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The Evolving Role of Academic Institutions in Innovation Systems and Development

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# **The Evolving Role of Academic Institutions in the Knowledge Economy: The Case of Vietnam**

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## **1. The Vietnamese context**

Vietnam has been experiencing dramatic changes over the past few decades in almost all its political, social and economic spheres. This has had a strong influence on the evolution of the academic system. Historically, the academic institutions (research institutes and universities) date back to the French regime. The first modern Vietnamese university (specialising mainly in the medical and pharmaceutical fields) was established in Hanoi. In addition, some research institutes, operating in the fields of medicine, pharmacology or biomedics, were established by the French such as the Pasteur Institute. Furthermore, during the war, academic institutions were developed in both the North (under the Soviet academic model e.g. Hanoi Polytechnic) and South Vietnam (more like the Western style e.g. Can Tho University). They had a strong imprint on war time activities with missions which focused more on training and provision of problem solving methods to serve military needs.

When Vietnam was reunited after the war in 1976, the economy relied heavily on agriculture and support from abroad. A centrally planned economy was implemented throughout the whole country. Industrial development focused mainly on heavy industry and was driven by import-substitution policies. Many ministries functioned like big companies, responsible not only for public services, but also for economic activities which were conducted by state owned enterprises. The academic sector was organized to support such a structure and was empowered by many enthusiastic young graduates from local universities and former socialist countries. At that time, universities were responsible for training knowledgeable personnel, and research institutes were responsible for basic, applied and engineering research. There was quite a clear division of labour and responsibility among these academic institutions, which reflected their management. Universities and colleges were the responsibility of the Ministry of Higher Education, whereas most academic research institutes came under the aegis of the Vietnamese Scientific Institute or State Commission for Science and Technology, and most engineering research institutes coming under their line ministries. Despite the many problems associated with the centrally planned economy, the academic sector functioned quite well with its focus on problem-solving and engineering solutions for the productivity sector.

By the 1980s, a lack of market incentives and the rigidities of central planning practices had dragged the economy into severe economic crisis and resulted in deteriorating living standards. Forced by domestic difficulties and encouraged by the changes in China and the former Soviet Union, the Vietnamese government initiated an overall economic reform known as “Doi Moi” (renovation) in 1986. Since then, the

country has gone through a so called “double transition”: from a centrally planned economy to a market economy, and from an agricultural to an industrial economy.

After 20 years of radical changes, the country has achieved some significant results. The GDP growth rate has been quite high and stable at around 8% for the last ten years. The country has increased GDP per capita from US\$440 in 2002 to almost US\$700 in 2006. More importantly perhaps, Vietnam’s standard rate of poverty has been reduced from 30% of total households in 1990 to just 7% in 2005. Most of the economic growth has been generated in the industrial sector, but services have also expanded rapidly. A large part of this growth can be attributed to foreign investment, and more recently, the development of the local private sector. The agricultural sector has been growing at around 4% per annum over the last decade. With liberalization and modernization of the sector, Vietnam has converted itself from a food-importing nation to one of the top three rice exporters in the world. However, agriculture still accounts for 22% of Vietnam’s economic output, and over two-thirds of its employment, primarily on small family farms.

For its economic performance, FDI activity plays a crucial role. Foreign investors have created an imported ‘private sector’ for a country that only had a fledgling private sector of its own at the beginning of the 1990s. With the advantages of short distances and cultural similarities, neighbouring countries such as Singapore, South Korea, Taiwan and Japan established early footholds in Vietnam soon after its open door policy was implemented. By the end of the 1990s, although foreign-invested companies employed less than 1% of the total workforce in Vietnam, they cumulatively accounted for around 27% of the country’s (non-oil) exports, 35% of the country’s total industrial output, almost 13% of Vietnam’s GDP, and contributed around 25% of total tax revenues (Klaus et al, 2005). For 2001-2005, FDI accounted for 16.8% of total investment, in 2004 the FDI figure was US\$4.2 billion, and in 2005 some US\$6.3 billion. Vietnam joined the WTO in 2006 with several important commitments like TRIPS, TRIMs, TBT, etc.. SOE reforms aimed at increasing efficiency have produced significant achievements in reducing the number of state owned firms from 5,600 in 2005 to 2,600 in 2006. Despite these achievements, there are still some outstanding issues. Although the poverty rate has been reduced, the gap between rich and poor has increased. International integration of the economy has brought benefits and at the same time, some conflict. The process of institutional reform of the legal and banking systems has resulted in demands for a more resolute stance from the leadership.

Nevertheless, economic changes have brought better living conditions for most people and more importantly, have connected the country to the global economy. Exposure to the global economy have opened up more options for enterprises and they are now freer to look for solutions to their specific problems from international partners. Firms appear to prefer this approach as it can provide quick, tried and tested solutions for them. Furthermore, in many cases, it helps them to connect with the international production network, an invaluable asset which firms previously didn’t have. The new generation of productive assets requires new and different skills. All of these factors put pressure on the academic sector and force it to change.

## **2. The Position of Academic Institutions in the Vietnamese National System of Innovation**

The present academic organizations of Vietnam can be classified into two groups: (i) general R&D and engineering institutions, and (ii) higher education institutions. In fact, there are overlaps between these two groups since the former are also involved in some formal training and the latter in doing research. Only a small proportion of Vietnam's R&D is conducted in productive enterprises, which predominantly are SME. Data from various surveys of firms have revealed firms' perspective on their linkages with R&D institutes and universities and on meeting technology demands of firms (NISTPASS, 1999, 2002 and 2004). Findings from these studies revealed that, in terms of general business services, Vietnamese firms still prefer to perform most services in-house. Firms tend to rely on their internal capacities for engineering, management and marketing, while relying on outside sources for computer-related services and training. Computer services are considered as the most important to firms, followed by training services. The limited extent of innovation in SMEs is concentrated mainly in process development and quality control. Many obstacles and disincentives prevent or discourage SMEs from developing their own innovation capabilities. Firms do not have sufficient resources to make long-term investments, including recruitment of highly-skilled labour and equipment to innovate, whilst many technical services are unavailable. They lack information on available technologies. Market barriers are also high, as SMEs are often unfamiliar with product requirements and distribution channels. Finally, SMEs have a hard time obtaining credit from banks.

The views from firms, as reflected in the abovementioned surveys, confirmed that there is demand for technology and training services to be provided by supporting organizations such as R&D institutes and universities. However, this demand has hardly been met. When asked about sources for innovative ideas, only 10% (of 126 respondents) cited R&D institutions and universities as an important source (Nguyen Vo Hung and Nguyen Thanh Ha, 2003). The lack of demand for technology services received by universities and R&D institutions appears related to the kind of innovation, and perhaps reflects some negative feelings on behalf of firms regarding the supply capability of universities and R&D institutes. Many enterprises do not use technology related services because they do not believe that providers offer the particular service that they need. This is especially true in the technology consulting field, where the majority of R&D institutes are unable to provide sophisticated services to industry. Findings from the firms' assessment showed that the capability of R&D institutes and universities was below firms' expectations. When it comes to technology innovation, firms tended to do this themselves, or relied on other firms, rather than domestic institutes and universities. Some of the reasons for this situation are related to the macro policy environment, monopoly positions, and the capabilities of firms and service providers.

In this context, it appears as if the specific features of the innovation environment in Vietnam have made commercial relationships (including competition) among firms the dominant interaction pattern. As a result, many Vietnamese academic institutions find themselves almost "left-out" of the innovation linkages of firms altogether. They are not effective in providing practical solutions for a range of diverse and specific problems that firms usually encounter in their innovation efforts. They are also not very good at providing integrated solutions, in the form of technological packages for instance, for firms which are influenced by the market.

Aside from this weakness, academic institutions still hold an useful position in the technological advancement of the Vietnamese economy. In many traditional sectors, such

as agriculture, forestry, and in some dynamic parts of the country (mainly in the south), academic institutions play a vital role in bringing technical solutions to farmers. For instance, in the Mekong River Delta (the main rice production area in Vietnam), more than 80% of the rice varieties in use have been bred by the Rice Institute of Mekong River Delta (a public research organization). The Institute of Southern Fruit Trees is also very active in identifying quality parent trees for breeding, in developing advanced cultivation methods for different types of fruit trees, and in disseminating technical knowledge to farmers, amongst others. It can be argued that the academic institutions involved in agriculture and the extension network have played an important role in the success of Vietnam's rice production. Recently, within the framework of the FAO's "South-South co-operation in agriculture", Vietnamese agricultural scientists and technicians have been sent to some African countries where they helped local communities to plant rice and other plants. The results have been highly appreciated by African colleagues and it is considered one of the most successful FAO programmes in Africa.

Another strong position of academic institutions is with regard to training, which is the principal mandate of universities and some research institutes. Vietnam has quite a developed higher education system. The system, to date, has contributed significantly to the provision of educated personnel for virtually all economic sectors in the country. University education has provided students with some basic foundations that have enabled them to continue their learning in the productive sector. However, not all training institutions are capable of training high quality personnel. Vietnam has attained a high literacy rate (94%) through its successful implementation of near-universal primary education. Despite this achievement, access to technical training and higher education institutions has been limited, and the skills level of the general workforce is insufficient for technology development. Enterprises rely on unskilled and semi-skilled labour and maintain low productivity levels. Vocational enrolment is low or consists of short-term training, with informal education playing an important role in the acquisition of new skills (UNIDO, 1999). Many firms maintain or improve production in export markets by investing in training of their own workforce. But most staff training focuses on short-term needs. Many firms do not train staff to higher technical levels either due to a lack of resources or due to the fear of losing well-trained staff to other firms offering better terms and conditions.

Fast growing economic activities and the liberalization process have put university training in Vietnam under significant pressure. As outlined earlier, opening up the economy has allowed productive sectors to acquire capital goods with embedded technology from more advanced countries. This enables firms in developing countries to reap the rewards of R&D conducted elsewhere and utilise them for their own benefit. Having acquired such production facilities, firms need to learn how to operate their production systems more effectively and this often requires direct exposure of engineers and workers to the systems themselves (opportunities that few academic scientists have). Since this process has happened so rapidly, university curriculum can hardly keep up with technological innovations and quickly become out of date. The staff are either overloaded with teaching or incapable of doing research to support their teaching. Equally, financial rewards and incentives are often insufficient to retain good staff in post. University graduates lack state-of-the-art engineering knowledge and it might take

them several more years to learn on-the-job before they can work effectively in the productive sector.

With regard to other activities, outside of traditional research and training, Vietnamese academic institutions have begun to offer a variety of technical services to firms, and even free public goods to serve community needs, especially in rural and mountainous areas. However, this “third mission” of academic institutions has faced several hurdles, particularly as the concept of free provision of academic goods is seen as contradicting the market mechanism. There is little argument about the contribution these institutions make to the overall socio-economic development of the country, but there are still a number of areas to be improved in order to turn them into true knowledge producers and innovation carriers.

### **3. Mapping the Academic System in Vietnam**

Following the reform in economic activities, the liberalization of the science and technology (S&T) sector was initiated quite early. Having initially been developed following the Soviet-style model, the academic sector has recently undergone several restructuring trials; some of which were quite serious and radical, at least in terms of what was proposed. Among these, Government Decree 35, enacted in 1992, is probably the most acknowledged one. It marked an important change in that the rights of S&T organisations to enter into commercial contracts with economic entities, as well as to establish affiliates (centres) for commercial purposes, were formally recognised. Since then, many centres have been established under this regulation (hence known as “Centre 35s”) by public S&T organisations and groups of individuals. However, due to a lack of supporting institutions and commitments, Decree 35 and some other efforts at restructuring the system have failed to deliver the expected outcomes. The S&T sector has lagged behind reforms witnessed in the economic sector, and although there have been some improvements, further critical changes still lie ahead. Recently, by another government Decree No.115 enacted in 2006, the R&D institutions have been required to become more independent in their management and functions, operating in a firm-like mode. This change would create a significant shift in R&D system.

#### ***3.1 R&D and engineering institutions***

##### *Public Institutions*

The bulk of R&D activities are conducted in research institutes under line ministries, as well as in two national research organisations for natural and engineering sciences and social sciences.<sup>iii</sup> More recently, R&D has been undertaken within some leading universities. Vietnam spent approximately 0.52% of its GDP on S&T activities in 2005 (MOST, 2006)<sup>iv</sup>, with most publicly funded R&D being conducted in government research institutes. The research infrastructure is perceived as being below international standards. Research tends to be theoretical, supply-driven, and only loosely connected to the needs of the productive sector. The national R&D system is "organised, financed and managed in such a way that technology transfer is difficult and expensive" (Bezanson et al., 2000). The total number of R&D organizations is presented in Table 1.

**Table 1: R&D Organizations in Vietnam by 31 Dec 2005.**

| Type of Administration   | 2002         |            | 2003         |            | 2004         |            | 2005         |            |
|--------------------------|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
|                          | Number       | %          | Number       | %          | Number       | %          | Number       | %          |
| <b>State sector</b>      | 631          | 56.5       | 668          | 55.7       | 688          | 56.3       | 694          | 52.6       |
| - Line ministries        | 437          | 39.1       | 466          | 38.9       | 481          | 39.4       | 484          | 36.7       |
| - Higher education       | 134          | 12.0       | 141          | 11.7       | 144          | 11.8       | 147          | 11.1       |
| - SOEs                   | 60           | 5.4        | 61           | 5.1        | 63           | 5.1        | 63           | 4.8        |
| <b>Collective Sector</b> | 440          | 39.5       | 487          | 40.6       | 481          | 39.4       | 556          | 42.1       |
| <b>Private Sector</b>    | 44           | 4.0        | 44           | 3.7        | 52           | 4.3        | 70           | 5.3        |
| <b>Total</b>             | <b>1,115</b> | <b>100</b> | <b>1,199</b> | <b>100</b> | <b>1,221</b> | <b>100</b> | <b>1,320</b> | <b>100</b> |

*Source: MOST (2006).*

Whilst these numbers may seem quite impressive, they do include a number of centres with just one or two staff, which are often set up simply for administrative reasons (e.g. they may enjoy more freedom and autonomy in their operations than their parent organisations).

Of all the R&D and engineering organisations in the country, the Vietnam Academy of Science and Technology (VAST) is by far the largest one. It has 18 research institutes and 9 regional branches operating in various fields of science and engineering. The Academy has established 16 enterprises (start-up); 21 scientific centres (under Decree 35); 16 higher education institutions; 7 administrative bodies; and 11 journals. By the end of 2005, the Academy had a staff of 2,404. Another state scientific research institution is the Vietnam Academy of Social Sciences (VASS). By the end of 2005, VASS had 27 research and supporting institutes; 5 administrative bodies; 15 postgraduate institutions; and 30 journals, and employed almost 1,400 people.

Traditionally, these two principal organisations have been privileged to receive funding from central government to carry out so called "State S&T missions". These missions are usually organised into research programmes aimed at providing a scientific foundation for policy formulation and the legislative process (social science), or for creating new S&T outcomes which are significant for economic and social development; for defence and national security; and for human resource development. However, in the absence of an effective mechanism to identify such missions, as well as to distribute their research results, it has been argued that the state S&T programmes lack effectiveness. During the last few years, the entire process of identifying, conducting, and evaluating state S&T missions has been reviewed, in an attempt to identify more efficient and effective procedures.

In addition to the above two institutions, there are several scientific organisations which have been set up and managed by line ministries and provinces. These institutions also receive public funding via their ministries/provinces to undertake research which addresses scientific, technical and/or policy issues directly related to the field of interest of the relevant ministry or province.

Public scientific organisations also include centres belonging to universities and engineering research institutions belonging to state owned enterprises. With regard to the former, by the end of 2003, 141 centres had been set up and were operated by public

universities and colleges. The latter are classified as public R&D organizations since their parent organisations, the SOEs, are considered as public entities.

### *Non-public scientific organisations*

Non-public R&D organisations include: (i) R&D organisations of non-state enterprises; (ii) R&D organisations of political, social and professional organizations; (iii) organisations belonging to professional associations; and (iv) foreign R&D organisations, including joint-venture R&D organisations. The collective scientific organisations identified in Table 1 are also included in this category since most of them fall under sub-category (iii) professional associations.

Given the small-scale of domestic private enterprises in Vietnam and the weak links with public R&D organizations, the limited non-public R&D activities are mainly conducted in-house by own staff, who may, or may not, have any formal education in scientific or engineering fields. R&D as an organised activity is not common in this sector. With regard to the foreign sector, there are relatively few foreign R&D organisations in Vietnam, and the majority of R&D and engineering work for this sector is conducted in the headquarters of parent firms.

There are numerous R&D organizations associated with political, social and especially professional organisations. However, their interest is mainly in offering consultancy and intermediary services. Few of them have research facilities able to undertake any serious engineering work.

In total, there are 1,320 R&D organisations, 11% of which come under universities and similar organisations. In terms of human resources, Vietnam has 274 R&D researchers per million people, lower than the average of 384 for developing countries, and much lower than the world average of 1,096 (UNDP Human Development Report Statistics, 2004<sup>v</sup>). Furthermore, the R&D human resource is aging, suffers from quality control issues and has skills that are not best suited for the current economic needs of Vietnam. Many of them received their training from learning systems which emphasised the linear relationship between S&T, heavy industry and state planning and control (Tran Ngoc Ca, 2002).

### *Funding of R&D institutions*

With regard to the governance of public scientific organisations, to date, the majority of them report to line ministries and other Government bodies, and as a result receive subsidies from the Government budget. Table 2 shows the number of scientific institutions linked with various government bodies, their affiliates and how they are funded. The merged column “Number of organisations funded by government” shows how many of them are fully funded, partly funded, or not funded by government. Those not receiving funds from the Government have to rely partly or wholly on a variety of consultancies with firms or other organisations. Several interesting features arise from Table 2. First, the actual number of public scientific organisations (parent only) is much less than the statistics in Table 1 above, after the “Centre 35s” have been removed. Second, most of them still rely on direct funding from the Government. Whether or not this is a negative or a positive indicator is still open to debate. Third, the table does not include public scientific organisations set up by cities and provinces. Although there are

still relatively few of them, in recent years, budget-generating cities and provinces have tended to establish research organisations under their own administrations in order to support their administrative works and/or to support their local communities.

**Table 2: Funding status of public scientific organisations linked with Government bodies.**

| No. | Government Bodies   | Parent only | Parent & Affiliate | Number of organisations funded by government |             |            |
|-----|---|-------------|--------------------|--|-------------|------------|
|     |   |             |                    | funded                                       | semi-funded | not funded |
| 1   | Ministry of Agriculture and Rural Development                         | 38          | 87                 | 1  | 82          | 4          |
| 2   | Ministry of Industry  | 23          | 35                 | 1  | 26          | 8          |
| 3   | Ministry of Health  | 18          | 20                 | 8  | 10          | 2          |
| 4   | Ministry of Fisheries   |             | 7                  |  | 7           |            |
| 5   | Ministry of Culture and Information                                   |             | 4                  | 3  | 1           |            |
| 6   | Ministry of Post and Telematics                                       |             | 2                  | 1  | 1           |            |
| 7   | Ministry of Labour, Invalids and Social Affairs                       |             | 5                  | 4  | 1           |            |
| 8   | Ministry of Construction  | 15          | 15                 | 1  | 12          | 2          |
| 9   | Ministry of Resources and Environment                                 | 3           | 9                  | 1  | 8           |            |
| 10  | Sport & Exercise Committee  | 1           | 1                  | 1  |             |            |
| 11  | Population, Family and Children Committee                             | 1           | 1                  | 1  |             |            |
| 12  | Committee for Ethnic and Highland                                     | 1           | 1                  | 1  |             |            |
| 13  | State Inspectorate  | 1           | 1                  | 1  |             |            |
| 14  | Labour Union  | 4           | 4                  | 1  | 3           |            |
| 15  | Youth Union   | 1           | 1                  | 1  |             |            |
| 16  | Ministry of Commerce  | 3           | 3                  | 2  | 1           |            |
| 17  | Ministry of Finance   | 5           | 5                  | 3  | 1           | 1          |
| 18  | Ministry of Planning and Investment                                   | 3           | 3                  | 3  |             |            |
| 19  | Ministry of Transportation  | 10          | 23                 | 3  | 19          | 1          |
| 20  | Vietnam Academy of Science and Technology                             | 26          | 44                 | 23   | 5           | 16         |
| 21  | Vietnam Academy of Social Sciences                                    | 28          | 28                 | 26   | 1           | 1          |
| 22  | Ministry of Defence   | 8           | 19                 | 19   |             |            |
| 23  | Ministry of Public Security   | 10          | 10                 | 9  | 1           |            |
| 24  | Ministry of Home Affairs  | 2           | 2                  | 2  |             |            |
| 25  | Vietnam Television  | 1           | 1                  | 1  |             |            |
| 26  | The People's Supreme Court  | 1           | 1                  | 1  |             |            |
| 27  | Ministry of Science and Technology                                    | 8           | 33                 | 1  | 25          | 7          |
| 28  | Ministry of Education and Training                                    | 18          | 155                | 3  | 21          | 131        |
| 29  | National Steering Committee for Clean Water and Environmental Hygiene | 1           | 1                  |  |             | 1          |
|     | <b>Total</b>  | <b>230</b>  | <b>521</b>         | <b>122</b>                                   | <b>225</b>  | <b>174</b> |

Source: MOST (2006).

Regarding the results of R&D activities, in Vietnam there has been an upward trend in patent applications and registrations in the past decade. The figure for registration of patents for inventions during the period 2001-2005 is given in Table 3. It shows the clear dominance of foreign registrations.

The number of patents for inventions<sup>vi</sup> is low and mostly applies to foreign ones. In 2001, there were only 7 patents for inventions awarded to Vietnamese residents, compared with 47,721 in Taiwan and 121,742 in Japan (Asian Productivity Association 2003). Industrial design patents<sup>vii</sup>, on the other hand, are more numerous and mostly obtained by Vietnamese residents, but they usually contain low technological content. The relatively low number of patents may partly be due to a lack of capacity to innovate, but also due to unclear and/or unenforceable intellectual property regimes that dissuade inventors from applying, for fear of a loss of IPR.

**Table 3: Registration of invention patents in Vietnam**

| Years   | 2001  | 2002  | 2003  | 2004  | 2005  | Total |
|---|-------|-------|-------|-------|-------|-------|
| Registration by Vietnamese applicants             | 87    | 136   | 145   | 179   | 362   | 909   |
| Registration by foreign applicants                | 1,201 | 1,206 | 1,136 | 1,390 | 1,800 | 6,733 |
| Rate of Vietnamese registrations per foreign ones | 7%    | 11%   | 13%   | 13%   | 20%   | 14%   |

Source: MOST (2006)

### 3.2 Higher education institutions

As mentioned above, although higher education institutions are considered an important part of the S&T system, not all of them are registered as S&T organisations in statistics. Table 4 shows the number of higher education institutions in academic years from 1995 to 2004.

Almost all universities and colleges fall under the administration of the Ministry of Education and Training (MOET). The Ministry is also responsible for primary and secondary education. For the academic year 2004 – 2005, there were 230 universities and colleges (93 universities and 137 colleges) employing some 47,646 lecturers, of whom 6,223 were Doctors (13%); 14,539 were Masters (30.5%), and 26,854 held university degrees (56.4%). There were 446 Professors (0.9%) and 1,842 Associate professors (3.9%) (MOET, 2005).

In Vietnam, gross enrolment in tertiary education totalled some 8.56% in 2001, up from 1.54% in 1992, and a total of 1.3 million graduates have attended technical training institutes. However, this still falls far short of Singapore's 45% or Taiwan's 77.12% gross enrolment rates (Asian Productivity Association, 2003). In addition, technical, engineering and management training institutions in Vietnam are of poor quality and do not provide the necessary skills to enable firms to modernise and be more competitive.

For the last few years, using various sources of funding, the infrastructure and facilities of higher education institutions in Vietnam have been significantly upgraded. Some laboratories have received new equipment, electronic libraries, electronic communication networks (LAN and websites). The introduction of tuition fees for higher education has also brought about substantial extra resources for the universities. In general, the Government has adopted a policy of creating a selective number of strong public universities as a basis for the further development of universities across the country (the establishment of national universities, regional or community and open

universities are just a few examples of such changes to the university system). As a result, several national universities such as Hanoi National University, HCMC National University and other so called “area universities” (serving a group of provinces having common features and conditions) located in Hue, Danang (central region), and Thai Nguyen (north) have been created. This move is aimed at creating “centres of excellence” for university education and research, in an attempt to achieve national recognition. Another key feature of the university system during the last decade was the establishment of Open Universities and the private university system. There are currently two Open Universities and 15 private universities in operation. Interestingly, these universities rely on teaching staff that still work for public universities (more than 70% of their staff). International cooperation has also been expanded in partnership with many international universities in order to renovate the curriculum and acquire broader experiences. Since 2005, the creation of universities holding an international status has also been explored as a major policy direction, in cooperation with several US and other leading western universities.

**Artikel I. Table 4: Universities and Colleges in Vietnam**

|                                     | 1995  | 2000         | 2001         | 2002          | 2003          | 2004          |
|-------------------------------------|-------|--------------|--------------|---------------|---------------|---------------|
| <b>Universities and Colleges</b>    |       | <b>178</b>   | <b>191</b>   | <b>202</b>    | <b>214</b>    | <b>230</b>    |
| Public                              | 109   | 148          | 168          | 179           | 187           | 201           |
| Non-public                          |       | 30           | 23           | 23            | 27            | 29            |
| <b>Teachers (thousands)</b>         |       | <b>32.4</b>  | <b>35.9</b>  | <b>38.7</b>   | <b>40.0</b>   | <b>47.6</b>   |
| Public                              | 22.8  | 27.9         | 31.4         | 33.4          | 34.9          | 40.0          |
| Non-public                          |       | 4.5          | 4.5          | 5.3           | 5.1           | 7.6           |
| <b>Students (thousands)</b>         |       | <b>899.5</b> | <b>974.1</b> | <b>1020.7</b> | <b>1131.0</b> | <b>1319.8</b> |
| Public                              | 297.9 | 795.6        | 873.0        | 908.8         | 993.9         | 1182.0        |
| Non-public                          |       | 103.9        | 101.1        | 111.9         | 137.1         | 137.8         |
| <i>In which: full-time training</i> | 173.1 | 552.5        | 579.2        | 604.4         | 653.7         | 729.4         |
| Public                              |       | 452.4        | 480.8        | 493.8         | 529.6         | 601.8         |
| Non-public                          |       | 100.1        | 98.4         | 110.6         | 124.1         | 127.6         |
| <b>Graduates (thousands)</b>        |       | <b>162.5</b> | <b>168.9</b> | <b>166.8</b>  | <b>165.7</b>  | <b>195.6</b>  |
| Public                              | 58.5  | 149.8        | 157.5        | 152.6         | 152.6         | 180.8         |
| Non-public                          |       | 12.6         | 11.4         | 14.2          | 13.1          | 14.8          |

*Source: Statistical Yearbooks (various issues)*

Traditionally, higher education organizations such as universities and colleges did not undertake research similar to the Soviet style model until the mid-80s. Instead, they concentrated on the provision of a planned labour force. Although training remains the principal mandate of universities, research has become a more routine activity recently, with attempts to turn universities into more research-led organisations. Still, only a limited number of university faculties have adequate resources to carry out significant

R&D. Only about 4% of public expenditure for S&T is currently assigned to universities, which accounts for approximately 15.3% of universities' R&D expenditure. The remaining funding for R&D expenditure comes from contracts with other organizations, of which, 29.2% is from enterprises; 6.7% is from other organisations; and 48.8 % is from international sources (Tran Ngoc Ca, 2006). In the period 1991-1996, universities undertook almost 200 pilot production projects relying on their own research results. From 1996-2002, universities coming under MOET, and the two national universities of Hanoi and Ho Chi Minh City, implemented some 3,800 R&D projects and were involved in 90 pilot production projects. Many universities have established their own R&D units. By the end of 2002, within the university sector there were 167 research divisions and 147 centres dealing with technology development and offering consultancy activities. There has also been some movement toward more entrepreneurial activities within university circles, with teaching staff doing more consulting for firms or local governments on a contractual basis. Nonetheless, it is perhaps too early to say that a strong culture of entrepreneurial universities has emerged in Vietnam.

Research at universities has several drawbacks. In terms of *perception and policy*, R&D activities within the universities system have not achieved their own recognition until just the last few years. Many universities are far from being considered as R&D "centres of excellence". Universities in Vietnam lack autonomous status. Although their operations have become much more independent than before, they still have to follow many directives and comply with regulations of either MOET, or in some cases, the line ministries that they belong to. Their staff, especially in public universities, have to face constraints in terms of salary ceilings, human resource management regulations, financial incentives, etc. In short, they are still deemed as government officials, rather than academics. Despite the move to abolish the separation between teaching and research, there has still been a well-documented lack of research and weak linkages between research and teaching.

The present incentive scheme does not promote a proactive approach among teaching staff in universities. There are few mechanisms to encourage them to interact with other institutions and firms. Cooperation (if any) is usually short term, and relies mainly on personal and informal relationships. As such, other than training the new labour force, the contribution of university activities tends to be isolated in nature. In the existing system to date, universities have not seen technology transfer activities as crucial for their own continued survival and any technology innovations are actually not seen as particularly attractive by firms. In many instances, the facilities and practical engineering knowledge of universities lags behind those of firms.

Another issue universities face is that of *human resources* for teaching and undertaking research. The number of professors and lecturers is relatively small compared with the number of students<sup>viii</sup>. Meanwhile, student enrolment is increasing. From 1995 to 2005, for instance, student numbers increased 4.43 times (from 297,900 to 1,319,754 students), while the teaching staff increased just 2.09 times (from 22,750 to 47,616 lecturers).<sup>ix</sup> Due to this overload of teaching, university staff simply do not have sufficient time left for R&D and/or other learning activities. An ageing staff is another problem, since the majority of professors and associate professors are over 55 years old, with few replacements in the pipeline. During previous years, many scientific and engineering disciplines failed to attract talented young students and as such a shortage of human resources in the university system is foreseen. Within the higher education

system, entrepreneurship is not a tradition. The most entrepreneurial characteristic witnessed to date is reflected in the desire of teachers to do “outside the class” teaching in order to supplement their income. The low basic salary of academic staff being offered as an explanation for this.

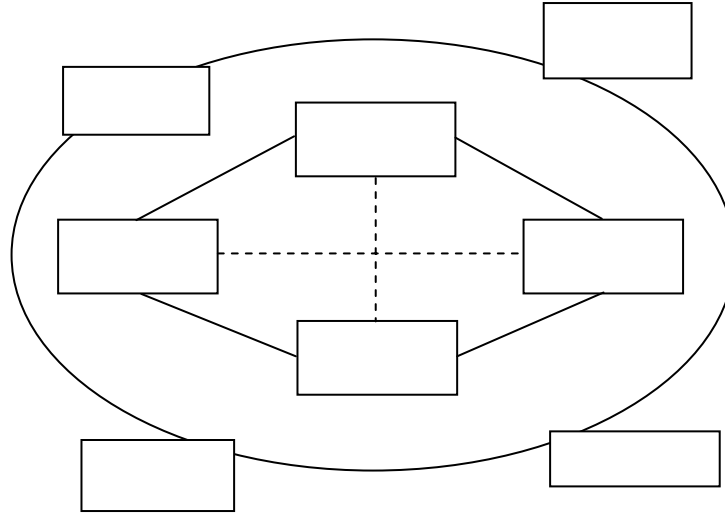
In terms of *infrastructure* and other teaching and R&D *facilities*, although the system has seen some recent investment for upgrading, this has tended to be only for larger universities. Many universities still use equipment and facilities dating from the mid-60 or -70s. Library systems in many universities are small, and outdated in both their quality and the scope of coverage. The bulk of foreign language literature is still in Russian and dates back to the mid-70s. There has been a lack of electronic links with the national library or investment in centralised information and librarian systems. Moreover, even for those universities that have English literature, the rate of use is often low due to the poor English capability of the staff and/or their current teaching workload. As a result, teaching curricula are often old, repetitive and lack innovative approaches and new knowledge. In terms of *international cooperation*, the changes of the international setting, causing difficulties in long term planning and unsuitable choices of the counterparts in cooperation, tend to put academic system in disadvantaged situation.

#### **4. The Current Vietnamese Debate**

As can be seen from the analysis above, the role and contribution of the academic system in the overall socio-economic development of Vietnam is somewhat unclear and presents a mixed picture. It can be both productive, useful for some and still of negligible value for others. Regarding the position of the academic system within the innovation community of Vietnam, this has always been an area of serious contention among academics, politicians, entrepreneurs and the public domain at large.

The first bone of contention relates to the *R&D institutions* themselves. There are diverse views on the impacts of S&T activities on social and economic development. This has been partly explained by the limited and dispersed resources. Another issue is the struggle between autonomy and command regime toward R&D institutes and universities. The need to compete for research grants and income-generating activities has also had a strong influence on the process. More recently, the issue of the intellectual ownership of research results has entered the discourse. Many argue that more intellectual property rights should be given to the creators of innovation and R&D results, including those working on activities funded by the public purse.<sup>x</sup> In the context of both the drive towards a market economy and the need for poverty reduction among larger communities, the issue of striking a balance between the provision of public goods and services (usually offered for free and intended to serve the needs of the poor and disadvantaged) and that of private goods and services on a commercial basis has become yet another area for discussion.

As discussed in some of the previous sections, as a result of the specific features of the innovation environment in Vietnam (namely a passive and under-developed innovation system) commercial relationships (including competition) have become the dominant interaction pattern with regard to innovation. Figure 5 below illustrates the dynamics of the innovation environment in Vietnam, and highlights the dominant role of business interactions over all other interactions, with academic institutions seemingly left out of the picture.



**Figure 5: Innovation environment highlights the dominant role of commercial interactions.**

Firms buy capital goods and raw materials from suppliers, and sell their products to, or subcontract to, their customers, who compete with one another. For those local firms which produce components for MNCs and/or large importers, in many cases any innovations are determined by their customers. Powerful purchasers might ask their producers to employ capital goods from reliable suppliers in order to guarantee quality. For suppliers, in order to sell their capital goods, they might have to sell on credit, and/or provide access to markets, introducing the firms to customers. The circle surrounding the diamond in Figure 5 indicates that financial institutions, academic institutions, government institutions and other services providers are not actively involved in the innovation process. The usefulness of these bodies, with regard to their support for innovation in firms, varies from sector to sector (the closer they are to the diamond, the more interaction there is between these institutions and the productive entities).

Recently, there have been a number of critics of the performance of the academic sector in Vietnam (Hoang Tuy, 2007; Pham Duy Hien, 2006; Pham Duc Chinh, 2006); although these critics have paid tribute to the few success stories, mainly in the fields of agriculture and public health. With regard to research activities, it has been argued that research undertaken in public R&D organizations and universities is unable to provide what the productive sector really needs. With regard to higher education training, critics have argued that graduates from universities lack practical, engineering and/or organisational capabilities. The result being that the graduates themselves, or their employers, have to spend significant time and effort re-training on the job, in order to improve their skills set. In general, it is argued that academic institutions fail to actively support innovations in the productive sector.

The second issue being debated is more directly related to *universities*. The conflicting objectives of these organizations and their staff, i.e. to generate income (via patenting or spin-off activities with commercial value) whilst simultaneously demonstrating scientific value (e.g. through academic publications), has been noted. The training mandate of universities has been criticised for being too focused on teaching in order to gain degree certificates rather than teaching in order to facilitate actual learning

(Dang Mong Lan, 2007; Vu Duc Nghieu, 2005). Teaching is more likely to be driven by theory without necessarily addressing the need for problem-solving skills sought after by the production sector (Vu Cao Dam, 2005). In addition, an ageing teaching staff with deteriorating and outmoded capabilities has been identified as yet another serious problem. Overall, within academic circles, these debates are viewed as critical and seen as a direct result of the quantitative development of the university system at the expense of any qualitative improvements. Such negative views can be heard being espoused not only from academic staff in national universities, but even from selected policy makers and members of the National Assembly (MPs).

Nevertheless, not everyone agrees with the above arguments. Several national workshops have debated the role of academic institutions without necessarily coming to an agreed consensus (Tran Ngoc Ca & Nguyen Ngoc Anh, 2005). Stakeholders in the debate are diverse, coming from a policy making background, like the National Council for S&T Policy, Ministries, Universities and firms. It has been argued that, despite all their shortcomings, academic institutions do, in fact, play a useful role in serving the emerging needs of firms, by creating various spin-off companies. Moreover, training, which is after all the key mandate of the universities, is seen to be well-delivered, despite its training shortcoming given above. Hence, the quantity versus quality discourse is alive and is being vigorously debated by various key players.

To further explore some of these issues, it is perhaps instructive to begin by understanding the nature of innovation in the context of the country's *external innovation environment*. The innovation environment in Vietnam, as a transitional and developing country, is quite different from what might usually be found in more advanced economies. Innovations in Vietnamese firms are influenced to a large extent by external factors, and also by the fact that institutions offering innovation support simply don't exist in large numbers. Some characteristics of the Vietnamese innovation environment are summarised below:

- First, the majority of firms in Vietnam are small (including FDI and SOEs) and often serve small, underdeveloped and unstable markets. They compete mainly on their access to cheap labour and the availability of natural resources (including land). Very few firms compete on the grounds of new technology or differentiated products.
- Many firms (especially those in exporting sectors) are making components for, or are subcontractors of, foreign business and/or MNCs; as a result their innovations tend to be incremental and determined by their foreign customers.
- The system of national and sector innovation is weak; public resources for R&D and other support for innovation are limited. Central government funding for R&D mainly goes towards projects of large public research institutions, which usually do not have a mandate or the mechanisms to provide services for firms with diversified and specific problems. Local government budgets for S&T activities are also limited and, in many provinces, any budget which exists is used internally, within existing local government bodies.
- A market for technical and innovation services has not yet developed. Alternative public services are also present or not effective.
- The body of common codified technical knowledge in Vietnamese is poor and not well organized, making it difficult for firms to reference and source.

- Knowledge of engineering is lacking, especially among academic institutions.
- Codifying technical knowledge is not a common practice in firms or academic institutions; as a result, large amounts of potentially valuable knowledge, which could be utilised effectively, is not codified, not generalized, and not appropriated, making it difficult to source.
- The institutional environment lacks transparency, is unpredictable and is not well communicated to stakeholders. Corruption is present in some public agencies, which inflates the cost of doing formal business. As a result, there are many informal economic activities, which do not favour innovation.
- The financial market is underdeveloped (the stock market is in its infancy, and there are a lack of mechanisms for venture capitalists and/or “business angels”), plus the relative informality of business makes it very difficult for investors to safely put their money into innovation projects. As such, many promising innovative projects simply cannot find appropriate funding.
- The lack of a level playing field makes rent-seeking the main priority of many firms, which, in turn, erodes the incentives for innovations.

Next, is the issue of *the nature of innovation* in a different context. Innovations in the Vietnamese economy, as in any typical developing country, differ from innovations in more advanced countries. Having analysed data from various surveys and case studies, some of the most distinctive features of innovations in Vietnamese firms can be summarised:

- Innovations are either incremental or “new to the firm”. Incremental innovations are common when firms try to solve specific technical problems which usually emerge from the operation of imported production systems or when firms try to produce “new” products using their existing production facilities. “New to the firm” innovations are common when firms acquire whole or parts of a production system in order to produce “new” products.
- It is not technological breakthrough, but rather technology diffusion and/or technology learning which are the main mechanisms for innovation. Acquisition of embodied technology via capital goods is the critical component of innovation. Partnering international production networks or key international players is important for technology learning.
- Many firms have to take a “second best” approach in their innovations, which means that rely on their own in-house teams to solve problems through a lot of “trial and error”. Most innovations arose informally, without an appropriate supporting structure such as standards, quality control, metrology, IPR, legal and technical consulting, information services, etc., and without systematically following best practices of technology management. Linkages with business partners, especially foreign ones, play an important role in firms’ innovation. Codified technological knowledge is under utilised.

Another much debated issue is *the mismatch between the production and S&T sectors* with regard to the capacity of academic institutions to carry out technical changes. The

central question of “Who can do what best, and for whom?” has been the subject of many workshops and conferences, as well as the media (Tran Ngoc Ca & Nguyen Ngoc Anh, 2005). Given the type of innovations described above, the academic sector should be easily able to support firms’ innovation effectively. The reason that they have not done so, to date, is because of the limited mandate of the academic institutions and their management bodies. As a result of the clear mismatch between the production and S&T sectors with regard to supporting innovation, it is perhaps not surprising that many firms prefer to do their own research, in cooperation with their business partners.

Since many of the innovations identified in Vietnamese firms are not science-based but rather problem solving in nature, firms assume that academic institutions are able to support them solve their problems, through their knowledge capabilities and/or technical services. However, academic institutions are often poorly organized and simply unable to provide effective innovation solutions.

**Table 5: Ranking of the most wanted services (by firms) and the most capable activities (for academic institutions) of enterprises and PROs**

| Type of services                                 | Firms’ Rank | Academic Institutions’ Rank |
|--|-------------|-----------------------------|
| Installation of new machines and equipment       | 2           | 10                          |
| Industrial Engineering                           | 5           | 11                          |
| Maintenance and fixing production machines       | 3           | 9                           |
| Analysing, testing product/material samples      | 1           | 4                           |
| Technical Training                               | 4           | 5                           |
| Modify product design or material specifications | 8           | 7                           |
| Modify production machines                       | 11          | 8                           |
| Manufacture production machines or components    | 10          | 6                           |
| Industrial R&D                                   | 6           | 1                           |
| Technology Information                           | 7           | 2                           |
| Advice on buying production machines             | 9           | 3                           |

*Source: Innovation Survey, 2002 & PROs Survey, 2000. NISTPASS.*

Table 5 shows the stark difference between what enterprises wish academic institutions could offer them and what academic institutions think they can, or should, offer enterprises. It is clear that while firms rank *“analysing and testing”* as the most desirable service from public research organizations (ranked 1st), PROs themselves rank this service 4th. Similarly, while firms rank *“Installation of new machines and equipment”* and *“maintenance and fixing production machines”* as the 2nd and 3rd most wanted, these are ranked 10th and 9th respectively by academic institutions. Table 6 also shows the reverse. While PROs rank *“Industrial R&D”* as their most capable service (ranked 1st), it is only ranked 6th by firms. Similarly, *“providing technology information”* and

"advice on buying production machines" are ranked 2nd and 3rd by academic institutions, whilst firms only rank them 7th and 9th respectively.

It is generally agreed that reform of academic institutions is sorely needed. However, any changes which are to be made should ensure that they are better able to serve both the needs of economic growth in general and as well as those which have emerged from the innovations of local firms in particular. According to a survey on firms' innovation activities, the following is a "wish list" of things which firms might wish to see in order to better orientate the academic sector. Given the specific features of innovations in a transitional developing country, firms would wish to see:

- A more innovative and friendly business environment where innovation activities were better supported.
- Easy access to detailed information relating to firms' innovation activities. Such information should cover all aspects of these activities, and be widened to include information on markets, materials, etc and not just technical information.
- Easy access to the pool of common technical knowledge which has already been codified and referenced in appropriate forms and languages, especially Vietnamese.
- Assistance be given in order to create links with production networks, both domestic and international.
- Access to reliable, affordable technologies, preferably in the form of a package of solutions which would usually include capital goods, technological know-how, training, supply of key materials, and access to markets.
- Access to a full range of technical services, at reasonable cost.
- Better training in technology management.
- Access to appropriate financial resources.

A new dimension has been added to the debate in the context of pro-poor growth and achieving Millennium Development Goals in Vietnam. In order to contribute to the solution of problems in areas such as the environment, poverty reduction, agricultural and rural development, gender equality, healthcare for all and education for all, academic institutions are now being asked to do more work on a voluntary basis. To provide free, or virtually-free, innovation products to these groups of recipients requires a totally different mindset and mechanisms. Not every organisation is prepared for this in a market economy. Potential conflicts do exist when they involve the interests of knowledge creators and knowledge users. Non-state stakeholders such as NGOs, associations such as the Vietnam Union for S&T Association (VUSTA), Women's Union or Trade Unions, can and would like to have a stronger voice in shaping the innovation landscape. Interestingly, private sector firms tend to simply stand-by and conduct business as usual, with or without the help of academic institutions.

These discussions lead to the debate about the need for an *institutional framework for innovation*. The *Science and Technology Law*<sup>xi</sup> states that it is necessary to: combine natural, engineering and social sciences and humanities; link R&D with training and education; and link R&D with business and production operations, in order to develop a technology market in the country. Another *Law on Education* (in its Article 15) regulates scientific activity (in the education system) and emphasises that universities and colleges

have a responsibility to coordinate their training with research and technology transfer, in order to better serve the needs of social and economic development. Leading Party documents<sup>xii</sup> also indicate that academic institutions have to become centres for R&D, technology transfer and applications in production and economy, in order to ensure closer linkages between research institutes and universities, and to link R&D with productive activities. Recent Laws on IPR (enacted in 2005) and Technology Transfer (enacted in 2006) have contributed a great amount to clarifying the issue of intellectual property ownership of research results and their commercialisation.

Still, a few continue to argue that the overall policy environment is not always conducive for their interactions. And interestingly, this policy environment could be adjusted and adapted to suit specific geographical locations by their respective governments. This might be explained by each specific socio-economic endowment of the relevant provinces and cities on the actions and performance of the academic institutions. But more than that, leadership of institutions is important where they could adopt pro-proactive approach in running activities (Tran Ngoc Ca, 2006).

There are a range of policies that need to be improved in order to facilitate improved linkages between academic institutions and firms. There has been a consensus that overall the innovation system in the country, in which academic organisations are the key actors, needs to be reshuffled, and research made more market-driven, better serving the need of both individual firms and industrial sectors as a whole.

## **5. Conclusions**

There have been many efforts to restructure the knowledge production system in Vietnam, which has been heavily influenced by the former Soviet-style model. The existing situation relating to the academic system in Vietnam shows that R&D institutions and universities are making significant contributions to the development of the country. Teaching has been the main function of the universities, and will continue to be so for more years to come. But there are still problems to rectify: under-qualified lecturers, poor infrastructure and curricula for training, limited capabilities of graduating students, to name just a few. In addition, innovation seems to be neglected, except for some major universities that have aspirations to become regional centres of excellence in the future.

Therefore, a re-orientation of the academic sector is sorely needed and a major overhaul is being planned. However, the roots of the problem lie in inappropriate incentive schemes for the academic system and the lack of a mechanism to diagnose the innovation needs of firms. Academic institutions need to focus more on problem-solving, an activity in which they used to excel. More autonomy is being given to academic institutions and with that comes more responsibility. There should be more improvement of incentive schemes so that they can promote these activities.

There are several key policy recommendations that can be made:

- A longer-term vision and a more strategic approach should replace the current short-term objectives of simply earning fees in order to benefit the academic system.

- To overcome the separation of research from teaching in the university system, there should be more autonomy and incentive systems to encourage innovative research.
- Investment should be more focused to avoid wasting resources and fragmentation.
- Modern university and R&D management practices such as peer review, advisory committees and performance-based evaluations should be thoroughly applied.

Balancing the potentially conflicting interests of offering more commercialised research, teaching and serving the public need is not an easy task for academic institutions in any economy. The establishment of companies to act as commercial arms or TTOs, TLOs is something which universities could pursue. A model of private universities built as centres of excellence<sup>xiii</sup>, with social “corporate” responsibilities, might be a sensible option for the country. Internationalisation of the academic system (via the introduction of new practices such as more international staff, international salary levels and modes of management, evaluation criteria and teaching quality, etc.) could create a drive for more competition and improved quality.

With regard to promoting linkages between academic institutions and firms, one should pay attention both to the extent of the linkages and mechanisms which is seen as affecting quantitative linkage, as well as to the mode of linkage that affects depth of linkages.

Any new mechanisms should be based on the overall principle of moving more towards a market economy, with macro regulations by the state. This should be seen as a long-term process, requiring determination and flexible solutions depending on the specific circumstances. Development of a technology market is one of the key outcomes of the increasing linkages with the production sector and could be achieved by the following measures:

- Creation and improvement of a legal system for a technology market (including regulations on science and technology contracts).
- Promotion of organisations required for technology management such as arbitration, registration of contracts, management of technology transactions, etc.
- Establishment of organisations dealing with market and technology brokerage, technology agents, and centres for leasing and contracting manpower for science and technology activities.
- Development of new forms of technology transfer, technology services, dealing with other technical issues of technology contracts.

Furthermore, to help solve the problem of inadequate linkages between academic organisations and production activities, several issues should be addressed: capabilities of the human resource; financial packages and incentives; organisation of R&D system; IPR issues; assessment of research results. At the same time, a key issue is to increase innovative capability in order to meet the technological innovation needs of enterprises. In addition to the two traditional domains of teaching and research, a third mission, that of serving the needs of the community, would appear to be appropriate in the current context.

The existing differences in their own capability assessments are one reason for the different approaches and attitudes in developing linkages between research organizations

and enterprises. When the universities (similarly to most R&D institutions) continue to under (or over) value their own capabilities, they will be seen as ignoring the views of enterprises and creating difficulties for enhancing the link with enterprises. In order to help the research community better understand the needs of production, one option might be to facilitate a dialogue between academic organisations and production enterprises to match their innovative need and actions.

Within this overall policy environment, specific policy changes, depending on the actual conditions of each location (cities, provinces), should play a pivotal role in shaping academic behaviour into being more business friendly and offering innovative productive patterns through their interactions with firms and the local economy.

This discussion suggests a more thorough investigation of some of the specific issues which have been raised needs to be undertaken in order to shed light on the academic study system and the balance between teaching, research and serving the society. This points to the need for case studies of selected universities to examine how this third mission is being carried out in practice.

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<sup>i</sup> National Council for Science and Technology Policy (NCSTP); National Institute for S&T Policy and Strategy Studies (NISTPASS)

<sup>ii</sup> National Institute for S&T Policy and Strategy Studies (NISTPASS)

<sup>iii</sup> These are known as Vietnam Academy of Science and Technology (VAST) and Vietnam Academy of Social Sciences (VASS).

<sup>iv</sup> Many OECD countries and China spend around 1.5% of their GDP on R&D.

<sup>v</sup> <http://hdr.undp.org/statistics/data>

<sup>vi</sup> An invention is a technical solution that is a world - wide novelty, involves an inventive step and is applicable to various social and economic fields (Art. 782, the Civil Code). The protection title is valid for 20 years.

<sup>vii</sup> An industrial design is a product's shape which is formed by lines, three-dimensional form, and colours or a combination thereof, and which is a world - wide novelty and is used as the pattern of industrial or handicraft products (Art.784 the Civil Code). The protection title is valid for 5 years.

<sup>viii</sup> 1 professor has to teach about 30 students, while in other countries this ratio is about 1/15

<sup>ix</sup> Data from Tsinghua University (China) shows that it has some 45 academicians, 929 professors, and 1,230 associate professors to serve 30,000 undergraduate students, 5,900 graduates and 2,600 postgraduate students. As such the ratio is only 1/9.

<sup>x</sup> As a result, there have been demands for “Bayh-Dole Act” style regulations.

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<sup>xi</sup> Enacted by the National Assembly of Vietnam, regulated in Article 5, sub-article 3 on the Principles of Science and Technology activities

<sup>xii</sup> Resolution of Party Plenum II on the Direction to develop S&T until 2010. Nhan Dan Newspaper.

<sup>xiii</sup> Chinese Tsinghua University is seen as a favourite model for Vietnam.