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Communication as Complement in Development

by Robert Hornik

Communication technology has been asked to play a large number of roles; its success in these roles depends largely on the ripeness of the circumstances and commitments in other segments of the society.

Communication for development crowds a dozen fields. Its practitioners have done and its investigators have written in great profusion and variety; a review of that work must choose its ground carefully, stress but a few questions and find, if it can, a central theme to organize responses to those questions.

We have focused on those applications which make some use of communication technology for providing education and information. Three questions dominate this review and serve as its outline: what roles do communication interventions play in development; what circumstances are likely to move a particular intervention toward or away from success; finally, and briefly, what do we know about the promise of specific applications.

One central theme resounds in all the most successful experiences of recent years. Communication technology works best as a complement—to a commitment to social change, to changing resources, to good instructional design, to other channels of communication, and to detailed knowledge about its users.

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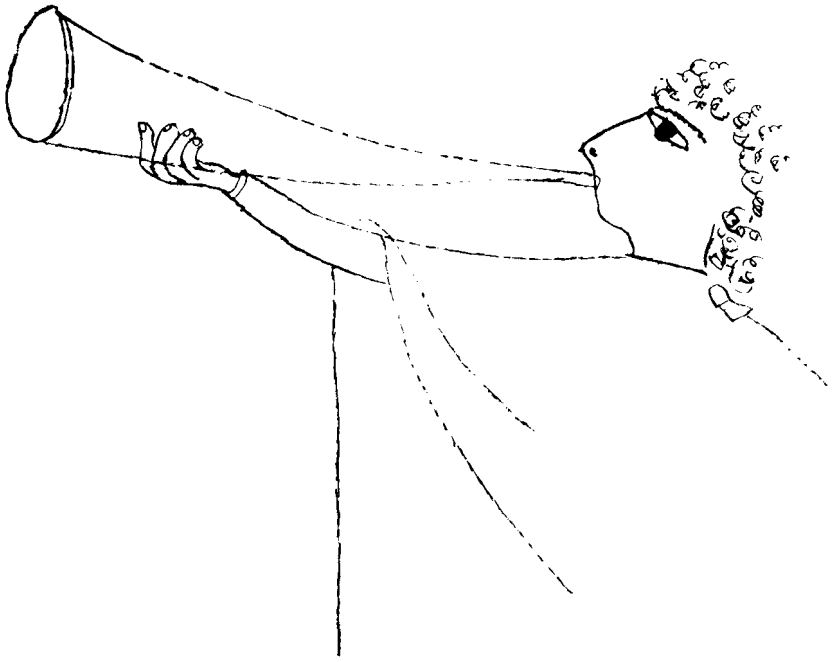

Ben Shahn

Communication technology has been applied to a wide variety of development problems as a component in a variety of strategies. The results of some of these projects are now in and we can begin to evaluate how well they have worked in practice. Using selected examples, we will first identify the variety of roles that communication technology has played, both expected or unexpected.

Communication as low-cost loudspeaker. In Guatemala, political considerations and limited budgets constrain the number of extension agents the Agriculture Ministry can hire. The shortfall means that a large proportion of subsistence farmers are not reached with information believed to be of value to them. With support from the U.S. Agency for International Development (USAID), an experimental program of daily agricultural radio broadcasts was started in 1973 to offer farmers information about agricultural methods and practices to encourage increased yields.

The results of the project were ambiguous. Nonetheless, it remains a good example of one use of communication as loudspeaker—extending the voice of expertise where it would not otherwise go. As in this case, the loudspeaker is sometimes the only feasible information-distribution strategy (1).

In other situations, there may be an available local voice, but that voice is not considered adequate to the task at hand. In El Salvador in the late 1960s, the government implemented an instructional television system with international funding agency support so as to provide the voice of the master teacher in the classrooms of newly enrolled students and their recently retrained teachers. By the mid-1970s the enrollment in seventh through ninth grades had more than quadrupled, with the quality of instruction maintained or improved, and at a cost per student lower than in the previous system (12).

The extension of the expert voice at an acceptable cost is certainly the prime justification for the use of mass media in education-informational projects. In some sectors, as in formal education, but also in agriculture or health when local reception groups with a volunteer monitor make use of radio broadcasts, the communication technology is used primarily to improve quality. In other sectors, for example, agricultural, family planning, and health projects, when rural target audiences are beyond the reach of the inplace extension network, communication technology is used to extend that network.

While communication technology has been employed most often as a low-cost loudspeaker, it has purposely or indirectly played other roles* vis-á-vis *development.

Communication technology as institutional catalyst. As noted above, El Salvador's instructional television system (ITV) was the centerpiece of a substantial educational reform (see 12). In this and other cases, it is appropriate to view ITV as catalyst of that change in two ways. First, ITV's operational character demands concomitant change in other components of the educational system—curriculum specification and restructuring, reorganization of the school day, changes in classroom teaching styles, development of teaching material like student workbooks and teachers' guides. All may be needed to accommodate television. Second, ITV's political attractiveness can mobilize sufficient political momentum to overcome the inertia of the educational bureaucracy. Instructional television was advocated by the winning candidate for the presidency of El Salvador in 1967, and as such, its political clout opened the way for many changes in the educational system.

Media-based projects have "star" quality and can therefore attract such support from a government. At the same time, the "star" quality holds risk. More technically appropriate strategies may be rejected in favor of politically appealing media-based strategies—a particular risk when it comes to what Wilbur Schramm (16) called Big Media, e.g., television and satellite transmissions. Also, political support may not last the course when it comes down to providing the essential infrastructure to make a communications project work effectively. Indeed, investments in communication technology can, in their worst case, provide the loud and public appearance of activity and thereby avoid the enactment of more meaningful reforms.

Communication as organizer and maintainer. An innovation in an educational process can be excellently conceived, and successful in affecting learning outcomes in its early use, but may not, over the long haul, maintain that success. Teacher retraining as a route to improved classroom instruction may suffer this fate. The teacher may be shown valuable new techniques, but when he or she returns to the classroom, the working environment remains unchanged. Facing the frustration inherent in trial-and-error applications of new methods that will precede their mastery, teachers will find it easy to slip back into customary practice.

Contrast this pattern of innovation with that inherent in direct instruction via mass media in the classroom. In Nicaragua, the USAID-sponsored Radio Mathematics project used thirty-minute, carefully developed radio broadcasts to teach mathematics to students in primary schools (19). Once the curriculum was complete, although modifiable, it represented a substantial deterrent against backsliding. It was there, every day, in the classroom, structuring the mathematics instruction. Once the radio was turned on, the organization of the classroom day and the probability of maintenance of the innovative educational process were enhanced.

Communication technology, when used directly in an educational process, can provide a backbone to both organize and maintain change in a resistant environment.

The Tanzanian adult education authority used radio as the pivotal element in its nationwide health campaigns (5). The ten- to twelve-week "Man Is Health" campaign organized discussion and decision groups (based on smaller pre-existing political and adult education units) to listen and act upon information received via weekly radio broadcasts. Clearly, the heavy involvement of national and local political forces was instrumental to the success of these campaigns (evaluations reported the extraordinary figure of 700,000 latrines constructed). Nonetheless, the campaigns were organized around the radio broadcasts which enabled the central planners to control the pace and essential structure of the campaign activities.

A recent U.S. example, the Stanford Heart Disease Prevention Program, illustrates another aspect of this pacesetting function (4). This experimental program used mass media to convince its target population to change heart disease-related behavior, including diet, exercise patterns, and smoking. However, changes in such habits are not meaningful unless they are sustained. This is particularly true of personal diet and exercise patterns. In such instances, mass media campaigns can reinforce change by continually providing reminders about recommended behaviors. Thus, communication technology, used properly, may serve all three of these subfunctions—organizing an educational process, maintaining an innovative process over an extended time, and reinforcing the change of behavior when new behaviors must be repeated.

Communication as equalizer. Whether one considers the distribution of teachers or schooling resources, agricultural extension agents or health services, history provides a close to invariant lesson—the rich get richer. More experienced teachers, better buildings, textbooks, and other instructional materials go first to the urban schools, the schools of the relatively advantaged children. Agricultural extension agents reach the larger farm owners, but rarely the mass of subsistence farmers. Health services spread only slowly from urban to rural communities.

Unequal distribution of resources is inevitable as long as such resources are limited, and the ability of particular constituencies to make claims on those

scarce resources is also unequal. One partial approach to that problem is to end the limits on resources, so as to permit universal access. Communication media, in their capacity as loudspeaker, can provide such universal access.

In El Salvador, the instructional television system was the first school resource ever to approach equal distribution across the seventh- through ninth-grade population. The fact that one school made use of the broadcast signal did not reduce the ability of other schools to make use of it, given that they all were provided with television receivers. In contrast, the fact that an urban school was able to attract an experienced teacher meant that another rural school could not.

In what may seem paradoxical, the communication satellites, often viewed as the most high-technology, capital-intensive communication investment of all, can sometimes fulfill this equalizing function. The Indian Satellite Instructional Television Experiment (SITE) (15) made use of the ATS-6 communication satellite to provide instruction to villages that were beyond the range of land-based broadcast distribution networks.

The equalizing potential of the communication technology is certainly here. Nonetheless, two caveats must be entered. First, a nation must want to take advantage of this equalizing function by committing the resources necessary for such a program to exist in the first place. Second, it must be recognized that communication technology offers only the promise of equalized access or opportunity, not necessarily an equalization of benefits. While the design of both hardware and software of a communication system can affect equality of benefit, a substantial inequality will remain as a function of abilities and resources.

Taking advantage of the special qualities of a variety of media through carefully designed software may enable the development of a different instructional process equal to or better than even high quality face-to-face instruction.

Communication for improvement in quality. The program design for the Nicaraguan Radio Mathematics project is a good illustration of maximizing the potential of the medium and not merely reproducing the voice of the master teacher. The contractors brought ten years of experience in constructing mathematics curricula for computer-assisted instruction to the creation of the radio-based curriculum. They spent one year in developing each grade: designing curricula and planning and producing programs with a complex and artful understanding of how mathematics is learned. Their experience was augmented through extensive feedback in the form of classroom observation and testing. Knowing that each program could be used in subsequent years, heavy investment in software development could be justified. Programs were produced or, more precisely, new curricula were developed that no master teacher was likely to duplicate.

The recent resurgence in distance education following the model of the British Open University illustrates the same issue (6). While correspondence educa-

tion, often including television or other media, has had a long history, it has also been characterized by high dropout rates and dreary instruction. The apparent and contrasting success of the ten-year-old British effort, and of similar ones elsewhere, including Everyman's University in Israel, may be due in no small way to the care with which instructional packages have been developed. As with Radio Mathematics, each course combined some radio and television broadcasts with textbooks, exercises, and some face-to-face review. Rather than trying to duplicate the educational process carried on in traditional universities or other training centers, these institutions strike out on their own, taking maximum advantage of all the channels of communication at their disposal.

Communication technology as accelerator of interaction. Rural people, for good or for evil, depend on communication with less rural areas for many aspects of their lives. Agricultural seed and fertilizer may come from outside, and cash crops are sold outside; consumer goods may be manufactured elsewhere; schools and health posts are supplied and supervised, if they are to be supplied and supervised at all, by central offices.

All of these relations with distant centers require communication. Such interaction can be accelerated substantially by the use of communication technology which will perhaps make a qualitative difference in the character of some of those interactions.

What we do not know is just what all the implications of such an acceleration would be. We do not know which center-periphery relations would be largely unaffected, which would be affected to the advantage of the rural participant (or all participants) and which to the disadvantage of the rural participant.

In Alaska, for example, small rural villages have only a health aide, a member of the community given six weeks of training, to provide ordinary health care (9). To support the limited skills and experience of those aides, the health system introduced two-way radios (eventually making use of a satellite to improve transmission quality) which provided daily contact with a physician at a regional hospital. While conceivably some slower form of communication might have been possible (mail planes irregularly arrived at the villages and might have taken messages), the character of the resulting health system would have been very different.

Communication as legitimator/motivator. Because it is broadcast over the mass media, it must be important and, vice-versa, if it is important surely it will be broadcast over the media. This "status conferral" function of mass media (11) is probably operative for most people in the world. Thus social advertisers use radio to sell *Superlimonada,* a rehydration formula to combat infant diarrhea, in Nicaragua (3). And while radio serves as a loudspeaker providing access to large audiences, the fact that the messages are on the radio gives them credibility for each listener. In a curiously circular logic, the advertiser buys audience-reach and because he has bought reach, he buys credibility for his product.

The credibility lent by access to mass media may extend elsewhere. The constant broadcast of a national language and other national symbols (anthems, etc.) may both teach that language and those symbols and legitimize them. A

family planning campaign on radio may be no more effective per dollar investment in providing access to information than alternative channels, but its extra credibility may affect adoption. Regular television broadcasts may motivate attendance at agricultural discussion groups, even if the same content could have been presented equally well through local means.

Sensitization of policy-making elites, and their consequent involvement in policy change in such areas as population and nutrition, may affect the success of development programs more than direct actions with target audiences can. Mass media presentation may legitimize a particular problem, justifying national attention, and thereby increase access for interested groups to the policy-making process.

An additional role of communication technology involves its use to magnify the ability of the mass of a population to speak to the central institutions which affect them.

Communication for feedforward. In its simplest form this involves the publication of letters to the editor of mass circulation newspapers focusing attention on one problem or another. In Senegal's "Radio Dissoo" program, the letters-to-the-editor notion was transferred to a broadcast medium (2). Seventy percent of broadcast materials were expressions of viewpoints, complaints, and questions from rural audiences. The rest were responses by government agencies to those comments, or provision of useful information. It was reported that substantial modifications of government policy were the result of the quick and large-scale peasant use of this feedforward channel.

The need for feedforward is most acute in the agriculture sector. It is often argued that the agricultural research agencies are unresponsive to the needs of subsistence farmers, in part because they have no regular means of hearing from those farmers through influential channels. In Senegal and other situations, the success of the feedforward channel in influencing policy did vary with the openness of the policy-making apparatus to such information.

Communication as a magnifier of dependency/integration. That communication reinforces the links between participants is obvious; what is not so obvious is the interpretation or the valuing of that result. The potential of communication for increased exploitation has to be balanced against its benefits. What to a government broadcast authority is sharing of national language and symbols to foster nation-building, is to its critics the systematic derogation of minority cultures. In each case the optimistic view (or the view of those with control over the technology) is of beneficial integration; for those to be integrated, fearing exacerbation of already unequal status, the introduction of some specific communication technology-based programs may suggest increased dependency.

That point has been made at a more general level also. Sophisticated communication technology, it has been argued, leaves its users at the mercy of those who control that technology. At the national level that may mean that central institutions increase their dominance of national information networks. An illus-

tration—while risking oversimplification—may make the point; the many itinerant entertainers and news carriers are replaced by the national radio station; multiple sources of information with their potential for divergence are replaced by the more efficient, more entertaining, and potentially more accurate—but often government-controlled—information sources.

The national dependence argument has its international parallel. Third World countries customarily import all of their technology, from transmitters and receivers to video tape for their ITV systems. Often only a single supplier manufactures equipment compatible with in-place systems. At least hypothetically, a shift in political winds can leave the user either stranded and faced with unexpected costs, or somehow forced to comply with what it considers interference in its own policies. This vulnerability is extreme when countries are faced with the huge capital costs of the purchase and launch of a satellite. A nation which, for example, leases time on a foreign-controlled satellite for its domestic communications network may perceive itself as risking substantial reduction in national autonomy in time of conflict. This fear of dependency has been voiced in the debates in developing countries over the appropriateness of satellites.

There are, in sum, a wide range of roles that communication technology has been asked to play or does play, regardless of whether or not it was meant to. In which of those roles has it been most successful? What has been learned from these many projects about what factors contribute to this success?

To answer these questions, we can draw upon the experience of the past two decades.

If they have taught us anything, it is the importance of ripe circumstance, of right context, of making communication activities fit as a complement to other activities. What we have gained over these years is increasing knowledge of how to recognize ripe circumstance (and not-yet-ripe circumstance) and how to specify what other activities must be going on if communication is to be an effective complement.

Foremost, we have learned that success of any communication intervention is improbable without *prior commitment to social change* in the sector by substantial political forces. In earlier, more naive times, communication enthusiasts had hoped that their awesome technologies might somehow circumvent current political interests. By changing the organization and speed of information distribution, it was argued, the distribution of power and society's goods could also be changed.

However, experience has taught us that the technologies, awesome as they may be, are under the control of those with power and will be used in ways consistent with those interests. The information that is to be transmitted and the feedback that will be heard are defined by those who control the hardware.

Mathematics education can be improved through the use of radio—but it will not be unless a real commitment to change is reflected in salaries adequate

to attract and retain high-quality production personnel, time and facilities to produce good programs, encouragement and training for teachers, and availability of sufficient resources to implement and maintain the project broadly.

By the same token, agricultural radio, which informs the farmer of an innovative way to plant his crop, will have little impact if the necessary follow-up visit of the extension agent does not take place, if the fertilizer the farmer needs is unavailable or too expensive, if the market system cannot absorb his surplus, or if the cost of credit, the insecurity of land tenancy, and the vagaries of weather make the innovation too risky. The programs will fail to meet development goals if, because there is no mechanism to assure that the agricultural research and development stations are developing innovations relevant for small farmers, the innovations are suitable only for commercial farmers.

Communications interventions must complement or be accompanied by changes in resources or environments.

There is a close fit between how people behave and the environment in which they live. This seems an obvious statement. Yet it has been implicitly denied by many past and current communication projects which assume that the transmission of information (about a new nutrition practice, for example) by itself, if only it can be phrased persuasively enough, will lead to behavior change. Perhaps, for relatively low-cost behaviors which do not invade important cultural territory, for behaviors which are easily adopted and which produce obvious rewards, information alone can produce change. However, with the economists and the anthropologists, we must assume that most behavior is not easily changed in the absence of substantial change in the environment supporting the behavior.

If new resources which change the character of the decision environment are available, communication interventions may be quite valuable in accelerating the pace and broadening the distribution of change. Similarly, if new resources are introduced into a community without complementary communication activities, projects may also fail. For example, efforts to introduce sanitary water supply systems into communities may fail to change the incidence of gastrointestinal illnesses. Families may persist in carrying and storing the pure water in open containers subject to contamination if no complementary communication campaign addressed to those practices is mounted.

New resources are only one way in which the environment can be changed. Social dislocation—caused by population pressures, new employment or schooling opportunities, deterioration of land, or changes in cost of foodstuffs or agricultural supplies—may mean that current behaviors are no longer reinforced by the environment. In such cases, new behaviors which fit well into the changed environment may be learned easily—and communication interventions may find fertile ground.

The introduction of new communication technology must also be *complemented by good instructional design.* Projects which are viewed by their

sponsors primarily as investments in hardware have little probability of success. While this may be commonplace wisdom to those who are experienced in media-based instructional projects, it is not always shared by the enthusiasts who are responsible for the creation of the dozens (perhaps hundreds) of media projects which appear annually around the world. Enthused by the extraordinary reach of the medium, they may not invest sufficiently in the design of the content they transmit to have any hope of success.

While it may be stretching the analogy, the necessity for good software design extends to two-way communication systems also. The best configuration of hardware for a given country will depend on what messages need to be transmitted on the system. Location of telephones within communities, who has access to the telephones, type of transmission system, order in which communities are given access to telephones, which telephones can be used to talk with which other telephones and at what cost are, in the end, software design decisions. These organizational issues are important "software" questions, just as message content is important for one-way transmission media.

The most repeated conclusion of researchers interested in persuasion via mass media is that effectiveness is magnified by complementing media messages with local audience groups organized for listening, discussing, and deciding.

In the abstract, we endorse that conclusion. However, perhaps because it is the oldest of the communication-as-complement principles, it no longer seems as telling as it once did.

The difficulty in executing this principle is the cost and complexity of creating and maintaining the field structures that such local groups demand. Projects find it difficult to maintain initial enthusiasm as administrative complexity grows and time extends beyond a few months. Projects which try to create field structures from scratch, so as to complement the broadcast message, are unlikely to succeed. Also, given normal social stratification in communities, some social groups do not join or are excluded from these organizations—often the poorest people are least likely to participate.

However, when they can take on more than one role, or when they have a function in the community that is separate from the use of broadcasts, or when they are not expected to serve as permanent organizations, local groups can be a powerful channel for magnifying the effects of a communication intervention. In Tanzania and in China, local groups based on political cell structures have been quite successful, as have been multi-purpose Mother's Clubs in the Republic of Korea (10).

Finally, a necessary ingredient for a successful communication intervention is that it complement *knowing what is going on in the field.* Communication projects make assumptions about what is true in the environment of their intended beneficiaries, an environment which may be at substantial geographic and cultural distance from the projects' sponsors and staff. Because of that dis-

tance, it is likely that those assumptions are wrong, either in general or in detail. Communication projects need to know what is going well and what is not. They need efficient data gathering mechanisms and, no less, time and flexibility within their operational structures to define the information which can be used, and to take full advantage of the information that is gathered.

Foremost among the obstacles to communication as complement are problems related to the distribution of power.

In the creation of any communication project, there are always competing interests. Both at the level of commitment to the expressed goals of a project and at the level of particular emphases within a project, those with economic and political power dominate. This may mean that subsistence farmers fail to guide agricultural research because others have first call on research institutions. Broadcast primary-school instruction may be stymied if other priorities—university education or teacher salaries—have first call on available resources. The list can go on, but the implication is clear. At the risk of repetition, project failure often is not merely a technical failure or a failure of management. Rather, technical and management failings may be symptoms of the true distribution of power in a society.

The problem of fitting communication into the existing system also stands in the way of success. Organizers of communication for development usually choose one of three administrative locations for their projects. The predominant mode has been to locate communication projects within the substantive ministry concerned. A second strategy has been to locate projects within the communications ministry (post and telegraph, telecommunications, or whatever its title) or national radio or TV service. The third strategy is to create a hybrid agency by drawing on two or more institutions.

Which of the above strategies is chosen will depend on the overall character of the project and, particularly, its political genesis and support. In that context, expert advice may be irrelevant. However, when there is some flexibility in the decision, the first mode is preferable. Placing communication within the substantive ministry concerned recognizes that communication must complement a broader intervention. It serves to accelerate change, not instigate it.

Realistically, projects organized outside the ministry which employs the agents or controls the resources cannot count on their long-term availability, no matter how sincere the promises of cooperation at the outset. The centrifugal pull of institutional loyalties, rooted in competition for scarce resources, may be too great. In general, projects cannot succeed if they are not guaranteed such long-term support of the substantive ministry, and they are not likely to achieve that support outside of the ministry.

While a view of communication as complement necessitates this recommendation, one can recognize two powerful counterarguments. One is that a substantive ministry is not easily galvanized and, while communication projects can be impressive catalysts to change, they may be insufficient to move an en-

trenched bureaucracy. The second is that projects organized within single ministries make rational telecommunication hardware planning difficult.

Sensible investment in production, transmission, and reception for a single substantive project will be very different from sensible telecommunication investment for a large number of projects aggregated across ministries and over time. The dilemma is real and not solved by letting things take their course. Under natural forces, the pattern of telecommunication investment is likely to reflect commercial and particularly urban interests, leaving rural development concerns in second or later place. Systems inappropriate for development communication uses may be the result.

In the abstract, a hybrid agency with representatives of all communication-using institutions advising the telecommunications ministry would be ideal. However, it is not clear how this will provide funding for development telecommunication, unless the advice is accompanied by binding commitments for budget subventions. In most nations, telecommunication agencies are expected to pay their own way; a change in that policy could require some new source of funds. Until rents from users (in this case other government institutions) are available, direct financial support from donor agencies may be necessary. User agencies may be able to pay their share of usage charges once facilities are in place, but special assistance may be required for the initial capital investment for rural systems.

In considering these roles of communication in development and the obstacles to be faced in their successful realization, what are the practical steps that can now be taken?

Three categories of given applications of communication to development problems can be distinguished. The first category includes two applications which have proved their worth. While there can be no guarantee, much of what is transferable from one setting to another has been learned. In-school core instruction through media represents the most successful application of communication technology to development. Substantial improvements in learning, an easing of the implementation of solutions to access problems, and effective catalyzing of broad educational reform have all been achieved. Costs can be manageable, and while the obstacles can be non-trivial—teacher reluctance, language diversity, and coordination of class schedules—the outcome is likely to be worth the effort.

A second application within this category is distance teaching of motivated young people and adults. Using some combination of broadcasts, correspondence, local tutors, and learning centers, institutions in both more and less developed countries have successfully reached physically dispersed audiences with educational programs. While most existing programs have addressed higher education, the approach has promise for the continuing education of field workers and teachers, and for primary-school equivalence education for post-school-age persons. Costs are usually lower than comparable residential training pro-

grams, both because capital costs are less and because opportunity costs are reduced since participants can remain at home and working in their jobs.

Several roles for communication technology which are ready for systematic evaluation, but perhaps not for widespread application, form a second category. Mass campaigns using radio, printed materials, local group meetings, and the full attention of national and local leaders have been markedly successful in mobilizing a large number of people to take concerted action in health and other sectors. However, success largely has been restricted to countries like Tanzania and the People's Republic of China that have well-developed political infrastructures. It is an open question whether a campaign in health, nutrition, or family planning would succeed in countries where tentacles of government do not reach the most rural villages.

Media-supported discussion and decision groups as exemplified in the radio farm forums of India and the radio schools of Colombia which taught literacy and other complex skills were the communication expert's gospel ten or even five years ago. But plagued by high dropout rates, poor learning, and administrative complexity, these programs have achieved only limited success. The evidence suggests that starting from scratch to organize groups for the specific purpose of receiving, discussing, and deciding to act on broadcast messages over a long term is probably unrealistic under most circumstances. However, when local groups are already organized, whatever educational function they serve may be magnified by using broadcasts as one channel of communication.

The use of communication for the social marketing of new family planning, health, and nutrition practices has become increasingly popular. Strategies range from simple advertising campaigns to sophisticated operations including extensive pre-campaign research, product development and distribution, and carefully pretested and monitored multi-media advertising. Such programs are promising, partly because of the reflected glow from the commercial sector applications from which they derive and partly because they promise a way around the administrative and logistical nightmares associated with programs that require extensive field infrastructure. Their drawback is that they may be appropriate only for a narrow domain of development goals which our current level of knowledge does not yet permit us to define.

Finally, there are three proposed applications of communication for development which deserve further research and development. The first involves incorporating two-way communication into rural health care systems. If a health care worker had immediate access to a physician for consultation about diagnosis and treatment of patients, might not the quality of care delivered be improved, and the confidence of both health workers and clients enhanced? Are the costs (particularly if they can be shared with other rural institutions needing two-way communication) appropriate given the changes that are achieved?

Second, some observers have suggested that the great advances in agricultural technology achieved in recent decades have had minimal impact on subsistence farmers—the technology is inappropriate for them because the needs of commercial farmers have guided the activities of research centers. Some have

argued th t a c mmunication system that provides timely and continuing information a'ou' ne needs of the small farmer will tie the national research and extension system to that farmer's needs. Information about how such a feedforward system should be designed, and whether it will influence research priorities, will be the product of development and trial.

The third proposed application incorporates the first two—creation of an all-purpose rural telecommunications infrastructure. Optimists argue that rural telecommunications investment will facilitate rural development broadly. Two-way communication will ease management and supply problems for networks of field workers, increase access to the levers of power for rural people, enable full integration of rural economies into national market systems, and accelerate distribution of useful information to rural audiences. Skeptics worry about an exceedingly high cost investment, at best absorbing resources better spent elsewhere, at worst facilitating further exploitation of the peasantry by those who have the resources to make economic use of two-way communication. The question remains open, and can only be settled by investigation.

In sum, it is a tale of caution and of a field maturing.

The central theme of this article, communication as complement, is new only in detailing. That communication and other elements of development are inextricably linked has been argued often (e.g., 16). What this article suggests is that we now understand that the character of those necessary links takes on a more complex hue. We understand that communication technology can take a myriad of roles in development and that its success in those roles depends on how it is done and in what circumstances. If as part of that richer understanding some additional caution is expressed, so be it.

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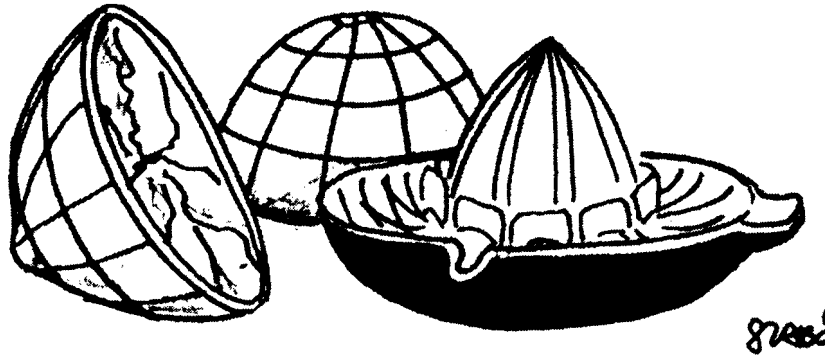

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