PROMOTING SCIENCE IN VIETNAM FOR NATIONAL DEVELOPMENT: A PROPOSAL

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Background and Summary

This proposal suggests upgrading the science and technology (S&T) training of Vietnamese scientists and engineers by creating two centers of excellence, one in Hanoi and one in HCMC. These centers would prepare and certify bright Vietnamese for graduate and post-graduate study abroad. It also foresees a Millennium Science Institute being started in Vietnam to provide a place for Vietnamese and other scientists to apply their skills and train others. These initiatives would be funded from a variety of sources, but two Learning and Innovation Loans from the World Bank to Vietnam would be critical. These initiatives should reinvigorate S&T in Vietnam and help it manage global integration on advantageous terms, if other supportive polices are also implemented.

The last decade of the twentieth century has shown the potential of using new technologies for economic development. The first decade of this new century will almost certainly see some nations that take advantage of these new opportunities and others that fail to do so. This will lead to some nations, not necessarily already rich, improving their relative position while others will fall back as they adjust too slowly to the increased pace of global change. Vietnam is poised to make a choice about which group it will choose to be in. Unlike many nations, it has a real choice to make. Its potential for rapid strides in science and technology are obvious to qualified observers. However, it has been difficult for the various groups to see clearly what needs to be done and to reach agreement on how to organize it. This paper proposes one part of a program that would re-energize Vietnam's training in graduate and post-graduate science and technology. Other steps would also be needed for the proposed investments to pay off fully, and these are also described briefly.

Vietnam has grown rapidly during much of the last decade, though the last few years have seen a marked slowdown due to a variety of reasons. While high oil prices give a temporary boost, it is evident that agriculture and mineral exports, while important, are not a basis for sustained rapid growth over the next few decades. Nor can simple labor-intensive goods such as garments and textiles provide sufficient scope for rapid export and industrial growth, though they too will increase in the coming years. Rather, Vietnam will have to make better use of its scientific and technological capacity. This will require a number of changes in policy. First, the *supply* of well-trained specialists will have to increase markedly. Compared to the 1980's, when up to 1000 graduates a year would go to study in the former Soviet Union, the current training is gravely deficient. Initially, most of this training will have to be done abroad, though upgrading local universities should gradually reduce the need for some overseas studies. Second, the *demand* for trained specialists will have to increase. Even now, many engineers and scientists have left jobs using their skills due to low pay and a lack of facilities. Unless the private sector can begin to use them in an appropriate way, no combination of aid and budgetary support will suffice to utilize their talents and further sharpen them. However, better organization of public money and, later, more of it would help attract and improve skilled scientists. Third, as these scientists apply their skills, there will be a broader impact on the entire economy and society, if other policies are favorable. These investments and associated policy reforms will help reduce poverty by accelerating overall growth and increasing the possibilities open to Vietnam.

The world is entering a period of rapid global integration. Computing power on a single microchip, roughly doubling every eighteen months while halving in cost, has dropped by a factor of 100,000 in cost since 1970. Communication costs are also plunging. The cost of sending a given amount of data has fallen from $150,000 in 1970 to 12 cents today, a better than million fold reduction. These trends are likely to persist for at least another decade or two. They allow firms to arrange global production in a much closer and faster way than previously possible. They also change the possibilities and modalities of scientific education, research, and collaboration. If the potential inherent in these technologies is used, both labor and capital can become much more productive. More can be produced with less. Incomes can rise with less sacrifice and astonishing rapidity. However, this does not happen automatically, even if a country is wired. To benefit fully, there needs to be deregulation and/or policy improvements in trade, investment, telecommunications, financial markets, education and law. While the winners are not numerous at first, their numbers grow quickly and include many outside of "modern" industries. A progressive science and technology policy, embedded in a pro-growth and anti-poverty set of overall policies, can transform a country within a generation. Vietnam is well placed to be one of the foremost nations to benefit from this potential.

The Science Institutes Group (SIG)

Various foundations and donors have been aware of the failure of science and technology development to keep pace in many developing countries. In league with a number of developing countries, they met in June 1998 in Chile at the invitation of President Frei and concluded that a new initiative was needed and would be productive. The core idea was to develop in particular nations an independent series of **"millennium science institutes."** (MSI) These institutes would share a number of defining characteristics:

- They will be efficient, small in size, and usually located within existing institutions.
- Their principal activity is scientific research, and their principal product is educated people.
- Each Institute will have a small permanent scientific staff of very high quality, a flow-through of junior scientists, and numerous visiting scientists.
- Institutes will be autonomous with respect to local institutional structures. At the same time, they will have linkages to other institutions, the private sector, government, and one another.
- Each Institute will have a leader of major scientific stature, with entrepreneurial qualities and charisma, who is able both to work at the frontiers of research and to serve local needs.
- Institutes should be flexible in concept and design, and adapted to local conditions.

Institutes or proposed institutes that desire to participate in the MSI will be expected to meet these criteria; other entities may join the MSI on a provisional basis as "Nuclei" when they have the potential for full membership.

Vietnam became a focus of the MSI after Dr. Phillip Griffiths had an opportunity to visit and engage in discussions with the local scientific community. The leadership of Vietnam has

recognized the potentially important role that science and technological innovation will play in the long-term development of the country. The government has, as a result, developed a long-term strategy for the development of science. In addition, it has recently created a taskforce assigned to help formulate and implement policy to promote the development of science in Vietnam. Finally, local leaders in Ho Chi Minh City have indicated a desire to support the MSI initiatives, even with their own resources.

Overall leadership of this Millennium Science Initiative is shared among the founding members of the **Science Institute Group** (SIG), a small group of outstanding research institutions that exemplify the qualities desired for Millennium Science Institutes. These members are:

- Institute of Pure and Applied Mathematics (IMPA), Rio de Janeiro, Brazil
- Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India
- Korea Institute for Advanced Study (KIAS), Seoul, Korea

The Institute for Advanced Study in Princeton, New Jersey, serves as the organizing and convening entity. The MSI leadership must be truly global if it is to represent the world's scientific community. The founding members of the SIG are well connected with the scientific communities of developing countries and with ministers of science and technology and of higher education. Dr. Rao of the Nehru Centre also serves as president of the Third World Academy of Sciences. Other members may be added as appropriate.

The purpose of the Science Institutes Group is to provide leadership, to help publicize the MSI within the scientific community (especially in the developing world), and to scout for potential new Institutes for the program. The members of the SIG will be responsible for selecting new Institutes, first as associate members and then as full members. Full members must demonstrate the ability to perform research and training at world-class levels and to maintain professional linkages with other Institutes and with the scientific community at large.

MSI in Vietnam

If Vietnam's long-term economic development strategy aims to create a robust, technology-driven industrial sector to provide jobs and meet the needs of its people, then it needs to renew the skills of its scientists and engineers. Once strong with thousands of students trained in the Former Soviet Union[1], Vietnam's pool of researchers in the science and technology though already well developed for its level of income, is rapidly deteriorating. Even though many of Vietnam's scientists have advanced degrees, many researchers now pursue activities that involve

[1] During the period of central planning, Vietnam was able to send approximately 1,000 students abroad per year for both undergraduate and graduate studies. Most went to universities in the former Soviet Union and Eastern European countries. By 1990, Vietnam had trained more than 6,000 scientists and engineers to the *Kandidat* and Ph.D. level. Since the end of Soviet aid in the early 1990's, the number of students able to take up studies in the natural sciences in the former-Soviet Union and Eastern Europe has been reduced to near zero. This has left Vietnam facing a growing deficit with regard to science

little basic science. Some of this can be explained by the lack of resources to upgrade laboratory equipment and to fund the networking activities (subscriptions to scientific journals, attending conferences, access to Internet, etc.) and collaborative efforts needed to keep abreast of current developments.

Already, by one estimate, Vietnam's science (mathematics and physics) is twenty years behind the rest of the world scientific community. A widening gap between Vietnam and the rest of the world in the sciences will ultimately hinder Vietnam's ability to develop a knowledge-based economy. The linkage is probably most clear in engineering, the most applied of sciences. Unless engineers are trained adequately, they will not be able to adapt to the quickly changing technology and will fail to keep up.

While the present education system is, in many respects, deficient, Vietnam is still able to produce young scientists of the highest caliber. Vietnamese mathematicians and physicists now hold teaching and research positions throughout Europe and the United States. Some of them are on the cutting edge with regard to research in their respective fields. The International Math Olympiad annually provides an opportunity for young Vietnamese students to excel. Vietnamese students consistently take first prizes at the Mathematics Olympiad.

The MSI hopes, in Vietnam, to reach out to this potential pool of future science researchers in order to begin the process of cultivating what may be one of the last remaining pools of scientific talent largely untouched. As presently envisioned, the MSI initiative in Vietnam will have two components as follows:

- Increase opportunities for high-end graduate studies in the sciences to help rebuild Vietnam's human capital in science and technology. An exchange program for graduate training in the sciences would be the backbone of this effort.

- Strengthen research in Vietnam by Vietnamese scientists. The MSI would work with the local scientific community to establish a nucleus or Institute that could be the focus of development for this initiative.

By creating opportunities for talented young Vietnamese scientists to study at the best universities in the world, MSI hopes to be able to make a substantial investment in the human capital required to create a substantial cadre of world class Vietnamese scientists. The MSI envisions sending relatively large cohorts of students abroad, mostly to the United States, for advanced degrees in basic sciences and engineering.

By investing in nuclei and institutes in Vietnam, MSI hopes to create research and academic opportunities that will attract the best of Vietnam's scientists to return to Vietnam upon completion of their studies overseas country. At the nuclei and institutes, they will be able to pursue work at the frontier of their discipline as well as to extend their knowledge into the surrounding communities, thereby helping upgrade scientific training and research beyond the doors of their institutes.

Expansion of Graduate Training and Exchange in the Hard Sciences and Engineering

Any meaningful effort to rebuild Vietnam's scientific human capital should include a mechanism to bring the quantity of scientific and engineering students in graduate training back to the level of the 1980s. (This would need to be supplemented by efforts to upgrade domestic research, which is the focus of the second portion of this section.)

For the medium term, an extensive foreign study program in the sciences is essential, and up to 500 students each year should be sent to the United States for graduate studies in the physical sciences, mathematics, computer science and engineering. This would bring Vietnam's graduate science training up to a level approaching the relative scale at which China has been sending its best students abroad over the past two decades.

In order to accomplish this quickly and efficiently, there needs to be a one-year screening, upgrading and certifying program. This course would prepare Vietnamese university graduates for GRE and TOEFL exams. More importantly, it would provide a one-year review curriculum in the sciences. At the end of the year, students would be eligible to take an exam that would demonstrate their mastery of a number of important concepts in the field of their choosing.

In addition to standardized tests, this independent examination process will be important in helping the first cohorts of graduate students gain entrance to high-end graduate programs in the sciences. In the admission process, US graduate programs are highly selective and as a result, the best programs rely heavily on the applicants' recommendations and the perceived quality of the previous degree. As a result, Vietnamese students face an immediate disadvantage in the application process. A standardized examination that might be certified by a reputable academic organization in the United States can help Vietnamese applicants overcome this hurdle. Over time, as the general quality of Vietnamese graduate students is better known, the need for such a preparation program and examination process will become less critical.

The one-year preparatory program will also provide potential applicants with placement counseling and finally a modest scholarship for those accepted to recognized academic programs. Given the current shortage of graduate students in the sciences, universities in the US usually provide generous teaching assistant or research assistant positions that pay both tuition and modest living expenses, especially starting in the second year. By developing a credible program to certify the background and ability of the applicants, it should be possible to obtain similar terms for the Vietnamese students. This would sharply reduce the overall cost of supporting foreign study, even if a first year stipend were included in the package to allow for a transitional period.

Some US scholars and scientists would also be included in the program's budget to visit Vietnamese institutions and to help transfer western teaching techniques, curricula, and research methods as well as help establish important collaborative links among scientists. Based on their mastery of the subject matter, older Vietnamese, with some upgrading, are qualified to teach younger Vietnamese in the one-year preparatory course.

This preparatory program might best be established in cooperation with the National Academy of Sciences and on the Vietnamese side the Polytechnic Universities in Hanoi and Ho Chi Minh City.

There are already two initiatives in Vietnam that are being pursued along the same lines as the initiative described above. First is a Ministry of Education sponsored initiative to send as many as 400 graduate students in a variety of disciplines overseas every year. A second initiative is sponsored by the Ho Chi Minh City People's Committee and aims to send 100 graduate students abroad over a period of five years to undertake advanced degrees in science and engineering fields. The MSI sponsored program will not seek to displace local efforts to increase the number of graduate students abroad. Rather, by focusing exclusively on the sciences and engineering, it will complement them.

A Science Institute

Vietnam's science and technology human capital also requires strengthening domestic institutions. The development of a science nucleus, or even a science institute, will go a long way to reinvigorating science in Vietnam. Vietnam's strength is that its institutes boast many talented researchers; the main barriers to progress are institutional. The nucleus will allow talented Vietnamese scientists the freedom to research potentially interesting areas without the constraints placed on them by Vietnam's normal bureaucratic structure and limited funding

By building a nucleus around a talented researcher, the MSI will be able to help Vietnam make contributions in areas where it has traditionally been on the forefront. For example, a nucleus might be built around biologists and geneticists in Can Tho as they are known for their work on rice and development of new rice varieties. With further training and facilities to take advantage of the recent publication of the rice genome, they may be able to produce even better varieties tailored to conditions in the country and region.

The key for the development of nuclei in Vietnam is to provide a mechanism for the most capable researchers in Vietnam to remain and prosper at home and conduct research at the cutting-edge of their disciplines. The existence of successful research programs in nuclei will attract the best recent Ph.D.'s to return home where they can remain at the leading edge while working in familiar environments.

To achieve this goal, each nucleus needs to be led by a professional researcher of outstanding scientific, educational and leadership capabilities. The stature of the director would enhance the prestige of the institute, helping make it an "intellectual magnet" for the nation and region, facilitating access to funding, and eliciting local and international collaboration. Electronic communication links would be used widely to reinforce personal contacts between colleagues spread throughout the world. The institutes themselves would form a worldwide network of small research institutions, bound by commonality of purposes and contacts between members. They would also form partnerships with institutions in the US, Europe, and elsewhere to increase collaboration and multidisciplinary interaction.

While research would be the primary activity of a Science Institute, it would not be its sole goal. To help the host country/region build a competitive and sustainable science base, Science Institutes will seek to catalyze outreach to both the academic community and industry. By reaching out to universities and students, the nuclei will be able to make a positive contribution to the education of the next generation of scientists and engineers.

These nuclei will strive to provide the best educational environment for talented young people. By increasing opportunities for young people to take an active role in assisting research, the nuclei will help motivate the next generation and help attract them to careers in the sciences and engineering. Linkages between institute members and universities will be encouraged so that advanced students are educated in a research environment, where they are more likely to be stimulated and inspired by the scientists surrounding them. Efforts would be made so that the same principles that serve to inspire students are disseminated down to the classroom level. Institutes will reach out to educators and teachers, exposing them to programs that convey the stimulation and practical uses of science-based activities.

The institutes created in Vietnam will have greater flexibility and more focused utilization of resources than traditional universities and research institutions. They require the freedom to investigate new, interdisciplinary fields that existing institutions may be slow to approach.

Short-Term Goals

For this proposal to be successful, the following steps must be taken. First, the Government of Vietnam must provide political support, so that an adequate institutional framework is allowed. Already, the Prime Minister has instructed the Ministry of Science, Technology and Environment to lead an interagency taskforce to oversee the implementation of science development program together with the Science Institutes Group (January 2000).

Second, detailed planning and assignation of responsibilities must be done in coordination with domestic and foreign partners. The immediate goals of the Millennium Science Initiative in Vietnam are:

- to continue the work of the Science Institutes Group, the core planning and monitoring body for the Initiative;
- to create a student exchange mechanism to jump start the process of sending large numbers of scientists abroad for study;
- to design and establish two nuclei (one in Hanoi and one in Ho Chi Minh City) to foster cutting edge research by the Vietnamese scientific community.
- to improve Internet access quality so that it can be used as an effective tool at reasonable cost. (This will require rethinking the “firewall” policy.)

The goal of planning program should be to enroll the first cohort of graduate students in the preparatory program by January 2002. Potential nuclei should be identified over the next two years so that the first nucleus might be in place by January 2002.

Medium-Term Goals

As the first tranche of foreign-trained Vietnamese scientists finish their training in a few years, many will have the alternative of staying on in the US or other rich nations. Salaries within Vietnam will undoubtedly influence their decision to return. At present, gross salaries over $800 a month face marginal taxation of over 75%, and average taxation well over 50%. Unless income tax rates can be reduced to levels prevailing in ASEAN or China, it will prove difficult or impossible to assemble the critical mass of talent needed for a Science Institute. Work should begin now on explaining this issue and working with the relevant authorities to remedy it. Failure to make progress on this issue will impair the viability of the Institutes and funding decisions should incorporate this consideration.

Longer-Term Conditions for Success

This proposal has only dealt with the supply of scientists. A successful nation and science system also fosters demand. Under the central planning system, most research was financed through government grants. Now, in any country, the private sector primarily supports, uses and develops applications for science. If Vietnam fails to allow a vibrant business-industrial sector to emerge, it will find its scientists seek work where it can be found. Thus, the emergence of a private sector will be necessary for long-run success, as government and aid-based demand for scientists will be limited.

Funding of the Vietnam Initiative

A number of possible funding sources are being investigated for Vietnam's Science Initiative. First, there could be two small loans from the World Bank. These Learning and Innovation Loans (LIL) do not detract from other aid pledged through annual donor meetings. They would be about $5 million each, and one would be used to initiate activities in HCMC and one in Hanoi. These funds would go only to Vietnamese entities. Second, several foundations are being approached and they may help support parts of the initiative, especially those involving critical management activities. Third, the mayor of Ho Chi Minh City has indicated he is interested in providing support, and the new software park might be a focus of activities. Fourth, the United States government may also offer support for exchange, including graduate and post-graduate

study in the sciences in the US and US scientists teaching in Vietnam. Each source will be needed for all the elements to fall into place.

Conclusion

By all accounts, Vietnam is a potential source for a large number of talented scientists. The proposal above is designed to assist Vietnam in developing its future as a major player in the world scientific community. It will be, necessarily, a long process. Gestation for any individual scientist can only be measured over many years. Also, the outcome is not certain. Science is part methodology, part creativity and part luck. No one can make any guarantees as to the final outcomes as a result of this effort to make major investments in people. Investments in people are, however, a prerequisite for success over the long term. Also, many of the changes in infrastructure should assist those living in Vietnam in both science and business. Without these changes, Vietnam will likely not be able to participate actively in the global knowledge economy.