed on the basis of a new idea or invention. It is worth noting that every new invention generates a right by its emergence. Patent is an exclusive right that inventor of a device or industrial method possess with respect to a certain item. This right never existed before and its existence requires making innovation in instruments, process or new application method that can be used in industry in its general sense. Thus, development and progress of society take place in the shadow of novel ideas and innovation of inventors, which must be obligatorily supported by law. In other word, human's welfare and progress depend upon creative capacity of people in technological and cultural fields, and legal supports and protections from creativities will encourage further investments leading to innovations. Differently speaking, patent is an advantage that government or a certain organization in a country bestows to innovators and inventors (for creating a novel innovation which is economically significant). Patent generally incorporates production and/or processes which include technical aspects or innovative performances. Patent actually grants the innovators with any kind of economical and financial exploitation from their innovation for a certain period of time and disallows others to have possession right to it (Reza, TAJABADI, 2006).

4.7. Reforming educational system in schools and universities

Establishment of a civilized organization and also promotion of organizational civilization level needs a

comprehensive view in the fields of education and human force development. In other words, organizational learning culture forms a part of infrastructure and foundations of organizational civilization. Yet, it must be noted that educational systems which are formed in a subjective space and far from real requirements of society will have merely instructional identity and will not remarkably influence establishment of innovations. In advanced countries, there are tight relations between research, education and production; educational units are in fact reflection and consequence of studies of researchers. Thus, identity of educational systems must be research-based so as to provide the context for novel innovations.

4.8. Encouraging submission of scientific papers in accredited international journals and conferences

Number of scientific papers submitted and presented in accredited international gatherings and journals is regarded as a yardstick for measuring science production of countries. Science production means novel thoughts and ideas that following theoretical and practical studies lead to publication of papers in accredited world's journals, patent registration and/or documentation and reference. It can be therefore stated that science production and publication of scientific papers is a disciplined activity which results in promotion of human's knowledge. A scientific theory, and consequently, an innovation will be obtained through answering to the questions posed in a research.

4.9. Encouragement and Propaganda in society for further benefiting from computer and internet

Computers can be very effective for advancing works because of high speed in data and information analysis, conduction of complicated and voluminous calculations and also due to saving time and expenses. It must be remembered that innovation signifies presenting a new and innovative product that can be either in software form (such as variety of services like educational and official services, etc.) or hardware form (such as industrial commodities, food products and so on). From another aspect, internet might be also considered as a medium for receiving news and information, etc. Therefore, it is concluded that further usage of computer and internet can help improvement of innovation environment and technological advance in all fields.

4.10. Enforcing thought-out policies for lowering the price of new production agents (innovation, information and communication technologies, etc.)

Taking rash monetary, foreign exchange and commercial policies cause deflection of relative price of older agents (like capital and foreign exchange) and also damages the new production agents (innovation, information and communication technologies) as compared to developed countries and thriving economies. This prevents from

creation of relative acquired advantage with the intention of having a knowledge-based economy. Therefore, it seems that the governments should cause deflection in relative prices of some factors (such as labor force, physical capital, human capital, innovation, research and development and management) by enforcing certain policies. In this way, economical activists are encouraged to move from resource-based and capital-based economy toward a knowledge-based economy. In other words, economical policies of government should be orientated in the direction of lowering the price of new production agents compared to older ones so that the demand for agents of innovation, human capital and information-communication technology increases.

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