



NORTH-HOLLAND

Strategic Role of Technological Self-Reliance in Development Management

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ABSTRACT

Thanks to technological advancements, every society — throughout the world — is now better off than before. Although this is true for all societies considered in an aggregate manner, within each society and between different societies, the relative gaps in prosperity are increasing. Reversing these gaps is the most important challenge for human development in the twenty-first century. A thorough scrutiny of the causes for the observed negative trends would indicate that technological gap is at the root of all. Success stories clearly tell us that technological capacity building is the best foundation for any meaningful economic growth that leads to a higher standard of living and greater prosperity for the citizens of a country. Moreover, technology-based creative problem solving and the ability to manage technological innovation are essential prerequisites for the success of contemporary business executives operating in the competitive globalized market environment. Paying attention to these lessons is the call of the day for any developing country government as well as for the business executives of that country. This article discusses the strategic role of technological self-reliance in development management, in terms of what we have learned so far and where we should be going, so as to reverse the widening technological capacity gap between the developed and developing countries. © 1999 Elsevier Science Inc.

I. Introduction: There May not Be Any More Wakeup Calls

World Development Report 1998/99 of the World Bank proposes that we look at the problems of development in a new way — from the perspective of knowledge [1]. The report states that: Poor countries — and poor people — differ from rich ones not only because they have less capital but also because they have less knowledge. And indeed, even greater than the knowledge gap is the gap in the capacity to create knowledge. The World Bank Report goes on to suggest that expanding telecommunications hold the promise to improve every developing country's capacity to absorb knowledge. Incidentally, back in 1987, there was a special issue of the *Technological Forecasting and Social Change* journal focusing on "Technological Capability Assessment in Developing Countries: A Discussion on Rationale and Possible Approaches" [2]. It was observed then that the crucial gap between the developed and the developing nations was a technological one. Clearly, the difference between the rich and poor societies may be money, but the difference between developed and under-developed societies

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is in fact technological capacity. Even now, many developing countries may be rich in some ways (for example, in terms of natural resource endowment, culture, etc.), but they are indeed very poor in technology.

While there is no doubt that the human race is better off as a whole than it was a few years ago, there have been noticeable increases in the gaps between the fortunate few and the unfortunate many. Specifically we can point to the following five dimensions of widening gaps between the leaders and laggards societies: gap in economic and business prosperity, governance and management maturity, political and legal stability, social and cultural integrity, and local technological capacity. One of the main reasons for widening of these gaps is that the current leaders understandably do not want to lose any of their power relative to the others. Their interest, therefore, lies in maintaining the status quo by preserving the established systems that favor them. With plausible justification, different kinds of established property rights maintain privileges of the already established. Notwithstanding these, World Bank recommendation is at best a partial solution. Without adequate attention to other gaps (most important of which is the technological capacity gap), improving global communications can further exacerbate the tensions between the rich and the poor. Thus, we may continue to experience and see a great global gap between the real and the possible. However, if increased gap in living standards leads to political instability and mass migration to richer areas, the rich may have a lot to lose!

Let us now observe some of the historical facts to establish the many causes of increasing gap in living standards between the leaders and the laggards of the contemporary world. We know that never before has so much technology been available to humankind. And if we speak of the world as a whole, there has never been a better time than now. We all live longer and better than before. The standard of living of each person (excepting only those temporarily affected by natural disasters, destructive conflicts or criminal activities) has improved over the years. According to the World Bank's *World Development Report* for 1997, the average per capita income in the developing countries grew 3.4% from 1986 to 1994, compared with 1.9% for the industrialized countries [3]. However, according to United Nations Development Program's *Human Development Report* for 1996, the gap in per capita income between the industrial and developing worlds tripled between 1960 and 1993, from US \$5,700 to US \$15,400 [4]. Therefore, the real problem is the increasing relative gap. The Millennium Project of the United Nations University, which is looking into the state of our future, offers more relevant information, which are noted below [5, 6].

The worldwide cohort of the poor has never been larger — nearly a third of the global population of six billion now lives under the poverty line (defined as per capita income below one dollar per day). One of the reasons for the poor becoming poorer is that: advances in literacy, life expectancy, nutrition, health-care, security and employment opportunities are being outpaced by population increases. There are many other reasons. The powerful and wealthy people claim disproportionate share of prosperity. Consequently, improvements in the conditions of work, employment, leisure and equal status for women are still in few areas of the globe. Only some rich minority groups are able to enjoy steadily improving quality of life. The poor majorities are left behind in lives of too much danger, too little hope and not enough opportunity. The majority groups are desperate and being led by the international media to believe that free market and democracy will bring them closer to the developed society living standards. However, the poor is impatient and want to have similar privileges, which the rich are reluctant to share, because no one would voluntarily give away their privileges! The

poor export low value raw materials to import high value processed goods. The rich countries get richer through steady capital gain and unending brain drain. Often, the rich rob the poor and poor rob one another. And the politicians in the developing countries consider themselves to be much more important than their countries' future. As a result, gaps in resources, capabilities and opportunities are widening.

Within the developed economies, we find, governments have safeguard mechanisms so that capitalism does not disproportionately benefit the wealthiest and further impoverish the poor. Developed country governments have established elaborate welfare systems and regulatory mechanisms for gap reduction within the country [3]. Now, developing country governments, multilateral institutions, non-governmental organizations and the private enterprises must all work together — to institute policies and action plans that will reduce the gap separating poor societies from the rich. However, it should not be forgotten that, ultimately the responsibility for reducing human development gap between the present day advanced and the laggard societies rests primarily with the developing countries themselves. Moreover, too much attention to election and frequent change of governments are not ideal conditions for gap reduction.

International development projects implemented through loans provided by a consortium of developed nations can only serve as catalysts for such developing country initiatives. It is high time that the laggards wake up to the realization that societies with limited technological capacity will be locked-out of the global economy — they will become non-players. They should have learned that only monetary measure of gap is misleading, because conventional corrective measures did not work. They have also learned that military power cannot solve the economic problems. Local political power is not the key to acquire wealth. The primary objective of long-term development can be summarized in very general terms as “sustainable economic growth, combined with social justice” [7]. Since every situation is different, development management calls for creative problem solving. However, though there is no definite path or country model for economic development, technology-based development initiative has proven to be more successful. Moreover, as the former Prime Minister of Singapore, Lee Kuan Yew has aptly stated “If you follow someone else's footsteps you will be always behind.”

Since technological change comes with both opportunities and threats, we need to be forewarned and forearmed — for which technology management is an essential tool — to pursue our technological capacity building goal. However, there are a number of prerequisites for successful use of technology in development management. Thus, to provide a framework for action, this paper focuses on the following questions: How is the present world changing and the why the need for technology management is increasing? If technological under-development were the root cause of the looming problem, would the leaders provide technology to the laggards for international market competition? What lessons can we learn from both the successful and failed examples? What are the imperatives for the developing countries?

II. Realization: Technology Management at the Center of It All

If there is a late awakening regarding the importance of reducing the development gaps, and given the resources scarcity, we have to address the most crucial of the underlying factors. For this, we now assess the emerging technology-driven international development paradigm. Figure 1 presents the various changes and their consequences in the international development scene. Technological advancement has become the centerpiece around which changes occur in the world today. Technology has transformed the way we live — more comfortably, with higher levels of consumption, and better

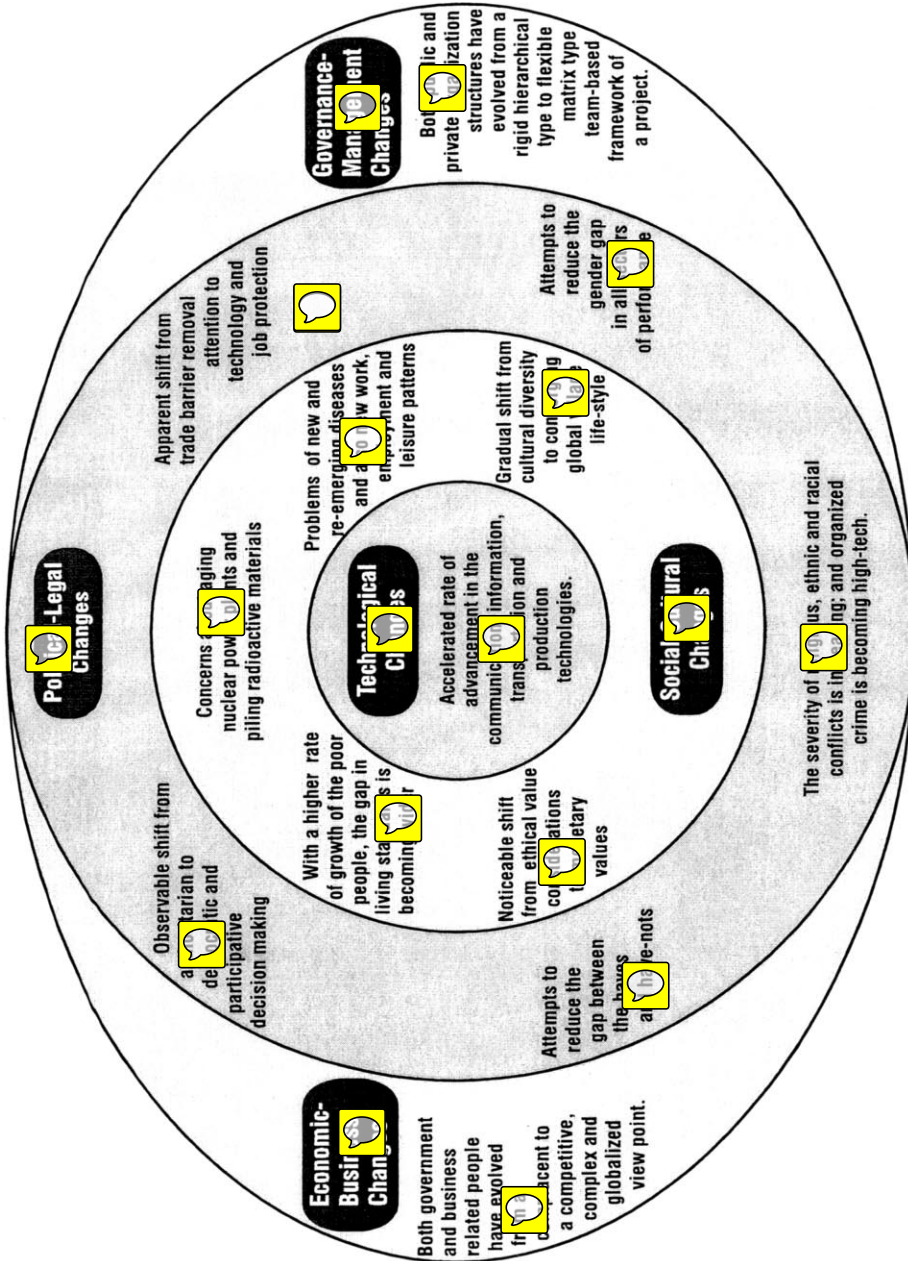


Fig. 1. Changes and shifting paradigms in the international development scene.

ways of doing things at work and play. Thus, socio-economic development is indeed technology driven. Evidence shows that societies best disposed to keep pace with latest technological developments have vastly improved their wealth and standard of living [6]. Politico-legal changes are now being propelled by technological and social changes.

However, one of the most crucial points to remember is that we live in an interdependent world. Regarding the interdependent development setting, first we note the fact — everything is interconnected to everything else in a complex, dynamic and systemic manner [8]. Next we note the myth — we are rapidly becoming a global village with one system and one standard for all [9]. Then we note the reality — the world is very competitive, and in a competitive world, no one gives something for nothing! Let us also note other contextual developmental issues related to global interdependence discussed in the 1997 Millennium report [5]. All businesses are global and all national economies, including the developing economies, are now globalized. Religious, ethnic and racial hostilities, held in check by the Cold War, have now emerged as a major theme of armed struggle. In an information age, when knowledge can flow in lightening speed, alas the knowledge gap is increasing! Global economy is driven by instantaneous capital and information flow. There is concentration of productive resources, and deepening class polarization due to the migration of the wealthy and talented. Increasingly, capital and natural resources flow to those countries with the stronger technology base, reinforcing inequality. Besides, the intellectual property right is an unavoidable evil that maintains the privileges of the technologically more advanced countries of the world. Globalization of goods, capital, and information flows may seem to be making it easier in principle to narrow development gaps between countries, but the current accelerated pace of technological change in the advanced countries means in many cases a widening gap in practice. It is leading to polarization of the “haves” and “have-nots.”

The handwriting is clearly on the wall that technological capacity building is an essential prerequisite for any developing country to survive in the competitive global economy. Advances in technology have come to be recognized as the most important single factor contributing to economic growth, and of overwhelming importance in producing more with less [10]. Ability to be (or not to be) a global participant and competitor in the marketplace will determine the ability of a nation to achieve sustainable development. Therefore, failure to build a technology society is, economically speaking, a snub to the future itself. It is a matter of national survival as well as security. Recognizing that technology is at the core of all our development efforts will allow us to focus on right policies and initiatives. Thus, the most important economic consideration is to reverse the current trend of an increasing gap in resources, capabilities and competencies caused by inadequate attention to technology [11]. And for that the strategic requirement is technological innovation for competitive advantage in the global marketplace through productivity gain.

III. Imperative: Self-Help for Productivity Driven Competition

Technology-based development objective is to improve competitiveness of the economy (i.e., local enterprises) in the globalized marketplace. Competitiveness of an economy is its ability to produce goods and services that meet the taste of international markets. Technology plays the most significant role here, because it enables a society to produce those. Therefore, a necessary prerequisite for adding momentum to a nation's modernization and development efforts is an orientation for technology-based competition [10]. The foundation for this orientation is that market competition is built on technological innovation, and technological innovation is a never-ending process (as

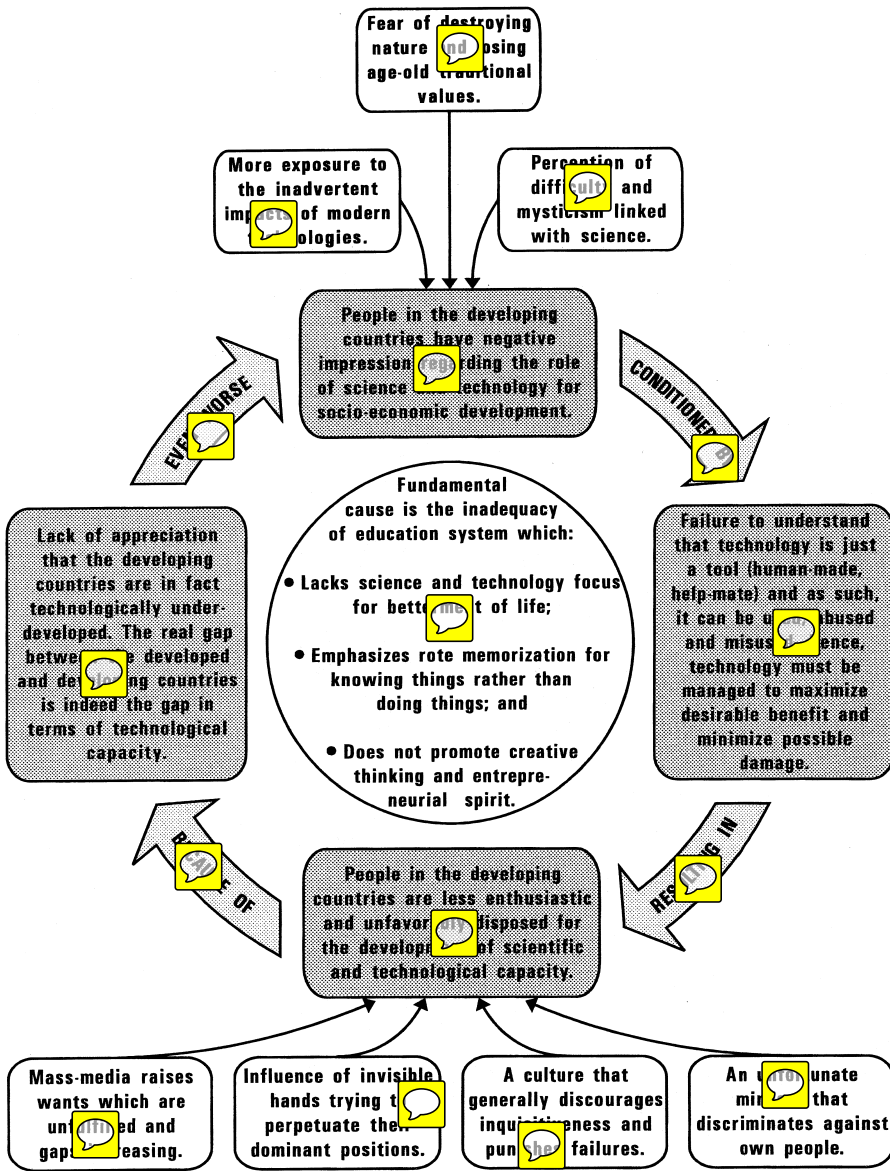


Fig. 2. Vicious circle of technological underdevelopment.

technology is human-made and people by nature like to compete, to excel). Thus, to be successful, we have to master the innovation process. However, most developing countries face two kinds of problems. First, they are generally in a vicious cycle of technological underdevelopment (depicted in Fig. 2). Second, they have an unreasonable expectation that outsiders are going to help them to become more competitive. Let us elaborate these further.

The world that we live in is shrinking daily in terms of rapid transferability of natural resources, produced goods, services and money [8]. However, there is ever more restrictions in moving people from the developing countries to the developed countries.

The global media has the power to make everything (from their point of view) instantaneously visible, and hence condition our mind and thinking. For obvious reasons, business tycoons of the developed world are monopolizing international mass media to serve their own interests. Developed countries in self-interest transfer only obsolete technologies to developing countries and keep them in a never-ending game of playing catch-up. Those who give loans for development like: privatization that makes their multinational corporations more powerful; increased international trade that favors the industrialized countries; some increase in purchasing power of the poor to promote export; and some improvement in productivity of raw-material extraction for cheaper imports.

The so called donors need to be reminded the virtue of an age-old Chinese saying: “If you really want to help someone, do not give fish, teach how to catch fish.” But in reality, we observe a very disturbing trend — more dependence of the poor on the rich is due to increased gap in self-reliance. Merely providing food and necessities to the poor has no return at all. It only provides relief to the hungry on a short-term basis until the money runs out. Evidence shows that World Bank funded development projects have mostly led to increased resources transfer in favor of the rich [5]. The infrastructure development projects helped exports of raw materials for the industries in the advanced countries, and in the developing countries, the beneficiaries are not the poor but the rich who are in the trading business. It is clear that established global financial mechanisms give advantage to those already established, and hence contribute to north-south polarization. Development assistance appears to be treating the symptoms, not the real cause of development gaps. Isn't it intentional, because nobody can be expected to provide assistance to endanger his or her own position? Obviously then, we should not expect outsiders to solve our problems. In a competitive world, we only have ourselves to depend on. And if we attempt to solve the right problems, there will be success. Therefore, getting out of the vicious circle of technological underdevelopment is our responsibility, and attempting technological innovation through self-reliance should be our priority number one. The will to change should come from within. No amount of support from outside (even if genuine interest) can actually help improve the situation in a country until the people are committed to improve themselves.

One should also keep in mind that the ultimate objective of any national development project is to help local enterprises join the globalized competitive market and be successful in international business. In producing outputs, every business enterprise needs technological resources to add value to nature-based derived resources, such as: matter, material, food, and energy. Evidence shows that in the present-day globalization condition, the market value of products and services depends more on the technologies utilized than the raw materials that go into their production [12]. Moreover, location-specific natural-resources-based comparative advantage is lost over time, while created technological resources can lead to renewable competitive advantage [13]. Therefore, achieving and retaining competitive advantage by a business enterprise in the ever-more globalized market environment, that is driven by rapid technological change, surely calls for continuous productivity gain and conducive treatment of conflicting stakeholder interests. In fact, making productivity gains will ultimately translate into better quality of life and much more harmonized stakeholder relations. The important elements of technological innovation and various stakeholder aspects are discussed next.

IV. Basis: Gamut of Technology Innovation for Productivity Gain

An enterprise achieves productivity gain conjointly through (customer perceived) output value maximization and (producer realized) cost minimization. Both of these —

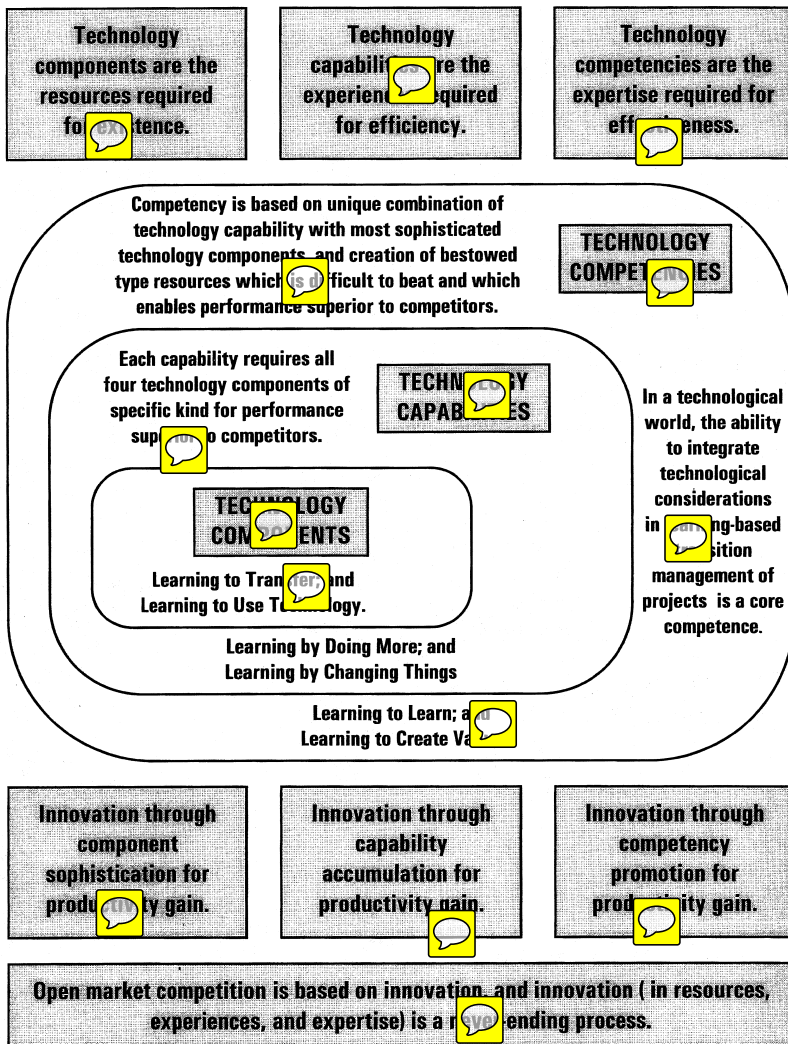


Fig. 3. Role of technology elements for competition.

value addition and cost reduction — require technological innovation, because new technology helps us to do more of the old things, better things, newer things, and things faster than before. Higher living standards are the fruits of higher productivity. And higher productivity can be achieved only with the application of improved technologies. Thanks to the natural human desire to excel, to compete, and to maximize utility of human creations, there will never be a finish line for technological innovations. Therefore, in this section we consider the technology elements for productivity-driven market competition. Figure 3 incorporates various aspects of technology-based market competition described in the literature [14–16].

Technology resources are the essential means used by any business entity to produce and market outputs. Since there are more than one kind of technology resources, and as they are dynamically interrelated, we call them technology components. Varying degrees of component sophistication provide many choice options. However, higher

degrees of sophistication give higher technology content addition potential, leading to high value added outputs. Therefore, for any business firm, technology content of its outputs is very much dependent upon the combination of technology components possessed and utilized in various functions of the business value addition chain. The following are the distinctive types of technology components and illustrative examples of their sophistication:

- Technoware — object-embodied physical facilities — equipment and artifacts. General purpose → Special purpose → Fully automated → Programmable machines. Technoware amplifies human power for producing goods and services.
- Humanware — person-embodied implicit abilities — individual tacit wisdom. Operational skills → Understanding skills → Assessment skills → Innovation skills. Without relevant humanware, technoware is simply non-functional or useless.
- Inforware — document-embodied facts and figures — recorded and codified knowledge. Awareness facts → Utilization facts → Optimization facts → R&D-related facts. Inforware enables quicker learning and saving in terms of time and resources.
- Orgaware — organization-embodied procedures and networks — methods and practices. Tradition-based → Research-based → Systems-based → Project-based techniques. Orgaware is for coordination of activities and resources in achieving desired goals.

Technology components are either bought from outside or made by the enterprise itself. These are the essential resources for the existence of any enterprise. Four technology components are dynamically interactive and are always needed simultaneously for each functional capability of the business. However, the relative importance among the four essential components is different for different specific functions. Combined interaction of all of the four components determines technology content of a business function. And, innovation in terms of technology component sophistication means (in operational sense) substitution of new for old. More sophisticated generally entice additional complexities but better outputs. The management role is to match available technology components to output requirements for existence of the enterprise.

Since tradeoff among technology components determines the unique contribution to possible value addition, important features regarding their interrelatedness are worth noting. The most sophisticated technoware often comes with built-in humanware and requires very sophisticated inforware. Any labor-intensive technoware usually requires higher level humanware and more labor discipline. Inforware best resides in well wrote, illustrated and complete documents, which can be used by the enterprise for changes leading to competitiveness. Knowledge, which is not documented or recorded, is not inforware; it is still humanware. Utility of available inforware depends upon the qualifications of humanware. Unimplemented techniques are not orgaware, but just inforware. These subtle distinctions are very important for management decisions regarding the choice of four technology components for any specific functional area of the business.

Having the means is one thing; being able to get maximum return from the available means is another. Capability is the power to do something — it is the necessary condition for business competition. Experience-based accumulation of function-specific capabilities, through adapting, adding and upgrading technology components, is crucial for the progress of any enterprise. The following are the major types of technological capabilities of business enterprises:

- Acquiring capability — obtaining essential input resources for the enterprise. (Generally includes activities related to sourcing and procuring.)
- Converting capability — transforming available inputs to marketable outputs. (Generally includes activities related to operating and supporting.)
- Vending capability — arranging distribution, sales and servicing of outputs. (Generally includes activities related to selling and satisfying.)
- Modifying capability — adapting and improvising products and processes. (Generally includes activities related to adjusting and improving.)
- Designing capability — converting idea to concrete shapes up to prototype building. (Generally includes activities related to conceiving and devising.)
- Generating capability — commercialization of new machines and processes. (Generally includes activities related to creating and introducing.)

Although some technology components can be bought, technology capabilities are only gained through actual experience or merger with experienced units. Moreover, having capabilities is a cumulating process. They are normally added in a particular order, depending on the enterprise situation and market options. Generally, capability advancement means better performance due to producer's cost reduction and productivity gain for the firm through efficiency of operation. Here the key word is efficiency — which means: “doing things right.” Higher efficiency is the result of more “learning by doing” and even more “learning by changing.”

Having the capability is one thing; making sure that their use leads to comparative advantage is still another. Technology competencies are the learning-based transition management expertise. It is the all-encompassing technological expertise of the firm enabling it to leverage capability accumulation and component sophistication for market value optimization. Competency comes from the creation and renewal of hard to beat and unique advantages. The following are the major types of technology competencies of business enterprises:

- Head start position given by factor endowment advantage in terms of NBDR (NBDR = nature-based derived resources);
- Leapfrogging opportunity given by human resource advantage in terms of IBCR (IBCR = intelligence-based created resources);
- Very difficult to beat strategic-alliance-based advantage in terms of LBSR (LBSR = linkage based synergy resources);
- Any uniqueness established by historical heritage advantage in terms of NBBR (NBBR = brand-name based bestowal resources).

Technology competency means more than technology component sophistication and technology capability accumulation. It means the ability to provide timely, high value-added outputs that are perceived by customers as value for money. More expertise means more learning (“learning to learn”) to create and renew advantage. The key word here is effectiveness — which means: “doing the right thing.” It may be treated as the sufficiency condition for competitiveness — the expertise that lead to extra leverage for superior performance in the market place.

Technology strategies are vital for visionary guidance to steer an enterprise to economic sustainability. Strategies are the directions for reaching up-value markets. As the enterprise sets higher targets in the competitive market, it faces more technological challenges. For the innovation project, strategic direction gives guidance for systemic progression through — technology components sophistication, technology capability

accumulation, and technology competency elevation. The following are the major types of technology strategies of business enterprises operating in the international market:

- Extender strategy — Salvation of obsolete technologies for input cost control. Target measures to meet the demand of price and performance sensitive customers.
- Exploiter strategy — Utilization of standardized technologies for profitable operation. Target measures to meet the demand of quality and reliability sensitive customers.
- Follower strategy — Adaptation of advanced technologies for market niche response. Target measures to meet the demand of feature and environment sensitive customers.
- Leader strategy — Generation of state-of-the-art technologies for new ventures. Target new outputs to meet the demand of image and status sensitive customers.

To summarize, technological capacity building includes technology component sophistication, technology capability accumulation, technology competency elevation, and technology strategy progression. The technology components are the basic resources required for existence in a global market. By learning to transfer and use technology, one can achieve strength for productivity gain. Through component sophistication drawn from innovation, they become capable in terms of experience that lead to efficiency. Technological capabilities enable greater efficiency by continuously changing to do more and better things. With the accumulation of capabilities, competencies evolve by learning how to learn and learning how to create value effectively. Technology strategy progression enables a firm to achieve higher levels of competitiveness, and hence obtain better returns on investment. All of these activities have to be properly managed as technological innovation projects.

V. Recognition: Management by Project with Multiple Perspectives

In the present world, organizations have to compete by drawing on the talents and creativity of all, not just few managers. Competitive advantage today comes from continuous, incremental innovation and refinement of a variety of ideas that spread throughout the entire organization [17]. Thus, the effective organizations are essentially people-oriented and learning type [18]. Moreover, due to information-technology propelled continuous power-struggle between the employer and the employee, organization structures in both public and private sectors have gradually converged from a rigid and closed system to an open team-based project structure. This evolution process is shown in Figure 4. It may be worthwhile to note here that the traditional view of management assumed that every organization needs two kinds of people [19]. The important people are the managers — these are the entrepreneurs, who are rewarded with fame and fortune. The other people include the workers — they put in a decent effort executing the entrepreneurial grand design, and are disciplined through clear rules and punishments. However, due to the evolution of stakeholders' power struggle, which may be largely due to technological, social, and political changes, now there is a fusion of the roles of managers and workers to collectively work as self-managed teams. Thus, newer organizations (commissions in the private sector and projects in the public sector) are made up of holistic, self-managed teams that can change with fast changing world and can ensure rapid deployment of new technologies.

Some say that project-based development planning in a rapidly changing world is now a necessity [19]. Therefore, we should consider the development management

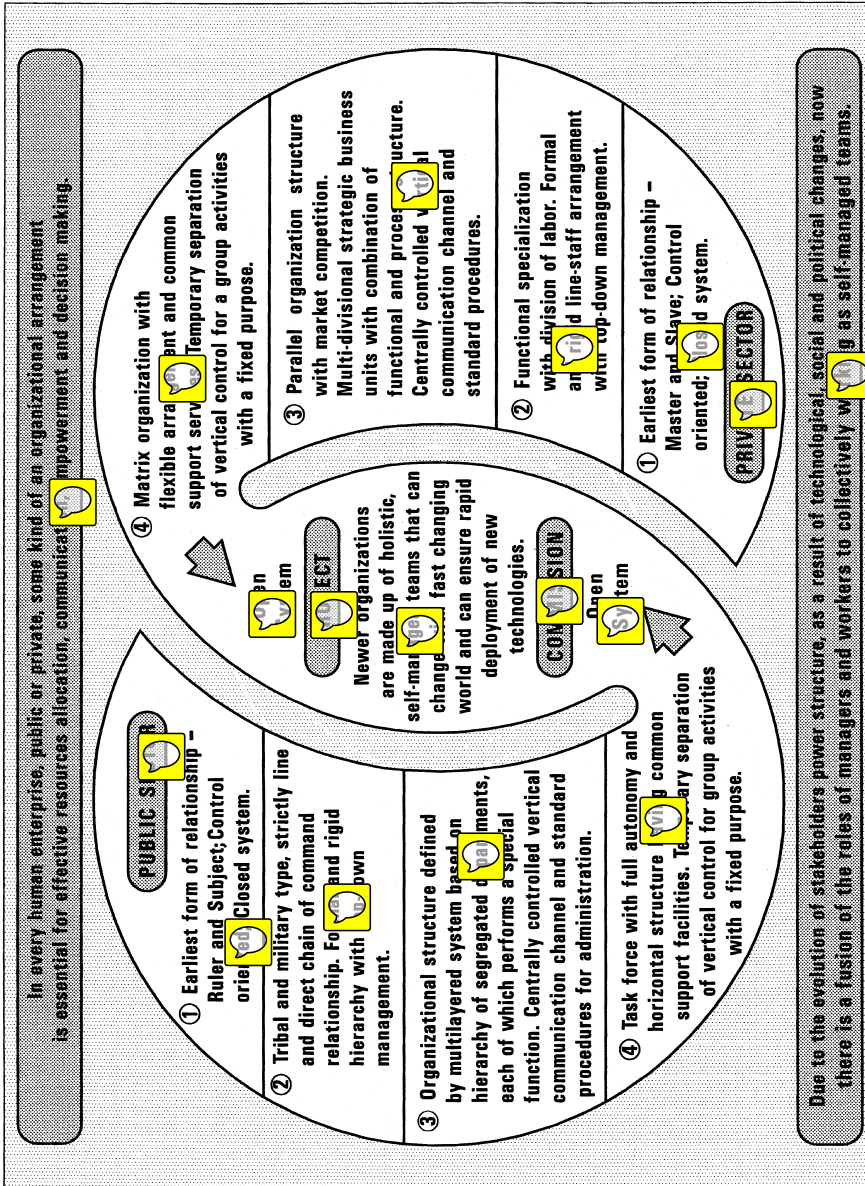


Fig. 4. Convergence of organizational relationship in the public and private sectors.

process in a project context. There may be enormous diversity in the settings and contexts that lead to perceive developmental gap identification and development path delineation. However, the actual work of development project management is usually an adaptive and cyclic process involving: planning, organizing, activating, and evolving functions. Hence, through specific technological innovation projects we have to bring life to the future of our societies. Figure 5 schematically represents the elements of development project management. Successful management of any project represents creative problem solving in action, where the only thing constant is change. Strategic integration management is concerned with comprehensive foresight and realistic insight analysis for full realization of emerging potentials. Human resource management is focused on getting wholehearted involvement and genuine commitment of all project personnel for harnessing their full potentials. Work breakdown management is associated with streamlined procedures and acceptable practices for achieving desired goals of the project as a whole. However, to ensure stakeholder harmony, we have to establish SMART (specific, measurable, attainable, rewarding and time-bound) objectives using technological forecasting in foresight analysis.

Moreover, in order to vitalize the decision making process that will minimize risks and harmonize the stakeholder interests, it is important to understand the true meaning of multiple perspectives in project related decisions. For technology capacity development management decisions, multiple perspectives and conflicting alternatives are the norms in a pluralistic society with resources scarcity. The following are the multiple perspectives [8, 20].

- **Technical/Analytical Perspective (or T-Perspective)** — This approach involves the use of relevant and up to date information, analytical models and scientific analysis for solving problems on the basis of rationality. It is supposed to be objective and impersonal, comprising both quantitative and qualitative variables. The emphasis is on systematic analysis of all available alternatives, possible consequences and optimal choices.
- **Organizational/Stakeholder Perspective (or O-perspective)** — This approach involves exchange of views and opinions among a group of stakeholder representatives. Modes of inquiry are consensual and comprise different forms of participation with various preferences for subjective analysis, which evaluate potential threats and likely support for an alternative solution. Political considerations, such as pragmatism and high chances of success determine the criteria for choice.
- **Personal/Individual Perspective (or P-Perspective)** — This approach is instrumental in entrepreneurship and leadership. Goals of this perspective are power, influence, and prestige. It attempts individual needs and ego satisfaction based on anticipated challenges and possible responses to the organizational perspective.

In any development project, decision-makers would generally consider technical/analytical and objective recommendations of independent professionals (advisors and consultants) as just one set of inputs. Under democratic conditions, decision-makers (project leaders) then consider the likely reactions of subordinate team members and other stakeholders, as additional inputs. However, ultimately, every decision is influenced by the immediate desire and future ambitions of the team leader's (or project manager's) own perspective. These perspectives are influenced by our culture (values) and also by the media. Generally, there are two distinctive calls by global media — one is the promotion of accountability and transparency in the decision making system, and the other is the need to sacrifice present consumption for future gain through leapfrogging.

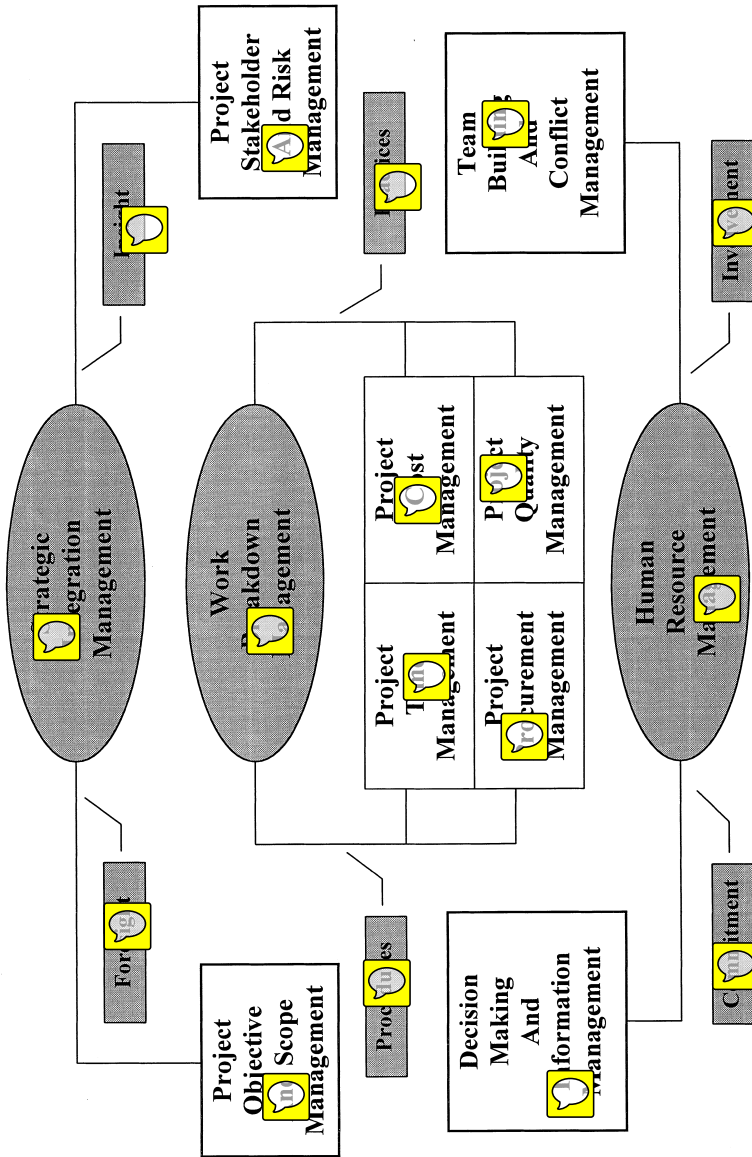


Fig. 5. Project management functions and knowledge areas.

VI. Lesson: Analytical and Acceptable Procedures for Leapfrogging

History teaches us that economic growth and improved environmental condition of the planet earth are essential for sustainable human development [6]. Also we have learned that sustainable development is impossible without these: public should be educated and considerate; media should be honest and responsible; business should be competitive and innovative; and government should be competent and transparent. In this overall framework, the only rationale for technological innovation is heightened efficiency and productivity, which will automatically lead to profitability. In fact trying to expand trade without increase in productivity is inherently flawed. But then, why so many countries have fallen into this trap? There appears to be two main reasons: most of the leaders of the developing countries are simply selfish; and the few who are honest do not have the T-Perspective focusing system in place for decision making.

All of us have seen that the international mass media thrive on sensational news focusing on differences, and they condition the minds of ordinary people to make inflated demands under organizational perspectives. In the developing countries, global media-conditioned publics give wishful justifications for not supporting the T-Perspective. Besides, the leadership in most developing countries focuses on personal (and political) considerations. Generally, people in power give all kinds of ideal justifications to hide their P-Perspective and make it appear to be O-Perspective. Therefore, unless there is very strong and statesman-like leadership (exemplified by Lee of Singapore and Park of Korea), developmental decisions suffer in two major ways — no real progress because tough decisions are avoided (Bangladesh), or only progress for a handful in the name of globalization (Indonesia). Clearly then, we have to pull up the group consensus from the lowest common denominator and push down the self-ambition of the leader to achieve the golden balance between the short and long term needs of real development.

We need better decision making process that may help manage stakeholders' conflicts. A process that encourages optimal participation by stakeholders, evaluates possible choices with objective and scientific methods, and which tend to be impartial and dispassionate. This may enable consensus building, transparency and acceptance of development projects. But the most difficult task in any decision is to be objective, fair and truthful. Moreover, "consensus" is rarely possible in a pluralistic and democratic society. Our next best option is "compromise" solution. However, to come to a compromise, we need a formula for decision-making that is acceptable to all parties. We need a new way of thinking, a new culture. A culture of empowerment that promotes self-management opportunity, with adequate safeguards against biases.

Best way to manage stakeholder conflict is to establish an acceptable and fair decision making system [19]. And acceptability, in the age of external media-power, is likely if people can see clear accountability and transparency in the decision making process for developmental project management. Demands for transparency in decision making simply means that the procedures eliminate biases, harmonize stakeholder needs and expectations, and are easily understood and open to enquiry. Therefore, we need established procedures for resolving negative conflict to positive cooperation. We should have discussions on the common interests in the process, rather than the opposing positions. Thus, it appears that such transparency can be expected only if we ensure adequate focus on T-Perspectives (pulling up the O-Perspective and pushing down the P-Perspective) and openness in the decision making practice.

Once the procedure is established and accepted, then and only then, we can address the substantive matters fruitfully. As elaborated in the previous sections of this article,

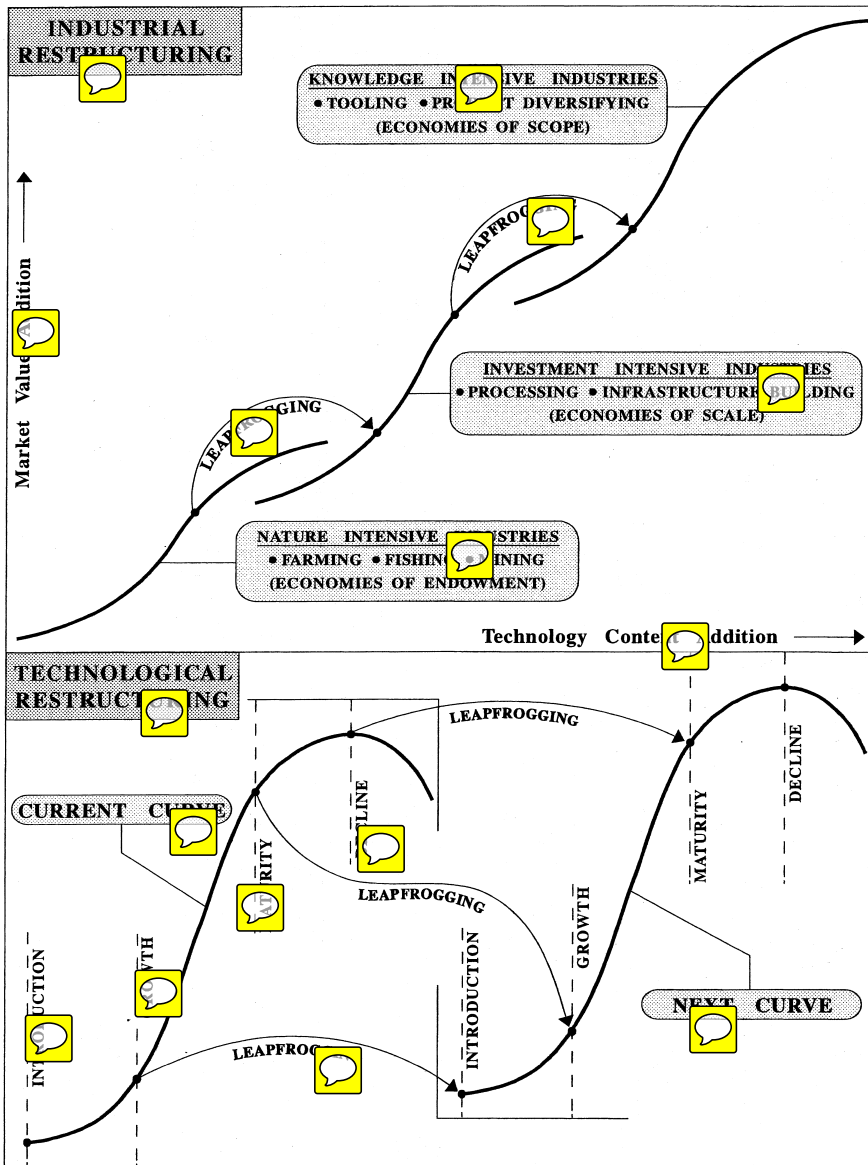


Fig. 6. Leapfrogging as a basis for restructuring.

in preparing developmental projects, not only technical feasibility but technological capacity building is a must. Moreover, for capability building that will enable the laggard societies to join the global economy, one has to try technological leapfrogging [21]. Technically it means jumping to the next s-curve (see Fig. 6) for strategic progression. This is because, open market competition is based on innovation, and innovation (in terms of components, capabilities, and competencies) is a never-ending process. Moreover, the path of industrial restructuring in a developing country — from nature intensive to investment intensive, and later to knowledge intensive production — has to be paved by technological innovations that enables required leapfrogging.

It must be logical to assert that management by project for technological leapfrogging makes it imperative that we rely on technological forecasting. Use of technological forecasting in strategic development planning is unavoidable. Technology forecasting forms the rational basis in foresight analysis — assessment of opportunities and threats related to alternative scenarios for innovation. Forecasting is a process of predicting a development, with a level of confidence and consistency, within a given timeframe, and with a specified level of support. The objective is to prepare possible and plausible projections of the future. Exploratory forecasting portray futures that seem to be possible, given action or inaction of the key players, exogenous developments, chance and the internal dynamics of the system under study. Trend analysis based on past data is useful for this purpose. Normative forecasts describe the hoped-for future.

Thus, for effective management of productivity driven innovation strategy, technological forecasting is, therefore, most crucial. Fortunately, the tools are there, we just have to use them. However, we must remember that we need forecasts not prophecies, and this should be through a process of collective judgment iteration — popularly known as the Delphi technique. The Delphi method seeks to benefit from shared expert judgment by a group of individuals with specialized knowledge or training on a particular subject. The Delphi method achieves many of the advantages of a group working together and sharing ideas. However, the views of the panel members are insulated from the potential disruptive influence of reputation, personality and rhetorical skill of experts. The Delphi technique can also be used to make the decision-making process focus more on the T-Perspective and reduce the impact of other perspectives. In summary, the lessons we have learned [22–24] from the success cases and failures point to the following development (for reduction of technological capacity gap) essentials — technology management (including technological forecasting and leapfrogging) ability; learning-based change management (focusing on the T-Perspective); and team-based project management (with a transparent decision making system).

VII. Conclusion: From Dependency to Mutual Interdependence

We cannot continue to do what we have been doing before. We cannot continue to live dangerously, with very little hope and no opportunity. What is needed now are more honest admission of shared faults, better understanding of real facts, and concerted reform programs. We have to declare war against technological poverty, ignorance, and gap. However, the poor cannot make something out of nothing — they need education and training, leading to technological capacity development, to produce something for the global market. Through proper education we have to convert the vicious circle of technological underdevelopment to a spiral of technological innovation. A suggestion regarding essential steps is shown in Figure 7.

Acknowledging the problem is half the battle. Then, making technology capability development as priority number one is the only real option for seeing light at the end of the tunnel. In the developing countries, both governments and markets do not always do what they are supposed to do. Moreover, the lack of a guiding force (a combination of independent media, non-governmental organizations, and the civil society) that can act as counter-balance to failing tendencies of markets as well as governments, requires that the decision-makers use impartial procedure (objective and transparent). When people are already interacting around the world for education, work, play, and leisure (through Internet), we now very badly need leadership skills to thrive on “technological innovation,” and “management by project” orientation to deal with global interdepen-

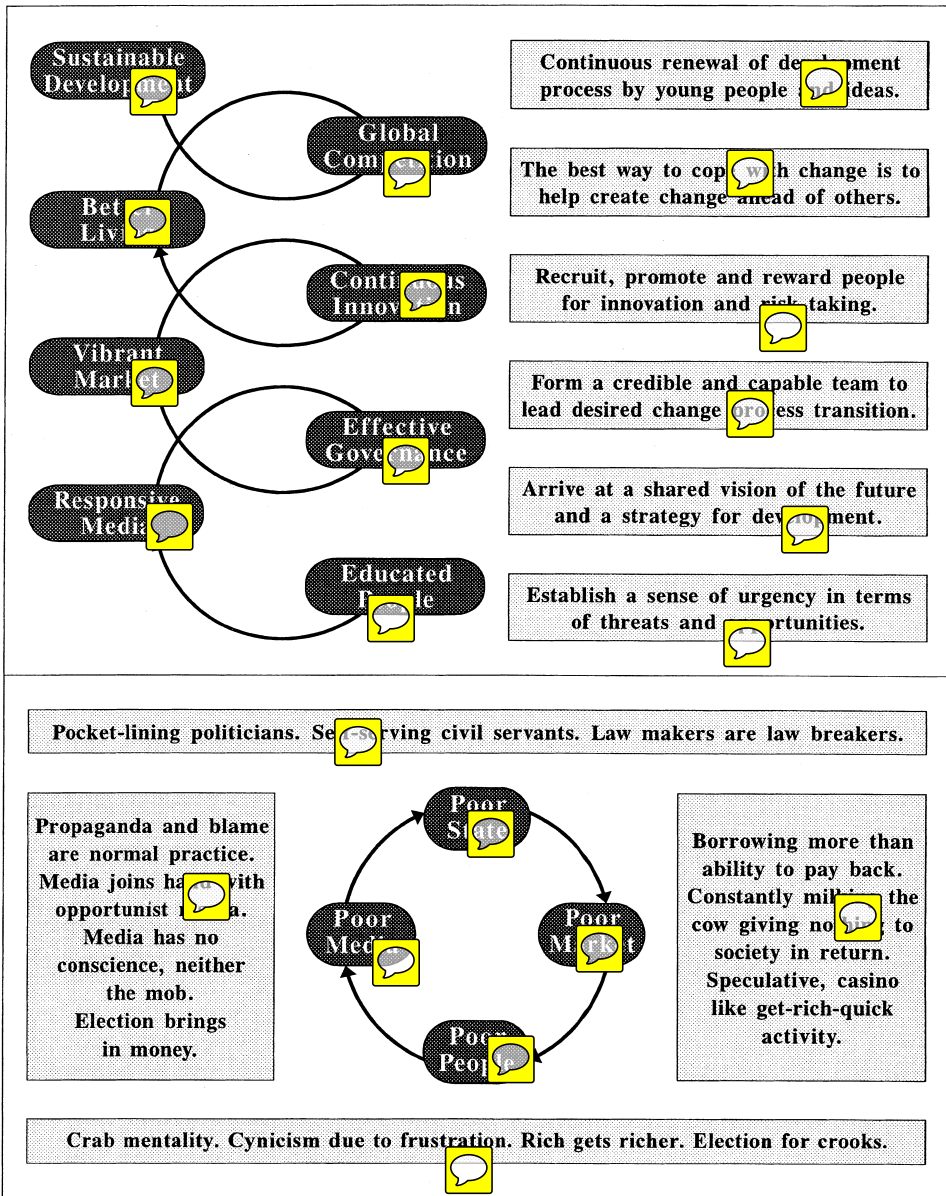


Fig. 7. Circle of degradation to spiral of innovation.

dence. The interdependence problems created by the Internet as a media of world commerce and learning are indeed quite challenging.

The catalytic factors for technological development are human creativeness, nature of competition, heightened aspirations, and reinforced interdependence. Since we have no shortage of brainpower, we should take a lead in developing methodologies for better decision making. We have to find a ways to understand and to deal with the real interdependence due to various factors in development project management. The current conditions are indeed daunting:

- Uncertainty and complexity: need better systemic reasoning and adaptive capacity.
- Commonality and diversity: need better integration of cooperation with competition.
- Creativity and destructivity: need better conversion of conflicts to positive forces.
- Sustainability: need better understanding related to quality of life and morality issues.

For the talented people of the developing countries, an opportunity to reap great profits will come if they could develop some conceptual models for dealing with the above problems of interdependence. This implies that instead of simply preparing for the future, we should attempt to shape the future. We cannot afford to be a bystander. Nobody is going to develop the tools for us to achieve technological productivity gain based on global market competitive edge.

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