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<td><strong>Author(s)</strong></td>
<td>Patel, Nitin.; Khalid Shams.</td>
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New IT Applications For Decentralized Development
In Asian And Pacific Countries

By

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&
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EXPERT GROUP MEETING

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NEW IT APPLICATIONS FOR DECENTRALIZED DEVELOPMENT IN ASIAN AND PACIFIC COUNTRIES

Nitin Patel and Khalid Shams

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NEW IT APPLICATIONS FOR DECENTRALIZED DEVELOPMENT
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Nitin Patel and Khalid Shams*

INTRODUCTION

Most Asian countries have witnessed in recent years a rapid expansion in the use of micro computers in government systems. Although, the private sector is increasingly playing an important role, the key responsibility for IT development -- as demonstrated by the experience of Singapore and other countries -- lay in fact with the government. It is through government initiatives that computers have been introduced both in the public and private sectors; they have been used for socio-economic development at local, regional and national levels; they have also promoted development of sectoral programs in such areas as education, public works, housing, agriculture and health care. Much of the development, however, has been on an adhoc and piecemeal basis in the absence of a coherent national policy for promotion of IT. A major constraint has been the inadequate communications infrastructure which has in turn accentuated reliance on stand alone micros. Where large central information systems were developed, these have

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languished due to difficulties in gathering and conveying reliable data to the ultimate end users in time.

While determinants of technological change are many, the importance of both market requirements (demand leading factors) and scientific-technological progress (supply leading factors) have been repeatedly stressed. In the regional context, government interventions accentuate the effects of both these factors, by generating new demand for IT investments on one hand and securing supplies and services in respect of computer installations, telecommunication facilities, etc., on the other. It is in this context that the Asian and Pacific Development Centre (APDC) in collaboration with the Commonwealth Secretariat and national institutions of seven regional countries undertook a study of:

(a) results of key policy interventions by governments for planned development of IT.

(b) recent experience with IT applications which have had a high development impact.

Findings of the study have now been published in a three volume monograph by APDC.* The centrepiece of the study consists of documentation of thirteen innovative

applications of different types of computers and information systems, considered to have had high development impact. This paper updates findings from the study, which is an ongoing project of APDC. The paper is divided into three sections. The first section explains the linkages between micro computer and the decentralization process and factors which facilitate the process. The second section provides the framework for classification of the application cases studied under the project. The third section offers tentative conclusions derived from the case studies, in terms of decentralized decision-making at local levels.

- I -

MICRO COMPUTERS AND DECENTRALIZATION

The case studies undertaken by APDC indicated clearly the impact of micro computers in terms of decentralized development. It represented an emerging trend that has a strong potential for future development. Decentralization, meaning dispersion of decision-making authorities to peripheral or lower echelons of an organisation, has been the objective of many an administrative reform, in the developing countries. The efforts were, however, generally frustrated, because decision-making has been concentrated in the top echelons. Decisions were centralized and therefore delayed since information was gathered by the bottom echelons, processed by the middle officials and finally
passed on to the top where decisions were given. The situation is depicted figuratively below:

**DECENTRALIZATION EFFECTS OF IT**

[Diagram showing two situations]

In situation 1, the organisational process depicts the following:

- All decision-making is concentrated in A or the top echelons.

- Information is collected and compiled in C, the lowest echelons.

- The mid-management in B, is involved in analysing and processing the information, in making recommendations and also taking some decisions.

- But all information ultimately moves up to point A for taking decisions, which flow backwards to C, for implementation on the ground.
The timeliness and effectiveness of decisions, among other things, depend on (a) reliability of information collected at the bottom (b) processing capacity of middle tiers and (c) time required for information and decisions to be transmitted between point C where information is collected and point A where decisions are made.

Situation 2 becomes feasible with the advent of microcomputers and end user computing. With more reliable data gathering and retrieval, faster processing of information and ownership of the system by the decision-maker, the following situation emerges:

- Subject to decentralization of decision-making powers, decisions are taken at point B, who becomes the end user.
- Information is gathered and processed at point C.
- The decision flow between B and C is considerably shorter in length than in situation 1.
- The mid-management of the organisational pyramid in situation 1 is now either irrelevant or collapses significantly.
- Final decision-making, presumably long-term policy making authority, is still concentrated at point A or the top echelon. But in operational matters,
only supervisory and co-ordinating functions are performed at the top.

Hypothetically, therefore, end user driven and micro computer based information systems are powerful propellants of decentralization in government. But computers themselves do not automatically guarantee decentralization; a major pre-condition is that the relevant government organisations must clearly specify the decision-making powers which will be decentralized and the level where such decisions can be taken. Decentralization has to be internally acceptable to the organizations concerned. What computerization can accomplish is to raise the decision-makers' competence at local levels based on (a) more reliable information (b) faster processing of information and (c) use of more sophisticated decision-making tools, i.e. model building, graphics.

Factors Facilitating Decentralization

The empirical evidence clearly shows an enormous possibility for decentralized development, particularly in sectors which had traditionally been bypassed or neglected. The more recent cases reported from APDC's project network highlighted new IT applications, for example, in respect of rural credit programmes targeted at the poor, integrated rural development projects, village based information systems for decentralized planning both by government and non-government organisations (NGOs). In Thailand, for
instance, resource allocations for village level projects can be prioritized on the basis of minimum basic needs criteria. Such criteria have been developed from a village information system that is updated every two years, enabling planning decisions to be taken in the provinces, in consultation with people's representatives and local institutions. In all these cases decentralization became possible because capacity for decision-making was enhanced through computer based information systems, operated at local levels (i.e. the provincial planning authority in Thailand; district administration in India, Malaysia and Sri Lanka; rural credit projects in Bangladesh, Malaysia and Sri Lanka).

A number of factors have reinforced this trend, which is likely to gather greater momentum in coming years:

a. Increased availability of micro computers and manifold increase in computing power for the same cost mean that government offices even in remote regions can now make use of IT. More and more local government institutions at provincial and district level as well as project managers are using micro computers.

b. This has encouraged the more enterprising managers located in geographically dispersed areas, to turn to end user computing to meet local requirements. They developed information systems to meet their
immediate management needs. They have become owners of the systems which ensure greater reliability and regularity in information collection and processing.

c. Genuine end user computing has been facilitated through the 4GL softwares, which are easily understood and can be conveniently used by administrators and planners at local levels, with some technical support. They can begin with small data bases, which they are required to manage by themselves and extract, sort, list and query for information needed for day-to-day decisions.

d. Information systems based on stand alone micros or PCs have largely come up because of undeveloped infrastructure in most countries. Power supply, particularly in rural areas, remains unreliable and telecommunications quite inadequate.

e. The micro computer and its convergence with other technologies like word processing, desk-top printing, increases very quickly the office efficiency. Local level officials and project managers, who face increasing work pressures as rural development activities expand in most countries, directly benefit from even simple applications of the new technologies.
AN OVERVIEW OF RECENT COMPUTER APPLICATIONS IN GOVERNMENT

The scope of government activity varied widely amongst the countries which participated in the project. The range of potential applications of computers is also very wide. However, it is possible (and useful for conceptualization) to classify all applications into six distinct types under three major groups - clerical systems, management systems and public systems.

A. CLERICAL SYSTEMS - The first three types of applications are concerned with handling large volumes of data. Their prime thrust is to introduce order and timeliness into what have historically been routinized clerical functions. Their computerization leads to improvement in the productivity of clerical workers involved in operating the system.

i. Statistical compilations: These are applications which are concerned with collecting data from a number of sources with the object of tabulating and summarizing them. Typically, this type of application is concerned with compiling statistical reports or making inventory lists for various different uses (often by different departments). Typical examples are:
o Population census
o Livestock surveys
o Company data base
o Price surveys
o Household consumption surveys
o Crop reports

With computerization, the main benefits would be speed and accuracy. A major advantage would be that since the detailed data is computer accessible, ad-hoc analysis and retrieval is possible.

ii. High volume transaction systems: These applications are concerned with situations where a large volume of transactions have to be generated and received on a regular basis from a number of points for updating records. The transactions may be processed periodically in batches or in "real-time" as and when the events triggering the transactions occur. Typical examples are:

o Property tax and land revenue systems
o Income and sales tax
o Vehicle registration
o Personnel systems
o Treasury accounting
o Banking functions such as inter-branch reconciliation, cheque clearing, ledger accounts

Direct benefits from computerization would be reduced cost, improved speed and release of staff from paper-work for more productive use. (However, the release of staff may, in itself be a disadvantage due to reduced employment). Another major advantage would be the ability to provide
rapid answers to queries and to perform ad-hoc analysis on the data. Also, in many situations this detailed data becomes the basis for future planning. As an example, if there is an existing data base of properties, proposed changes in the rate and structure of property tax can be quickly simulated to work out the incidence and impact of the changes.

An important area for this type of system is in inter-organizational sharing of data between government departments. An example would be a railways freight movement data base which could be accessed by coal-producing units or petroleum companies to enable close co-ordination of operations.

iii. Office Automation: is concerned with using computers to perform the typical clerical office functions such as writing letters, filing correspondence, sending mail and memos, keeping record and making copies. In government departments a major application of office automation would be to speed up decision-making by word-processing to create documents and then using electronic mail to move them rapidly between concerned departments.

B. MANAGEMENT SYSTEMS - The next two types of applications are mainly concerned with assisting managers to improve
their controlling and planning capabilities. Such systems often draw on and are dependent upon computerized data-processing systems of the three types described earlier. They are, however, quite different in their basic orientation which is to assist managers to better control on-going activities and to make better decisions for the future.

1. Monitoring Systems: These are applications where administrators are provided with information which will enable them to have a firm grasp of the activities for which they are responsible. Generally, these applications involve comparing actual achievements with target and highlighting significant deviations. Typical examples are:

- financial budgetary control systems for departments.

- monitoring progress at various levels of detail of large construction projects such as power-stations, sub-ways, ports, bridges, highways, dams and canals.

- monitoring performance of programs such as family planning, rural poverty alleviation, adult literacy and vocational training.

- financial and physical monitoring of implementation of large numbers of small projects
such as low-income housing and village drinking water schemes.

- monitoring prices of farm produce, industrial goods and essential commodities.
- monitoring trends in imports, exports, production and trading of various commodities and product-groups.

Computerization would provide the benefits of quick recognition of trends and a more detailed level of control for highlighting of exceptional condition. A further major benefit would be that the target-setting can be based on more sophisticated models which take into account the effect of several factors.

ii. Computer Models for Planning Decisions: These applications focus on helping a decision-maker to make a better decision by constructing a mathematical model of the situation. The model provides the decision-maker with an experimental laboratory set-up which can help him in several ways. The model can enable him to automatically explore a large number of possible actions, to single out the best one evaluated according to a criterion supplied by him. Or the model can enable him to explore how sensitive a proposed action is to changes in assumption about factors.
like inflation rates, technological obsolescence, productivity and project gestation periods. Or the model can be used to assess the potential risks and to work out what happens under different scenarios. Typical examples are:

- macro-economic planning models for the entire economy or for a sector such as energy, agriculture and transport or for a region.
- capital investment analysis models for assessing alternate investment options and their sensitivity and risk.
- locational models for deciding on the best locations for a set of services such as location of schools, primary health units, grain-storage depots and milk-chilling plants.
- forecasting models which make projections of future levels of such variables as population, prices, demand for electricity, natural resources availability, and land-use.

Almost all realistic models require a computer for running them. An important new approach to using models called decision-support systems, has begun to emerge as a practical decision-making tool. A Decision Support System attempts to blend the capacities of models with the
intuitive judgement of the decision-maker. This is an important innovation, especially in government systems where there are often several objectives to be balanced (some of them implicit) and also where the situation is too complex or not well enough understood to be captured adequately in a computer model. Decision Support Systems provide a computer environment in which the decision-maker can interact with a computer model so as to use his judgement on the fuzzier aspects of the decision which are not explicitly evaluated by the model.

C. PUBLIC SYSTEMS

Public Participation Systems: These are computer systems in which the government data (at a detailed level) are made available to people outside government, to enable them to participate better in development. Such systems are rare. In fact none of the thirteen country case studies is of this type of application. The area calls for considerable innovation and perhaps a major change in orientation of bureaucratic systems which are more used to collecting data from the field, rather than to opening up government data to outside access. It has been often remarked that community participation can provide a major stimulus to improving the effectiveness of developmental efforts of government. Computer technology holds promise playing a greater role in promoting more participatory and
decentralized development. For example, in a rural development program one could provide public graphics displays in a village on infrastructure available at comparable villages. This would generate better awareness of what has been achieved elsewhere. It would also put specific public pressures on local leaders and officials to improve their performance. Similar exercises could be done relating to efforts in other programs such as adult education, malaria eradication and family planning.

The overall impression one gets of the range of applications from APDC study is that in most of them, several applications of the first two types -- statistical compilations and large volume transactions handling -- have been undertaken. The first type is probably more prevalent. In the second type, applications involving real-time transactions handling and wide-area data-communications systems are rare and recent. The fourth type of application -- monitoring systems -- is the next most commonly occurring system. Office automation is mostly at the level of word-processing and its penetration varies widely between the countries. Use of computer models for planning decisions has been quite rare especially for micro-level models. There seem to be virtually no applications of the public participation systems type.
In all, thirteen cases have been reported by the seven country studies, but most of the information systems are of very recent origin. Table 1 gives an overview of the development impact of each case study. Table 2 indicates the range of coverage of the cases with reference to the applications typology developed in the overview section of this paper.
<table>
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<tr>
<th>Case Study</th>
<th>Year of Installation</th>
<th>Development Impact</th>
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<tbody>
<tr>
<td><strong>1. CHINA</strong></td>
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<tr>
<td>Technology Transfer Project Management (TTPM) Sub-system of the State Economic Information System (SEIS)</td>
<td>1986</td>
<td>Control of technology transfer agreements.</td>
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<tr>
<td><strong>2. INDIA</strong></td>
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<tr>
<td>a. Karwar rural development information system</td>
<td>1984</td>
<td>Monitoring of rural development program, reduction in delays and scope for petty corruption. Led to nationwide initiative to replicate system in other districts.</td>
</tr>
<tr>
<td><strong>3. MALAYSIA</strong></td>
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<tr>
<td>Integrated Development Project Information System (SETIA)</td>
<td>1984</td>
<td>Monitoring financial and physical progress of projects at national level.</td>
</tr>
<tr>
<td><strong>4. PHILIPPINES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Remote sensing of natural resources</td>
<td>1977</td>
<td>Updated and accurate natural resources inventory.</td>
</tr>
<tr>
<td>Case Study</td>
<td>Year of Installation</td>
<td>Development Impact</td>
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5. SINGAPORE

| a. Housing Development Board Information Centre development               | 1982                 | Flexible retrieval and reporting for planning and control.                           |
| b. Housing Development Board office automation                             | 1985                 | Enhanced clerical productivity and faster routing of mail.                            |

6. SRI LANKA

| b. Central Bank's Information System                                        | 1982                 | Clerical productivity, faster processing of data.                                    |
| c. Company Data Base System                                                 | 1978                 | Retrieval of data on company performance.                                             |

7. THAILAND

| a. SIAM4 Economy wide Energy Model                                          | 1984                 | Demand projection of energy under different energy pricing policies.                 |
| b. Water Resources Information Systems (WRIST)                              | 1984                 | Access to water resources data for several government agencies.                      |
# Classification of Computer Applications Reported in APDC Regional Study

<table>
<thead>
<tr>
<th>Classification of Computer Applications</th>
<th>China</th>
<th>India</th>
<th>Malaysia</th>
<th>Philippines</th>
<th>Singapore</th>
<th>Sri Lanka</th>
<th>Thailand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical Compilation Systems</td>
<td>Tech. Transfer</td>
<td>Project Mgmt.</td>
<td>SETIA</td>
<td>Remote-sensing Natural Resources System</td>
<td>Company Data Base</td>
<td></td>
<td>WRIST Water Resources Information System</td>
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<tr>
<td>High Volume Transactions Systems</td>
<td></td>
<td>Karwar District Rural Dev. System</td>
<td></td>
<td>System</td>
<td></td>
<td>Central Bank</td>
<td>10</td>
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<tr>
<td>Monitoring Systems</td>
<td>System 1</td>
<td></td>
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<td>System 4</td>
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<tr>
<td>Computer Models for Planning Decisions</td>
<td>Dharampur Planning Models</td>
<td></td>
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<td>Housing Board Information Centre</td>
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<td>7</td>
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<tr>
<td>Office Automation</td>
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<td>Housing Board Office Automation</td>
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<td>8</td>
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<tr>
<td>Public Participation Systems</td>
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<td>SIAM 4 Energy Model 13</td>
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CONCLUSIONS

It would appear that a preponderant number of IT applications reported in the study were concerned with routine clerical operations in the government. They have been used for statistical data processing, mostly at central government level. Very recently, with the spread of micros, attention has been focussed on operational information systems which are organisation specific. More interesting is the fact that many of these systems are now end user driven and seem to have an immediate impact on productivity in terms of local or decentralized development.

In addition to the thirteen case studies completed in 1985-86, APDC in the second phase (1987-89) has undertaken supplementary research on IT applications which have direct relevance in terms of decentralization. Preliminary reports on some of the recently developed applications were presented before a regional seminar at Chiengmai in June 1988. The evidence so far strongly supports the hypothesis that micro computer applications, particularly those developed by end users themselves at local levels, can facilitate decentralized development. There has been a growing trend towards diversified use of the micro computer and development of new applications of the user friendly softwares. The main conclusions from the study so far are the following:
1. Decentralization with micro computers has been facilitated in terms of:

   a. Project management at local levels. These relate to integrated area development (Philippines), agricultural rehabilitation (SAMIS, Philippines), water resources management (Thailand), large irrigation projects (Sri Lanka).

   b. Sectoral programme management. New computerized management information systems have been used in integrated rural development programmes (IRDP, Sri Lanka), housing development (Housing Development Board Information Centre, Singapore).

   c. District administration and village data base management for planning and monitoring functions. Cases reported were concerned with traditional administrative functions (pension payments in Kalutara district, Sri Lanka), implementation of rural development programme (Karwar rural development information system, India), decision support system for infrastructure planning (Dharampur, India).

   d. National project monitoring systems, like SETIA in Malaysia, although operated centrally and were very large in size, have facilitated speedier processing of project related information as well as decisions.

2. The new local applications of micro computers at the district and project level are mostly concerned with setting up of new management information systems, or computerization of the existing manual system. It has led to greater efficiency through faster processing of data, improvement in project monitoring and more effective project implementation.
3. Trend towards end user computing, particularly in geographically dispersed locations is apparent. More important is that end user computing has led to more reliable and pragmatic information systems, which are owned by users themselves, thereby ensuring collection and distribution of more authentic data.

4. Even though decentralized applications tend to be end user driven, there is need for support services from a central organisation like the 'information centre' of the Housing Development Board in Singapore. Such a centre can help data standardisation, integration amongst agencies, evaluation of hardware and softwares, avoid duplication of development, provision of technical services, including training of end users.

5. There are not, however, many instances of decision support systems which have been developed and actually put to use for purposes of taking planning or policy decisions.

The regional study has clear cut implications in terms of IT policies at the national level. Firstly, it underscores the fact that advanced computers, their large size or location, by themselves do not determine the impact on development. It is the nature of application which determines the final impact. Accordingly, there is need in
the first place to prioritize choice of applications, which would accelerate decentralization of information systems in the government. Secondly, planned efforts are needed to encourage end user computing at local levels. By placing micro computers at the point where data is generated as well as where it can be utilized, it is possible to develop quickly many local applications which have high impact and greater reliability. But such end users have to be provided with adequate support services. Thirdly, with many new applications being developed in the region, there is now a clear opportunity for technical co-operation amongst developing countries. Countries, governments, agencies, NGOs and training institutions, can definitely learn from one another's experience. The newly developed application softwares can be exchanged on a collaborative basis. Learning can take place without reinventing the wheel every time and this may be a more effective way of bridging the information gap that now separates our countries.