

Challenge in Distribution of Knowledge

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Development, transmission of knowledge are keys to social and economic development in world

Knowledge and its applications have distinguished our species from the beginning. They have led to the understanding and utilization of forces of nature, to the design of artifacts, to the creation of factories and organizations, and to knowledge of our environment, its earth and its space.

For only in the last 50 years has knowledge become the leit motiv of our society, in the biological, in the technological, and in the social domains. We have reached a stage when knowledge, more than any other factor, has become the key to social and economic development, to competitiveness, to military strength, to our health, and to our relation to the environment.

In terms of social and economic development, Japan in the last 140 years has shown how, in spite of limited resources, it is possible for a country to base its development on knowledge both acquired from abroad and developed indigenously and education. This lesson has been repeated in Taiwan, Korea, Singapore, and a few other countries. In terms of competitiveness, information and knowledge have become the determining factors, whether in biotechnology (knowledge of the key information base of our life, the genes) or in computer technology — the technology that affects virtually everything we do. In terms of military strength, the soldier is not any more just a unit of power, but also a unit of information — an information that, in turn, reinforces power and that envelops the soldier in a network connecting him to the entire battlefield system. In terms of health, genetic information is gathering in

in-genetic medicine. In terms of our relation to environment, we are making gigantic steps forward through our knowledge of cosmic holes, of hurricane effects, of population dynamics, etc. These points certainly do not need to be highlighted.

It is important to distinguish between knowledge and information, although at times the two are used synonymously. Information is a mathematical-statistical concept, the removal of uncertainty. Knowledge can be defined as information plus judgment and skills. It is less quantifiable. It can be embodied in products or services, or it can be contained in individuals, or, intangibly, conveyed by books, etc.

Given the key importance of knowledge, it becomes essential, today to know how it is generated, transmitted, and utilized. Here, as well as countries are operating in an ever more competitive environment in which knowledge makes the difference between success and failure.

Even as individuals, we need to know how the information we receive is generated (so that we can assess its reliability) and our stake in keeping it being generated, and whether and how we receive all the information we need. We also need to know whether the information that reaches us is being manipulated in the process, and whether we utilize well all the information available to us.

These questions need to be examined in a global context, because knowledge knows no frontier. It can be generated anywhere; it can be transmitted to anywhere; it can be utilized anywhere. Thus, a firm, a country or an international organization need a strategy to address these issues on a global scale.

KNOWLEDGE STRATEGY

Basically, this demands the development of a knowledge strategy. In general can be very simply stated: how to obtain the necessary knowledge, and how to use it effectively. For some organizations like the U.N. or the World Bank, or some government agencies, the goal is to insure that the knowledge necessary to their constituencies is generated, diffused and utilized.

If the goal of a knowledge strategy can be simply stated, deriving a strategy to obtain it is complex. It involves a series of decisions, such as whether to generate one's own knowledge, or rely on the ability to utilize the knowledge generated elsewhere, or develop a mix of the two approaches, whether to control the channels of transmission, or rely on open channels or on a mix of the two, and whether to impose or force the utilization of knowledge — and if so, to what extent — or accept a more gradual, but possibly more effective, absorption through market mechanisms, technology transfer and other non-coercive means.

Although seldom a strategic choice is a pure black-and-white one, and a mixture of approaches is likely to be preferable, there have been historic examples of almost pure choices. For instance, Japan, at the beginning of its industrialization in the mid-1900s, relied heavily on receiving knowledge from abroad, and continues to this day to be a heavy importer of that knowledge. In the 20th century, Peter the Great forced the Russians,

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often against their will, to diffuse knowledge from abroad. More recently, Sri Lanka mandated a free market in virtually every commercial and industrial enterprise.

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The capability of the knowledge infrastructure available, together with a set of societal attitudes, beliefs and practices, are key to the success of any knowledge strategy. The knowledge infrastructure includes the research infrastructure, the educational system, government, markets, financial institutions, the finance-how embedded in industry, databases, communication systems (telecommunication, the press, etc.), science and commercial agencies abroad, the legal system and the mechanism for encouraging and protecting intellectual property, etc.

While economically advanced countries generally have a well developed — if not uniformly efficient — knowledge infrastructure and a favorable social environment for the generation, transmission and utilization of knowledge, most developing countries do not. (Recently the World Bank, conscious of this need, is focusing, with the assistance of the U.S. National Research Council, on a methodology for assessing the knowledge of a country) (PWC, 1991).

CHALLENGES FOR DEVELOPING COUNTRIES AND FORMER SOVIET UNION COUNTRIES

Thus, if they want to participate in a global market in which, increasingly, knowledge is the key factor of survival and success, most developing countries, face two inter-related challenges:

1. How to develop an appropriate and realistic knowledge strategy.
2. How to develop the knowledge infrastructure to support such a strategy.

A telling example of the difficulties that developing countries or economies face in this context is that of many countries of the former Soviet Union (FSU). There are, of

course, major differences among these countries. Some, like Russia, are highly developed in many sectors of technology, and are particularly outstanding in high-tech sectors like aerospace and military technology and are capable today, thanks to the confidence of those sectors, to enter into joint ventures with leading industries abroad. (This is exemplified by the participation of RSC Energia, Russia's leading space company, and the Ukrainian NPO Lavitskyi-Obrukov of ballistic missiles, in a consortium with Boeing and KraussRuechri (Europe's largest shipbuilders) to build the Launch, a strap-on satellite launching complex) (Lipin, 1990.) Other countries, like Uzbekistan or Kazakhstan, are rich in resources, but their technology is based only on certain sectors, like mining. Many possess well-trained scientific and technical personnel, and are quite limited in their civilian-oriented industries.

Generally, however, all countries of the former Soviet Union face the same kinds of problems in developing and utilizing the knowledge needed to develop a market economy and to attract participants in world markets. The reasons are multiple (Bogliarello et al., 1986; Weisler, 1990):

- Inadequate R&D and industrial skills for a market economy.
- Difficult inter-institutional cooperation.
- Lack of experience in international market practices and approaches.
- Inadequate systems for protection of intellectual property and technology exchange.
- Spotty standards, regulations and quality assurance mechanisms.
- Lack of appropriate financial markets.
- Inadequate telecommunications.
- Limited and incompatible databases.
- Inadequate management skills.
- Inadequate professional journals, meetings and other means of communication.
- Discontinuities in small and medium industries.

These problems are encountered not only in most countries of the FSU but, in varying measure, in vir-

tually every country of the developing world. They may also be encountered, in some measure, in developed countries, although what makes these countries developed is their ability to address with success, in the aggregate, such issues.

Lack of the deficiencies identified above represents a major stumbling block to a knowledge strategy and to the development of a knowledge infrastructure for that strategy. And each plays a role in the generation, transmission and utilization of knowledge. For instance, while R&D is a fundamental process for the generation of knowledge, it is important to recognize that inter-institutional cooperation, intellectual property protection, financial markets to support the commercial applications of that knowledge, effective databases, means for rapid exchange of information among researchers, etc., are all ingredients that greatly assist and encourage R&D. A knowledge strategy that focuses on R&D while neglecting these is doomed to failure.

TO OVERCOME THE OBSTACLES

To briefly review some of the obstacles that need to be overcome: The R&D system needs to be restructured to a market orientation. To quote Z.I. Alifirov, Vice-President of the Russian Academy of Sciences, "We were good scientists but bad businessmen" (Alifirov, 1990).

Inter-institutional cooperation was made very difficult in the past (and, because of tradition, continues to be so today) by rigid barriers among institutions — among research institutions, among factories, among university units. Yet, the kind of knowledge necessary for today's resources, social and industrial development is largely interdisciplinary, from biotechnology to materials science to environmental economics. Thus, making institutional barriers porous is a high priority not only among similar units, but also between government, industry, businesses, and universities.

Market practice. Formerly rigidly controlled economies have great difficulties in adjusting to the con-

cept of a lack of central organization to operate free markets, "without [the] organization [of] an international center... [that] may serve as a catalyst... the establishment of business contacts will be rather ineffective and take a long time and much money." (Ardichovic, 1996)

Lack of experience in international markets and its business-like practices generates unrealistic expectations, and hampers development because of constraining bureaucracies and fiscal practices, suspicions, etc. This is not only a problem of developing countries. The transfer of technology from one own national laboratories to the civilian sector has been impeded by unrealistic expectations held both by the laboratory scientists and the potential outside investors. It has been hampered also by suspicions — at times borne of experience — about the fairness with which the outside investors would treat the scientists' inventions.

Inadequate protection of intellectual property is a major stumbling block to the commercialization of indigenous inventions and to international joint ventures. Hence, the capacity to develop a strong and sensitive system, including skilled patent officers, and intellectual property legislation. Even in a country like Turkey, increasingly a participant in the global market economy, until very recently only about 200 patents were granted a year in spite of a substantial system of universities and research institutes (total, versus over 30,000 in Spain in spite of its smaller population).

Lack of appropriate forms of services — particularly small capital markets — is a NANOALJ — makes it very difficult for the new small-scale enterprises that are the backbone of a solid economic development to gather the necessary capital and for entrepreneurs to be rewarded substantially for their efforts. The traditional source of financing — the large banks or, directly, the state — are usually too inaccessible, bureaucratic and often corrupt to respond to their need.

Deficits — providing all sorts of information, statistical and otherwise — are an important underpinning of a knowledge strategy. Data

have enabled a country to learn about its own capabilities, about its own markets, about world markets, etc., and they help entrepreneurs learn about make informed decisions about possible investments in the country. In most PSL countries, and many LDCs, there is a need to expand and, above all, coordinate databases that are often spottily maintained, or are kept inaccessible (e.g., for historic security reasons) or are incompatible with each other.

Deficits in management skills for a global market are perhaps the most serious standing block. Lack of a market tradition, increments of authoritarian attitudes, limited experience with business practices abroad, lack of skills in the administration of investment and the development of a cooperative atmosphere with partners, rigidity in dealing with customers, are all factors that need to be addressed. They require time to be corrected, or in-depth education of the managers. This should be one of the highest priorities in helping PSL participate in a global market economy.

Inadequate telecommunication. "In the Soviet era information flows within and outside the country were carefully filtered and blocked. Right now they are open but totally chaotic. Experts do not know what their colleagues are doing, businessmen do not know what the prices and opportunities are in neighboring regions, and government does not have a complete picture of the situation in Russia's regions. It is difficult to make calls to another city and electronic networks, barely developed, don't offer even the most basic services they offer in the West, such as managing your banking account, booking tickets or shopping... The lack of telecommunication networks increases the cost and time span of virtually every activity in the country." (Batusky, 1994)

KNOWLEDGE IMPARTIBLE, TUBE, KNOWLEDGE ASSESS- MENT AND KNOWLEDGE PUNCT

In the light of the foregoing, ad-
dressing the infrastructural knowl-

edge needs of a country and devising an effective knowledge-based development strategy require three distinct but interrelated sets of actions that involve not only the country, but also, in varying measure of its interest, the outside community — that is, other countries — as well as international organizations, etc.

• Setting up an adequate knowledge infrastructure.

• Assessing the country's knowledge.

• Developing appropriate knowledge policies aimed at the social and economic development of the country.

Setting up an adequate knowledge infrastructure cannot be achieved without relying on the cooperation of other countries possessing extended experience in doing so. Developing countries, in addressing every key element of the knowledge infrastructure, can benefit from that experience. They can thus avoid the repetition of mistakes (e.g., the dominance of computer manufacturers) and capitalize advantage of new leapfrogging technologies (such as wireless telecommunication).

In the process, countries and organizations are offering their experience to PSL. And developing countries can be successful in that they are not patronizing and are willing to accept the fact that those countries have knowledge and skills to offer in return. Indeed, any LDC has something to offer, whether it is the knowledge of medicinal plants, of other natural resources, of some cooking skills, of desirable social practices, or whether it is the traditional ability to produce simple, robust and cheap technologies. (The latter is the reason why equipment from PSL countries was demanded in some developing countries.)

A country's knowledge assessment, exemplified by the World Bank initiative described earlier, is necessary to identify, clarify and, where possible, quantify the various sources of knowledge that the country possesses. Not yet well understood data related to knowledge are the economic value-added (i.e. value added created by knowl-

edge associated with different industrial sectors) as well as the correlation (or lack thereof) between information investment per employee and return on equity. (Strassmann, 1994)

A knowledge assessment also serves to identify the obstacles to participation in a global market, starting e.g. with the difficulties a foreign company may encounter in setting up an operation in the country. Thus, multiple knowledge assessments may be desirable for a multiplicity of purposes: for instance, generalised assessments by an entity like the World Bank, in collaboration with the country; industry-specific assessments by a given company in the country or from abroad; government-initiated initiatives, e.g. in education, training and research. An important element of knowledge of a country are also social and economic models that synthesise and attempt to predict significant trends.

The development of appropriate knowledge policies to serve the social and economic development objectives of the country is the ultimate goal of a knowledge strategy. These policies need to address a number of fundamental questions. The answers are predicated on the characteristics of the knowledge infrastructure and on the results of a knowledge assessment:

• What is and how to develop the knowledge required to enhance the country's potential/competitive advantages (e.g. raw materials, agriculture, tourism, mathematical or programming skills, mechanical industry, and human services)?

• What are the time lags in the development and utilisation of that knowledge in support of specific industrial, commercial, social and environmental priorities? Particularly crucial in this respect are decisions concerning the elements of the knowledge infrastructure (such as telecommunication networks) that are critical to every other aspect of a knowledge strategy, and that need to be given high priority.

• What is the relative emphasis to be given to in-country creation of knowledge, versus importing that knowledge from abroad (with implications for R&D investments, technology transfer, researchers and student exchanges, etc.)?

• What are the appropriate decisions as to the extent and speed of connections to world markets, and about the extent of privatisation of the knowledge infrastructure (including private telecommunication networks, stock and commodity exchanges, voluntary quality control mechanisms, not-for-profit schools and universities)?

• What should be the appropriate incentives for cooperation with foreign entities in the strengthening of the infrastructure and in assistance in the development of knowledge-based strategies?

• What are the mechanisms for periodic assessment of the progress toward specific knowledge goals and for appropriate revisions?

These mechanisms need also to monitor the possible negative economic and social implications of knowledge-oriented policies (including, for example, the possible extent of brain drain).

CONCLUSION

Although knowledge has been a key factor in human development since the emergence of our species, it is only in the second half of this century that it has clearly and explicitly become the key ingredient of social and economic development, as well as of military prowess. The development and transmission of knowledge knows no frontiers. Countries that are unable to respond to the challenges and opportunities that this entails are destined to fall ever more behind in their share of global progress and well-being.

All nations are now facing a new game, with new rules, new players, new games, new winners and new losers. This is evident, for instance, in what telecommunications make possible. (Bughiovski, Spring, 1994)

In assessing the effectiveness of its knowledge resources and developing an appropriate knowledge strategy, a country needs to be reminded not only of the multiplicity of factors involved, but also of possible side effects of such a strategy, such as impacts on employment, and the necessity of a rapid escalation of investments in the knowledge infrastructure. A knowledge strategy to respond to the challenges of a global market must be developed with awareness, because it is not automatic. For instance, that investments in the knowledge infrastructure will yield higher returns on investment. Other socio-technological factors can make the difference between success and failure.

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