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Technology leapfrogging for development

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Technology Leapfrogging for Development:
Panel Session to be held at the IFIP94 Conference
AIT, Bangkok, Thailand, Dec 16-18, 1998

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Technology Leapfrogging

Technology leapfrogging refers to the implementation of a new and up-to-date technology in an application area in which at least the previous generation of that technology has not been deployed. Whilst new technologies are often used in developed economies as replacements for earlier, obsolete, versions of the same or similar technologies, it is often said that developing countries which are starting from an earlier phase in their technological development are able to adopt the latest versions of a technology without having to proceed through the successive phases of using its earlier incarnations. As an example, the newly industrialised countries of East Asia have invested heavily in telecommunications and specialised networks and in so doing have leapfrogged several generations of communications technologies.

As a global information infrastructure emerges, developing countries must ensure they are not isolated. In this regard, it is sometimes argued that latecomers are better placed than the developed countries to take advantage of IT as they are not hindered by investments in obsolete technology which they cannot afford to abandon. Furthermore, as IT has been recognised as a means for accelerating development, and as the cost of obtaining IT continues to fall, most developing countries are now anxious to acquire and adopt IT for their development endeavours.

In the conventional view, developing countries passively adopt technology as standard products which have been developed in the industrialised countries and which can be put to useful work immediately. However, successful use of IT

involves more than just its installation. Achieving the full benefits of IT involves more than the mere application of systematised knowledge. It also requires the application of implied knowledge regarding the organisation and management of the technology and its application to the contextual environment in which it is to be used. The gaining of such implied knowledge of IT is often the result of accumulated experience with the deployment of previous technology, and such experiences may even contribute towards the shaping of the new generations. The absence of the earlier experiences may therefore inhibit the accumulation of the knowledge which is required to make the new generations successful. Furthermore, new techniques frequently require modifications if they are to be applied successfully to a new environment, and such modifications generally require a high level of skill. The learning processes of organisations and societies are often constrained by their past practices, their existing knowledge base and their propensity for innovation. Consequently, while leapfrogging may appear as an attractive option for the late adopters, it may not provide the intended results in all circumstances. The greatest danger is that of a new “cargo cult” by which the developed economies observe the benefits which later and succeeding generations of IT bring to the industrialised nations, and hurry to acquire the same technology in the blind belief that similar benefits will quickly accrue to themselves. Such opportunities may exist, but a reality check is now appropriate in order to protect the investment of the scarce resources available for IT in most developing nations and to expose the circumstances under which leapfrogging can be successful and distinguish them from those under which it might not be.

Such questions arise as: Does leapfrogging always imply jumping from a state of obsolescence to state-of-the-art technology? As leapfrogging implies a rapid evolution from older to considerably newer technology, at what rate of evolution can leapfrogging avoid the dangers of suffering from insufficient implied knowledge to make the new technology work successfully? Which technologies offer the most favourable opportunities for successful diffusion in developing societies, and which technologies might be less appropriate? Will developing nations be able to compete internationally without leapfrogging, and if not, what measures are required in addition to the acquisition of technology to make it successful in the new environment? To what extent is it necessary to integrate the learning achieved from experiences with past practices in order to make a rapid transition to much newer ones ?

IFIP WG 9.4 Working Conference - Panel on Technology Leapfrogging for Development

Introductions and Frame Setting

Setting the scene - definitions and directions

Technology leapfrogging refers to the implementation of a new and up-to-date technology in an application area in which at least the previous version of that technology has not been deployed. In developed economies, newer versions of technology are often used to upgrade older versions, but in developing economies where still older versions of technology are often prevalent or non-existent, the opportunities for leapfrogging over the successive generations of technology to the most recent version are that much greater. To give a simple example, in rural parts of PNG the telecommunications infrastructure has gone from nothing to satellite - in one generation. Similar moves in China will see cellular telecommunications introduced to replace much older land lines.

As a global information infrastructure emerges, developing countries must ensure that they are not isolated. The whole issue is fraught with complications and differing views. The purpose of this panel is to explore the issues that face developing countries and to suggest possible solutions. We emphasise that this is a discussion in an ever-changing environment. We are not certain that we have the answers, but hope that through the presentations and the discussion with you that will follow, we will get that much closer to the answers. The key question we address is: "Will developing countries be able to compete effectively in the world market if they do not leapfrog? If not, what measures are necessary to make technology effective in the new environment where it is used?"

Introductions to the 3 other panellists and what they will talk about.

Noel Jones is Vice President, Europe, for Capacity Building International (CBI). CBI specializes in Capacity Building for individuals, institutions and countries. Noel was formerly a Senior Management Consultant in the Institutional Change and Strategy Department of the World Bank up to February, 1997. Noel will present the key issues converning technology leapfrogging in developing countries.

Doug Vogel is Professor of Information Systems at the City University of Hong Kong, formerly at the University of Arizona. Doug's interests lie in …. Doug will present views of technology leapfrogging from three continents - Egypt, Slovenia and Mexico.

Roger Harris is Lecturer in Information Systems at the University of Malaysia Sarawak, Malaysia. Roger is currently involved in research relating to the use of IS in developing countries, examining aspects of behaviour and culture. Roger will present issues relating to the cultural adaptations that are implied by technology leapfrogging in developing societies.

Wrap up:

Process of leapfrogging may surface issues that have to be tackled if technology is to be implemented effectively.
Leaps forward may also create leaps backward socially - consider the situation of Egypt where it may be argued that too rapid Westernisation has caused some social instability and conflict with more fundamentalist groups.
Some countries don't have well developed INFORMATION infrastructures. They may have systems that rely heavily upon memory and verbal agreements, for example. If there is no paper trail to automate, it can be hard even to start leapfrogging. Furthermore, if the culture does not promote strategic planning or long term planning, preferring instead an acceptance of risk rather than its management, then systems need to be carefully tailored to meet those circumstances.
Countries that are not tied down by their older technology may find it easier to leapfrog than those that are required to abandon the old technology and relearn concepts. Leapfrogging itself has to be adapted to as a concept.

There are many unanswered questions and issues, and more than enough work for all of us and more for a long time to come. We look forward to fruitful times ahead.

Call for papers for HICSS and for JGITM.

Technology Leapfrogging for Developing Countries

Example of Leapfrogging

Many people from both the public and private sectors have adopted the use of cellular telephones to access international telecommunications networks from developing countries rather than waiting for their National PTTs to become digitized -- which will take 10-15 years in many cases.

Leapfrogging and Obsolescence

Technology Leapfrogging may or may not render earlier technologies obsolete. For example, the introduction of PCs or laptops does not render typewriters obsolete or indeed mainframe computers in large government organizations. However, the introduction of new software for pentiums or 486 PCs and laptops may render 286s and 386s obsolete due to the need for greater memory and power required by these modern software programs.

Software Development

Many people believe that software development is not geared to the needs of developing countries. This is indeed true. There is a need to do appropriate diagnostic work to determine the software and hardware needs of developing countries. However, it should also be realized that countries such as India and Sri-Lanka have a very high capacity for writing and developing software for world markets. These markets are mainly those in developed countries where current demand comes from. In developing appropriate software technology for developing countries, greater attention will need to be given to such variables as culture, how business is transacted there and the issues surrounding the presence of multiple languages or writing systems in many of these countries.

Impact of Earlier Developments on Leapfrogging

Early developments in technology in a given country may in fact either enhance the value of leapfrogging -- cellular telephones, or inhibit it, as experienced in countries where fundamentalist (political or religious) regimes attempt to prevent such leapfrogging for fear of the consequences of open access to information worldwide.

The Example of Collaborative Technologies in Developing Countries

Recent experience of the World Bank in introducing Collaborative Technologies (GSS) has demonstrated that it is both possible and indeed valuable to use collaborative technologies for such tasks as developing greater outreach consultations with different stakeholders in society in preparation for the development of a National Development Strategy, or at the sector level -- the development of a National Environmental Strategy. GSS has also been used as a tool to help review and evaluate National Portfolios of Development Projects with stakeholders representing a wide range of society, e.g., ministers, permanent secretaries, heads of Government departments, private sector leaders, NGOs, donors, civil society leaders, regional and district officers and community leaders.

Technology Leapfrogging for Development

Leapfrogging provides opportunities for rapid introduction and diffusion of technology, not always with similar or anticipated effects. Leapfrogging phenomenon in three countries (Mexico, Slovenia, and Egypt) on three different continents will be compared and contrasted.

- Mexico phone service went from miserable to (almost) world class with the introduction of cellular telephones. Many of the countries businesses have prospered and a powerful barrier to international interaction eliminated as a result. On the other hand, it can be argued that the country as a whole has not progressed and has increasingly broadened the gap between the “haves” and the “have nots.”
- Slovenia is a country barely five years old that has embraced electronic commerce as a way to prosper and actively participate in the world’s economy. The standard of living in Slovenia is on a par with much of western Europe. The country has achieved amazing stability and international presence while, within 100 miles, war and political turmoil has its former partners regressing rather than progressing.
- Egypt began a conscious program of diffusion of decision making based on databases developed, maintained and directed by the governorates. The PC-based systems staff and developers were predominantly women from the local areas. Programs are now on hold and expansion curtailed as fundamentalism attitudes have assumed political power, especially in rural regions of the country.

It is interesting to reflect on drivers in these circumstances, especially in terms of rate, management, and acceptance of change. It would appear overall that technology leapfrogging can indeed exist, but may in no way in itself, guarantee (or even encourage) prosperity. It perhaps is only when leapfrogging is combined and consistent with a variety of elements including cultural and governmental attributes as well as broad-based focus and a robust collaborative process that sustained innovation diffusion can occur in an atmosphere of enhanced quality of life. All of the considerations relevant to development effect cannot be anticipated in advance from afar. Rather, a conscious on-going collaborative process of engaging a broad base of stakeholders from multiple perspectives is warranted. Stakeholder participation and a focus that embraces social and political as well as technical issues is suggested for successful sustained innovation in the presence of opportunities for technology leapfrogging.

IFIP Panel WG 9.4 Working Conference
Implementation and Evaluation of Information Systems in Developing Countries
Panel Discussion on Technology Leapfrogging for Development

Presenter: Roger W. Harris

Behavioural Adaptations Towards Leapfrogged Technology

The Social Context of Technology

Abundant evidence testifies that successful IT installations are attributable to the synergy which is generated between the technology and the social context within which it is deployed. It is a myth to believe that technologies prescribe their own course of action. The responsibility for technological outcomes resides within the social order - within individuals and groups and within the institutions through which they organise their lives. Consequently, it is dubious to assume that technological success can be transplanted between social contexts without some form of adaptation, either by the technology or by some of the components of the social context.

Implied Knowledge About Technology

Achieving the full benefits of IT involves more than the mere application of systematised knowledge. Often, it requires the application of implied knowledge regarding the organisation and management of the technology and its application to the contextual environment in which it is to be used. The gaining of such implied knowledge of IT is often the result of accumulated experience with the deployment of previous technology, and such experiences may even contribute towards the shaping of the new generations. For example, the rapid and widespread use of PCs, which was facilitated by new technology, was stimulated by the social context within which mainframe and mini-computers were used.

Attitudes Towards Technology

The attitudes that people have about computers have been shown to affect their computer-related behaviour and they provide a measure of one of the aspects of the social context within which computers are used. Measures of such attitudes are often taken from individuals whose social circumstances contain exposure to previous generations of computers - mainframes and minis. There are many settings in which such exposure has either been very limited or totally absent. Consequently, attitudes towards personal computers, and by inference, their use, can be expected to vary according to the exposure to previous generations of computers which individuals have experienced.

Tentative Indications

Early indications are that individuals in societies that have been less influenced by the use of mini- and mainframe computers are probably more positive about PCs than are those who live in societies in which these older forms of computers have been used extensively. The possibility exists that implied knowledge of previous generations might therefore be a hindrance to the acceptance of new generations rather than a stimulus. For PCs then, one is drawn towards the startling speculation that, notwithstanding the economics of acquisition, the social circumstances

surrounding their use in developing countries might give rise to a faster adoption of their use than has been experienced even in the developed nations. Consequently, leapfrogging into PC technology may have more potential per individual for developing countries than it does for developed nations. This would be even more so given the low base from which many developing countries are beginning with their use of IT.

Panel Layout

1 Introduce the Panelists

2 RD - Define the term and set the scene

3 Introduce the Layout of the panel - what each panelist will talk about. 10 minutes each.

4 NJ - Awareness of issues in LF - Pros, Cons and Implications of LF

5 DV - Lessons that come from examples of LF in practice - successes and failures, and reasons for those.

6 RH - The behavioural adaptations required in LF contexts

7 A question for the audience - is leapfrogging worth doing?

This conference has raised many issues that relate directly and indirectly to LF - we have seen/heard the term in papers, in presentations and in conversations.

Purpose - raising awareness - of all of us, of IFIP94 - of LF; an alert of reality check, open to discussion, examples that we have seen. We don't have an agenda for this discussion - it is open to you.

Tentative Description of the area to set the scene.
Technology LF refers to the implementation of a new and/or up-to-date technology in an application area in which at least the previous version of that technology has not been deployed. On occasions there may have been no previous version of technology, such as the www. In developed contexts (countries, economies, sectors), newer versions of technology are used to upgrade older versions, but in developing contexts the opportunities for leapfrogging are greater as existing technology is still older, or even non-existent. We wish to clarify that by developing contexts, we do not wish to imply that such contexts should inevitably follow paths taken by developed contexts, but simply that the contexts are developing in their own, unique directions. Developed contexts may also leapfrog new technology, and it is likely to be easier as infrastructure is already in place.

To give a simple example of leapfrogging, China is leapfrogging its telecommunications technology from land lines to cellular systems. In Bangladesh we heard this a.m., the infrastructure has been upgraded from nothing to cellular. Parallel LF at different rates. PNG nothing to satellite in one leap.

Elites as catalysts or parasites
Pros - catalyst for development
Con - Making a situation worse
Con - LF is seen as always a good thing - because it it western.
Pro - Jump phases of development - leapfrogs evolution
Pro - creates opportunities for formerly impossible activities
Implication - fast and best may not be necessary or good
Con - excess expenditure requirements arise - Pentium MMX 200 is not necessary for many of the activities, though it may be to run the software
Forced upgrades which costs $$$
LF and comparative advantage in different countries - compare Africa and China.
The opportunities that arise through having computer skills
Leapfrogging enables a person to possess some uniqueness and a special skill that can be invaluable in a DC
Skill differentiation can be the key to success, but this may just create elitism
What is the role of elites - to catalyse, and create opportunities that can benefit the country as a whole
How can leapfrogging mould to local contexts?
Cultural adaptation and training - training may not change mindsets.

Social Construction of technology
India not a map-based society
Cultural adaptation and training
Training is not changing the mindset
Danger of LF is that it requires changes that may be significant in the mind set of locals
Cultural values often conflict with technology
No simple trajectory from global imperatives
Globalisation does not imply homogeneity
How can Developing Countries influence globalisation
Arrogance to suggest that it is / should be all Western led globalisation
IS/IT to support cultural diversity
Local Actors improvise rather than follow practices from outside
Cultural Appropriation of technology
Plasticity of technology and its adaptability
Locals may not have a good idea about their own country either
Use IS to promote cultural diversity
GIS as a less plastic software and hence hard to adapt to?
Compare word processing software
Plasticity of GSS software
See Ciborra 1996, Giddens 1990, 1991
How can leapfrogging mould to local contexts - cultural adaptation?

The need for a questionnaire to be face validated in the culture(s) where it is to be conducted. This task must be undertaken by the collaborators themselves. Alternatively, request the collaborators first of all to generate possible questionnaire items. Then modify the extant questionnaire that is developed for another culture - cultural moulding to generate a questionnaire that is if not culturally unbound, then at least not culturally biased in only one direction - i.e. using a Western instrument.

a) get ideas from ppts on questionnaire
b) use some extant questionnaire items
c) share items around the ppts and get face feedback
d) get Noel's feedback
e) distribute
f) do detailed case study in each country to get more qualitative information

Leapconf

its been great to be here - has provided lots to think about

I'm the chairman of the IFIP 8.4 WG - focus on office systems

have worked in over a dozen countries over the past 10 years with various leapfrogging efforts - mainly centered around introduction of group support technologies

would like to provide 3 examples to move our conversations along and generate discussion

Mexico

interactions over the past 8 years

phone service miserable - now from your car on the way to work

extension to education - distributed with Satellite - very state of the art

group support technologies

now for the rest of the story -

diffusion very limited and benefitting only a small % of the population

peaso devaluations - colleagues and workers barely surviving

perceived broadening gap between the "haves" and "have-nots"

political problems

Egypt

Sherif Kamel's paper - IDSC

Hissham El Sheriff charasmatic

extending out into the governornates

self-sustained decision support environments

But!!

tremendous religious and political unrest

terrorism and return to fundamentalism

maybe you could argue that once they get of all of the negative external influence and purge the society, the environment they are building will emerge to give Egyptians the quality of life they seek

but could easily also become a casuality

Slovenia

associations started over 10 years ago while still part of former Yugoslavia

referendum and formation of a country that is now over 5 years old and postured to become an active part of the EC - high standard of living and broad-based prosperity - on a par with much of Western Europe

started with a “screw-driver” IT industry

now very successful in electronic commerce with IT technology heavily integrated into government and businesses - helping other countries with telecommunications technology -

port of Koper is Austria’s access to the Adriatic, replacing Italy in that capacity

have used GSS to formulate and implement government policy - e.g, tourism

lot of caveats here:

correlations weak or non-existant

many, many sides to these stories

government policy, cultural and infrastructural components - need to have something to leap from, contextual environment - forgetting to consider the people issues - not just a technical issue

other factors can easily overwhelm leapfrogging

sometimes the capability is there and it doesn’t occur

only time will tell

Often can’t anticipate all of the issues in advance - need to use a collaborative process with a broad base of stakeholders to generate possibilities and anticipate impact and implication of leapfrogging

feeds back to the purpose of the panel

Audience feedback:

go back and forward

build on what you already have

need to change practices and behavior

optimize utilization and adapt to local needs

key problem - how to push business sector
into providing solutions that have broader impact

look at capacities to innovate - how is leapfrogging differentiated from technology transfer

term leapfrogging misleading - but used again and again - perhaps worst example of technological determinism -

by installing tech, you don't get there

momentum comes from all sides - is this leapfrogging

need collective interaction

let a thousand flowers bloom

perhaps the alternative to leapfrogging doesn't exist

instead of emphasizing potential for results - focus on process, then let technologies help you achieve some results

can be tricky to get the process ingrained - need to be careful to not impose a process that does not fit - need to develop the process

can not assume providing infrastructure is sufficient -

privatization is very tricky - how governments can manage the process to ensure people's needs

problem of hitting a balance between broad-based interests - the public good and entreprenuership (which private or public)

tension between government and private initiatives

wholistic planning in a complex economy is impossible

but leaving everything to private enterprise invites disaster

cooperation is key - consider Ireland

key problem is that we have poor tools for analyzing options

problems of cycles of obsolesence

do you want reduced technologies

need for programs

Albania - sometimes a bad model that can work is better than a good model that can’t be applied

watch how far you jump and in what direction

not really by-passing anything – something may be no longer relevant - if there is a communication need, you solve it with the best tech of the time - notion of leapfrogging may be bullship

social engineering

watch the installed base - cultural as well as political as well as technological

Overall:

focus on process first

don’t impose either a technology or process

tech can go the wrong way or too far, etc.

process can get bogged down or take a maddeninly long time to emerge or may be mis-directed

tension and cooperation between government and private roles within countries and between countries and private enterprises