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PASITAM DESIGN NOTES

No. 1 September 1975

How Administrative Arrangements Can Influence Program Outcomes

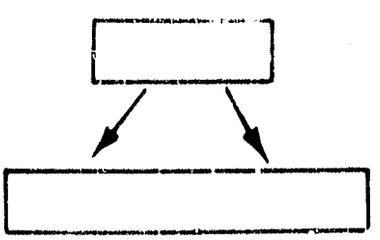
The form of the administrative arrangements used to implement a project or program can be crucial to its success or failure. Even when there is the will and the capacity to conduct a project or program, and strong justification for it, the outcome is more likely to depend on the type of arrangements used to implement it than on the ideology of the leadership of the character (i.e., democratic or authoritarian) of the regime.

An excellent illustration is found in John D. Montgomery's study of twenty-five land reform programs.

Montgomery categorized land reform programs, in terms of their administrative arrangements, as *centralized, decentralized,* and *devolved.* For each he measured changes in four factors: 1) peasant incomes, 2) peasant land tenure security, 3) peasant political power, and 4) political power of the bureaucracy which conducted the program.

Centralized

Montgomery found that those regimes which, regardless of their political character, employed an existing centralized administrative arrangement were generally unsuccessful in increasing peasant incomes and political power, only partially successful in improving security of land tenure, and consistently successful in increasing the political power of the bureaucracy. (See table, "Effects of Administrative Arrangements.")



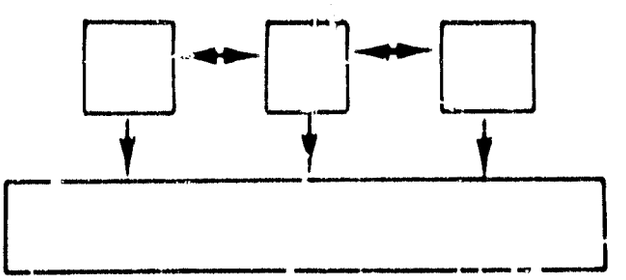
Centralized: There are two actors: the central authority which may be some variant of a Ministry of Agriculture and Land Reform and the peasantry. Information is collected among the peasantry and flows up to the center. Decisions flow downward.

The social links of an elite bureaucracy are more likely to be with prominent landholders than with peasants. Land reform programs offer an almost irresistable opportunity for economic and political self-aggrandizement. Centralized authority and decision-making arrangements discourage the perception, expression, and satisfaction of local needs and interests.

Centralized administrative arrangements involve certain diseconomies of knowledge use. Centralized decisions about program implementation require knowledge and judgments about local conditions. Physical, social, and political distances encourage delay, misinterpretation, and irresponsibility. Decisions which must be sent down from the center for implementation may not fit local conditions. Delay itself is often enough to block the successful implementation of a program.

Decentralized

Decentralized administrative arrangements, where a number of agencies were each given partial responsibility for program implementation, resulted in greater increases in peasant incomes and land tenure security than did centralized arrangements. But peasant political power did not increase, and the bureaucracy's political power increased in every instance observed. (See table, "Effects of Administrative Arrangements.")



Decentralized: The specialized agencies may be Ministries of Agriculture, Social Welfare, National Development Banks, and Farmer Representatives. Information is collected by these agencies among the peasantry, coordinated among the agencies, and decisions made.

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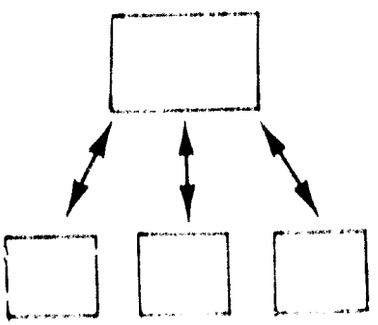
Decentralized arrangements may result in better program information. When each agency develops knowledge within its particular sphere of competence it may do so more rapidly and economically. Yet there is duplication of information-gathering activities, confusion and conflict over authority, and dispersion of responsibility. Accountability and control are problems.

Devolved

In devolved arrangements, where significant administrative responsibility was vested in local political leaders and structures, peasant incomes and political power increased in a majority of cases. Land tenure security increased in all cases. With one possible exception bureaucratic power did not increase. **(See table, "Effects of Administrative Arrangements.")**



Devolved: **The central authority initiates, coordinates, supports, and guides the program. Decisions are made at the level of tenant associations, *campesino* unions, and farm tenancy committees.**

Greater efficiency and effectiveness in decision-making occurs when those with knowledge of local conditions are given responsibility and authority for implementing the program. There are obvious increases in the rapidity of decision-making when knowledge which is locally available is used by local authorities to make decisions of local concern.

This does not imply a lack of governmental involvement; rather, it calls for new patterns of response in support of local authorities to whom the centralized bureaucracy is now in some measure accountable.

Conclusion

The evidence indicates that the devolved arrangement promotes long-run political stability because of the responsiveness of the bureaucracy to local needs and interests and because of increased popular support.

Montgomery's study was concerned only with land reform programs, but his illustrations of the effect of administrative arrangements on program outcome have implications for many kinds of efforts.

Administrators and technical assistance experts at the national, regional or local project level should consider the possible use of devolved arrangements in their specific enterprises.

For further information see:

Montgomery, John D. "The allocation of authority in land reform programs: a comparative study of administrative processes and outputs." *Administrative Science Quarterly* 17:62-75.

U.S. AID. *Spring Review of Land Reform.* 12 vols. 1970.

This Design Note was prepared by Paul Cunningham.

Effects of Administrative Arrangements in Land Reform Projects

Administrative Mode	Peasants Increased Tenure Security	Peasants Increased Political Power	Peasants Increased Income	Increased Bureaucratic Power
Centralized (9 cases)	2 (22.0%)*	1 (11.6%)	1 (11.0%)	9 (100.0%)
Decentralized (6 cases)	4 (66.6%)	0 (0.0%)	2 (33.3%)	6 (100.0%)
Devolved (10 cases)	10 (100.0%)	8 (80.0%)	8 (80.0%)	1 (10.0%)

Source: John D. Montgomery, "Allocation of Authority in Land Reform Programs: A Comparative Study of Administrative Processes and Outputs," *Administrative Science Quarterly*, 17(March 1972):62-75.

***Number and percentage of cases.**

PASITAM DESIGN NOTES

No. 2 September 1975

Effect of Training Programs on Work Behavior

Training strategies of international institutes significantly influence the post training work behavior of participants. Consequently, these strategies also affect programs of the national institutes to which trainees return.

An excellent illustration of the relationship between training strategies and post-training work behavior is found in a recent study conducted by Burton E. Swanson of the International Maize and Wheat Improvement Center (CIMMYT) in Mexico and the International Rice Research Institute (IRRI) in the Philippines.

Swanson identified three training strategies: a *basic research project* approach which trained workers to engage in knowledge-generating activities, a *production strategy* approach which trained workers to communicate technical information to producers but not to train other personnel, and an *on-the-job training* approach which trained workers to develop and improve adaptive production technology.

IRRI Research Training Program: A Research Project Strategy

The IRRI Research Training Program assumes that the major weakness of national rice research institutes is a shortage of competent research workers. IRRI seeks to remedy this situation by providing trainees with solid research experience enabling them to independently design and implement research programs.

The educational objective of the program is the development of the trainee's ability to analyze and to conduct research which will generate new knowledge concerning rice production.

Trainees work closely with an experienced agricultural researcher, participating in one facet of his research and eventually conducting a research project in one disciplinary area under his supervision.

The IRRI program is highly successful in realizing its primary objective, with a large percentage (71%) of its former trainees working in knowledge-generating research activities and publishing technical papers.

IRRI Rice Production Training Program: A Production Strategy

Responding to the need for qualified extension personnel, the IRRI Rice Production Training Program seeks to create a multiplier effect by "training the trainers": rice production specialists who will be able to design and implement a rice production training program for extension personnel. They are also trained in analytical skills sufficient to conduct applied research.

Trainees spend half their time in the classroom familiarizing themselves with modern rice techniques. The remaining time is spent in the field integrating this theoretical knowledge with practical training and developing their ability to communicate the new technology to others.

While the majority of former trainees are making use of the training received at IRRI, only a small percentage (12.8%) are working as rice production trainers. One fourth of the rice production trainees are employing the analytical skills developed at IRRI.

CIMMYT's Wheat Training Program: On-the-Job Strategy

CIMMYT's training strategy assumes that the major constraint to the transfer and development of wheat technology is an organizational weakness: the inability of national research institutions to organize themselves to solve technical production problems. CIMMYT focuses on one specific problem—the need for new genetic technology—and seeks to upgrade the research skills of its trainees to a level sufficient for them to design and implement a wheat research program.

The major educational objective of the program is to develop the trainee's ability to *synthesize* available genetic lines in the production of new genetic varieties. At

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the same time CIMMYT seeks to develop positive attitudes toward practical application on the part of the trainees by requiring field work and rewarding those trainees who internalize CIMMYT attitudes.

This training methodology develops wheat research manpower and acts as an "early-cut" selection tool for identifying those trainees who will most benefit from further training.

In terms of its objectives CIMMYT is very successful. The vast majority of its former trainees (90%) are now engaged in wheat research or improvement activities of a technology-developing character. CIMMYT has been less successful in producing trainees who engage in production improvement activities.

CONCLUSION

The character of research training programs significantly influences the post training work behavior of former trainees and the development and orientation of the national institutes to which they return. A serious constraint on increasing agricultural production is the inability of national research organizations to produce new technology aimed at solving local production problems. If the aim of training is field applications, the strategy should emphasize *synthesis* and applied technology development. If the aim is to foster further laboratory work, the training strategy should emphasize *analysis*. International institutes of training and other organizations considering the design and implementation of training programs should pay particular attention to the needs of the environment to which the trainee will return. They must be particularly conscious of the influence their training objectives and methodologies will have on the post-training behavior of their students.

Source: Swanson, Burton E. "Training Agricultural Research and Extension Workers from Less Developed Countries." Ph.D. dissertation, University of Wisconsin, 1974.

For further information see:

Moseman, A.H. "Research Systems." In *Institutions in Agricultural Development*, edited by Melvin G. Blase, pp. 139-48. Ames, Iowa: Iowa State University Press, 1971.

Ruttan, Vernon W. "Research Institutions: Questions of Organization." In *Institutions in Agricultural Development*, edited by Melvin G. Blase, pp. 129-38. Ames, Iowa: Iowa State University Press, 1971.

Ruttan, Vernon W., and Hayami, Yujiro. *Agricultural Development: An International Perspective*. Part IV. Baltimore: The Johns Hopkins University Press, 1971.

Swanson, Burton E. *Transferring Research Capacity*. Bloomington, Indiana: PASITAM, 1975.

This design note was prepared by Paul Cunningham.

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EASITAM DESIGN NOTES

No. 9 September 1975

A Management Information System Model for Multi-Purpose, Multi-Method Rural Development Projects

Under certain conditions a Management Information System can help reduce error, improve effectiveness, and promote participation in agricultural and rural development projects. This Design Note presents one model of such a system.

Management Information Systems (MIS) serve various needs in complex organizations, such as increasing control capabilities of management and providing strategic information for coherent decision-making at different points within the organization.

Properly designed MIS can help management under the following conditions:

1. Where the organization is so complex that balanced and coordinated activity and assessment of organizational states require specialized information processes (accounting and budgeting were the original MIS);

2. Where the organization's environment is so complicated and unstable that continuing analysis is essential to effective action; and

3. Where *influence*, as opposed to authoritative control, is an important technique for pursuing the organization's aims in its environment.

Information can have two effects on influence: (a) It can provide a common view and interpretation of a situation, leading to agreement on a line of action. (b) It can build support for project or program goals when *targets* of the organization's influence contribute information which is reflected in the organization's "behavior."

An effective MIS requires: (1) Determining *relevant* information needs (and minimizing irrelevant data); (2) Providing *reliable* and *economical* responses to relevant information needs; and (3) Delivering information to *users* in a timely and meaningful manner.

MIS in Agricultural and Rural Development*

Project-level MIS assumes flexible project design and effective management at the project level. Guiding aims are to *integrate analysis with action*, to *build a learning capacity* into the organization, and to *enlarge influence* by generating influential information from clients and others. Three kinds of information are needed: (1) Contextual or baseline data; (2) Current information about the status of project implementation; and (3) Data about project effects.

1. Baseline Data

Baseline data are the foundation of an effective MIS. Most agricultural and rural development projects undergo continuing design, as lessons are learned from experience and initial conditions are changed. Baseline data is necessary at the outset. It continues to be relevant throughout the life of a project, and is often used in conjunction with other kinds of information. The model described here emphasizes the continuing generation and use of baseline data for a multi-purpose, multi-method project.

Baseline data provide answers to questions about the *task environment* of the project: What are the pertinent social, economic, political, and physical features of the

*This particular model of an MIS for certain kinds of agricultural and rural development projects is based upon Peter F. Weisel, "Data Collection Design to Support Rural Development—the Case of Vihiga, Kenya," Vihiga Special Rural Development Program Discussion Paper No. 9, November 1974 (offset, 19 pp. plus attachments). Obtained from the Working Group on the Rural Poor, U.S. AID, Washington, D.C.

Each of these Design Notes states a lesson which may be useful to those engaged in planning, managing, or evaluating development efforts, such as technical assistance projects. A given note may describe a technique and discuss its use, may present and explain a useful concept, or report a functional relationship between some intervention and some outcome. Design Notes are backed by cited evidence from EASITAM studies, published literature, or the reports of development agencies. Comments and queries are invited, along with requests for additional copies and supplemental materials.

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environment? How does the environment "work?" What are the patterns, values, pressures, potentials, and controls? In an agricultural or rural development project, there is an additional question: How can we get the intended clients of the project constructively involved?

Baseline data are in several ways crucial to project selection, design, and management: (1) for testing, refining, and perhaps rejecting the assumptions in which a project explanation is initially based; (2) for devising and implementing a project strategy; and (3) for establishing relevant indicators of project effort and effect.

Typical baseline data include:

(1) *household-generated economic information* about incomes, resources, employment, output, expenditures, farming practices, tenure, taxes, and diets;

(2) *household-generated socio-cultural information* about perceptions, attitudes, and expectations, including data about values placed on homesites, land, particular crops, use of time, aspirations, and assumptions about the future; and

(3) *non-household-generated information* about markets, nonfarm economic activity, and other relevant features of the institutional setting.

Baseline data must be produced in a timely, reasonably reliable fashion and packaged in ways that encourage use. Trade-offs between timeliness and rigorous analysis are likely to be important. Use of scarce, high-cost talent should be minimized. Baseline data should be developed in ways that build project support.

The most comprehensive baseline survey reported for the Vihiga project took 88 man-days of senior analyst time and 192 man-days of field work over about a four-month period. Supplemental surveys might take 10 to 20 days of senior analyst time and 30 to 60 days of field work.

2. Project Implementation Data

Project implementation data include *implementation indicators* (information about inputs, outputs, costs); *utilization indicators* (data about numbers and types of beneficiaries, kinds and amounts of benefits); and *involvement indicators* (information about the amount and kind of involvement on the part of intended clients and others).

Implementation analysis addresses these questions: Do current aims make sense, or are there preferred alternatives? Does current project strategy fit project aims? What are the current constraints and deficiencies?

3. Evaluation Data

Evaluation data are also generated by MIS. Implementation analysis provides evaluation data by examining such things as relations between beneficiaries and intended beneficiaries and relations between project effects and intended effects.

Experience with this particular model suggests: (1) Implementation and evaluation analysis has two important elements—a flow of data generated directly from project operations, and special studies of particular project activity. (2) Consultation with government officials before, during, and after analysis affects the value of the data (as does preparation of findings in brief written form with focus upon specific options). (3) Consultation with project clients and potential clients in obtaining information about implementation effects, and effectiveness, is crucial. Well-planned consultative approaches tend to minimize error in project planning and management, enlarge the influence of the project, and produce true participation in development efforts.

MIS for A & RD: Organization and Resources

Management Information System applications must be fitted to specific aims and circumstances. Key features include: beginning to establish baseline data before project start-up; incorporating a continuous reporting system into ongoing project operations; and where appropriate creating a project management analysis staff with a stringent obligation to serve project decision-makers.

Resource requirements for this particular model include a specialized staff unit. An example, based on the Vihiga experience, includes:

(1) A *senior analyst*, with a Ph.D. in economics or agricultural economics and prior rural field research experience to define and structure analysis work, determine findings, communicate results, and generally supervise the field staff.

(2) An *associate senior analyst*, trained in a field of behavioral science other than economics, with practical experience, to share in the design of analysis, assessment of findings, instruction of field staff, and communication of results.

(3) An *assistant analyst*, a *local* person with about a Form 3 or high school level education and some field research experience to participate in supervising field work, collect some kinds of data, and do some tabulation and preliminary analysis.

(4) *Field staff*, a small number (2 or 3) of *local* individuals with Form 4 or 5 or high school level education, responsible for data collection.

(5) *Clerical support* which may be assigned to the analysis staff or drawn from general services available to project management.

(6) Access to *transport*.

(7) *Data processing services* generally obtained externally from a college, university, or research institute.

This particular model fits a rather large multi-purpose, multi-method rural development project, with substantial needs for containing specialized analysis. It is not a universal model, nor is this a complete picture. Much data development for MIS, particularly implementation and ongoing evaluation information, should be built into project operations, as noted in other forthcoming PASITAM notes on MIS. The essence of MIS is not a particular form of organization. It is the capacity to identify information needs, produce appropriate analyses, and use them in effective management decisions.

Costing an MIS presents a problem: A good MIS *eliminates* costs that can be judged but not measured, such as the costs of error and the costs of limited effectiveness. The highest possible cost of error is the value of resources used in a project that failed, plus the opportunity costs of failure to the participants.

Concerning effectiveness, agricultural and rural development projects are usually *satisficing* rather than *optimizing* in their resource use. Projects which cannot be substantially "standardized" *can* be subjected to certain critical threshold tests of effectiveness, such as favorable internal rates of return. But reasonably precise measures of effectiveness, *relative to a sure standard of what the project as a bundle of resources should produce, do not exist.*

It is therefore impossible to apply a determinate cost/benefit calculus to MIS. The prime benefits are the avoidance of error and an increase in relative effectiveness. But *what* errors were avoided, and *what* increments of effectiveness can be attributed?

Errors avoided through effective management don't show up in the data. "Better results" raise the challenge: "Better than what?" Thus the basic argument for MIS is the elemental need for better management in a field where the rate of error is high and results are limited.

A specialized MIS unit should probably not be labeled a "Research Staff." Labels don't change odors, and titles don't necessarily specify functions. But labels and titles do imply something about meanings and expectations. To most people "research" is not "management." The term "research" suggests a separation between analysis and action. Analysts, managers, and those who design and fund projects should understand what is involved. MIS is a flexible, systematic arrangement for producing and using information to manage complex endeavors which operate under conditions of novelty and uncertainty and which are highly vulnerable to error.

An Example from Vihiga

One facet of the Vihiga Project involved loans to low and middle income maize growers for seed and fertilizer—and problems of making loans, getting them to the right people, getting the funds used properly, and collecting debts. Between 1971 and 1973 lending grew, but repayment declined.

According to the guiding assumption of the activity, credit was the chief barrier to the growth of hybrid maize. Implementation analysis after about three years revealed:

(1) The bulk of the borrowers were wealthy rather than low and middle income farmers;

(2) Credit was not a constraint for these recipients;

(3) But credit was a constraint for the *intended* clients.

These findings, based upon analyses that drew from baseline data, other materials, and extensive meetings ("village level maize credit seminars") with 1974 loanees, led to redesign of the 1975 loan package.

The seminars revealed:

(1) Farmers were not interested in being lectured or threatened concerning repayment.

(2) They were interested in talking about their problems, and *the development of their farms.*

(3) They felt the existing loan arrangement didn't meet their most pressing needs.

(4) Farmer interest in the program and the seminars grew as they perceived that the project management was responsive.

As a result, the 1975 loan is a *farm development loan.* Borrowers have been grouped into categories on the basis of need and a repayment incentive strategy (i.e., shared repayment obligations for certain categories of borrowers). Farmers must specify the farm activities for which they seek credit (an instance of participation at the individual level). Borrowers must join a group of not less than five other loanees *of their choice,* and default in repayment by one member jeopardizes the entire group's access to further credit (an arrangement of collective participation). Farmers deal with a full-time loan officer, operating within the framework of certain general loan criteria. Credit availability varies according to the resource endowments of borrowers—i.e., only farmers with demonstrated skills would be eligible for grade cattle loans.

This experience indicates a need for as well as an application of the MIS approach. Several years passed between the effort that began in 1971 and the project redesign occurring in 1974. Along with the brilliant lesson that an MIS can stimulate participation there is evidence that the MIS approach should be well-incorporated from the very beginning of project activity—actually prior to that beginning in the case of baseline data.

This Design Note was prepared by William J. Siffin.

PASITAM DESIGN NOTES
No.4 DECEMBER 1975

Targeting as a Tool of Program and Project Design

A target is an intermediate goal used in measuring progress toward the broader aims of a project or program. The ideal target is a clear, reliable indicator of movement toward a major goal.

Translating project goals into targets is a fateful—sometimes fatal—step in program and project design. Targets can be powerful tools of project design and implementation, but they are often used improperly.

Item: Rural development is the goal of an extension program in a Middle Eastern country. The number of on-farm demonstrations by extension agents is used as a measure of progress toward the goal. Farm demonstrations increase enormously, but rural development does not.

Item: A rice program in an Asian country includes the eradication of insect pests as a sub-goal. The aggregate number of hectares sprayed is set as a target. But aerial spraying of large areas has negligible impact upon pest control and the spread of rice cultivation.

Item: A fertilizer program in an African country uses the number of sacks distributed to farmers as an indicator of program effectiveness. Large numbers are distributed, but farmers discard or sell some and misuse others.

THE LOGIC OF TARGETING

To set a target is to act on certain assumptions (or to act *as if* these assumptions can properly be made):

First, that ends are known.

Second, that appropriate means are also known and available.

Third, that measuring the application of means indicates progress toward ends.

When these assumptions are sound, targets can be used as simplifying, summarizing indicators of the state of complex efforts to move toward some goal or goals. Note, however, that these assumptions require reliable knowledge of the cause-effect relations in the situation.

Targeting techniques evolved in engineering fields where there are many tested indicators of cause-effect relations. Items such as yards of earth excavated, welds completed, or concrete poured can index progress in building a road, a ship, or a dam. Given reliable and valid knowledge, targeting can be used to monitor progress, schedule and reschedule activities which must be synchronized, identify lags or danger spots, and otherwise serve the aims of planning, management, and control.

TARGETING IN UNCERTAIN SITUATIONS

With proper care and understanding, targeting can also be used in situations much less certain than those found in engineering activities. Uncertainty means imperfect knowledge about goals, about means-ends relations, or both. When *everything* is uncertain there is no basis for action. The most definite knowledge is likely to be about inputs—units of material, time, and effort—into a program or project. Inputs which can be measured and controlled become possibilities for target setting. In addition to flows of inputs, accomplishment of certain kinds of intermediate objectives can often be "measured" or determined in a relatively precise fashion, e.g., amount of land leveled, irrigation facilities

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completed, storage sheds built, etc. Physical achievements—intermediate bricks and mortar outcomes—are also attractive subjects for efforts to set targets.

To use selected inputs as the basis for targets is to know (or assume) that there is a determinate relationship among all inputs and their combined effects. To use intermediate products as the subjects of targets is to know (or assume) how these are causally related to goals. When key inputs must be made by clients or a "target group," important knowledge is often lacking, and false assumptions may be made. Partial inputs and intermediate outcomes may be necessary to achieving project goals—but not sufficient.

Valid information about inputs or intermediate accomplishments can be an utterly unreliable indicator of outcomes. Reliability depends upon knowledge of means-ends relationships. A scarcity of such knowledge is typical of developmental efforts. This is especially true when a means-ends chain is long, e.g., when certain input combinations are expected to increase the volume of outputs, increased outputs are supposed to raise producer incomes, and higher income is supposed to lead to well-being, commitment to more growth in output, an enlarged sense of efficacy and independence, and increased support for the socio-political system.

PATHOLOGIES OF TARGETING

Guy Hunter has observed that bad targeting can stem from a number of things:

> . . . either from bad central planning, or from failures in a single sector to meet what were reasonably planned deliveries, or (and perhaps most frequently) from an over-ambitious programme, which allows effort on a country-wide scale with resources equal only to two-thirds of the country, or engages simultaneously in half a dozen schemes which all compete for the same administrative resources. (p. 62)

In other words, bad targeting stems from ignorance of sound program and project design principles, willful violation of those principles, or a combination of the two. Sometimes initially sound targeting is falsified by uncontrollable environmental factors. When every reasonable effort has been made to guard against this, a breakdown can only be accepted as a fact of life in an uncertain developmental setting.

Two of the most common pathologies of targeting are *false targeting*, when goals or means-ends relations are not really clear, and *attempting to use targets as substitutes for management*.

Targeting When Goals Are Unknown. Larger goals of development projects and programs are often expressed in intangible terms—"promoting rural development," "increasing peasant income," "improving the health of a target group," etc.

Vague goals can be useful and are sometimes necessary. They can minimize conflicts. They can help mobilize support for a line of action—general goals are usually virtuous. They can enable action to begin when the problem is more obvious than the most appropriate solution. When it is necessary to act in highly uncertain circumstances, wise men will opt for intangible goals if only to minimize their own vulnerability. Progress may be assessed impressionistically and defended or indexed by illustrations such as "appropriate events" or deliveries of means.

But there is a trade-off. Intangible goals are incomplete guides to concrete action and an insufficient basis for systematic evaluation. How shall rural development be determined? What is a proper and effective level of increase in peasant incomes? What is an adequate improvement in health?

When goals or means-ends relations are not clear, premature targeting is a serious design risk. Targets become *de facto* goals, although their logical soundness is not established. See the examples at the beginning of this note.

Targets as False Substitute for Management. Targets are tools of management and control. Where there is reasonably certain knowledge of means-ends relations, failure to meet a target signals management that there is a problem. When there is a high degree of uncertainty in the situation, the meaning of failure to meet a target is ambiguous.

Targets are sometimes used to standardize and simplify a large-scale effort. Designers reduce the desired action to a set of recipes and minimize the discretion required for implementation. A large volume of activity can thus be made compatible with a very small supply of managerial resources.

Given near-perfect knowledge, this is a sound approach. Lacking such knowledge, it is an invitation to disaster. Targets create a false appearance of certainty. Field forces strive to meet them—or falsify actual accomplishments. When rewards depend upon meeting targets, field personnel will tend to report fulfillment. If the targets are false, achieving them may actually undermine higher goals. Some of the worst results occur when targets are set by central agencies operating with limited knowledge and no direct control over implementation.

Pathological Targeting: A Case in Point. Guy Hunter's example of Village Level Workers (VLW) in India succinctly illustrates a pathology of targeting. The VLW Hunter describes is typically assigned to cover 1,000 farm households and is responsible for introducing agricultural innovations. The principal means of carrying out this responsibility are direct contacts with the

farmers and the demonstration of new techniques. Demonstration targets, record keeping, reports, and diaries are primary means of control exercised by senior extension agents.

Measuring VLW performance in terms of the *number* of demonstrations carried out assumes a direct functional relationship of demonstration to successful innovation. But the effect of demonstrations upon actual adoption of the innovation is not definitely known. Striving to meet their targets, VLW perform far more demonstrations than they can control for content. The attention paid to each demonstration and to each farmer diminishes; quality is lost in the effort to fulfill the target. At best, demonstrations degenerate to "tea-drinking visits." At worst, VLW file false reports or attempt to force farmers to adopt unsuitable innovations. Records indicate dramatic increases in the number of farm demonstrations. Do these "explain" innovation and development?

The answer is supplied by the only important audience, the farmer. In a survey of five Indian states to determine how cultivators learned of or were persuaded to try new methods, more than half cited the VLW while a quarter cited the influence of other farmers. Less than ten percent mentioned demonstrations.

EFFECTIVE TARGETING UNDER UNCERTAINTY

Targets *can* be used as effective tools of planning, management, and control in uncertain situations, provided certain principles are honored:

1. Broad planning goals should not be presented as operational targets. Target-development, rather than stipulated targets, should be made part of an initial action plan when programs or projects are exploratory or not altogether certain responses to clear needs.
2. Such targets must be treated as contingent and subjected to frequent review—not just in terms of their accomplishment but in terms of their soundness.
3. Targets being set for a client group should be set in consultation, negotiation, or testing with that group and subjected to periodic review, usually as part of an annual or seasonal action planning effort.
4. Targets should be justified by explicit citation of the evidence or experience upon which they are based. When target-setting is part of ongoing programming or project management, targets should be presented in conjunction with appropriate baseline data.
5. Finally, trivial or formalistic targets can be built into a program or project design to satisfy requirements of a programming process which insists upon targets, when the designer knows that sound targeting is not yet feasible.

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This Design Note was prepared by Paul Cunningham and W.J. Siffin.

PASITAM DESIGN NOTES
No. 5 March 1976

Technology Transfer and the Gatekeeper Function

"Gatekeepers" appear to be one factor in the successful transfer of technology through industrial research institutes in less developed countries.

A gatekeeper functions as an informal, redundant channel of communication between the external scientific/technical domain and domestic colleagues and clients. S/he also brings distinctive technological competence and judgment to the work of an institute.

The gatekeeper function can be deliberately organized and encouraged. It might have applications outside the domain of industrial research institutes, from which this description is drawn.

TECHNOLOGY IN LDCs

Science in less developed countries (LDCs) has been described as a "research desert." LDC scientists and technologists tend to be isolated from the international scientific community, from other LDC research institutes, and from potential local clients. *Isolation* is a principal cause of the migration of scientists. It also limits their awareness of technological developments which might have immediate local relevance.

Linkages between an LDC research institute and the international scientific community are usually weak, but they are often stronger than linkages *among* LDC research establishments at home and abroad.

Isolation from the local setting limits the capacity of LDC research institutes to respond to needs and demands even though such response capacity is vital. Most successful innovations are developed and adopted as a result of market or production demands. Demand determines supply much more than the opposite.

In many LDCs potential clients are unaware of possible technological solutions to their problems, are unable to articulate their needs, or are wary of risking limited capital on unproven research institutes. Often these clients need only "low-level" technical solutions to simple problems. Paradoxically, many LDC research institutes cannot respond at this level. Researchers, educated and trained in industrialized countries, tend to concentrate on problems more germane to the concerns, resources, and reward structure of developed countries — a phenomenon aptly described as "internal brain drain."

THE FLOW OF INFORMATION

It is commonly believed that technical information within the scientific community flows rather directly through two long established channels: professional literature and consultation with colleagues. In typical LDCs these channels are not effective.

The average technologist has little time for reading professional journals, even when journals and other materials are available. Subscribing to and translating large numbers of journals is often prohibitive in cost and skill requirements. Information engineering — the acquisition, processing, and dissemination of large amounts of information — is poorly developed.

The second assumption — that scientists transfer technical knowledge through frequent consultation with colleagues beyond their immediate circle — is also often false. In many organizations it is dangerous to admit ignorance.

TECHNOLOGICAL GATEKEEPERS

According to recent studies, the most important source of technical information transfer within LDC industrial research organizations is a small group of frequently consulted individuals. These *technological gatekeepers* mediate between the larger international technical/scientific community and their colleagues and

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clients. They select and translate foreign-generated technical information into the cultural and organizational "coding system" of their institutes. They identify, articulate, and seek to meet client needs. The gatekeeper role is not designated as part of the formal s[illegible] the organization. The gatekeeper works as [illegible]ital, *redundant* information channel parallel to [illegible], less efficient channels.

Gatekeepers appear to share certain properties. They are generally high performers, respected and consulted by their colleagues. Gatekeepers are well linked with sources of professional information, including professional and scientific journals. They attend international conferences, develop useful contacts from such meetings, and maintain those contacts through correspondence.

The apparent key to the gatekeeper's role lies in the fact that gatekeepers *have worked abroad in their own fields.* Successful professional experience, even for rather short periods, seems sufficient to establish the necessary perspective and linkages. Gatekeepers are most effective in their role upon their immediate return from such experience, and they tend to become obsolete in the absence of updating opportunities.

Foreign experts seldom function as gatekeepers. Even when more familiar with recent technological information, they are not sufficiently well integrated into the host institute. But they may "lend" their own extensive contacts to the gatekeeper and otherwise support the gatekeeper function.

The gatekeeper role does not necessarily involve a high administrative position. The hierarchical arrangement of an organization is commonly assumed to reflect the relative competence of its members. More often than not, however, the real technological expertise is not at the top; and the important information flows through gatekeepers' networks outside the formal, hierarchical arrangement of the organization.

CONCLUSION

The gatekeeper appears to play a vital role in acquiring and disseminating timely technical information in certain kinds of organizations. Within limits, gatekeepers can be deliberately created, and their roles can be reinforced. Incentives are important to this process. So is the existence of updating arrangements. Periodic retooling and contacts with visiting experts can help meet this need. Managerial acceptance and support of the gatekeeper function is, of course, essential.

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This Design Note was prepared by Paul Cunningham.

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PASITAM DESIGN NOTES

No. 6 May 1976

How Uncertainty Affects Decision Making

An organization is an arrangement for doing something. One of the most important things it does is make decisions. In part, every organization is a design for decision making. Many factors affect the quality of decision-making designs. The most important of those factors is the degree of risk and uncertainty faced by the organization.

Under conditions of considerable risk or uncertainty, synoptic decision-making arrangements (i.e., comprehensive sets of pre-programmed decisions) are an invitation to error and to failure.

Another term for synoptic decision arrangements is premature programming. *In unstable or uncertain conditions premature programming blocks the use of vital information drawn from unfolding experience.*

This Design Note examines four categories of decision making, the notions of risk and uncertainty, and the pitfalls of premature programming.

The four categories are not mutually exclusive. Different parts of an organization may use different strategies, ranging from a highly determinate procedure in the finance department to a trial and error approach in an R and D unit.

The decision-making strategies of an organization may change over time. One of the critical responsibilities of managers is to determine what kinds of conditions they confront, and what decision-making strategy is therefore suitable.

Decision-making strategies are embodied in organizational arrangements. An organization's rules and assignments of responsibility can be viewed as a program for decision making. A rigid, elaborately specified organizational structure (illustrated by the detailed pyramidal organizational chart) is compatible with and generally reflects—a highly programmed decision-making strategy. This is consistent with operations in a highly certain or predictable environment involving the use of reliable methods and technologies.

Organizations faced with high levels of uncertainty will, if they are rational, use other patterns. These may include deliberate duplication of functions (e.g., organizing activities in parallel rather than in series) and arrangements for arriving at decisions through bargaining.

DECISIONS

A decision is a choice. All deliberate decisions are based upon facts* and values or goals. The knowledge needed for a decision may or may not be available. Goals or values may or may not be agreed upon. These two basic elements facts and values enable us to classify decisions into four basic categories.

*In practice, "facts" include determinate knowledge and assumed or "believed" knowledge. "Conventions" are part of the latter. A convention is a premise which is literally taken for granted, a stipulation which is not subjected to verification.

Each of these Design Notes states a lesson which may be useful to those engaged in planning, managing, or evaluating development efforts, such as technical assistance projects. A given note may describe a technique and discuss its use, may present and explain a useful concept, or report a functional relationship between some intervention and some outcome. Design Notes are backed by cited evidence from PASITAM studies, published literature, or the reports of development agencies. Comments and queries are invited, along with requests for additional copies and supplemental materials.

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FOUR CATEGORIES OF DESIGN

Facts or Knowledge about Causation and Instrumentation	Values or Goals: Agreed	Values or Goals: Not Agreed
Certain	1. Computational or Programmed Decision Making	3. Bargaining and Negotiating as the means of decisions
Uncertain	2. Trial and Error or Pragmatic Decision Making	4. Gravage Anomic Behavior Charismatic Leadership or Strong Man Decision Making

PROGRAMMED DECISION MAKING

Cell no. 1 represents agreement about aims and knowledge of ways and means. This enables *computational* or *programmed* decision making. Computers work on the basis of this model. So do some organizations. They have tight, linear, and pyramidal structures.

Decision making is easy in these circumstances: all that is needed is knowledge of and adherence to the "program." Errors can be quickly detected and easily corrected. When this model applies, risks of failure are slight; and under such highly determinate conditions, it is appropriate for management to emphasize *control* to assure compliance.

PRAGMATIC DECISION MAKING

Cell no. 2 displays agreement about goals but uncertainty about facts. The organization knows what it wants to do but is unsure of how to do it. Here a rational decision-making strategy involves trial and error, search for knowledge, or experiments (heuristic approaches) to build knowledge in order to move toward cell no. 1. The most critical need is for relevant knowledge. Yet uncertainty may be increased by added knowledge if it opens up additional unexplored avenues.

Conditions of uncertainty in this situation demand *managerial* responses which go beyond control. Management implies the awareness or acknowledgement of uncertainty and the calculation of risk based upon past performance. Under these conditions an essential managerial task is to define the boundaries of knowledge and uncertainty and to establish receptivity to error signals. Managers must treat policies as hypotheses as educated guesses informed by experience and subject to confirmation, disproval, and adjustment on the basis of experience. An efficient organizational structure for these purposes is characterized by *redundancy* by parallel arrangements and overlapping jurisdictions. Considerable use of committees and collective decision making will be found. Overlapping generates tension, which is not cost-free but can help generate information. Parallel channels of action and of information generation and transmission will increase system reliability and reduce the probability of failure.

Intelligence agencies are extreme examples of this kind of organization. Many development efforts also fit into cell no. 2. At some level of generality aims are clear, but means are not.

BARGAINING AND NEGOTIATING

In cell no. 3 facts are non problematical, but there is disagreement about goals or values.

Many development activities fall into this category. Technologies and other resources are available, but the true aims of action are ambiguous or not altogether coherent. A degree of ambiguity is characteristic of goals in quite a few development efforts, partly because of underlying potentials for conflict among parties to the undertakings. Then wise managers may deliberately adopt vague formal goals over which participants can agree.

Less Machiavellian but no less common is the need to allocate scarce resources among a group of desirable activities. Honest men will disagree about choices, and goals cannot in such conditions be set by "logic" or by the discovery of an underlying consensus. The only rational way to resolve such a situation is through bargaining and negotiating.

A disposition to bargain and negotiate indicates that the participants do value the organization or effort, at least to some degree. Participants in bargaining do not have to be equal in power. But any actor must be able to inflict sufficient harm or disruption to encourage the others to bargain. This is common in international relations, in labor negotiations, and in organizations where subordinates can sabotage decisions with which they disagree. Under such conditions rational managers provide for consultation and negotiation.

INSPIRATIONAL DECISION MAKING

When disagreements about goals or values are greater than commitment to the organization, and when there is even disagreement about the relevant facts of the situation, *cleavage* may result: internally unresolvable conflict. This is a state of *disorganization*. The situation looks normless and purposeless. Participants may withdraw or exhibit anomic behavior. Occasionally organizations fall into this state. There are three possible exits: (1) the organization can collapse; (2) the lesser opposition can be driven out; or (3) the organization can override the disagreement. A cell no. 4 situation usually leads to some form of outside intervention. An external agency may send in a strong man to impose direction and order upon the situation. As a crises measure this often works; but an underlying structure of agreement must also be evolved. Organizations built upon one man are inherently unstable: remove the leader and the organization collapses.

The strong man forces the organization to act *as if* it were in a different condition, to act as if there were agreement on goals and certainty of knowledge. To succeed, the effort must acquire the quality of a "self-fulfilling prophecy."

PREMATURE PROGRAMMING

Acting "as if" may be termed *premature programming*. Organizations tend to prematurely program when outside forces require the appearance of assured and determinate control of an uncertain situation—when action is imperative but operational ways, means, and aims are less than clear. Premature programming *appears* to provide an orderly, coherent view of the environment and the organization's response to it. It is usually reflected in comprehensively programmed decision making. Decisions are approaches *as if* facts were known and goals agreed upon. A linear, elaborately specified, well-articulated system of formal decision making is used.

Premature programming appears to make decision making easy: it enhances the illusion of certainty and control. The cost is reduced access to knowledge about the environment, the effectiveness of means, and the acceptability of goals—in short, reduced ability to detect and correct errors. Potential for organizational learning and effective decision making is undermined.

In the real world there are many cases where organizations must act *as if* goals were clearer than they actually are, and *as if* all the necessary facts were at hand when they clearly are not. Action requires programming even when the actors know it is premature. Premature programming can be constructive *if* it is supplemented by decisional arrangements which recognize that the pseudo-determinate stipulations of fact and value are really highly contingent. To do this imposes important requirements upon an organization and its management, including intensive monitoring and assessment of current experience, a large capacity for flexible action and change of direction, and an incentive system which discourages cover-ups and encourages error detection and correction at operating levels. Programming processes in such cases are continuous rather than linear.

CONCLUSION

Development activities usually take place in environments characterized by high levels of uncertainty, where knowledge of means-ends relationships is far from perfect and where there is potential for serious disagreements about goals. The essence of management under these circumstances is to acknowledge this uncertainty and adopt organizational forms and decision-making strategies aimed at reducing it. This approach is inconsistent with rigid, comprehensive initial specifications of organizational design and decision making. In such a situation, the basic requirement is that planning and action proceed concurrently more than sequentially—granting that some planning must always come first.

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This Design Note was prepared by Paul Cunningham.

PASITAM DESIGN NOTES

No. 7 May 1976

An Agricultural Management Information System: Lessons from Masagana 99

Some kind of Management Information System (MIS) is essential to any large scale agricultural development program which involves synchronized local, regional, and national level decisions.

An effective MIS for such a program does not necessarily require elaborate automatic data processing arrangements.

The MIS may be built into field operations, with basic data obtained by agricultural technicians as part of their regular work.

The analysis of that data may be quick and relatively simple (depending partly upon the kind of program).

The system can produce timely results information useful for making operating decisions.

The key problem is likely to be the extent to which the data are actually used in top level policymaking.

THE PROBLEM OF RURAL SECTOR INFORMATION

Any agricultural development program requires technical expertise and information about what is going on. Information is a crucial and scarce resource for effective project identification, operation, and evaluation.

When projects are too large for direct, on-the-scene planning and monitoring, management requires an information system. In agricultural and rural development, reliable, timely information is usually hard to get. Yet there has been little systematic study of management information systems for agricultural and/or rural development.*

**PASITAM Design Note No. 3 describes one version of such a system, derived from the experience of the Vihiga Project in Kenya.*

The reasons why conventional MIS theory and procedure must be adapted to fit agricultural projects include:

1. Links between information sources and decision points are often extremely loose and limited.

2. Causal factors are not always clearly known, making it difficult to determine what is *relevant* information.

NOTE: This Design Note is based upon material prepared by Kenneth F. Smith, of the U.S. Agency for International Development, who played a key role in the establishment of a management information system as part of the *Masagana 99* program to increase rice production in the Philippines. "Masagana" is "bountiful harvest" in Tagalog; "99" refers to the target production figure.

Each of these Design Notes states a lesson which may be useful to those engaged in planning, managing, or evaluating development efforts, such as technical assistance projects. A given note may describe a technique and discuss its use, may present and explain a useful concept, or report a functional relationship between some intervention and some outcome. Design Notes are backed by cited evidence from PASITAM studies, published literature, or the reports of development agencies. Comments and queries are invited, along with requests for additional copies and supplemental materials.

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3. Collecting data presents problems of cost, resistance, and tendencies to lie.

4. The diversity of information sources can threaten the coherence and reliability of an information system.

The MIS developed in the Philippine's *Masagana 99* program sought to overcome these constraints and to establish an "on line" information system for monitoring and managing a comprehensive effort to increase rice production.

CONCERNING MANAGEMENT INFORMATION SYSTEMS

Kenneth Smith identifies three kinds of management information systems:

1. *Comprehensive MIS.* All possible information is gathered in the belief that "it may be important." This usually involves a sophisticated computerized system, and it is often as bad as it is costly.

2. *Status MIS.* One or a few crucial indicators of program or project status are identified and monitored. Examples might be compliance with a time schedule or a cost projection. Techniques such as Program Evaluation and Review (PERT), Critical Path Method (CPM), or Line of Balance (LOB) may be used to plan the action and plot the progress. When significant variance from time, cost, or other indicators appear, management is alerted.

3. *Control MIS.* Somewhat more loosely than in a Status MIS, "a few key data elements are selected for continuous observation, recording, monitoring, statistical analysis, and summarizing for management." Performance standards are established for the data items. As long as accomplishments fall within acceptable limits, management does not intervene. When results fall outside established limits management is informed, investigates, and tries to take appropriate action. This approach is commonly known as "Management by Exception." The *Masagana 99* MIS fits this category.

THE MASAGANA 99 MIS

The objective is a fast, reliable information channel between rural target areas and central government analysts and decision markers. Essential features include:

1. *Baseline Data.* Smith notes the importance of not labeling baseline data collection as "research." *Rice Profiles of the Philippines* present baseline data for Masagana target areas, including the anticipated timing of planting. These data are developed by the provincial agriculturalist, his staff, other local personnel, and community leaders.

The information provides a measuring point for gauging results. It is used in planning and scheduling credit and other input requirements. The baseline surveys include social data and bring target groups into the planning process, minimizing tendencies toward errors and misunderstandings when the program is implemented.

2. *Standard Indicators.* Factors used in the Masagana scheme include input levels, timing of input delivery, area of coverage, unit production figures, and other items directly related to production.

3. *Performance Standards.* When possible, the standard indicators become the basis for setting targets.* Times are set for the achievement of targets. The acceptable range of variance from target times and figures is determined.

For some indicators it is not possible to set clear standards or acceptable degrees of variance. The *Masagana 99* program is carried on simultaneously in many different areas so that, in the absence of more precise standards, top and bottom performers (provinces) on particular indicators are singled out as "exceptions" for management scrutiny.

4. *Standardized Formats for Reporting and Analysis.* Different formats are used for worksheets (for recording data) and reports (for transmitting data). As Smith notes, a traditional MIS problem lies in sending too much unanalyzed data to management.

5. *"On-Line" Data Collection.* Field data are collected by the provincial agricultural technicians as part of supervising and assisting farmers. Monthly data on each farmer's operation are recorded on standardized worksheets. Each month the technician aggregates the information for all of his farmers and sends it to the provincial program officer, along with a standardized form noting any problems and asking for any assistance.

The provincial supervisor and his staff summarize this information and send cumulative provincial totals to the national MIS office by the fastest available means: telephone, radio, telegram, personal dispatch, or other.

6. *Data Analysis.* At the national level separate tables are prepared for each key indicator. Data for every province are compared with the target for the indicator, and provinces are rank-ordered according to performance. Provinces falling above or below pre-set tolerance limits become objects of central staff attention.

Rank-ordering makes it possible to identify extreme cases when there is no performance standard for a particular indicator.

No efforts are made to correct obvious errors or misrepresentations in raw data. By using exactly what is

*See *PASITAM Design Note* No. 4.

reported, Smith argues, technicians and provincial supervisors know that their inputs are being accepted and used. Obvious errors are handled in "flying visits" to the provinces.

The need for reliability is reinforced by selective checks of the validity of field data.

The central office prepares a short summary and comment on the monthly tables for *Masagana 99* Management Committee, highlighting problems and other important items.

7. *Feedback.* Each province receives copies of the monthly report comparing provincial standings for verification and local management use.

8. *Evaluation.* Monthly visits by the central staff are made to "exceptional" field sites. Periodic intensive surveys and reviews are also mounted by the central MIS staff, by the Agricultural Program Evaluation Service (APES), and by another Special Studies Group from the Department of Agriculture. These latter organizations, independent of the MIS staff, are in close contact with it. The MIS staff also takes random field samples of production. The other organizations investigate problems of input availability, managerial effectiveness, marketing, and other conditions inhibiting target accomplishment.

As a further check on MIS reliability, the Bureau of Agricultural Economics (BAECON) performs quarterly provincial sample surveys of rice production. BAECON is experimenting with new techniques of sampling to determine yields. When fully operative, these data should provide a reliable check on MIS data.

9. *Causal Analysis.* The *Masagana 99* program is based on certain assumptions about what causes increased rice production. For example, a correlation between intense supervision and increased yield is assumed. It is assumed that credit availability correlates with yield, and that low yields are linked with low repayment rates.

Rank-order correlations between the various indicators used in the MIS should contribute to the analysis of these operating assumptions. But conclusive findings are not yet in.

10. *Decision Making.* Any MIS is only an instrument for making better decisions. A key area for inquiry is the way in which *Masagana 99* MIS aids top management in the Philippine rice production program. The evidence is not clear, and more extensive study would be needed to determine this. But as a *model*, this MIS offers one example of an important management tool for agricultural development efforts.

The *Masagana 99* MIS has been in operation since May 1973. The data it has produced are far from perfectly reliable, but they are available in a systematic form, on a timely basis, and can be used in operational decision making. The *Masagana 99* MIS is seen as an important step in building "a permanent capacity within the National Food and Agriculture Council (NFAC) and BAECON to monitor provincial level agricultural data" in the Philippines.

The *Masagana 99* program has highlighted the need for decentralized decision making in Philippine agricultural development. The MIS offers possibilities for strengthening provincial management within a national developmental scheme.

Two years' experience have proved that fully centralized management is impossible. The time-lag between problem and response is too great, with a rice-growing season of four months or less. Only the most basic activities can be programmed nationally, such as credit and fertilizer allocations and the assignments of key personnel. Short range decisions can be *monitored* nationally, but they can be made effective only at intermediate or provincial levels, e.g., reallocating fertilizer when one area exceeds a planting target and another fails to meet it.

In principle, the *Masagana 99* MIS would enable or facilitate such decentralization of decision making. In practice, the Masagana program is now trying to build MIS-based analysis capacity into regional program offices and selected provinces. Lack of competent staff is a major constraint.

Poor data quality is a continuing and inevitable problem. Farmers may "poor mouth" yields out of the fear of taxes. Technicians have a vested interest in reporting achievements. Earnest and well-publicized checks are an important part of the program.

Adequate staff resources are crucial to this MIS. Analysis requires skilled and experienced personnel. The entire MIS must be sustained by incentives to report accurately, quickly, and usefully. The key incentive for making this system work is evidence that good information is really used in making sound, timely, practical decisions.

In extensive programs like *Masagana 99*, an MIS is no cheap, casual undertaking. But intelligent decision making requires reliable, relevant information, and large-scale agricultural development programs cannot be sensibly managed without such information.

Systems select, gather, synthesize, analyze, and report data. But the question is whether the results are used in making decisions. The *Masagana 99* MIS demonstrates that a good system can be developed without elaborate computerization or a swarm of specialist field data collectors. Whether the products of that system are to be used effectively remains to be seen.

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This Design Note was prepared by Russell Stout, Jr.

The following Design Notes are available upon request from the Documentation and Analysis Center, 1005 East Tenth Street, Indiana University, Bloomington, Indiana 47401.

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PASITAM DESIGN NOTES

No. 8 JUNE 1976

Designing Organizations to Increase Reliability and Minimize Error

Duplication of efforts and overlapping of functions are generally regarded as wasteful and inefficient. Yet duplication and overlap are essential to efficiency, reliability, and flexibility under certain conditions—conditions which often exist in development efforts. Typical development projects and programs are marked by high levels of uncertainty and substantial risks of failure. Managers yearn for system reliability, error avoidance, and flexibility. Duplication and overlap can help produce these conditions.

Designing tight, linear, detailed organizational arrangements is aimed toward economy and efficiency. The organizational model is a machine which assumes known means and clear purposes. Given these conditions, plus a stable, predictable environment, one can design a reliable organization with little or no redundancy. The machine model makes sense in these circumstances as long as it acknowledges that all organizations are composed of people, who are sometimes unreliable, unpredictable, and multifunctional.

Real-world environments are unstable and unpredictable. Organizations often lack perfect knowledge about the means they must use, or they do not have complete control over those means. Purposes or goals are often debatable.

Given such uncertainties, wisely designed organizations do not follow the machine model. They deliberately arrange to make certain kinds of decisions by bargaining or trial and error. They try to minimize mistakes either through *redundancy*—deliberate duplicating functions, *overlapping* jurisdictions, or a combination of both. Such arrangements sometimes emerge unplanned, in spite of formal organizational designs.

DUPLICATION

A certain amount of breakdown or failure is inevitable in complex organizations. Duplication of means is one way to compensate. It allows us to construct a chain stronger than its weakest link, an organization more powerful than its weakest member, an arrangement more reliable than its least reliable component.

Information channels offer one example of how this works: a communication system with two points, A′ and B′, has a connecting channel. There is a good chance that this channel will fail once in every ten times.

A′– – – – – – – – – – – – – – – – – – –B′

But the goal of the system is to move messages from A to B with maximum reliability and minimum failure.

The reliability of this system can be greatly increased by adding an identical separate channel, A″ and B″.

A′– – – – – – – – – – – – – – – – – – –B′

A″ – – – – – – – – – – – – – – – – – – B″

NOTE: Previous Design Notes have dealt with examples of redundancy: Design Note No. 5 presents essentially a redundant information channel in the international technological gatekeeper. Design Note No. 1 presents another example in the multiple means chosen by some governments to effect land reform.

Each of these Design Notes states a lesson which may be useful to those engaged in planning, managing, or evaluating development efforts, such as technical assistance projects. A given note may describe a technique and discuss its use, may present and explain a useful concept, or report a functional relationship between some intervention and some outcome. Design Notes are backed by cited evidence from PASITAM studies, published literature, or the reports of development agencies. Comments and queries are invited, along with requests for additional copies and supplemental materials.

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Now the probability that a message will not get through is reduced to one chance in one hundred (1/10 X 1/10). Adding more channels will further multiply reliability. Arithmetic increases in channels cause geometric or exponential increases in overall system reliability.

The usefulness of duplication for lowering the chance of failure is not limited to communications. It dramatically increases the reliability of aircraft, human beings, and farming systems.

A few decades ago, it could be assumed that an aircraft engine would fail once in every 500 hours of operation, for some reason other than faulty maintenance. Adding a second engine and designing a plane that could fly on just one of those engines reduced to almost zero the statistical (and real) chance of disaster from simultaneous engine failures (assuming good maintenance).

Duplication does not *eliminate* errors. Mistakes or breakdowns remain probable. Duplication *minimizes* the costs of such errors to the system.

To exploit the possibilities of duplication, individual units or channels must be arranged so the failure of one does not impair the others. This arrangement is labeled "parallel" channels (or units, or workflows). The machine model of organization generally calls for the arrangement of units or workflows in "series," and the breakdown of one unit stops everything. Serial arrangements also create a "ripple effect." The effects of an error at some point may be magnified as the action moves along the organizational channel. Duplication reduces the effects of breakdowns by taking advantage of probability. It will not work in the event that all channels or units are simultaneously eliminated.

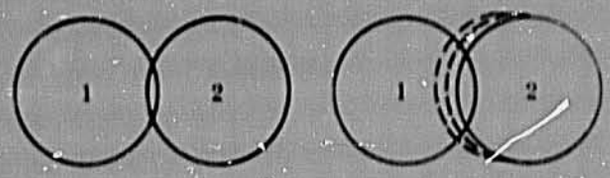
Well-designed duplication may actually be cheaper than a non-redundant system with high maintenance costs and periodic losses from breakdown or errors.

As a useful rule of thumb, duplication is justified when the cost of a failure exceeds the cost of duplication. When the probability of breakdown can be estimated, the cost/benefit value of duplication can also be established.

OVERLAP

The effects of a breakdown within an organization can also be minimized by overlapping functions—in direct violation of conventional organization theory. Overlapping units have excess capacity. Each can do some of the work of one or more other units. While this is generally considered wasteful, in some cases it is actually quite efficient.

Overlap may add to the repertoire of organizational capabilities. It can be illustrated by a relationship between two jurisdictions, A and B, within a system. In response to a breakdown in unit A, unit B takes over some of A's functions because the capacity to do so already exists. The system can continue to operate at reduced capacity until the damage is repaired.



One source of overlap is evident in staff members whose skills and knowledge exceed the requirements of their jobs.

Overlap involves costs which must be measured against the costs of breakdowns. It can create problems of jurisdictional disputes. But it can also increase an organization's adaptive capacity.

CONCLUSION

The most reliable systems are marked by high levels of duplication and overlap. Eliminating redundancy can be downright dangerous. Loss of diversity and "excess capacity" in the genetic properties of plants increases their vulnerability to disease, just as the lack of such capacity in organizations makes them more vulnerable to error and breakdown.

There is no cookbook for designing efficient redundancy in human organizations. There are some practical models and rules of thumb. Most important, there is a very sound basis for recognizing that efficiency does not necessarily equal parsimony, and that some kinds of "waste," in the form of excess organizational resources, are a wise investment against the probability of costly breakdowns within the system.

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Design Note No. 2, "Effect of Training Programs on Work Behavior." Bloomington, Ind.: PASITAM, September 1975 (prepared by Paul Cunningham).

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Design Note No. 7, "An Agricultural Management Information System: Lessons from Mexico '09." Bloomington, Ind.: PASITAM, May 1976 (prepared by Russell Stout, Jr.).

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PASITAM DESIGN NOTES

No. 9 September 1976

Shinyalu: Credit for Small Rural Businesses

Given certain conditions, a non-official local committee can be an effective means of providing credit to small-scale rural businesspersons, some of whom may be members of the committee itself.

The effectiveness of such a scheme appears to require:

1. Significant opportunities for the effective use of modest amounts of credit;

2. A representative governing/lending committee, accountable to the community; and,

3. Social peer pressure as a source of responsible committee decisions and as a means of enforcing loan repayment.

THE SHINYALU CASE

In Shinyalu, Western Kenya, a traditional funeral committee was converted into a commercial loan committee. Most village business operators took advantage of the loan scheme and responded with an exceptionally high repayment rate. The credit scheme provided a learning experience for small businesspersons. It illustrated the effective use of credit and contributed to the success and improvement of business operations.

A credit scheme's purpose is to combine resources, opportunities, and incentives to enlarge wealth beyond the cost of the credit. This case describes such a scheme. It may offer lessons useful to persons interested in village economic development and the promotion of small-scale commerce and service businesses as part of a rural development effort. Partnership for Productivity (PIP), a non-profit private voluntary organization, started the Shinyalu effort in 1972.

SETTING

Shinyalu is located at a crossroads nine miles southeast of Kakamega, the provincial capital. It has 80 market businesses, more than 50 permanent shop buildings, and a diverse business population. More than 12 clans are represented in the village. Quakers and Roman Catholics are the most numerous, but there are several Muslim and Protestant shopkeepers. Most of Shinyalu's businesspersons* also are involved in farming. Several manage commercial farms, and at certain times of the year there is a cash flow from farm to business and vice versa.

The market businesses are small, typically with one or two employees. Sixty-five percent are trade enterprises (selling provisions, maize, charcoal, and meat); 20% are service enterprises (restaurants, bars, maize mills, bicycle repair shops); and 15% are service or fabricating enterprises (tailor, carpenter, furniture).

There is only about $1,500 in the Shinyalu loan fund. Loans range from $60 to $300 over a term of 3-6 months at 0% interest. All business managers in the village are eligible to apply for loans. The schedule of loans is publicly projected, and each person knows who has the capital which he might borrow in the future.

*Over 30% of Western Province business operators are women.

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The loan scheme has four objectives.

Objective 1: To test the effect of injecting small amounts of capital into selected businesses to finance specific plans for change or expansion.

A cultural anthropologist assessed the program's impact on 23 of the first 40 loan recipients. He obtained a composite view of each case through discussions with the recipient and members of the loan committee, and by general observation.

In the short-run, 16 of these businesses increased their inventories or otherwise expanded their enterprises. Over a longer term, 14 of the 23 borrowers increased their stock and improved their record-keeping and business methods. Four exhibited only slight progress. Eight showed no evidence of such change. Those who used their loan capital wisely in the short run also showed a long-term improvement in business activity.

After the initial loan recipients had received and repaid their loans, PIP established a business management extension service. Interestingly, the loan recipients who had used their loans wisely requested assistance from the management extension service.

The management service is independent of the loan mechanism. PIP's experience indicates that when loan and management advisory activities are combined, borrowers view the management advisor as a loan collector.

Objective 2: To provide a loan service to small-scale businesses beyond the normal reach of existing commercial and governmental credit facilities.

The loan scheme has now been used by most Shinyalu businesses. By December 1975, 52 of Shinyalu's 82 businesses had received one or more loans. Over 70% of all manufacturing enterprises, 70% of the trade enterprises, and 50% of the service enterprises had borrowed at least once.

The exact number of Shinyalu businesspersons who have received commercial or governmental loans is unknown, though the number is relatively small. Formal requirements and application procedures of the Shinyalu scheme are certainly less rigorous than government and commercial procedures.

Objective 3: To test a local, self-governing loan scheme.

The Shinyalu Market Committee, previously a funeral committee, has about 16 members, elected to 5-year terms by secret ballot in a general meeting. Community pressure can force the committee to resign and face new elections. There were two elections held between January 1973 and January 1976. In one case, the chairman and vice-chairman were forced to resign, suspected of asking for kickbacks. In the other, the secretary resigned after asking for money to process a loan application.

The Committee follows certain procedures. It meets monthly to review loan applications, interview applicants, and select loanees. Not more than half the loan funds may be held by Committee members. Loan repayments are made to the Committee treasurer according to a pre-determined schedule.

Criteria for borrower selection are simple. The applicant must be an established business operator, occupy a secure building, possess inventory greater than the value of the loan request, state how the loan will be used, keep certain records, have completely repaid on time any previous loan, and have a non-committee person guarantee the loan.

Peer pressure operates on two levels. As noted, committee members are subject to sanctions within the community. There is also peer pressure on loan recipients to repay their loans on time so that other business operators may borrow. "In one case, a man received Kshs. 500 ($70) to aid in improvement of his hotel tea room. He did not put the money to its intended use, and at the end of the four-month period he declared himself unable to repay. But in the face of constant reminders from committee members, and sharp criticism from his peers, he sold a cow and paid off the debt."(Barclay, 1974, p. 4)

There is considerable evidence that peer pressure at both levels is a prime factor in the success of the scheme.

Objective 4: To train small-scale rural businesspersons in obtaining and using credit.

The loan scheme has educational value. It involves a small amount of capital which must be quickly turned over. Significant business development requires larger amounts of long-term capital from commercial and governmental sources. But more formal application procedures and requirements tend to be too complex for most rural small-scale business operators. The revolving loan scheme gives small-scale businesspersons experience with loan requirements, applications, and repayments.

PIP is now studying the effects of the credit education. Results are not yet available.

OTHER PILOT SCHEMES

Since 1972, revolving loan schemes have been established in six other Western Kenya villages, one with as few as 13 and one with as many as 97 businesses. Most did not have traditional committees which could be converted into loan committees. On the whole, they have not been as successful as Shinyalu.

First, local loan committees had to be created and trained in committee procedures. Factors such as corruption and political manipulations initially proved to be problems. These problems lessened with experience. Second, small villages with less than 25 businesses lacked sufficient peer pressure to ensure loan repayment. Third, the largest village may be too heterogeneous and "cosmopolitan" to ensure sufficient peer pressure for loan repayment.

These problems have helped define the success parameters of the loan scheme. No loans have been written off. The repayment-on-time ratio for the six other pilot schemes has been 92% (155 loans), compared with the 99.6% (120 loans) in Shinyalu as of January 1976.

DISCUSSION AND SUMMARY

The Shinyalu loan scheme has achieved its objectives. The other six loan schemes, within an experimental context, have helped build knowledge of the requirements for this type of scheme in Western Kenya. An aggregate on-time repayment record of 96.4% is remarkable for any rural credit scheme.

The experience supports the thesis that peer pressure is a primary determinant of success. We can also conclude that sizable economically active rural markets, with relatively homogeneous business populations and experience in cooperation, provide the best environment for a successful revolving loan scheme. The area should have between 25 and 100 full-time operating businesses. It should be an actual or potential economic growth center and should show evidence of good loan committee potential.

One major question concerning such a scheme concerns the possibility of its replicability. The literature suggests that organizations with built-in peer pressure are an effective means of facilitating rural agricultural credit. The literature also indicates that commercial and governmental loans, made directly to small-scale rural enterprises, have a poor on-time repayment record. There has been little testing of intermediary mechanisms for small-scale rural business loans. This scheme might be tested more extensively by organizations operating in rural areas.

PIP has experimented with a small-scale, low-cost business management extension service to complement the loan scheme. This extension service provides advice in accounting, inventory control, sales management, quality control, and similar management skills. The extension service might also be tested elsewhere. It is not, however, essential to the loan scheme.

The future directions of the loan scheme remain unclear. It could evolve into a cooperative or a credit union where members provide part of the capital. It could be superceded by commercial and governmental sources as recipients learn to qualify for credit. But the Shinyalu experience demonstrates that modest amounts of money can be effectively and creatively used. Its future will be determined by further innovations.

Additional information may be obtained from PASFAM or Partnership for Productivity, Box 243, Kakamega, Kenya.

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This Design Note was prepared by Richard L. Ramey.