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Research And Development (R&D) For Technological Policy

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Abstract: The most important concept of the economy engages in Research and development (R&D) because of R&D expenditure is designed to locate new or improved products and to reduce the manufacturing cost of the industry. At the same time, industrial structure determines the process of the R&D in the economy. This relationship was introduced by Schumpeter in 1950. This concept and indeed most of the theoretical investigations in recent years on the economic and technological changes have contributed to new economic trends. We called this "Positive economics". In this Paper we explain this concept of R&D, according to economic theory and technological policy, and importance of the technology policy.

Keywords: R&D, Knowledge Production, Technological Policy, Challengers. Practice of Technological policy.

1. Introduction

The literature on R&D and technological innovations in industrial organization concepts were introduced by Schumpeter (1934,1950), and Arrow (1962). Also, Tirole (1998), and Scotchmer (2005) explained the social value of innovation in the industry. The importance of the Monopoly power for innovation and implications of the nonrival nature of an idea are explained in Romer (1990,1993). Most of the industrial organization literature illustrate the importance of innovation and technological progress in the economy. For example, Scotchmer (2005) discussed this concept and recently it was criticized by Boldrin and Levine (2007). This technological innovation and R&D idea were developed by Reiganum (1981,1985), Aghion and Howitt (1992, 1998). Chamberlin (1933) is the classic reference on monopolistic competition. The so-called Dixit Stiglitz model is developed in Dixit and Stiglitz (1977) and in Spence (1976). This model was the first to be used for an analysis of the R&D in Dasgupta and Stiglitz (1980). An Excellent exposition of this model is provided in Matsuyama (1995), and Tirole (1988). They discussed the production innovation, the technological industrial policy, and implications according to this model. Another dimension of this innovation and R&D is the stimulation of innovation and the size of the economy, which was introduced by Schmooker (1966). Recent evidence is illustrated by Newell, and Stavinns (1999), Popp (2002), Finkelstein (2004), and Linn (2004).But this paper explains what preceded the current burst of activity in this field. There are three forces that were seen to determine the nature and the extent of R&D effects in an economic growth as well as the value of the information for the development policy. This degree of capabilities of R&D and its benefits were introduced to the economy by Arrow (1962). While the extent of the market or the market expansion was presented by Schomooker (1996), Rosenberg (1976) introduced the innovation opportunities.

2. Knowledge Production

First of these is that there is an incomplete appropriability in the world which results in an asymmetric information condition. This in turn causes a market failure. Therefore, it is a problem for the actions of the economic agents, namely, the actions of the government. But this can be resolved through the knowledge and information generated by R&D, which can be combined with the pure public goods. This was one of the important concepts in Arrow's classic 1962 article. Another important benefit of information/knowledge is the production of information or more broadly, production of knowledge, which is a key concept in the economic and technology policies. Reducing risk and increasing the technology is combined with information or knowledge in the economy. Therefore, the actions of the government are a more important, complicated, and an advance task in the economy. Recently, Dasgupta and Stiglitz (1980) illustrated the reasons for public policy to be much complicated in the information field. It was noted that one reason was that the R&D benefits depended on the technological opportunities. This technological condition is combined with several other structures, industries, patent laws, maintaining secrecy etc. Therefore, policy in the field of technology becomes more complicated. Research is directed towards the accumulation of knowledge. Therefore, research is destined to yield information to the investigator. Generally, research involves reducing uncertainty. But research also involves the expenditure of resources. Therefore, not all information is effective every time. But this does not mean research is not significant in gathering information, because we have planned it in a significant way. How have we planned this? When one conditions an experiment or research, one does not know in advance what the outcomes will be. But usually one can catalogue the various possible outcomes and assume the most important outcomes. One can assess in advance the implications that would follow from each such possible outcome. Moreover, one knows in advance what the actions are in each possible outcome. Then we can maximize the expected net benefit in each outcome. Thus, we need to analyze the cost of the experiment and the expected net benefit of the experiment itself. Finally, there are many possible experiments or researches to choose among. One now chooses that which deliver the maximum expected net benefits. However, recently Joel Mokyr (2017) published interesting book called "The Gifts of Athena Historical Origins of the Knowledge Economy" this book explains the development of the connection between knowledge and the exploitation of natural regularities and resources is the stuff of the history of technology. This book illustrates one of important relationships between propositional knowledge (Ω),prescriptive knowledge (ʎ), and feasible techniques in

knowledge theory. He collaborates to propositional knowledge and prescriptive knowledge using the techniques and explain this theory. This distinction differs in important respects from the standard distinctions between science and technology that have produced a vast literature but has increasingly come under scrutiny. Let we identifier these valuable concepts using the comparison analyze.

Table 1: *propositional knowledge* (Ω) *Vs prescriptive knowledge* (ʎ)

propositional knowledge (Ω)	prescriptive knowledge (ʎ)
• (Ω) is the discovery. it is a piece of knowledge and at least one person knows this knowledge in society. • propositional knowledge has two forms one is the observation, classification, measurement, and cataloguing of natural phenomena. The other is the establishment of regularities, principles, and "natural laws" • (Ω) can be correct or wrong it depended on the beliefs of the society. until they respect the knowledge it is stabilize in the knowledge theory. • propositional knowledge is historical knowledge as a reason Moker (2017) said it is Cultural Knowledge • (Ω) can be transmitted on the social organization of knowledge, storage technology, and IT (Information Technology) • propositional knowledge is collective knowledge for the innovations , (ʎ)	• The instructions in the(ʎ),like all knowledge, reside either in people's brains or in storage devices. they use this storage or knowledge to produce innovations, these innovations or production knowledge called prescriptive knowledge. • (ʎ), set of society would be regarded as an "invention". • prescriptive knowledge can be used at any point in time. How society "selects" some techniques and rejects others is an important question. • prescriptive knowledge is stored in people's minds or in external memory. External memory takes the form of technical manuals and e decoded by the user and carried out effectively. • Simply, , (ʎ) means that, meaningfully distinguish within a single individual knowledge of a set of parameters about a problem and an environment from a set of instructions derived from this knowledge that directs an individual to take a certain action.

According to the Mokyr (2017), He illustrates most important bridge of the between propositional knowledge and prescriptive knowledge is techniques. He explains this relationship using the simple model. It is represented by Figure (1)

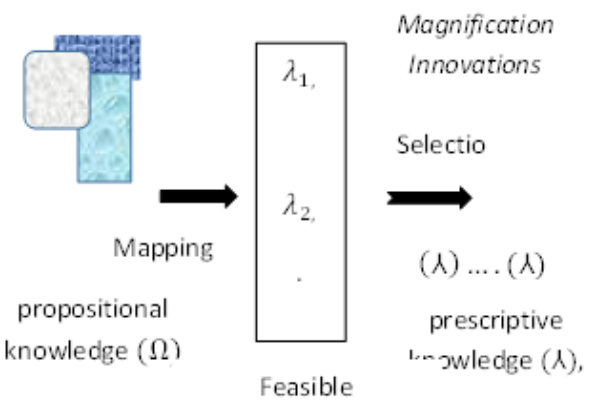

Figure (1): Propositional and Prescriptive Knowledge

Source: *Joel Mokyr (2017)*

Figure (1) shows that the basic setup of the model: The Propositional knowledge "maps" is a set of information determines that what this economy can do. These set of feasible selected techniques denote magnificent Prescriptive Knowledge for the economy. The set Propositional knowledge mapping and Prescriptive Knowledge selecting process are results of the quality projects of the research and development (R&D). Simply these technics are dependent on the R&D. Therefore, he mentioned union of all the techniques known to members of society. Because of that a piece of knowledge. It depends on the effectiveness of justification, the extent to which rhetorical conventions accepted in a society persuade people that something is "true," "demonstrated," or at least "tested.", Finlay society respects this knowledge and as a reason " technology will follow automatically". For this, using the R&D and Education push, we need to generate these techniques. simply this tetchiness depended on the policies .in the next sections we explain this policy process is detailed.

3. R&D and Knowledge policy for Social Organizations

This section explains the concept of the economic policy of the technology policy. Personally, I believe that even though science policy and technology policy are two different policies, technology policy explains the combination between science policy and technological innovation. Firstly, science resides in the abstract plane of ideas, while technology is grounded on the development of production and manufacturing process. Secondly, we discuss how the characteristics of the research output affects the types of information or knowledge, the manufacturing process, and production growth. Information is a commodity, but it is not an individual homogeneous commodity, because policy makers use information to solve novel and diverse problems in the economy at different times. Therefore, information generates several types of benefits in different fields and it affects the different policy makers in these respected fields. Thus, this research generates inputs and knowledge (literature) for the benefit of future researchers and this is one of the positive externalities of base research. This is more significant for different applied research in the future. Today, most of the research is conducted not only in

universities but also in the industries, business organizations, and different markets. Paul David (1986) mentioned that policy makers must consider the significant role of science and technology inside the broad Social Organizations in the world. Because of science and technology, Social Organizations (SO) are generating much information not only on an induvial level but also in a larger societal level. Therefore, Dasgupta and David (1986) explain the importance of the research field within SO. A social organization is different from other companies. It views knowledge as a public consumption good, while technology regards it as a private good. An important advantage of SO is that scientists and researchers deliver all new findings for the other members in the community. Therefore, this new knowledge is distributed to even the poor groups of the society. As a result, SOs generate a relationship between science (full disclosure) and technology (secrecy). This relationship works all over the society and provides a number of technological benefits for the economy.

3.1 Priority rule (Science Discovery)

Motivating research concepts, policy makers use the Priority rule option. It serves two purposes. First, it establishes a context for the scientific discoveries. According to this concept, a scientist is rewarded not for his effect nor his good intentions but for his achievement. Moreover, this concept appreciates the impact of the findings and makes the prizes valuable to the achievement. There are no "runners up" awards here. The winner takes all. Second purpose of the rule of priority is governing public disclosure of new findings, which means this process creates a privately-owned asset, a form of intellectual property from the very act, providing the researcher the executive position of the new knowledge. Simply, the rule of priority is a form of reward, or payment to scientists. But the main criticisms of this concept is that the benefits of that additions to knowledge, which may or may not have met the test of being additions to knowledge, is depended on the willingness to pay for the scientists engaged in the research. Therefore, this knowledge is not Priority of discovery.

3.2 Secrecy Provide (Technological Discovery)

Secrecy means capturing rent for new findings. It connects technological findings with the right to exclusive use of discovery or Knowledge through the patent system, undertaking to solve the problem of financing the pursuit of scientists. That is publicity disclosed knowledge. This patent system is both interesting and problematic because it shows a connection of the scientific and technological discovery that generates new information or knowledge. But this also has criticisms; the scientists must bear the cost of the process until the discovery. They are able to cover the cost of all the expenses only after the invention/discovery. Because of that there may be little effort to prevent them from making the same discovery later and sharing the rent. Therefore, these are much expensive conditions for the instructors and the economic agents in the economy. Also, if the scientists do not get a considerable price for their discovery, they can withhold the knowledge. For this all reasons Dasgupta and David (1986) explained that technological policy of economics results in imbalances of the science policy but benefits of the technological policy are much more important and contain a higher value for the future scientific discovery.

4. The challengers of the R&D policy

There are at least five interrelated questions in the economics of science and R&D policy that generate difficulties for researchers.

I. What is the research problem of the agenda?
II. How many and what kind of the research projects are there?
III. How resources are to be allocated to the research project?
IV. Who is conducting the research?
V. Who ought to have the final owner of the research outcome?

Let's find out the answers for these questions,

I. Research problem

This is the major problem in the R&D field. Experiments give a number of occasional undiscovered possibilities or problems for the researcher, but we do not know which one is worth investing or not. Therefore, we use decision theory where we conclude the all possible problem outcomes and write down the mutually exclusive events. This is called the revision process. Then we find out the best result or problem outcome for the research. But this research must generate public stability and technological and scientific innovation for the world.

II. How may and what kind of the research project?

We already explained the role of the sciences and SO. Because of that SO continually provides the public services for the screening the research workers. Undoubtedly, better information provides better research outcomes and best researchers for the world. What kind of a research project is suitable for the work? There are two types of project structures in the world. The first one is Public choice of project, which means the output of this research must give a solution to a problem in the community. Thus, we need to use the theory of the social cost benefit analysis to identify the benefits of the research outcomes. Moreover, in choosing a research project, one is choosing the probability distribution of the net benefit. Therefore, these are related to equation 1 and 3. Social cost benefit analysis of the investment in this project also has been found to be useful in problems as we discussed it in the beginning of this section. The second one is the private choice of project. This is also one side of explaining the public choice project. But here, the researcher discovers the behaviors of the private market, patents of the innovations, and social surplus of the discoveries on an individual level (market vices, institution vices, or personal vices)

III. How resources are to be allocated to the research project?

The feasibility of the research or projects are probabilistically indented of one another. Dasgupta and Stiglitz (1980), and Eric Masking (1986) illustrated R&D investment process for the technological policy. The research products or outcomes provide different kinds of benefits generated by the R&D and are faced with the portfolio problem with the investment. The portfolio problem is different from the real investment problem because portfolio problem involves with the society. Therefore, as we noted above, we need to choose the best outcome counts for the given product or benefits of the projects.

IV and V

This is a problem of the "asymmetric information". This addresses the question, who is the best person for the research work? Some people are better at one field of academics than others. Other people are better at some other disciplines. A person knows his own capabilities. Generally, these abilities will differ from his potential employers' knowledge of his abilities. But he will not necessarily know more. Self-dissection can easily fail. Therefore, the role of a good teacher is to support his talent and in order to achieve this, most of the universities have a responsibility to conduct trainings that consists of tests and that are designed to screen potential researchers. Therefore, adamic institutions have a strong responsibility for securing the quality of the researchers and projects in the economy.

5. Technological policy for the economic policy

Technological policy must be seen as a part of the economic policy. Economic policy can be illustrated as actions of wealth creation, productivity growth in long run, national income growth, consumption growth etc. Technological policy can be illustrated as the actions consisting of those actions in economic policy, especially concerned with ensuring firm customers and government. Moreover, technological policy improves the opportunities of a government. For example, the government has access to appropriate and new technology at the lowest possible cost, forecasting and encouraging invention and innovations, and it can adapt to technology related advance economic advantages. Another important benefit of technological policy is healthcare development in the economy. The success of the technological policy must be judged not only on how fair these intermediate objectives are achieved but also on how to translate this objective into output and productivity growth.

5.1 Practice of technology policy

This section examines the practice of the technological policy in the world

5.1.1 Sources of technology,

Technological policy should be concerned with the use and exploitation of technology as well as with its sources. Keith Pavitt (1989) introduced the principle sources of technology. He illustrated four types of technological sources inside the industry or firms. There are several implications of technology policy in the way in which firms develop technology forms and customize them. Firstly, activities such as R&D and production technology should be the factor of the policy not simply because R&D is the source of innovations. Secondly, the whole process highlights the importance of diffusion of products and the process innovation, and of the transfer of technology. Thirdly this technological knowledge is transferred between firms or universities or research establishment firms. Fourthly, this technological knowledge reminds the policy makers their role in the economy.

5.1.2 Production use of technology,

This means that the technology policy should connects itself with the size of the firms, small, medium and large, across the full range of production industry. Production technology should not just connect itself only or even primarily with the production of technology. It is also concerned with the physical capital and human capital. Finally, policy makers expect quality production end of this production technology process both domestically and internationally.

a. Technological fields,

Here, we discuss applied research in the technological policy. This includes the technological working fields in the technological policy, for example, innovation field, production field, wealth creation field, inputs or capital industry etc. Therefore, technological policy is a much advance policy in the economy.

b. The International dimension,

International dimension is a more valuable concept in the technology policy. It works in several technological fields such as R&D, knowledge arguments, and patents of the innovations. This dimension connects the advance industrial countries together. Simultaneously, it makes inclinational free movement. But it has some difficulties such as cost of movement, property right, language, distance, secrecy etc. Therefore, this intranational dimension is also a piratical concept in the technology policy. In this section we explained what appear to be some of the basic concepts and issues in the economics of technological policy, and especially we discussed research and production information policy in the technological policy. We also illustrated practices of the technological policy. Next, we use dome empirical evidence to explain this condition in cross countries.

c. Technological collaboration,

An important concept of the technological policy is the engagement with the collaboration between domestic firms and foreign companies or firms. As a result, it provides a a number of benefits to the domestic firms. Collaborating between similar domestic firms and the foreign companies or industries transfer a number of short -term and long-term benefits through fulfilling the lack of pooled knowledge and the number of research technology in to the domestic economy. Specially, this is the best budget technology approach can apply in the current world.

d. Technological policy and Science policy.

There are several fields of the government policy that do not have wealth creating as their prime objective and are not generally in the technological policy. We now like to consider how science policy, improves the advantages of the knowledge policy impact in the economy through technology policy. The science policy is closely integrated with the health policy, the environment protection policy and the technological policy. When a successful technological policy is implemented effectively, it generates numerous benefits for the economic policy and for the economy. Therefore, policy makers have a responsibility to choose the correct and significant policy instrument, and they must use this in an appropriate way in the economy. In the next section we can see the implementation and empirical situation in these policies in the world.

6. Conclusion

In conclusion of this paper, we tried to summaries what appears to me to be the basic issues in the R&D and technological policy. I stated the informational role of the R&D policy and significant benefits and costs of this role. I

also explained the value of public policy and SO in the society. Then, I explained the role of technological and science policy along with implementations, policy instruments. However, the academic history proves the significance of the technology for the economic growth and development. This descriptive research also proves this significant relationship again. Also, this work provides knowledge to policymakers to identify the important areas in the technological policy. Finally, this work theoretically and empirically proves the importance of the R&D with technology.

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