Village Telephones: Socioeconomic Impacts and Implications for Rural Futures

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TALKING BACK

The information age promises and threatens to bring social transformations at least as profound as those which accompanied the industrial revolution in the west. Thailand and many other countries are experiencing the combined impacts of waves of change accompanying industrialization together with those associated with information technology, new forms of international economic integration and other global transformations. This paper explores some of these processes through the lens of rural telecommunications, a specific, but influential aspect of the linkages through which rural people are affected by and seek to cope with the processes of globalization.

Information technology has the capacity to give access to the world's wealth of knowledge and opportunities. The ability to duplicate information for free and link distant users to information resources potentially creates radically new opportunities, fundamentally different from the materialist constraints which frame most social and political discourse. It is possible to sketch attractive visions of information rich, resource conserving paths to enhancing rural livelihoods. Telecommunications can help empower rural people to voice their concerns and defend their interests. Many individuals and groups are exploring how electronic mail and other computer mediated communications can help empower those concerned with social justice, environmental preservation and other causes (Rittner 1992, Annis 1992).

Most media such as radio, television and newspapers have been developed for one-way broadcasts of information. In contrast to the hierarchical patterns of broadcast technologies and exclusive private networks, decentralized networks of communication through the public telephone network can strengthen civil society. Telephones provide interactive two-way communications. Telephones can help empower people to talk back, to ask questions, make deals and maintain networks of social relationships. Thus they are constitute tools for the strategies people employ in coping with the opportunities and threats brought by globalization.

However, the stark fact is that villages without telephones lack even the most basic requirement for participating in an information society. This lack raises important questions about whether access to information and telecommunication will be available, or whether disparities will create new forms of "information poverty" (Hill 1990). Will telecommunications development increase or decrease the huge disparities in wealth and power between rural Thailand and Bangkok.

Global transformations potentially threaten to further destroy rural livelihoods, while computerization downsizes employment opportunities in the manufacturing and service sectors (Rifkin 1996). Local communities are becoming more linked to distant markets, governments are changing their policies to suit the imperatives of economic development and demands of international capital investors, and life is increasingly pervaded by international culture in movies, songs, video and other media. Globalization is sometimes pictured as if it were a one-way process invading and overriding local conditions, with local communities passive victims, at best engaging in somewhat desperate acts of resistance. Looking at the role of telephones is one part of looking more clearly at how these processes are interactive, mediated and negotiated, as people use the means available to shape meaningful lives for themselves.

Telephones are an enabling and facilitating technology (Pool 1977). Their impacts are not automatic or obvious, but depend on how they are employed. This does not mean they are neutral, indeed one reason for interest in rural telephony is the potential for empowerment and support for civil society. Impacts also depend heavily on interaction with other conditions, including other infrastructure elements such as roads and electricity and well as the opportunities and pressures of the larger political economy.[1]

This paper draws on a 1996 socioeconomic impact study in Thailand to examine some of the implications of rural telecommunications for rural society.[2] Community surveys gathered information through over a thousand interviews in twenty-seven villages, located in nine provinces in all major regions of Thailand.[3] Research in each province was conducted in a village without public telephone service, one which had obtained service within the last year and a village which had telephone service for several years. Interviews were conducted with telephone users, public call office operators and with a range of sector key informants including traders, shopkeepers, landless laborers, women heads of households, students, teachers, health workers, village leaders, migrant workers and their families.

In the initial phase of the study, rapid appraisal visits in north, northeast and southern Thailand helped identify key issues. Interviews were conducted and issues discussed with staff of the Telephone Organization of Thailand and others concerned with rural telecommunications. Additional information came from a telephone survey of public call office (PCO) operators and secondary information on monthly PCO revenues. Analysis of rural telecommunications also draws on the authors' own participant observations, as residents of Chiang Mai and as researchers and practitioners in rural development.

The second section of this paper reviews some of the technological and institutional changes occurring in telecommunications. The third section outlines rural telecommunications technologies and services in rural Thailand. The next three sections analyze impacts on migration, business and government. This is followed by a discussion of some of the implication of current policies, and policy alternatives, for rural futures. The last section presents major conclusions of the paper.

TELECOM TRANSFORMATIONS

Telecommunications are being driven by a series of technological and institutional changes. Wireless (radio) technologies are making is easier to deploy new services in rural and urban areas, where before wired links were necessary. Fiber optics bring huge capacity, high quality and low costs to long distance connections. Satellites make it possible to link any point on the earth, although at costs usually higher than alternative technologies. Digitalization of telecommunications signals improves quality and reliability and allows much more efficient use of communications bandwidth, particularly radio spectrum.

Telephone exchanges use computerized equipment for switching calls. Computer technologies, with their rapid changes, declining costs and rising capacities, are rapidly converging with telecommunications. Telephone planners who used to be able to carefully make massive investments with a ten or twenty year time horizon now face dramatic uncertainty about technologies and institutional conditions next year. The rapid evolution of technology has created opportunities for countries such as Thailand to leapfrog to state of the art technology, with higher performance and lower costs.

Telecommunications used to be regarded as a classic example of a natural monopoly. The high fixed costs of installing lines to every subscriber were believed to make it uneconomic for competitors, but this is no longer the case. Governments concerned about obtaining the benefits of better telecommunications and improving their international competitiveness have been increasingly willing to require traditional monopoly operators to allow entry and interconnection by competitors. This may start in value added services, such as mobile phones and data services.

Thailand's decision to have Telecom Asia install two million new lines in Bangkok and Thai Telephone and Telecommunications (TT&T) install one million lines outside was a watershed in ending the monopoly role the government-owned Telephone Organization of Thailand in fixed line service. Frustration at high costs and poor performance combined with the attraction of lucrative concessions to induce changes. Expansion of mobile telephones had already shown the high demand and rich profits to be earned, under cozy arrangements which kept prices far above those prevailing in more competitive countries. The overall trend in the telecom sector is toward liberalization, as what was a bureaucratic monopoly is transformed into a competitive business. There is still much lobbying and debate over the course to be taken to that ultimate destination, and the rich pickings which may be available along the way. This transition can be difficult and contested, particularly as various interests seek to convert state monopolies into private monopolies, or institute exclusive cartels to keep profits high and risks low. Rural telecommunications has usually been a minor sideshow in these larger struggles.

RURAL TELEPHONES

Telephones are heavily concentrated in Bangkok, like much else in Thailand. An overall average of slightly over 6 lines per hundred people nationwide, as of early 1996, was dominated by over 27 lines per hundred people in Bangkok. Outside Bangkok there were less

than 3 lines per hundred people, most of which were concentrated in provincial cities and district towns.[4]

A range of technologies are used to provide telephone service in those areas beyond the reach of wired connections from urban exchanges. TOT's 470 MHz cellular network has the broadest coverage, claimed to cover 60% of the country. A doubling of the number of base stations will expand coverage to about 90%. However handsets remain expensive, at 40,000 to 50,000 baht or more. Fixed antennae on towers can be used to increase the range up to 60 kilometers or more from a base station, but at an even higher cost.

Popular mobile phones in the 800 and 900 MHz bands are less expensive, but usually only work within 5 to 10 kilometers of a base station. Prices are still much higher than in other countries, but are now dropping, now often below 25,000 baht. Mobile phone base stations are being aggressively expanded into district towns and along major highways, to meet the needs of business travelers. However the limited range from each base station still leaves most villages without access to cellular service. Monthly fees of four hundred-fifty baht or more are still high compared to ordinary fixed lines. Upcoming Personal HandyPhone (PHS) services are likely to be cheaper but will have similarly limited range.

Various older radio technologies, VHF and UHF, have been used to provide service to rural businesses able to pay a 30,000 baht installation fee and frequency rental charges of 1,000 baht a month, plus a 100 baht a month maintenance charge. Many government agencies have installed private radio networks, as discussed later in this paper.

Larger businesses may be able to afford their own direct satellite links (VSAT). Iridium and other future schemes plan to use satellites to offer global or region-wide telecommunications. At estimated costs from $3.00 per minute to $0.50 per minute these are mainly aimed at international business travelers.[5] Government regulations will probably require dual purpose handsets which go through national cellular systems whenever they are within range of terrestrial cellular base stations.

Research by the East-West Center in the 1980s helped to point out that private phones were relatively inaccessible to other users, and that public call offices were much more effective for providing access to telecommunications (Chu, Srivisai and McDowell 1985). Villagers interviewed in the 1996 study similarly felt that availability of private cellular phones was not adequate to meet the need for public telephone service. Private telephones provide wealthier businesspeople, politicians and others with access to mobile phones and other means of telecommunications. However they do not meet the needs of the majority of rural people.

In some cases shopkeepers and other villagers have used cellular phones to open up call offices, making telephone services available to the public. In addition to charging for notification of messages, operators can profit by charging at the rates which apply to TOT telephones, e.g. 18 baht a minute maximum daytime long distance charge even though the for cellular calls is 12 baht a minute. However even in many villages within range of cellular base stations such call offices have not been developed privately.

The first substantial expansion of rural public telephones beyond district (amphur) towns came during the Fifth National Plan (1982-1986) when over 1800 stations providing one or more public telephones, were installed in larger and more prosperous subdistricts (tambon), with implementation continuing into the Sixth plan period and beyond. During the Seventh plan a further 4,500 stations are being installed. Most of these stations use Time Division Multiple Access (TDMA) radio technology, which employs time slots to allow more efficient use of radio spectrum. Coverage of all tambon is expected to be complete by the end of this year. In July 1996 the Prime Minister and Cabinet ordered that telephone service be extended to all villages by 1998, an ambitious three years ahead of the previous target of 2001.

Under the current public telephone project, each remote station typically serves a public call office (PCO) set up in the home of a puyaiban or other villager, as well as two or more coinbox payphones. Depending on distance, one remote station may serve several villages. The PCO operator receives incoming calls, sending messages or notifying people when to come to take a call, as wells as timing and charging those making outgoing calls. Rural public phones play a key role in providing more equitable access to rural telecommunications. The following sections explore how villagers use that access.

CALLING HOME

First, and perhaps most significant, it should be pointed out that villagers like having telephone service. Most have family and friends working outside the village. People highly value immediate two-way communication, compared to the delays involved in mail, the impersonal one-way nature telegrams or the time and expense involving in traveling. Beyond this, villagers feel that having telephones makes them less disadvantaged compared to those living in town. Availability of telephones is a part of their own conceptions of development and having a better quality of life. These feelings are striking and consistent in all parts of the country.

It was difficult or impossible to get rural people to identify negative impacts from telephones. When pressed, people would point out that telephones could be used for good and bad activities. Telephone usage is certainly not confined to activities which are officially approved. Queues at the telephone were reported to be the longest on the days the underground (illegal) lottery results came out. The general conclusion, strongly emphasized by respondents, was that telephones were good. Their prime concerns were to get more telephones and improve the quality of current services.

Most telephone calls are to family and friends. Business calls are less than a quarter of all calls and only a few percent of calls are on government affairs. Most personal calls are to and from those working or studying outside the village.

The current economic boom has exacerbated outward labor migration, with some villages being composed mainly of the old and young. High rates of temporary and permanent migration are not a recent phenomenon in Thailand. Historically they can be linked to shifts between patrons, the quest for agricultural land, marriage patterns where men move to live

with their wives, and other long-standing characteristics of village culture. On a longer time scale, trading networks have long affected village life, as have the consequences war, famine, disease and voluntary and involuntary population movements. Extension of state administrative control over the past century, construction of canal, road and rail networks, and increasing integration into international markets have further enhanced the extent to which villages are open systems, highly subject to external influences. The changes referred to as "globalization" are only the most recent chapter in this long history of regional and global linkages.

Migrant workers call home to keep in touch, cope with problems, notify family about remittances, invite others to come apply for jobs and for a host of other reasons. Telephones allow migrants frequent dialogue, without the delays and formality of letters. Telephones give a faster means for dealing with problems when they do arise. It is clear that telephones do act to enable and facilitate migration and other changes. Within the context of these changes villagers feel that telephones play a positive role, making things better than they would be otherwise.

Telephones are not just used by wealthier villagers. Poor people reported that they did use telephones, and when they did it was important to them. By calling rather than traveling people not only saved the cost of travel, but the loss of earnings from time spent traveling. Most poor people interviewed during the study had family in other parts of Thailand, and used telephones to keep in touch with them.

There is little to suggest that telecommunications will reduce migration. Any impacts which stimulate rural economies and so make staying home more attractive, appear likely to be more than offset by the ways in which better, quicker information acts to increase migration. However telecommunications contribute to better informed decisions about where to go. Migrants have more choices than simply traveling to the Hua Lampong train station in Bangkok and seeing what work they can find. Migrants reported that information from telephones made them more able to go work in other places than Bangkok, with more information about the jobs they were going to. Thus telecommunications will not stop urban growth, but may contribute to a better informed, more dispersed patterns of migration.

PCO operators reported that about two percent of incoming calls were from other countries. PCOs are not currently allowed to originate international calls, though sixty percent of operators surveyed indicated they had customers who wanted to make international calls.[6] International migration first became prominent in the 1980s, as many workers went to the middle east, particularly from northeast Thailand. Northeasterners still seem to be most prone to migrate, but now most migrant workers seem to be going to other parts of Asia, particularly Taiwan, as well as Malaysia and Singapore.

Students used telephones to gather information about schools where they could continue their studies within their home provinces and in other parts of the country. This helped them to be aware of a broader range of choices. It also appeared that the availability of telephones for keeping in contact made parents willing to let their children study farther away, particularly for female children. As with migrant workers, students used telephones both for solving

practical problems, like lack of money, as well as for maintaining family relationships.

Telephones reduce the disruption which migration created in personal relationships. Telephone contacts enable to better sustain relationships than they would have otherwise. These networks of relationships, with shared concerns and trust, embody the social capital (Putnam 1993) which shapes societies' capacity to cope with changes and respond to new opportunities, such as those created by globalization.

In sum, personal calls to family and friends seem to play a key role in building human capital through better education, in allowing poor people and other villagers access to more opportunities to earn money, and in maintaining and building the social capital embodied in networks of family and friends. The availability of telephones, and communications via telephone were highly valued, in terms of villagers' views about improvements in their quality of life.

BUSINESS

Some fifteen to twenty percent of calls are made primarily for business, as categorized by callers and by PCO operators. In contrast to the researchers' initial expectations, telephones seemed to play little role in the purchase of agricultural inputs and in restocking of inventory by village shops. Farmers and shopkeepers preferred to travel into town to make their own purchases. Only a minority used telephones to place orders or check on availability of goods. Many suppliers of village shops already had well worked out systems for delivering their goods on a regular basis, and so far these seemed little affected by the availability of telephones. While there are theoretical grounds for expecting telecommunications to improve logistics and input acquisition, little effect was apparent on these routine kinds of purchases.

Farmers and traders did make use of telephones to check on prices, particularly for goods with volatile prices and those where quality and timely shipments were important, such as perishable fruit. Impacts were less apparent on commodity crops, whose prices were already well publicized through newspapers and radio. There was little indication that technical information obtained via telephones influenced initial decisions to diversify into new crops, but telephones did affect the returns received.

Fruit shippers used telephones to make more direct links to buyers, reducing the need to go through wholesalers and Bangkok markets. For example, a mango grower in Chiang Mai called directly to Had Yai in southern Thailand to set up shipments. Shrimp farmers, with high capital investments, bought cellular phones to keep up with fluctuating prices. Telecommunications thus allowed farmers to be better informed about prices and less obliged to simply accept whatever price was offered by buyers who came to the village. In this way telephones helped increase farmers' incomes and reduce monopsony power in agricultural markets.

The survey covered eighteen villages with public telephones and nine without. It was striking that rural manufacturing enterprises were found only in the villages with telephones. While the sample size is too small for rigorous generalization, this indicates the extent to which lack

of telephone service may either block the growth of rural businesses, or force entrepreneurs to move into town.

GOVERNMENT

Police, Local Administration and other government agencies have already used two-way radios to extend their control and communication networks into rural areas. Such radios are officially prohibited for private use, though this does not prevent some individuals form obtaining and using them. Even where two-way radios were available, telephones tend to be preferred, for their ability to access to broader network of people, reliably and confidentially. Radios need to be left on and monitored to be useful. Only one person can talk at a time, so conversation requires a formal hand-off between speakers. Radio conversations have little privacy, since anyone may be listening in. Different agencies have radios using different frequencies, which are not able to contact each other. Even the police, with the most powerful and flexible radio network, end up having to relay radio messages step by step, and often prefer to use telephones which allow more direct and confidential contact. Not only do telephones provide rapid two-way communications to ordinary people, who previously lacked access, they also show the advantages of an open public network, even for those who access to two-way radios.

The most dramatic benefits from rural telephones came when they allowed rapid reporting and response to emergencies, such as fires, crime and accidents. More prosaic benefits came from allowing people to set up appointments, avoiding wasted trips to see people who were not there. It appeared that telephones may have contributed to better lateral coordination between agencies. While formal written communications must go through hierarchical channels, government workers used telephones to informally bypass bosses and talk directly to colleagues in other agencies.

Villagers reported little use of telephones in the initial stages of obtaining government documents, such as drivers licenses and land titles. Villagers still relied on village heads to assist in initial contacts, or to act as agents for villagers. However telephones were used to check whether documents had been completed, prevent wasted travel to try to pick up documents if they were not ready.

Village teachers and health workers reported using telephones to keep in touch with friends and colleagues. They said this made them feel less isolated. It appears that this contributed to greater willingness to accept and stay in rural postings.

IMPLICATIONS

Some futurists and other analysts have optimistically suggested that advances in telecommunications may act to end urban dominance, demolishing the tyranny of distance and transport costs which support urban centralization. In this view, rural areas may no longer suffer under disadvantages relative to cities. On this argument, Thailand and other largely rural developing countries might not be fated to repeat the transformations which made the developed countries largely urban. Instead there might be other pathways, allowing

greater decentralization and more opportunity to sustain the best elements of rural lifestyles.

So far there is little to indicate that telecommunications are doing much to change long-standing patterns of urban dominance. Unlike North America, rural Thailand does not yet seem to have any migration of professional knowledge workers trying to combine rural lifestyles with what have traditionally been urban occupations. At best, such people may be buying homes in the "edge cities" growing up around Bangkok, or moving to a few favored provincial centers, such as Chiang Mai. The continuing difficulty in obtaining private telephone connections is a major constraint on any such decentralization, aside from the many other factors which are also relevant.

Deserted villages, with the only people remaining being grandparents taking care of their grandchildren, with all the young and middle-aged adults off working in town.[7] This is an extreme picture of rural Thailand, as the economic boom draws in increasing amounts of rural labor. While overdrawn, such patterns are present, particularly in northeast Thailand. Telecommunications is enabling such changes, while somewhat mitigating and transforming their impacts on family relationships. The choices being made, in the context of individual values and Thailand's current political economy, seem to be driving towards the urbanization of rural areas, with villages becoming peripheral extensions of a growing consumer culture. The difference telecommunications make is that rural people are less restricted to just watching this new society unfold on their TV screens, and, for better and worse, more able to participate in it.

There are policy choices which can influence how rural telecommunications develop, and the opportunities which may be created for more diverse and decentralized patterns of development. The government's rural telephone projects have focused almost exclusively on the installation of public phones. However the cost structure of the TDMA network used to link public phones means that the incremental cost of adding private lines is relatively low. There are many villages, perhaps the majority, which have a demand for tens of lines, but not the hundreds which would be needed to justify installation of local telephone exchanges. Therefore a key way to improve rural telecommunications will be if TOT (and other providers perhaps) could more actively market private rural lines, in addition to public telephones. This would help to spread the overhead costs of the rural network. Charges could be set to recover full, unsubsidized, costs of installing and delivering services, so that users help finance system expansion. Such a policy would allow rural people to make more of their own choices about how much, and what kind of telecommunications services they desire.

In many countries, including the U.S., Canada and Japan, small local telephone companies and cooperatives have played a key role in extending services into rural areas. Thailand's laws still enshrine the monopoly position of TOT as the only provider of domestic telecommunications services. Legal means have been found to allow big business to enter the telecommunications business as concessionaires, usually on a built-transfer-operate basis, where legal title to equipment is passed to the government and revenues shared, even though private enterprises make the investments and operate the systems. Similar creativity has not yet been exerted, under current laws or proposed revisions, to allow small businesses to also provide telecommunications services. Technically the same kind of small private exchange

(PBX) used for offices and apartment buildings could be used to deliver low cost services within a community, with one or more lines connecting it to the public telephone network. Such a policy change could do much to stimulate local initiative in expanding rural telecommunications, rather than leaving communities with little choice but to await government or private projects to install exchanges only after demand grows to the level of hundreds of lines.

Fiber optics and computerized exchanges are vastly increasing the capacity of the telephone network. and making the marginal costs of a call almost independent of distance. This change creates an economic logic for doing in telephones what was done some two hundred years ago in the postal service. What was once a radical reform is now taken for granted, the ability to send a letter anywhere in the country for the price of a single stamp. In addition to the technical and economic logic of low flat rates for long distance telephone calls, there would be major benefit in the improved distribution of development activities.

In North America long distance call charges are now declining towards $0.15 per minute or lower. In Chile, which allows free entry of telecommunications operators, long distance rates are about $0.10 per minute anywhere in the country, regardless of distance. Thus a sound basis exists for suggesting that Thailand could benefit from restructuring long distance charges going from the current maximum of 18 baht per minute to a uniform national long distance rate. Comparative international experience would suggest three baht per minute anywhere in the country, at least as a starting point for consideration.

Such a restructuring of rates could also do much to stimulate greater access and usage of data communications, such as electronic mail and the Internet. Internet services are just starting to expand beyond Bangkok to the some larger provincial cities. Access for rural areas will be difficult as long as call charges add up quickly. This is particularly a problem for schools, such as rural high schools, which could benefit most. Demand for data communications is not yet strongly felt, but is almost certain to grow quickly. Demand for e-mail connectivity is likely to grow rapidly, just as fax rapidly shifted from an innovation to a business necessity over the past decade. The World Wide Web is providing a framework to realize the potentials for sharing information for education and other needs. At this point it is not clear what the best models are for providing access to computer-based communication and information in rural areas. It may be that a cost-recovery model, like PCOs is relevant, or that the public benefits are so high that a more subsidized model is suitable, like public libraries. There is a need for study and experimentation (VITA 1995), to look at how data communications can be made available, as demand grows over time. Regardless of which model applies, lower telecommunications rates would contribute greatly to more equitable access.

Like the rest of the telecommunications sector, the development of rural telecommunications would benefit greatly from establishment of a capable, independent regulatory body. Such a regulator could promote a more transparent process of public decisionmaking. A regulator could encourage policies for serving rural needs, both by making rural services commercially attractive, which could serve most needs, as well as targeted subsidies and other policies to support services for those rural people and areas which are left out of the market. More

generally a regulatory body could help reduce unnecessary monopolies, promote more efficient and equitable spectrum allocation and establish interconnection policies which encourage open and fair competition, which would serve the interests of telecommunications users and promote a more efficient and equitable process of telecommunications development.

CONCLUSIONS

Telephones are a tool rural people can use in coping with the forces transforming their lives. Affordable access to rural telecommunications can help people identify new opportunities for working, studying and for selling their products. Telephone calls help to maintain and build the social capital embodied in relationships between family members, friends, business colleagues and others. Access to rapid two-way communications through telephones is itself an important ingredient of how rural Thai people perceive their quality of life.

Telecommunications act to greatly lower the transactions costs of dealing with people outside the local area. Telephones lead to better informed choices. Telecommunications is certainly no panacea. It accelerates ongoing processes, for better and worse. A faster pace of change and increased international linkages are key parts of globalization, and telephones play a major role in contributing to this process. At best telecommunications benefits come as an enabling factor, whose impact depends on and interacts with the availability of other infrastructure such as roads and electricity. Realizing the potentials created by telecommunications to enable people to cope with changes in better informed ways depends crucially on the availability of services to provide equitable, affordable access.

NOTES

[1] For reviews of earlier work on rural telecommunications¡ see Hudson 1984 and Saunders, Warford and Wellenius 1992.

[2] "Socio-economic impact study of rural telecommunications in Thailand" a study conducted for the Asian Development Bank and Telephone Organization of Thailand by Midas Agronomics International. February-October 1996.

[3] Provinces included in the study were Khon Kaen, Srisaket, Sakorn Nakorn, Chumporn, Trang, Rayong, Suphan Buri, Lampang and Nan. They were chosen to include middle income and poorer provinces with recently installed public telephones.

[4] At the end of September 1996 TA and TT&T officially transferred over 3 million lines to the government, raising the national average to about 10 lines per hundred people. This includes many lines which have been installed but are not active, e.g. in unoccupied condominiums. The pattern of urban concentration remains the same.

[5] These are costs estimated for schemes which have already received regulatory approval. A so far unapproved scheme from Teledesic (whose backers include Bill Gates and Craig McGraw) claims to be able to provide service for 5 cents U.S. per minute. This is technically controversial, but if feasible could radically reshape competitive cost structures, even if the Teledesic's own satellite-based service were subject to capacity constraints.

[6] The reasons for not being able to originate international calls from PCOs are not completely clear, but relate in part to bureaucratic rivalries between TOT, which provides domestic telephone services, and the Communications Authority of Thailand. CAT is the

monopoly provider of services to all countries except Thailand's immediate neighbors. CAT retains almost all the income from international calls.

[7] For a recent discussion of these trends, see Phongpaichit and Baker 1996.

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