

COMPUTING IN THE HOME: IMPLICATIONS FOR THE PROVISION OF GOVERNMENT SERVICES

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Abstract—The pending and widespread adoption of computers in the home necessitates that governments view this development and its implication for the delivery of service. It is the contention of this paper that while many potential services may be delivered via home computing devices, there are also significant constraints that must be considered. This paper explores the major types of governmental services that may be delivered and facilitated by computing in the home. The paper then identifies several major constraints that must be considered in the implementation of such services. The constraints fall into five categories: (1) infrastructure, (2) technological constraints, (3) economic constraints, (4) socio-cultural constraints and (5) political constraints. The final section provides guidelines to governmental policy makers.

INTRODUCTION

The role of government in providing consumer services has been widely discussed in the policy literature. Specifically, in the area of telecommunications and information technologies, there is a body of literature that is widely known. Baer [1], Danziger *et al.* [2], Elton *et al.* [3], King *et al.* [4], Kling [5], Knight *et al.* [6], Kraemer *et al.* [8] and Saunders *et al.* [10]. The traditional telecommunications policy area has been concerned with two types of systems, the mass communication systems (broadcast radio and television) and interpersonal systems (the telephone and the telex). With the advent of computing technology the boundaries between mass telecommunication systems and interpersonal systems seem to be blurring. What we are approaching is an information society with impending revolutionary changes in the way the society's communication and information needs are being transformed [9].

In this paper, we address the issues of how the government may respond to the needs of a society that is facing several choices in the adoption of home computer systems.

BACKGROUND

The recent decrease in the cost of microcomputer technology has permitted the serious consideration of computing in the home [11, 12]. This paper explores the implications of widespread adoption of computers in households for the provision of government services. While the introduction of computers into the home raises many interesting social issues, the purpose of this paper is to focus on issues relating to the provision of government services through computing apparatus in the home.†

The presence of computers in households presents many opportunities and possibilities for the provision of government services which may lead to rapid and efficient communication among citizens. However, while many potential services may be delivered via home computers, it is also important to realize the significant constraints and problems to be solved. Specifically, the computer assisted provision of government services (CAPS) through home computers raises issues of privacy, control over personal information, cost, types of services, and restriction of efficient access to government services. To effectively cover the issues surrounding this subject, this paper begins with a discussion of computing in the home. Second, the paper examines the types of services that could be provided through computers in the home. Third, the paper identifies the major constraints on the provision of government services via computers in the home. The paper concludes with a series of guidelines for governmental policy makers.

†The purpose of the paper is to assess the issues surrounding computing in the home as a vehicle for the provision of government services. In this paper we will use the acronym, CAPS, to stand for Computed Assisted Provision of government services.

COMPUTING IN THE HOME

Computing in the home is to be distinguished from the plethora of home video game units, the latter being primarily limited to entertainment activities. Computing in the home, on the other hand, is defined as the use of a computer in the household to perform a variety of activities such as: working at home, managing home resources, home education, home entertainment and recreation, and home access to electronic information services. During the last 4 years numerous homes in the United States have purchased personal computers for home use.† In fact a recent article in a popular personal computer magazine indicated that between 50 and 70% of the IBM personal computers sold through retail outlets had found their way into homes.‡

Computing, as an activity in the home, is a relatively recent phenomenon. Currently, most of the computer equipment in the home are transfers from technology used in the office of technology used in the development of video games. Venkatesh and Vitalari [11], in a study of 282 home computer users found that the major computing activities in the home are:

- (1) games and hobbies;
- (2) business applications;
- (3) word processing;
- (4) children's education;
- (5) Household record keeping.

The study indicated that the home computer user uses the computer for one of three types of purposes: word processing, working at home or entertainment and games. This finding parallels closely the current designs and capabilities of home computers. Specifically, the current state of the art in home computers falls into four major areas:

- (i) entertainment and games;
- (ii) word processing and personal finance;
- (iii) educational applications;
- (iv) primitive telecommunications.

None of the technology that is currently available satisfies specific household requirements. For example, it is likely that computers in the home might be useful for energy management, telephone answering, or home security. However, the current technology in the home is mainly a transfer from computer technology developed for the office, or technology developed for video games.

Thus, in terms of the current state of the art of computing in the home, we can say that it is in a very primitive stage. The technology being used in the home has either been optimized for use in the office or for use as an entertainment center primarily centered on video games. Second, from an economic perspective, the home computer market has not developed at the pace of the office and small business computer market.§ Third, the communications capability available on home computers is based on the RS232 asynchronous communications interface which is dependent on the quality of the existing analog telephone network and is constrained by its relatively low speed and capacity. Also the average household is not trained to handle the technological complexity involved in a computer's use. Given these constraints it is likely that the provision of government services through computers in the home is at least 5-10 yr into the future.

CATEGORIES OF GOVERNMENT SERVICES

A variety of governmental services may be delivered via computers in the home. The services may be divided into 5 major categories. These categories are not mutually exclusive but can be differentiated based on their major purpose:

†Industry analysts estimated that over 5.5 million home computers will be sold in 1985.

‡PC Magazine, Vol. 8, August (1983).

§While there are many add-on features for home use provided by independent vendors, this developing technology is, in actuality, only available to the sophisticated home computer user. The technology is limited because the user must often trouble-shoot incompatibility problems, avidly read computer magazines, and be willing to take a risk that the technology will not work as desired. Thus we contend that the major home computing activities are constrained by the technology provided by the original vendor.

- (1) Electronic mail.
- (2) Information access and retrieval.
- (3) Emergency services.
- (4) Opinion polling and political process facilitation.
- (5) Automated billing of government services units.

The five major categories apply to federal, state, and local governmental services and parallel major governmental services which are now available, such as the U.S. Postal Service, telephone information services, opinion polling, and civil defense/emergency groups.

However, on a state and municipal level the potential range of services provided through computing in the home is quite large. Zimmerman [13] conducted a study of service needs in 2248 local governments and developed a generic list (see Table 1) of governmental services. This list contains over 75 different types of services provided by local governments to its citizenry. Out of this list of over 75 services, only 15 types of services are real candidates for delivery through computers in the home. These services are illustrated in Table 2. The 15 candidate categories were selected on the basis of their immediate impact on the individual citizen. In other words, these services are at the interface between the citizen and the government. From this list is clear that quite a few of the traditional government services could be augmented by home computing.

Table 1. Types of governmental services provided by local governments (adapted from Zimmerman [13])

Assessing	Jails and detention homes
Payroll	Juvenile delinquency program
Tax collection	Probation and parole
Treasury functions	Work release
Election administration ¹	All fire services
Legal services	Fire communications ¹
Licensing	Fire prevention ¹
Microfilm services	Training of firemen
Personnel services ¹	
Public relations ¹	All civil defense ¹
Records maintenance	Civil defense communications
Registration of voters	Civil defense training
All public health services	Bridge construction/maintenance
Air pollution abatement	Building and mechanical inspection
Alcoholic rehabilitation	Electrical plumbing inspection
Ambulance services	Electrical supply
Animal control	Engineering services
Cemeteries	Refuse collection
Hospitals	Sewage disposal
Mental health	Sewer lines
Mosquito control	Snow removal
Noise abatement	Solid waste disposal
Nursing services	Street construction/maintenance
Water pollution abatement	Street lighting
Welfare	Water supply
	Water distribution system
Flood control	
General development	Special transportation service ¹
Housing	Management service for publicly owned transit
Industrial development	
Irrigation	
Mapping ¹	Libraries ¹
Planning ¹	Museums
Soil conservation	
Urban renewal	
Zoning and subdivision control	
Parks ¹	
Recreation facilities ¹	
All police services	
Crime identification	
Criminal identification	
Patrol services	
Police communications ¹	
Police training	
School crossing guards	
Traffic control	

¹ Government services amenable to computer provision.

Table 2. The feasible set of governmental services to be provided through home computer links

(1) Election administration
(2) Personal services
(3) Public relations
(4) Mapping
(5) Planning
(6) Parks
(7) Recreation facilities
(8) Police communications
(9) Fire communications
(10) Fire prevention
(11) All civil defense
(12) Special transportation service
(13) Libraries
(14) Museums
(15) Schools

Election administration

Election administration includes a wide variety of services such as voter registration, notification of elections, publication of guides to election issues, and control over the validity of the election process and results. However, with the mass adoption of computers in the home it may be possible to expand the services that government can provide by augmenting the political process. One option would be to solicit and conduct opinion polls about various issues. This opinion polling could be specifically targeted to issues that affect certain geographic locales and focus on specific local issues. This information could be utilized to support a referendum or actually gather support for a specific referendum.

Personnel services

The most obvious service in personnel services would be to provide a computerized directory of jobs available in government. Other possible services include the maintenance of a "gripe line" by which citizens who have had trouble with a particular government agency or its employees could send a message outlining their complaint.

Public relations

Public relations efforts could be aided by two of the facilities mentioned above, opinion polling and a gripe line. In addition, community public relations could be facilitated by providing the citizen with a community bulletin board and an indexed directory of public proceedings and publications that are available. Many of the problems that exist today, in terms of public relations, are the result of the sheer complexity and labyrinthine nature of most governments. Public relations might be improved if the citizens were provided with clear entry points through which to gather pertinent information about its representative government.

Mapping and planning

Mapping and planning functions are becoming more important as older cities attempt to reinvest and redesign and newer cities attempt to plan their growth. While these services have mainly been available to the administrative staffs within the government, it may be possible to provide maps and planning agendas to the citizenry on a limited basis. In addition, certain professional groups could benefit and provide revenue in purchasing computerized mapping services.

Parks and recreation facilities

The administration and scheduling of park and recreational services have become an expensive and labor-intensive task in many local, state and federal jurisdictions. With the presence of computing technology in the home, it may be possible to have citizens submit their requests for a camp site, park site or enrollment in a civic recreational program directly through the computer. The computer, in turn, could automatically schedule and register the individual and issue a permit to be mailed or sent electronically to the individual confirming the reservation. This type of service could reduce some of the administrative burden of this government service.

Another service that could be offered in this area is a computerized directory of the available parks, recreational facilities and recreational programs. This could reduce the need to send individualized programs to each home, and thus reduce some of the costs associated with publication and distribution of announcement.

Police, fire and civil defense communication

A number of emergency services could be facilitated by computing in the home. First, police communications could be facilitated by a directory of police services provided on the computer. The police computer could provide a menu of services and the home computer could automatically dial the service. This could be especially helpful in emergency situations. Home security could also be facilitated by increasing the use of home computer security systems that would automatically call the police in the event of a break-in.

Fire communications would likely be part of the police communications system. However, the fire department could also use the computer in the home as a training tool by which to provide information on fire prevention and safety tips. Safety tips related to other emergency situations usually handled by the fire department (such as heart attacks, poisoning, burns, etc.) could be facilitated by a ready-reference system on the home computer about what to do and who to call in these situations. It is clear that the opportunities in these areas are almost endless.

In the area of civil defense, special emergency situations such as floods, tornados and hurricanes, may require evacuation or notification and could be facilitated by computing in the home. It is likely that home computers of the future will be implemented with telephone connections. Thus messages and warnings could be sent to the home in the event of a major adversity.

Special transportation services

For the elderly, the indigent and the handicapped, special transportation services perform a vital role in their daily lives. These transportation services could be facilitated by computerized directories of services, computerized scheduling and reservation systems, and special bulletin systems to notify users of these changes in schedules, routes, or problems in service.

Libraries and museums

Computers have long been viewed for their potential in supporting library services. However, the investment and the cost of maintaining computerized library systems has been prohibitive. In addition, the traditional librarian has not been trained in computer technology and methods. For these reasons, it is unlikely that libraries† will change radically in the coming years except in the largest cities. However, in those cases where change is possible, computers in the home present libraries and museums with many opportunities.

First, libraries and museums could notify citizens through a CAPS network of new services, new books, schedules of programs, and special events of interest. It is conceivable that this notification process could be done on a selective basis, keyed to certain interest areas identified by the citizen.‡

Second, libraries and museums could extend their ready-reference services through the use of home computers. The requestor could enter a request via the computer and receive the response later via the same computer.

Third, libraries may find themselves getting into the software rental business. Although this creates many problems in terms of software privacy for commercial products, libraries may see it as their role to provide certain non-profit, or free software to their citizens.

And fourth, libraries in the future may provide automated catalog and bibliographic systems for users in order to search for references, books and articles. It is likely that some of these services may be first provided by State Universities with systems like MELVIN, currently in operation at the University of California.

†The State of Washington is planning a computerized library system.

‡The identification of "interest areas" by the citizen raises an interesting privacy issue. It may be necessary for the government agency to *guarantee* the confidentiality of that information to prevent its being sold or used for other purposes not intended by the citizen. The concept of government-citizen trust, a trust to facilitate the government service, may become an issue of debate in the future.

Schools and education

Contrary to the futurists' belief that educational services will shift to the home as a result of household computing, it is likely that the major part of education will be provided by computer-augmented instruction within traditional educational institutions. However, because educational institutions will increasingly incorporate computer technology into their curricula, students will be doing homework and additional study via their computers in the home. It is likely, therefore, that educational institutions will provide central computer services and computer applications to facilitate home centered, computer-based, educational activity and applications. These services will range from electronic mail to support curriculum administration, sophisticated database storage capabilities for class assignments and large scale computing power for computer-aided instruction and instructional exercises.

CONSTRAINTS ON THE PROVISION OF SERVICES

Serious constraints stand in the way of the computer-delivered services. The constraints may be classified into five major areas:

- (1) infrastructure constraints;
- (2) technological constraints;
- (3) economic constraints;
- (4) socio-cultural constraints;
- (5) political constraints.

The following paragraphs examine each of these constraints in detail.

Infrastructure constraints

One of the major constraints on the provision of government services through computing in the home is the lack of developed infrastructure. The infrastructure to support the provision of government services in the home requires an administrative infrastructure, an economic infrastructure, a technological infrastructure, and a participant infrastructure.

First, each local government will have to develop an agency for citizen-government tele-communications. This group will be responsible for managing the computer networks to support government-home communications. This agency will support citizen user requests for service, monitor the service levels, arbitrate in conflicts and assure that the best security and privacy safeguards are in effect.

Second, long-term arrangements for economic resources to support the computer network, its operations and improvement must be made. This support will include initial investment capital and a stream of budgetary allocations each fiscal year.

Third, a public or private group will have to purchase and maintain the computer network that will allow for electronic mail, electronic bulletin boards, and other services that are deemed necessary to provide citizens with access to a CAPS network. This will require advanced and sophisticated technology that is presently outside the feasibility horizon. However, as the communications and computer technology become available, the networks will be designed and implemented to provide the vehicle to link the home with the government center.

Fourth, the citizens themselves must accept the idea of computing in the home and support the new mode of access to governmental services. Without this support and their investment in home computing, the CAPS concept will not work.

Technological constraints

The current state of the art in home computers is primitive compared to the capabilities required to provide government services. The major technological constraint is the lack of inexpensive two-way electronic data communication. The channel capacities and speed required to support a community of 100,000 citizens for electronic mail and online real-time response are in the multiple megabit per second range. Current telephone technology supports a maximum of 4800 baud (with line conditioning), well below the required level. CATV networks (cable TV) provide a larger

capacity but it is not clear whether CATV bandwidths will support the level of activity, interconnection, and switching that are necessary. It is likely that it will take at least 5 years, and probably closer to 7 years to implement networks of this capacity. Clearly the incentives exist for the investment, and most likely the large scale telecommunication utilities will provide the networks. In addition it is possible that new start-up companies will offer special networks to users with services that governments may buy in order to provide their services.

A second technological constraint is seen in the computer technology itself. Current home computers have extremely primitive and simplistic secondary memory devices ranging from magnetic cassettes, wafer drive media, and in some cases floppy disk drives. For home computers to facilitate the services we have been discussing in this paper, the home computer must have the following capabilities:

- (1) large capacity main memory of at least 512 kbyte to support integrated applications and high density data communications;
- (2) large capacity secondary memory of at least 5 Mbyte for storage of electronic mail, computer programs and data;
- (3) relatively transparent communications hardware and software that integrates data communication and voice into a single system;
- (4) high-resolution display technology with graphic capability;
- (5) multi-tasking operating systems to support multiple tasks and, if necessary, multiple users simultaneously.

A third limitation in computer technology is the lack of standards. Although standards sometimes impede progress, it is also true that some standards, especially in the area of communications, graphics, and electronic mail, are required. A basic set of standards in these areas are required if home computers are to become the so-called window to the world and a usable appliance for the household.

The fourth and final limitation centers on the problem of household requirements. It is clear that the current collection of home computers were not built on the basis of a careful systems analysis of household requirements. More study and research are required to understand and isolate the key features that are needed in home computer systems.

Economic constraints

By far the most important constraint for the provision of government services is the fiscal budget. Current state and federal budgets are undergoing economic dislocation. For example, it is well known that the National Highway System requires a sizeable reinvestment for repair. Thus, given the major priorities facing governments, what is the likelihood that governments will allocate significant economic resources to providing computing supported services for the household? In the current economic picture the probability seems quite low. Furthermore, the astute public administrator may simply ask whether such a technological path is really meaningful at such an early stage of development.

Consequently, it is unlikely that most governments will begin to provide government services via computerized links for at least 10 years. In 10 years governments will know whether computers in the home are truly a mass phenomenon, and sufficient public support may exist to support such investment. Thus a more likely scenario is that private industry, in the form of regulated computer utilities, will invest and develop the necessary technological infrastructure. Subsequently, the government will purchase from these utilities the computing links to the household through which to deliver the services.

Socio-cultural constraints

A very important, and often overlooked consideration, in the adoption and use of technology is the socio-cultural environment in which the concept is to operate. The socio-cultural environment includes the roles, social habits, social interactions, relationships, attitudes, beliefs and values of the individuals, groups and society. All of these components form the social reality in which people live.

The proposal of using computers in the home as a new medium and window to the world has the potential to alter many of the traditional ways of government-citizen interaction, and citizen-to-citizen interaction. To some extent (not to be underestimated) the current social reality represents a significant amount of inertia to people's behavior. As a result it remains to be seen whether individuals will respond to the provision of government services through computing in the home in a positive manner. It is indeed possible that individuals may desire the face-to-face contact currently provided. It may also be true that many of our citizens would be happy to live without the face-to-face contact. The point is, there are no guarantees for one scenario or the other. It can only be answered after empirical study.

Political constraints

No doubt someone in the future will write an article in one of the major newspapers about "the Politics of Computing in the Home." For some this idea will raise the spectre of the big brother, for others it will present new opportunities for participative government, and for others still, the idea will be cynically viewed as another attempt to make government more distant from the people. Whatever the perspective, a debate is likely to occur. Although it is impossible to foretell the exact issues, we believe that some of the following issues will form the debate.

- (1) Will the computer-assisted provision of government services actually contribute to better government?
- (2) Does the provision of government services through home computers pose a threat to civil liberties?
- (3) Will computer technology in the home fragment the provision of government services and actually constrain the services?
- (4) Will this type of delivery of government services undermine the human character of government contributing to an increasingly impersonal government?
- (5) Will computers used in this fashion decrease the number of civil service jobs in government?
- (6) Will the legislative and administrative processes be unduly influenced by the technological elite and diminish the influence of other constituencies?

From a pragmatic perspective the issues above and the debate they will create are constraints on the CAPS concept. Suitable and appropriate answers and compromises will have to be found before the concept can be implemented. The debate will also produce some important guidelines and information and force society to evaluate the potential of the new technology and its effect on government and its citizens.

GUIDELINES FOR POLICY MAKERS

Given the types of services that could potentially be offered by governments and the nature of the constraint set influencing the implementation process, policy makers can adopt several policies.

The major issue is to determine if governmental services should be provided at some future date through computers in the home. If this decision is affirmative, then policy makers must decide the various roles that the public and private sector will play. There are at least five major policy-making areas to be dealt with.

Economic policy

First, policy makers must deal with the constrained budgetary situation. It is important to note that the financial resources required are sizeable, including not only development, implementation, and entry costs, but also the ongoing maintenance and management costs. This problem may be dealt with in several ways, each policy reflecting a different political perspective.

- (1) Adopt a *laissez-faire* policy *vis-à-vis* the regulation and control of computing in the home and the attendant computer networks. Allow the private sector to determine the viable and profitable services and provide those to the community. Both Federal and State government may want to pass legislation that will encourage such investment and development, mainly with tax credits and tax exclusions.

(2) The Federal and State governments may want to subsidize the development and creation of telecommunications networks in a manner similar to the creation of the National Highway System during the 1940s, 1950s and 1960s. This type of approach would be financed largely through a tax on computer equipment, software and related supplies, along with some general funds from income tax revenues.

(3) Pool slack resources from existing governmental agencies to form a general fund for the development of telecommunications networks. Collections for the fund might be based on a pro-rata forecast of each agency's benefit from the network. Agencies may also recharge citizens for specific services supplied through a CAPS network.

Policy on standardization

Policy makers must also decide to what *degree* government will become involved in developing and establishing standards in this area. From a conservative political perspective, standards should be minimized and the market will ultimately provide the de facto standard. From a more liberal perspective, the government may be seen to promote the standardization process. In the computer industry both policy approaches are evident, each with its share of successes and failures (i.e. COBOL, CODASYL, IBM PC and S-100).

A middle position is also possible and may become increasingly appealing due to the nature of international competition. The middle position sees the role of government as a coordinator for the standardization process and even offers incentives to encourage the process. Incentives might include the support of research into the development of standards and creation of industry groups.

Implementation policy

A third policy-making area involves the setting of priorities for which governmental services may be deployed using computers in the home. This may involve the development of pilot projects to understand which services are useful and important. It is important for policy makers to realize that they *must* conduct a thorough systems analysis to determine what is really needed out of such systems. Otherwise, the government runs the risk of creating useless and unacceptable systems under the guise of progress and innovation. The recent history of innovation in the provision of government services in the U.S. is replete with this type of failure [7].

Policy on citizen privacy and security

The fourth policy-making issue is the most difficult of all. How should the government deal with the privacy implications of highly sophisticated electronic information processing machines in the households of its citizens? The privacy issue in this case is multi-faceted. First, to what extent should government agencies honor the privacy of citizens who voluntarily provide private information to the government to facilitate the provision of a service (i.e. what is public information or private information)? Second, what types of safeguards and policies should the government adopt to protect its citizens' privacy from unscrupulous government servants or criminals. The introduction into society of large scale computing networks linked to individual households has the potential of making individuals susceptible to electronic eavesdropping, electronic surveillance, and criminal activity. The government probably has the ultimate responsibility of control and assuring adequate privacy and security for the transactions in the network. The third component of the privacy issue is the vulnerability of government systems to criminal or unscrupulous citizens. The more integrated and complex computer networks become, the more possibility for a breach of security and the potential for sabotage, data theft and data alteration.

Social policy

The fifth policy-making area deals with a long-term social problem of implicit or unilateral restriction of efficient access to governmental services. In other words, if government services are provided through home computer links, will certain segments of the society be effectively hindered from participation in the government process? This state of affairs may evolve for several reasons:

- (1) computer illiteracy:
- (2) functional poverty:

- (3) voluntary non-participation;
- (4) cultural bias.

Each of these factors could exclude a segment of the population from computer usage and/or using government services. In the long-run these behavior patterns could exclude several segments of the society. It is also likely that many of the contemporary disadvantaged segments would be the segments excluded in the future. Policy makers will have to develop policies to encourage voluntary use and make access points to the CAPS network available to these groups.

CONCLUSIONS

Not since the development of television has a new media been developed that can influence and augment the relationship between the government and its citizens. The mass adoption of sophisticated computing devices in the home presents both opportunities and problems for the democratic process and participative government. The CAPS concept has the potential to: (a) reduce the cost associated with paper and automate some of the burden on government agencies; (b) provide targeted services to citizens; (c) extend existing services; and (d) provide simpler access points to government services.

In this paper we have outlined both the opportunities and the problems in the provision of government service via computers in the home. We draw five major conclusions from this analysis. First, it is clear that the complexity of the technology and its *potential* to create new modes of service delivery and citizen participation requires that policy makers, citizens, and the relevant legislatures examine the issues carefully in a public forum.

Second, policy makers have the difficult task of deciding how the CAPS concept is to be implemented and developing guidelines and laws to regulate the process.

Third, a major investment in computer networks that will serve as a basis for providing government services to its citizens, as well as other non-government services is needed.

Fourth, the choice of which services to offer and how they will be offered will be determined primarily by economic constraints. However, the choice will also be heavily influenced by the various power brokers within government.

And fifth, some degree of standardization is absolutely necessary. Otherwise, problems over which vendor to choose will create unnecessary problems and add confusion to the CAPS implementation process.

If the CAPS approach is to be implemented and used in the future, many of these problems will have to be resolved and it is likely that the solutions will require cooperative arrangements between the public and private sectors.

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