

EXPERIENCE OF SOME COUNTRIES ON THE ORGANIZATION AND OPERATION OF SCIENCE AND TECHNOLOGY ENTERPRISES, SUGGESTIONS FOR VIETNAM

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Abstract:

Science and Technology (S&T) enterprise is basically a type of business which realizes the production and trading of products, goods created from the results of science and technology achievements whether obtained by the enterprise itself or integrated from domestic/ international sources. However, the majority of this type of businesses is active in those S&T areas which are of national, regional, local priorities, or even the S&T enterprise's. Normally, established S&T enterprises operate in the field of high technology. Therefore, they are entitled with the state incentive policies in view of encouraging the development of high technology. Experience of the countries mentioned herein may provide useful suggestions for Vietnam during the establishment and organization of activities of S&T enterprises.

Keywords: *Science and technology enterprise; Organization of science and technology enterprises.*

Code: 14100601

1. Some basic concepts

1.1. Start-up firm

In conventional sense, this is a newly established enterprise. In reality, in newly industrialized and developed countries, start-up enterprise is considered as the first phase of forming medium and small enterprises as it is the key of the innovation system in general, and the industrial innovation, in particular [7]. It has been "incubated" in a certain type of business incubator (of universities, high-tech zones or science parks,...).

In some directions of emerging technologies, where market demand is still uncertain, the risk is still high, then these firms have more advantage than large companies by their flexibility, dynamic in decision making and concentrating resources on innovation priorities. Obviously, for a country with many start-up businesses, it will have an advantage in the knowledge economy.

1.2. Spin-off enterprise

It is a type of grown up enterprise resulted from the commercialization of one or more technologies directly incubated at research institutes, universities or technology incubators. It is the last stage of start-up firm, i.e the mature stage.

Currently, this formality is quite popular in the US, Canada, China and Russia. Depending on the country context, the enterprise of this type has different names: Innovation enterprise (US) based on self-management form, Spin-off enterprise (Canada), Science and Technology enterprise (China), Small and Medium Innovation enterprise (Russia).

In the US and China, these enterprises are often set up by collective (or individual) scientist based on commercialized ideas/results of S&T. Enhancing the role individual scientists in the establishment of this kind of enterprises, people call them “put out to sea” person.

It should be emphasized that the name “Science and Technology Enterprise” as spin-off firm is used only in socialist countries in transition where the link between science and production and training is loosen, no autonomy, independence, self-reliance mechanism exists in compliance with the market mechanism by its nature. For developed countries, when a business is called innovation enterprise then there should certainly be S&T personnel available as the key factor for the development of the enterprise and it is usually established within the scope of emerging S&T (high and new technology, core technology,...). The phrase “Science and Technology Enterprise” used in those countries often refers to a Research-Training-Production complex like a S&T village within which there is university being as a nuclear [5,6].

2. Experiences on organization and operation of S&T enterprises in some countries

2.1. Canada

With the goal of building innovation clusters with spin-off businesses playing the role as nuclear entities the government of Canada has considered the establishment of regional industrial centers with a wide range of critical components (in which innovative businesses operating in the direction of future technologies such as biotechnology, gene technology (only 20 years behind the US) and in several directions of traditional technologies (car technology in large research centers in Windsor with major branches in Michigan, London, Ontario). Innovation clusters have the

function to link different technology components, funding and manpower for the purpose of innovation and development.

Since 1995, Canadian Government has assigned the National Research Council to establish new technology companies based on intellectual resources, technology and knowledge available in the country. As a result, from 1995 to 2000, there were 400 technology companies established by the Council, out of which 40 were of spin-off type [1, 2].

Presently, Canada has about 150 enterprises spin-off from national laboratories, out of which 110 from the National Research Council; 800 spin-off enterprises from universities. The annual turnover of these enterprises was about USD 2 billion with 12,000 jobs created. Particularly, spin-off enterprises of the National Research Council generated USD 1.2 billion/year with 7,000 jobs, respectively.

In respect of technology transfer organization, Canada though that spin-off/start-up enterprises was the appropriate form for quickest transfer of technology/commercialization of research results (*see Figure 1*). The process of development of this type of enterprises associated with the technology incubation program, it is also known as the technology incubation development strategy in Canada. This process could not be implemented without venture capital sources.

Policy and legal support

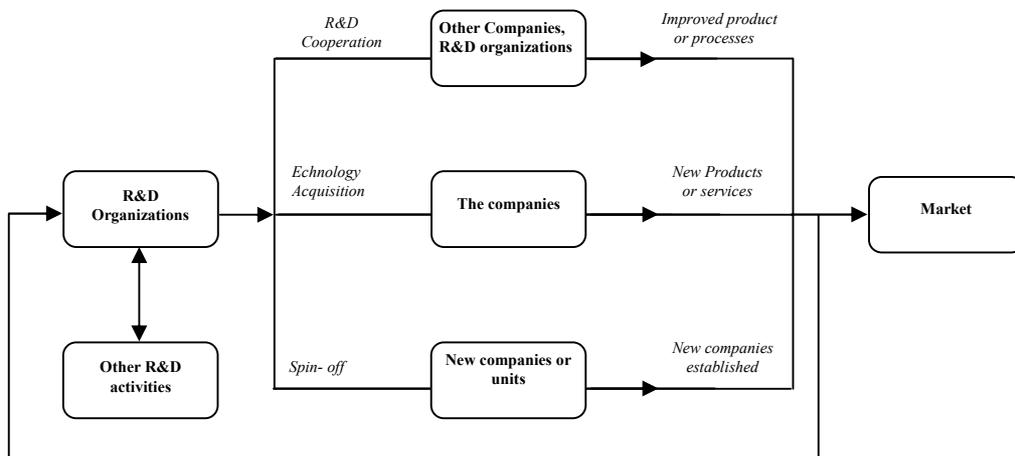
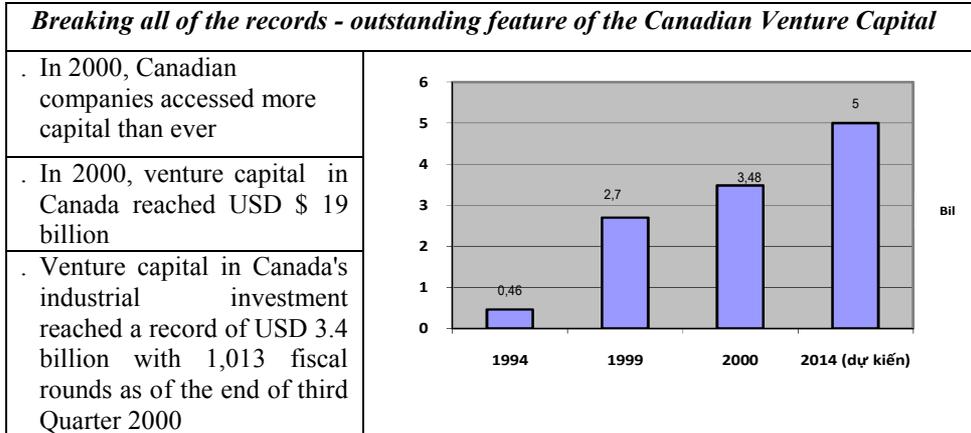


Figure 1. Technology transfer channels of Canada

As mentioned above, the operation of innovation enterprises in Canada could not undertake without venture capital as well as tax incentive measures. Canada considered that tax exemption for these businesses was

actually not tax losses but it was the tax deferred for the future. Venture capital for innovative businesses in Canada (see Figure 2).



Source: Canadian Research Council

Figure 2. Venture capital for the operation of innovation enterprises

2.2. Russian Federation

As we are aware, Russian Federation acquired the majority of assets left by the old Soviet Union including nearly 150 Science - Production Unions. By that time, Science - Production Union was defined as a complex of research and design institute, enterprises manufacturing series zero products in a particular field of technology (priority technology). Research institute played a key role in the operation of the Union, the institute's Director was also the CEO of the complex. This kind of Union together with its research institute was disintegrated when the Soviet Union collapsed. The process of privatization of the economy in general and privatization in the field of S&T in particular was evaluated as "the abrogation of the most important component of the scientific and industrial potential" [4]. Before that situation, the Russian government took a number of actions:

- Establish, on the basis of these Unions, a series of small and medium multi-ownership innovative enterprises, turned the location of Unions into science, technology village (like Silicon Valley style) with full services attached such as financial-industrial complex, banks, investment complex, etc;
- Create mechanisms for large research institutions to associate with businesses having capacity of applying and replicating available high technologies, for example, capital sharing by contributing existing physical foundations and intellectual property.

The Russian Government had implemented the reform program of Science-Production Unions in all sectors: agriculture, transport, manufacturing... and set up a system of small and medium innovative enterprises. Most of these enterprises were built in the premises of the old Science-Production Unions that invisibly creating, formal or informal, a sectorial and interdisciplinary link among enterprises to reach a common objective of technological innovation. By this way, Russians have set up high-tech parks, innovation zones [3,4,5]. In order to facilitate the operation of this type of businesses, the Russian government had set up a system of financial and non-financial facilities, such as venture capital funds, and venture capital companies, physical reserve funds, technological development foundation... At the same time, the government established business incubators to receive start-up businesses and through which to develop innovative enterprises under the holding company modality.

Above are comprehensive measures to support the operation of Russian innovation enterprises. In more detail, we could see the following:

- Russian State paid special attention to the adjustment of the price of new technologies on the supply-demand basis to ensure three factors in place: sufficient compensation of the production cost; clear profit sharing among stakeholders participating in the science-production process, appropriate discounts applied for technology users depending on the areas where new technologies used.
The discount is conducted on the basis of full costs calculation simultaneously taking into account intangible depreciation in terms of economic, social and environmental aspects. Rising price may lead to reduced new technology application, but on the other hand reducing price may result in reduced supply. Governments should therefore have appropriate regulatory policies because for new technology sometimes it is impossible to control the free market. The price subsidy may be made through centralized funds.
- The state also paid attention to the application of accelerated depreciation mechanism to promote the process of technology innovation, in general and the product innovation cycle of S&T enterprises, in particular. This was something that Russia should learn from US experiences where this mechanism has widely been applied over more than 50 years.
- Russian State paid special attention to the role of Bank credit by creating mechanisms for banks to make joint investment with innovation enterprises, reducing income tax in order for banks to get only 50% of the interest of the over-due loan of the enterprise; reducing 50% of

compulsory reserves for banks making investment to innovation; ensuring timely payment up to 50% of the total credit of commercial banks by the Central Bank gets zero receivable interest for a given period for overdue loans; reducing 50% interest rate for medium and long term loans for innovation, but increasing 30% for misuse of short-term loans.

- Tax incentives applied: It included the reduction of corporate income tax, exemption of corporate income tax to 2-3% for new products; deferred tax debt; investment credit tax,... Specifically, no collection of tax in case of transactions of sale and use of license, no collection of corporate income tax of innovative businesses on their profit equal to the total cost for research and development, simultaneously progressive tax was increased for monopoly businesses from year 5 onwards. 100% property tax exemption in 1st year, 50% in 2nd year, 30% in 3rd year and 20% in 4th year for innovation enterprises with new equipment. Reducing social insurance premium by 30-50% with the rest be subsidized by the State budget [4].

2.3. United States of America

One of the forms of organization of innovative businesses in the innovation process of USA was the establishment of small and medium innovative enterprises, also known as self-entitled businesses [3]. This form of organization was mainly aimed at maximizing the individual role of scientists, scientific collectives in the formation of innovative enterprises similar to the case of Trung Quan Thon electronic street of China. In the early '80s, in USA, the individual role in business was big, especially in the field of producing products with high tech content.

Innovative business is understood as an entity initiated by individual scientists, engineers, inventors specialized in the generation and commercialization of scientific and technological results. The notable feature of this kind of enterprise is the potential gray resource, the creative freedom which is not bound by formal instructions. Americans think that all the components creating S&T system are man-made, therefore they must be supported by an infrastructure system consisting of finance, technical material, information, legislation and psychological aspects... Self-entitled enterprises can stand independent, can also be part of larger companies, depending on their own needs.

One important feature of this type of enterprise is the sociability between ownership and use: The business owner is also the business leader, the level of success of innovation depends on the efforts made by their own.

Innovation businesses, in addition to struggling for their existence, they must overcome many risks in the process of innovation implementation. Only by producing new products it can create opportunities to gain temporary monopoly and get high profit. Therefore, small S&T enterprises are more creative and highly dynamic. This conclusion is illustrated in Table 1 below.

Table 1. Innovativeness and Scale of innovation enterprises

Turnover of innovation enterprises (USD million/year)	Annual occurrences of new products	
	In millionUSD	In million USD spent on R&D
Less than100	0,113	3,76
100-350	0.067	2,17
350-1000	0,027	1,49
1000-4000	0,010	0,66
upon 4000	0,007	0,59

Source: Research Management Journal, 1986. Vol 29, N^o4, P.4

According to statistics of the US National Science Foundation, companies with 500 people or less often have innovation pace per researcher of 2.5 times higher and investment for research of 24 times higher compared to large companies with 10,000 people or more [1].

It should be added that out of total of more than 600,000 small and medium enterprises, 50% was founded by scientists.

The US government attaches great importance to the existence and development of this type of enterprises. Even in the 40's, American Senate established Agency for Small and Medium Enterprises Management to implement military orders. In 1953, it established the Small Business Management Agency (SBA). In 1973, the National Science Foundation launched a program to establish innovation centers to support early stages of the innovation process as well as the establishment of innovative enterprises.

In US, innovation enterprise is regarded as a symbol of the nation. In the Federal's message on the occasion of 20th anniversary of SBA foundation, President R. Nicks on confirmed: "Small business is a proud symbol of freedom and success of our nation".

General policy of American administration is to support properly the development of right innovative enterprises at all levels: federal and state authority. Government establishes venture capital funds, encourages

venture business, increases budget expenditures for research and development in innovative enterprises (more than 1/3 of the federal budget was spent on research and development), 60-70% of venture capital funds was spent on this type of enterprises [2]. The support of the government is provided in three main directions: (1) Funding by objectives; (2) Attracting private investment; (3) Providing preferential credit, tax,..., applying accelerated depreciation (2-3 years) to promote the innovation process.

Furthermore, the US is a country with the most abundant business incubators (currently over 400) to receive and house start-up enterprises, laying a step for the existence and development of innovative enterprises. These incubators are located whether in high-tech zone (150) or in universities as core entity (200).

Specifically, there are following tax preferential policies applied for innovative enterprises: tax exempt by 25% in respect of the increased amount spent on research and development (before the new tax Act 1986, the figure was 20%); and by 6% and 10% of the value of equipment if their depreciation time is 3 years and longer, respectively.

3. Policies of some countries with regard to innovation business development

3.1. Japan

The Japanese government has promulgated numerous laws and under-laws to institutionalize and create leverage to encourage S&T enterprises (innovation business), namely: special treatment in taxation for R&D expenditures and financial support provided by enterprises from their own resources to promote science and technology. The financial and tax leverage for R&D activities are specifically as follows:

- Special preferences given to credit provided for private sector. The Japan Development Bank is ready to supply 90% of capital for those businesses having association with basic research, provide soft loan for businesses to conduct applied research with an interest rate of 7.1% per year - if the research failed, businesses shall not need to pay interest;
- Tax incentives: 25% tax reduction for businesses with research and bring new products to market;
- Risk sharing between businesses facing risks and the government and state agencies concerned depending on the field of study (from 40% to 60% of the total research funding);
- Encouraged competition mechanism in research in both public and private sector. The state only plays a coordinating role;

- Since 1982 up to present, the Government has enacted and enforced the regime whereby allowing S&T personnel of universities to have research collaboration with scientific and technical staff of enterprises with financial support of such enterprises, and also allowing S&T staff of enterprises to do research in the laboratory of universities.

3.2. Republic of Korea

Since the early 80's, the government has implemented policies whereby the development of science and technology is considered as a prerequisite condition for economic development of the country, focus was placed on accelerated development of small and medium enterprises. Through the "Law on Technology promotion" enacted in 1972 and the revised Tax Law, a very attractive leverage regime was created for the development and use of technology. There have been many measures to encourage the private sector for them to play the key role in the development of industrial technology. According to the "Law on Technology Promotion" and the revised Tax Law, it was clearly stated:

- Encourage the development of technologies imported from overseas and some domestic technologies by considering expenditure for technology development as R&D expenditure to develop new products or processes, funding for research to acquire and improve imported technology, purchase technological information, conduct of research works, the cost of registration and commercialization of industrial property rights shall be regarded as losses and untaxable income in the financial balance sheet. This policy has created conditions for national economic sectors to reserve funds for investment in R&D; no tax imposed on the funds for new product and technology process development. The maximum level of reserve for technology development fund is 20% of before tax income, or 01% of the total revenue obtained in the income generating period;
- Direct/indirect support given to public and private sectors on the basis of their cooperation in the field of energy technology. Indirect support for the private sector on competitive principle;
- Issuance of incentive measures such as tax exemption, provision of special subsidies, financial aid, long-term development loans with low interest rates.

3.3. Singapore

Singapore has a "R&D assistance system" (RDAs - under the Department of Science and Technology) to support for R&D projects of especial

significance for small and medium enterprise shaving limited resources for R&D in order that these enterprises can cover expenses related to feasibility studies, implementation of under patent prototype production. However, this assistance is very limited.

The more appropriate financial leverage applied to companies implementing R&D activities are as follows:

- *Pioneer regulation and pioneer services*: (1) income tax exemption for entire 10 years for companies that perform pioneer R&D activities or services in the early stage of industrial development; (2) Granting pioneering certification for companies which have created jobs for workers; (3) Tax exemption for enterprises implementing production activities in the final stage of creating value-added and high-tech content for average time of 5-7 years; (4) Increased tax exemption time for companies implementing special R&D activities;
- *Leverage to encourage post-pioneering*: (1) tax income reduction for 3-5 years to below 10% for enterprises are about to end pioneering period; (2) Tax rate reduction for more 2 years for companies with appropriate R&D projects;
- *Double deduction of expenditures for R&D* applied particularly in some selected production or services in the health sector, information technology, technology applied in agriculture, horticulture. In this connection, the R&D expenditure relating to basic construction cost is considered as income and shall be entitled with double deduction. The concept of R&D also covers activities related to technology mastering, improvement, technical design, and enhanced quality of the product or technology process.

In addition to the above leverage policies there are also others to promote/encourage enterprises to expand their production, namely to allocate 20% of accumulated income for R&D; depreciation of capital and investment support; encourage individuals to involve in innovation.

3.4. China

Based on the analysis of the failure of policies concerning promotion of S&T planning. In 1985, Chinese leaders initiated a resolution on the S&T management system reform in the spirit of commercialization of S&T activities and creation of technology market.

In January 2006, China completed and adopted the medium and long-term development plan of S&T for 2006-2020 after many years of preparation and elaboration with the participation of more than 2,000 specialists. The

plan divided the national innovation system of China into four components, namely: the technological innovation system (in which enterprises is the key player); knowledge innovation system (in which public research institutes in collaboration with research institutes of universities is the key player); defense innovation system (including both civil and military sector); and regional innovation system (including areas with specific conditions and particular strengths).

By identifying specific objectives, China strives to become by 2020 an “Innovation-Oriented Country” instead of the objective set out in the 70's of last century where it was the goal of becoming an industrialized nation. This is proof that China has rapidly moved to think about and approach to innovation systems in their development strategy planning.

In addition to the move to build up the national innovation system with Chinese identity, the reform of S&T system in the coming years were identified aiming at support for businesses (instead of S&T institutions) for them to become the key player in technological innovation activities. The clearly and properly defined the key player in technological innovation activities is an important prerequisite for building up innovation capacity and formation of the national innovation system.

To materialize and realize the direction, goals and tasks mentioned in the above plan, a series of solutions was initiated to reform S&T sector, build up the national innovation system of the color of China in relation to fiscal policy, public spending, intellectual property and standards, collaboration between military and civil S&T, international cooperation and expand the linkage between domestic innovation efforts, improving the people's knowledge of S&T. The plan also emphasized the role of investment in S&T infrastructure construction and human resource development for S&T.

4. Possibility of application of different types of science and technology enterprises under specific conditions of Vietnam

The study on experiences from a number of industrialized and newly industrialized countries (including China) in respect of organization, operation and state mechanisms to promote the development of innovative enterprises would suggest the following:

- (1) It would be possible to apply the US model of the 60's in the present condition of Vietnam, i.e innovation enterprises at small scale founded by collective/individual scientists while the State provides enabling measures in terms of preferential tax, fees and other incentives for businesses to grow;

- (2) It would be difficult to apply a standard model in terms of S&T staffing, R&D expenditure as prescribed by China. It would need "flexibility" in using this standard before trial and error in our country;
- (3) It should promote the establishment of venture capital, set up and implement a "technology incubation", "business incubation" program by organizing a number of training courses in wide range from business skills to making investment in the construction of business incubators in the two high-tech parks in Hoa Lac and Ho Chi Minh City, and in some other areas around national universities, national science centers.

In summary, the reality showed that there was a number of S&T enterprises set up in Vietnam in the form of spin-off located whether in research institutes or universities or independent, self-entitled such as the Additives and Petroleum Products Development Company (APP), or Science - Production Union such as the Institute of Machinery and Industrial Tools (IMI). The question here is that it is necessary to review to get lessons learnt and on that basis to develop "rules of game" for each modality/arrangement in purpose of continued improvement of and facilitation to the establishment of new enterprises of this type in our country./.

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