

Alternative Innovation? The National Innovation System of Nordic Countries

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In April 2015 when I was invited to visit the University of Tampere in Finland, I paid a visit to a creation center in a new factory, where there was a project called “Demola”. Founded in 2008, it was a student entrepreneurial network dedicated bridge the imagination of the students and the development of enterprises through project design, so that they can provide the companies with a variety of complementary or alternative solutions to problems. This innovative incubator nurtures various brilliant and imaginative ideas. I have learned that each year 450 students are working in teams for 100 projects, of which 40% are international students. 80% of the project results are adopted by partner companies and 15% of the students are hired by partner companies.

This is not a new story. In Northern Europe, industry, academy and research collaboration as well as creativity cooperation have become a social habit and mentality. The social and economic development of Nordic countries shines with exceptionally creative ideas, from simple and fun games, such as "angry bird", to home design, waste disposal, environmental management, and renewable energy. In terms of the innovation ability, varied metrics produce different results. But no matter how the rankings were done, the Nordic area today is by all means a vibrant player in global innovation. So how did the Nordic countries, especially Denmark, Sweden, Norway and Finland, managed to emerge as a region with strong creativity and competitiveness in the past half a century? What has been nurturing and supporting its innovation? Contemporary social scientists are fascinated by the root cause and driving force of the Nordic innovation system, as much as by the welfare and political system of the land. In cases such as the Demola, there may be clues to the mystery – for instance, cross-border cooperation, flat organizational structure, equal and inclusive culture gene and so on. However, no single factor can fully explain the Nordic innovation capability. Their innovative ability and economic competitiveness are shaped by their natural resource endowments, certain economic and industrial policies, education system, social welfare system, the size of the

country and relevant historical, cultural, and geographical factors.

According to Schumpeter, “innovation” is an activity combining new factors and conditions of production and introducing them into the production systems. The practice of “innovation” is illustrated at all technical, economic and social levels. In the economic and social development process, the transferring of creative inspiration and ideas into the market and social products depends on the creative allocation of various factors and resources, as well as on the operations of the “knowledge and value chain” of and delivery. And all these cannot be accomplished without the so-called “innovation system” – group policy tools, organizational systems and norms. This paper does not go beyond to systematically introduce and analyze the national innovation systems and influencing factors of the Nordic countries. However, one still can outline some key institutional features, particularly the nationally promoted research councils and major funding agencies, which have systematically driven the national innovation.

Government intervention and system choice can define and highlight the most creative departments in a country's economic and social development. Historically, most of the Nordic countries have built their pillar industries in the economy by national industrial policy and R & D investment. For instance, Sweden, though missing the first industrial revolution, had in early 20th century, seized the opportunity of the second industrial revolution based on the use of electricity and oil, fostering ABB and Ericsson and other competitive actors across the world. From the 1930s to the 1970s, it was the golden age of the so-called “Swedish model” form. Its essence was the cooperation and partnership among large enterprises, trade unions and the national government.

In this “critical point”, it has become a social and political consensus to boost the economic growth and to meet the needs of social welfare through the R & D investment of the public and private sectors. Thus large enterprises and knowledge sectors (universities) grew vigorously, which together became the backbone of the Swedish innovation system. In 1940, Sweden for the first time set up a “Technical Research Council” (TFR), replaced by “Technical Development Council” (STU) in 1968. In order to better promote the combination of technology and industry, and to effectively promote the large-scale enterprises to participate in

national technological innovation projects, the "National Board for Industrial and Technical Development" (NUTEK) was established in 1991. It has adopted major projects like "Capability Centers Program" to operate academia-university-research exchange network and to create interdisciplinary research environment with concentrated resources, in a bid to attract the companies to take an active and persistent role for the long-term benefits. In 1995, Sweden established 28 Capability Centers in eight universities, covering four major R & D areas including energy, transportation and environment, production and production technique, biotechnology and biomedical technology, and information technology. Capability Centers consist of the government, universities and companies. The enterprises invest more resources than the government. And large-scale companies like Volvo and Ericsson were all involved in the cooperation of the centers.

Since the 1970s, this public-private partnership and "picking winners" strategy have been challenged by neo-liberalism and the development of the internal EU market, but relying on company-level innovation and university research and development, they have, in fact, been further growing. In 2001, the "Swedish National Innovation Agency" (VINNOVA) is further fostered based on the original framework of NUTEK. VINNOVA not only supports companies, manufacturers and universities, but also encourages the innovation of SMEs through policies. In 2009, "Swedish Economy and Regional Development Agency", another mechanism born out of NUTEK, was established. These dominant mechanisms and some small-scale innovation supporting organizations together build up the new national innovation system of Sweden.

Similar experiences and mechanisms are also seen in the other Nordic countries. For a country starting its growth with a dependence on natural resources, Norway naturally has different innovative fields and relatively low R & D investment, however, its universities also play a key role in the innovation system. Norges Tekniske Høgskole (NTH, founded in 1910, later known as the Norway University of Science and Technology) and some other colleges based on certain industries have provided appropriate knowledge and workforce skills for the economic and industrial growth of the country. In order to develop a knowledge-based economy, the "Science and Technology Research Council" (NTNF), led by the Ministry of Industry, was established in 1946. The council consisted of a large

number of various research institutions and research committees. With the increasing of the innovators and the strengthening of the R & D investment, mechanisms dedicated to coordination of these institutions have also been developed. The Norwegian Research Council (NFR), starting operation in 1993, was an integration of the five scientific research committees, including the Industry and Science Research Committee, Nature and Humanities Research Committee, Agricultural Research Committee, Fisheries Research Committee, and the Applied Social Science Research Committee. The newly-established council belongs to the Norwegian Education, Research and Religious Affairs Department (KUF). It now consists of six research committees, responsible respectively for biological production and processing, industrial and energy, cultural and society, medical and health, environment and development, as well as science and technology. NFR is a strategic department and the central government's advisory body for the general principle of research and development policy, dedicated to formulating the country's research strategy. In 2004, by merging the existing Tourism Associations, the Trade Council, the Industry and Regional Development Fund as well as the Governmental Investors Advisory Office, they also established the "Innovation Norway", in an effort to more effectively contribute to the country's industrial development and to benefit the companies and national economy.

In Denmark, agricultural products used to be the mainstay of the economy and the export. However, many competitive sectors evolved in the Danish economy in the twentieth century, including pharmaceuticals, medical equipment and environmental technology. This story of successful innovation could still not happen without the government investment in research and development as well as the organizational structure concerned. It should be noted that the early innovations in the agricultural sector had an important spillover effects. In 1837, with the support of the Agricultural Association, the first agricultural college was established and later evolved into various folk high schools, providing basic education and skills training for young people from the rural areas. At the national level, the University of Agriculture was then established in 1856 and incorporated into the University of Copenhagen in 2007.

As it is in other Nordic countries, research institutions and knowledge sectors Commission are crucial in the innovation activities in Denmark.

Through the “Centre of Excellence” the government allocates the research and development funds to key areas, including food, biotechnology, nutrition and health as well as environmental technology, new materials, information and communication technology. In 1998, Denmark set up a research department to co-ordinate various research committees and university researches, which was later named the Science, Technology and Development Department. In order to enhance the competitiveness of the country, the state re-defined the universities as the 2003 University Act vigorously advocated new forms of university governance, stressing the “third mission” of universities, which was the knowledge transfer and commercialization. Meanwhile, in the past decade the research committee system has also undergone significant restructuring. The new framework includes a number of committees serving basic studies, one Strategic Research Committee and one Technology and Innovation Council. Some functional foundations also joined this innovation platform, including the Danish National Advanced Technology Foundation founded in 2004 and the Danish Growth Foundation established in 2006. The former took up venture investment in high-tech in order to promote the high-tech growth of the Danish economy; and the latter supports the regional and local SMEs. In 2013, the major political parties reached a new consensus to establish a large-scale Danish Innovation Foundation by merging the existing three organizations (Technology and Innovation Council, Strategic Studies Committee and the Advanced Technology Committee). This new institution has its own independent board of directors and its annual budget is expected to reach 1.5 billion Danish kroner, equivalent to the Swedish VINNOVA. Overall, Denmark's national innovation system is very sensitive to the changing global competitive environment. And it focuses on knowledge transfer through the integration of resources, public-private interaction and the marketization.

Although Finland is a latecomer in the industrialization in the West, it has achieved remarkable success after 1970s and become the European leader in innovation. In its innovation system framework, the formation and evolution of the Public Research Organizations (PRO) is crucial. World War II gave birth to the Finland Science and Technology Research Centre (VTT), which was intended to serve the manufacturing industry. It has tapped into the functional areas in the postwar, such as transportation, manufacturing and energy supply and is now hiring more

than 3,000 employees. VTT, known as the biggest applied technology research institution, provides knowledge and services for the growth of companies. After the Second World War, the universities also developed very fast and laid a foundation for a quality labor market. The Finnish government attached great importance to the selection of priority areas and boosted the electrical and telecommunications industries in the 1970s. In 1983, Finnish Trade and Industry Department established the National Technology Innovation Agency (TEKES). As a major national institution that invests in research and development, it provides funding and network support for the public and private sectors in research and innovation projects, promoting the community cooperation among science and technology organizations, manufacturing companies, suppliers, customers and end-users. TEKES plays a leading role in coordinating enterprises, universities and research institutions, in carrying out forward-looking national technology plans (normally with a duration of about 5 years), and in promote the formation of industrial clusters. In the funding scope of TEKES, about two-thirds are given to companies, and the rest one-third to universities and public research institutions. It finances not only technological innovations, but also welfare, design, business models and social governance reform.

In order to meet the challenges of and increasingly open economy and globalization, Finland unveils a new round of innovation mechanism reform that includes the merging of universities. One prominent example is the Aalto University, which intends to be one of the world's top universities after merging. This university harbors great ambitions in commerce, science and technology and design, etc. Furthermore, in order to boost in the longer term traditional industries (such as forestry and metal), energy and environment, bio-economy, construction innovation and health as well as other strategic areas, the country founded "Science, Technology and Innovation Strategy Center" (SHOK), a non-profit organization that will "implement programs carrying long-term implications for the future and seek innovation breakthroughs on a global scale, innovations that can bring economic growth and social well-being."

The Nordic innovation system shows many universal features and revelations and is considered an "alternative" form of the capitalism diversity. In addition to its extensive and in-depth cooperation among the research councils, knowledge sectors and the industries, the education

safeguarded by the welfare system, a high degree of social mobility and collaborative governance structure all jointly support the innovative capacity and competitiveness of those countries. It should be stressed that innovation is certainly, in a cultural sense, in need of “national feelings” or “mentalities”, but the system selection and institution design are essential. The Nordic development experience illustrates that the government has an indispensable role in creating an innovative environment. It also seems that certain kind of welfare system is in a positive relationship with innovation capacity, which means that the more solid the government supports are, the more innovative the social and economic growth will be.

Translated by Wang Youping