

The French Videotex System Minitel: A Successful Implementation of a National Information Technology Infrastructure ¹

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Abstract

Building an advanced national information technology infrastructure can provide a competitive advantage for the countries that develop it as well as for the companies that operate in those countries. This article describes the development of the French national videotex system Télétel, also known as Minitel. The factors—technical and political—that made Télétel successful are explained and contrasted against other national videotex systems that became commercial failures. Political intrigue, technical capability, creative choices, and the deep pockets of a government-owned utility are all part of the Télétel story.

Keywords: Information technology, computerization of society, diffusion of innovation, IS technology transfer, public policy, videotex, case study

ISRL Categories: AI0102, BC03, BDO101, DD0502, EL05, HA0804

Introduction

Establishing an advanced national information technology infrastructure has been argued to provide competitive advantage not only for the countries that develop it but for the companies that operate in those countries. For example, in the United States, a proposal to implement a national data superhighway has been enthusiastically endorsed by the Clinton administration as a means to improve American competitiveness (Markoff, 1993). Singapore has been offered as an example of a country with a national data highway (King and Konsynski, 1990). Researchers have attempted to explain the degree of success of national information technology projects by analyzing the political and economic environments of those countries. This article follows that line of inquiry. It describes the development of the most successful national videotex system—the French Télétel system—and explains why it was successful while most other national videotex systems have been commercial failures.

This article has two purposes. The first is to document the major decisions—technical and political—that made Télétel the most successful commercial videotex system in the world. The second is to understand the factors that made Télétel successful in order to generalize from its lessons. The material for the article came from a series of interviews, from 1990 to 1992, with former and current senior officials of France Télécom, British Telecom, the Bundespost, and US West; with service providers and users of Minitel; from internal documents from a variety of government agencies, and from published materials.

In the late 1970s, videotex² was an important fixture of the telecommunications landscape of most industrialized countries. Many national Post, Telephone and Telegraph (PTT) companies and commercial ventures started pilot videotex projects. Videotex was seen as one of the driving forces in the movement toward an information society. In 1982, there were at least 50 videotex projects in 16 countries of Western Europe, Japan, and North America.

A decade later most of those projects have failed. One noted exception is France's famous Télétel.³ Télétel is the most commercially viable national videotex system so far. As of 1993,

Télétel has over 6 million subscribers and 20,000 services, and handles close to 2 billion calls and 110 million hours of connection time a year. These statistics dwarf, for example, the privately owned American systems Prodigy and CompuServe, which have around a million subscribers each and two thousand services. Britain's Prestel (150,000 subscribers and 1,300 services) and Germany's Bildschirmtext (250,000 subscribers and 3,500 services), which ranked second and third in the world during the 1980s, are today considered commercial failures, and their prospects for growth are not promising (Schneider, et al., 1990).

What made Télétel such a success?

Background

Information technology and French industrial policy

In the mid 1960s, particularly after the American Congress denied a permit to export a large IBM mainframe computer to the French government, French political commentators started to voice concerns that France was falling behind the United States in information technology. Some predicted this would soon be an intolerable situation of technological and cultural dependence. For example, President Valéry Giscard d'Estaing stated that "For France, the American domination of telecommunications and computers is a threat to its independence in the crucially significant if not overriding area of technology and in the field of culture, where the American presence, through television and satellite, becomes an omnipresence." Similar concerns continued through the 1970s and influenced a central piece of the industrial policy of the country.⁴

In 1975, President Giscard d'Estaing asked two researchers—Simon Nora and Alain Minc—to suggest a strategy to computerize French society. Their report became a best-seller (Nora and Minc, 1978) and coined a new word "Télématique" (from telecommunication and informatique). It was proposed as the cornerstone of French industrial policy.

Télématique describes the merger of computers and communication technologies so as to create information processing applications with broad societal impact. Nora and Minc predicted that eventually Télématique would affect all aspects of society—education, business, media, leisure, and routine day-to-day activities. By increasing access to information, Télématique was expected to decentralize government and business decision making, increase national productivity and competitiveness, and improve the ability to respond to an increasingly fast changing environment (Nora and Minc, 1978).⁵

Nora and Minc's vision would require a new national communication infrastructure, a long-term strategy, and cooperation between the government and business sectors. One recommendation was for the Direction Générale des Télécommunications (DGT), as France Télécom was then named, to encourage cooperation among computer services companies and hardware manufacturers. Together they would produce the technical components of the required infrastructure. Another recommendation was for the DGT to implement a research program to develop applications to leverage the infrastructure investment (Nora and Minc, 1978).

Such recommendations are typical of French industrial policy. The strategy of having the government orchestrate and subsidize large technological projects by creating alliances among companies had been used frequently in the transportation sector (e.g., Ariane, Airbus, Concorde, TGV). The government has gone as far as "rationalizing" an industrial sector (e.g., electronics) by encouraging mergers. As Jean-Paul Maury, director of Minitel at France Télécom, put it, "This type of large industrial projects, or as we [the French] call them, 'les grandes aventures,' have always captured the imagination of French politicians."

The French telephone system in the 1970s

In 1974, when Giscard d'Estaing became president of France, the French telecommunication system was very weak. Less than 7 million telephone lines served a population of 47 million. This was one of the lower penetration rates in the industrialized world and equivalent to that of

Czechoslovakia. Customers waited four years to get a new line, and most rural areas were still equipped with manual switches (Chamoux, 1990; Mayer, 1988).

President Giscard d'Estaing made the reform of the telecommunication infrastructure a top priority. In April 1975, the Conseil des Ministres (a cabinet-level meeting among the secretaries of all agencies) approved the president's program under the banner "Le téléphone pour tous" (a telephone for everyone) (Marchand, 1987a).

Also in 1974, Gérard Théry took over as director of the DGT. At that time, the strategic direction of telecommunication technology was set by the Centre National d'Etudes des Télécommunications (CNET). The CNET was, and continues to be, the research and development arm of the DGT. The CNET was dominated by engineers whose responsibility and vocation was the design of new products. They focused on technical prowess and innovation.

Once the design of a product was complete, the CNET negotiated directly with the telecommunication industry for the development and commercialization of the product. The CNET engineers were constantly trying new technologies without a clear technological migration plan. This practice forced manufacturers into short production runs, made manufacturing economies of scale impossible, drove prices up, and made network compatibility difficult to achieve (Housel and Davidson, 1991).

Théry changed the orientation of the CNET. The CNET adopted a more commercial and pragmatic attitude (Dondoux, 1990). The change in culture was difficult at first and led to a long and bitter strike. Eventually, Théry's vision prevailed, and a new relationship between the DGT and the French telecommunication manufacturers was forged (Housel and Davidson, 1991; Marchand, 1987a).

A more commercial orientation at the CNET was realized by creating the Direction des Affaires Industrielles et Internationales (DAII) and by bringing an outsider in as its director. One of the principal functions of the DAII was to ensure standardization of equipment. The DAII invited bids not only from the traditional suppliers of the DGT (e.g., CIT-Alcatel, Thomson) but from others as

well (e.g., Matra and Philips). To drive equipment prices down, the DAII announced that an important criterion in choosing suppliers would be their ability to export and acquire larger markets.

The government push toward standardization and export of equipment was partially responsible for lowering subscription charges, resulting in more than doubling the number of telephone lines between 1974 and 1979. By the late 1980s, the penetration rate was at 95 percent, one of the higher among the industrialized nations (Chamoux, 1990).

The transformation of the French telephone network from the "joke of Europe" to the most modern of Europe took some 10 years and a tremendous amount of resources. Indeed, from 1976 to 1980, the DGT was the largest investor in France, averaging around 4 percent of the total national investment in the country (Hutin, 1981). The total cost of the transformation has been estimated at around FF120 billion⁶ (Dawkins, 1992).

Télérel

A strategy to increase telephone traffic

The magnitude of the investment required to create the telephone network raised questions of how to maintain its expansion and how to recuperate the modernization costs. In early 1978, with the telephone penetration rate growing very quickly, Théry realized that telephone traffic alone would not be enough to pay back the investment in the telephone network and the public packet-switched network (Transpac). Théry asked the CNET to generate ideas for new services to increase traffic. These services would have to: (1) provide greater access for all citizens to government and commercial information, (2) benefit as many elements of society as possible, (3) demonstrate the value of merging computing and telecommunications, (4) be flexible enough to avoid quick technological obsolescence, and (5) be profitable (Housel and Davidson, 1991).

Théry prepared a report for the Conseil des Ministres detailing six projects: the electronic telephone directory, the videotex, the videophone, the wide distribution of telefax

machines, the launching of a satellite for data transmission, and the voice-activated telephone. The background for his presentation was the Nora and Minc (1978) report and the need, as perceived by Théry, to counter the threat of the American computer manufacturers capturing critical strategic markets if left unchallenged.

The Conseil des Ministres approved videotex and the electronic telephone directory. Three years after the successful launch of the "Le téléphone pour tous" campaign, "la grande aventure du Télétel" had begun.

Télétel: A brief history

Work on Télétel began in the mid 1970s. The first prototype was shown at the 1977 Berlin Trade Fair. The British demonstrated at that show a very impressive operational videotex system. Théry realized he had to move fast. In late 1978, he persuaded the government to allow the DGT to pursue the Télétel project, and a test was set for December of 1979.

France Télécom initially made plans for just two applications: the development of an electronic telephone directory and classified ads. While the electronic directory service was a welcome innovation, the press and its powerful lobby generated a political furor over the government meddling in the classified ads business. The DGT dropped the classified ads idea and concentrated on justifying the videotex project on the electronic telephone directory alone.

With seven million new telephone lines added between 1974 and 1979, a telephone directory was obsolete before it was printed (and it was printed twice a year). Also, the cost of printing the French telephone directory had gone up so rapidly that in 1979 the paper telephone directory lost FF120 million. Between 1979 and 1984, another 7 million phone lines were expected to be installed. The cost of printing the directory alone was expected to double in five years, and the quantity of paper was expected to quintuple from 20,000 tons of paper in 1979 to a projected 100,000 tons by 1985. Directory assistance was hopelessly overloaded. It required 4,500 operators to provide a barely acceptable level of service. The number of operators needed in 1985 was forecasted to be 9,000 (Dondoux, 1978; Marchand, 1987a). But the success of the electronic

telephone directory required that a great majority of the subscribers be able to use it. To do so, subscribers needed to have access to an easy-to-use, inexpensive terminal.

DAI planners explored a scenario of distributing terminals free of charge to subscribers. They reasoned that with the cost of each paper telephone book being FF100 (and increasing), the FF500⁷ cost of a dedicated terminal could be recovered in less than five years.⁸

The initial testing of the electronic directory began in July 1980, in Saint-Malo, a small town of 46,000 people in the county of Ille-et-Vilaine. The town was chosen for its size and proximity to the headquarters of the CNET where the electronic directory was developed. The actual videotex experiment started in Vélizy—a suburb of Paris with a representative socio-economic profile and a good telephone network in place—in June 1981 with a sample of 2,500 homes and 100 different services.⁹ After two years, the Vélizy experience showed that 25 percent of the users were responsible for 60 percent of all traffic, that a full one-third of the sample never used the device (this proportion of non-users has remained constant throughout the dissemination of minitels), and that overall, households had a positive experience with Télétel. The experiment was considered a success in both technical and sociological terms (Chamoux, 1990; Marchand, 1987a).

In February 1983, a full-scale implementation of the electronic directory was started in the whole county of Ille-et-Vilaine. The county is made up of both rural and urban areas and is home to 250,000 people. In the opening ceremony, Louis Mexandeau, the new secretary of the PTT, exulted "We are here today to celebrate the beginning of a 'grande aventure,' an experience which will mark our future." François Mitterrand had replaced Valéry Giscard d'Estaing as president of France, the "left" was now in power, but the rhetoric on the importance of Télématique to the future of the country and the underlying industrial policy were unchanged.

Soon after the successes of Vélizy and Ille-et-Vilaine, the voluntary and free distribution of minitel terminals began: There were only 120,000 minitels in France by the end of 1983, but over 3 million by December 1987, and more than 6

million by December 1992 (see Figure 1). Videotex services went from 2,000 in January of 1986 to 12,000 at the end of 1989 to more than 20,000 by December 1992 (see Figure 2). Table 1 shows that traffic on the Télétel system and on the electronic telephone directory has steadily increased over the years. It is interesting to note, however, that the average monthly usage per terminal has gone down from 106 minutes in 1986 to around 90 minutes at the end of 1992. Indeed, the number of calls per minitel has remained constant through that period and has even shown a slight increase. The answer seems to be that not only the transmission rate is faster for the new generation of minitel terminals, but also that users are becoming more efficient and the system's interfaces friendlier to use, thus reducing the average length of a call by almost 20 percent. France Télécom's commitment to continuously expand and improve the system to match the increase in overall traffic can be seen in Table 2.

The early challenges

Télétel had to overcome four serious challenges in the early years. First, there were vicious attacks

by newspaper owners, in particular by François-Régis Hutin, owner of Ouest-France, who saw among many philosophical reasons to stop videotex, a very pragmatic one (Hutin, 1981).¹⁰ A government-run, videotex-based classified ads service was a serious threat to one of the newspapers' main sources of revenue. After a long fight, a political compromise was reached. The newspaper owners agreed to drop their resistance to the videotex concept in exchange for a say in the development of Télétel services, subsidies and technical help from the DGT to develop their own services, and a virtual monopoly on services for two years.

A second challenge came from politicians who felt the system could be abused by the state. They saw this new mode of information dissemination as a potential threat to the liberty, and Télétel as the latest attempt, of the state to manipulate information. Later, the rapid proliferation of "chat" (messenger) services, some of which range from the mildly erotic to the pornographic (messageries roses), brought criticism from both government and private groups who were concerned that the state was billing and indirectly subsidizing immorality.¹¹

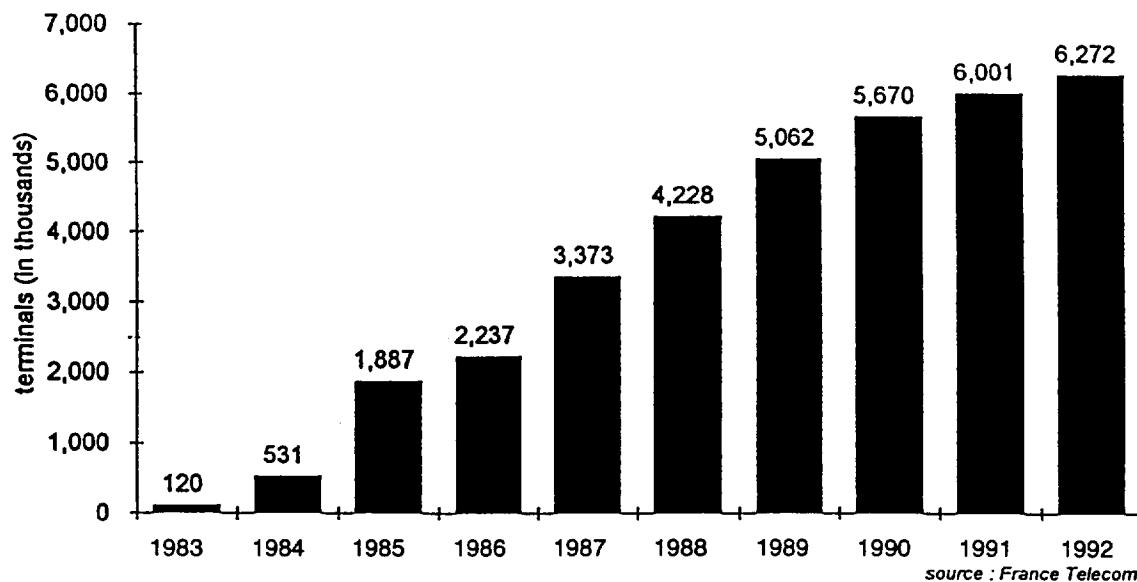


Figure 1. Rate of Minitel Distribution

(Adapted from "La Lettre du Télétel," *France Télécom*, December 1992 and December 1993)

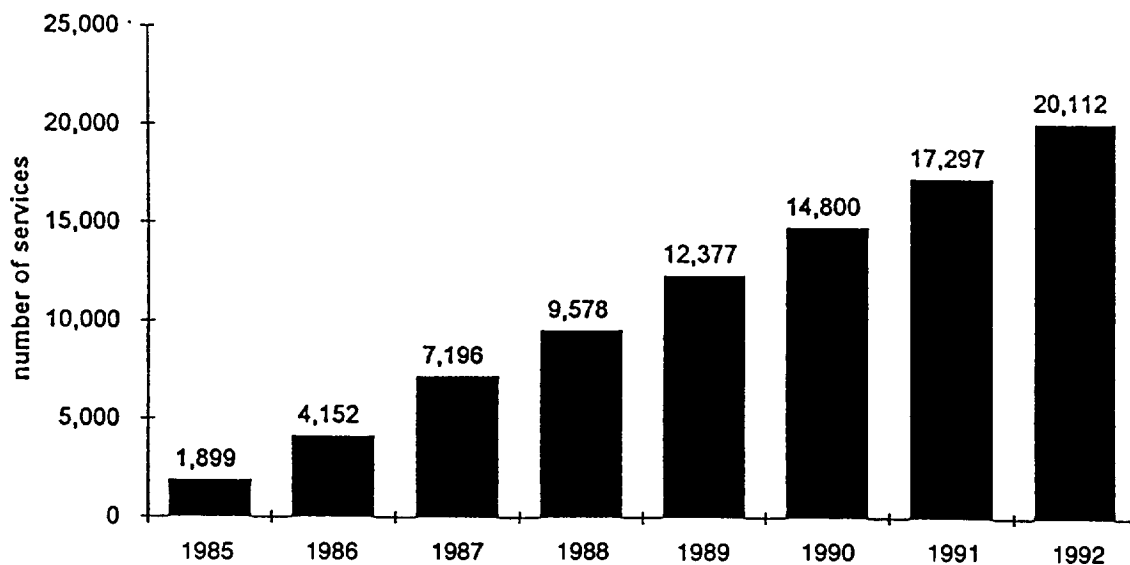


Figure 2: Growth of Videotex Services

source: France Telecom

(Adapted from "La Lettre du Télétel," *France Télécom*, December 1992 and December 1993)

A third challenge was the early battle to establish an international videotex standard. The more advanced videotex system in the 1970s was the British system, Prestel. Prestel was based on the CEEFAX standard, which was different from the one being used by the French. The DGT, realizing that it was at a disadvantage, tried to have its own videotex standard recognized at several international forums. In a decision typical of the regulatory politics in Europe, the Conférence Européenne des Postes et Télécommunications (CEPT) established in 1980 a European videotex "standard" with 10 variations! One of these variations was the French standard. The fact that this decision assured the incompatibility of the European videotex systems during the 1980s notwithstanding, the decision allowed the DGT to continue the development of Télétel as planned.

The fourth challenge that Télétel had to survive was the negative publicity created by the "crash of '85," the only system failure since its inception. The crash was the result of very heavy traffic of "messageries roses" services. The heavy traffic caused an overload of the Transpac switching system, and the network went down generating considerable attention in the national press. The technical problem was easy to solve: the switching system was changed to handle higher

volumes, and there has not been another crash since. The perceptual problem that Télétel was mostly about "sex" lingered much longer, slowed down Télétel's development, and, paradoxically, increased its international visibility.

Overcoming these public controversies made Télétel stronger in the long run. Indeed, the political fury that Télétel generated in the period 1978-80, and later in 1985, led to a full and rich discussion on the issues of privacy rights, authority of the telecommunication agency, regulation of computer services, and the need to prevent the creation of a second class of citizens shut out of the information age. These discussions involved the president of France and the most notable political commentators and intellectuals in the country. They eventually created a broad national consensus on the use and limitations of the technology.

Today, Télétel is an integral part of the French life-style. A survey conducted by France Télécom in October 1992 indicated that 48.5 percent of the working population had access to minitels at home or at work. Another survey, conducted in 1992, showed that the system was used regularly by a broad cross-section of the population in a variety of ways. Table 3 shows that users are

Table 1. Télétel Traffic Statistics Including ETD* (1986-1992)(Adapted from "La Lettre du Télétel," *France Télécom*, April and December 1992, and June 1993)

	1986	1987	1988	1989	1990	1991	1992
Total Number of Calls (in millions)	466	807	1,010	1,242	1,482	1,656	1,775
Total Connect Hours (in millions)	37.5	62.4	73.7	86.5	98.2	104.9	110
ETD Connect Hours (in millions)	6.0	10.0	13.2	16.4	19.9	22.0	23
Average Number of Calls per Month	21.9	24.0	22.2	22.3	23.2	23.8	24.2
Average Usage per Month (in minutes)	105.9	111.3	97.0	93.2	92.4	90.2	87.6
Average Call including ETD (in minutes)	4.8	4.6	4.4	4.2	4.0	3.8	3.7
Average Call excluding ETD (in minutes)	6.3	6.2	5.8	6.5	5.5	5.3	5.1

* Electronic Telephone Directory.

Table 2. Evolution of the Electronic Telephone Directory (ETD) and Videotex Networks (1987-1992)(Adapted from "La Lettre du Télétel," *France Télécom*, 1989-1991, 1993)

	1987	1988	1989	1990	1991	1992
Number of Access Points to the ETD	58	72	78	82	86	88
Number of Ports to the ETD	14,220	17,280	19,020	19,020	20,640	21,120
Number of Information Centers	31	40	42	44	47	49
Number of Documentation Centers	15	18	22	23	25	27
Number of Videotex Access Points (VAPs)	43,160	49,611	50,500	53,000	57,000	59,500

almost equally divided by gender, with 60 percent of the users being in the 25-49 years-of-age range. More than 55 percent of the users are executives, and office and skilled workers. Calls for all professional applications represent 52 percent of the connect time. The proportion of calls to the electronic telephone directory represents more than 43 percent of all calls to Télétel but only 21 percent of the connect time. Interestingly, the most (in)famous calls of all, the calls to the "chat" services, represent only 6 percent of all calls but still make a significant 15 percent of the total connect time (Table 4).

Recent developments

The line of minitel terminals has been expanded to include eight models with varying levels of in-

telligence and functionality (e.g., color screen, extended keyboards, compatibility with ASCII standards, service number memory). These second and third-generation terminals are no longer free; they must be paid for or leased. More than 1.5 million had been installed as of June of 1992. The latest model, which includes a color monitor and an expanded keyboard, sells for FF4,420.

The new generation of minitel terminals allows the user to prepare a message before placing a call, to monitor call setup, and to switch between voice and text transmission during a call. They also serve as an automatic answering device with protected access. A portable minitel that can be used over the cellular telephone network is also available. ISDN¹² terminals have already been tested for the Télétel system. Numeris, as the in-

Table 3. Demographic Statistics of Minitel Users and the Overall French Population
(Adapted from "La Lettre du Télétel," *France Télécom*, December 1991)

	Minitel Users (in %)	French Population (in %)
Gender		
Male	49.8	47.9
Female	50.2	52.1
Age		
15-24 Years	15.6	19.4
25-34 Years	30.3	18.8
35-49 Years	36.2	25.7
50-64 Years	13.5	19.4
More Than 64 Years	4.4	17.7
Job Category		
Agriculture	4.4	3.4
Small Business, Handicraft, Trade	10.8	6.0
Liberal Professions, Executives	23.2	11.1
Office and Skilled Workers	38.1	23.1
Non-Skilled Workers	15.3	25.2
Non-Working	8.2	31.2

tegrated services digital network is known, had 150,000 subscribers at the end of 1991. An electronic mail service, Minicom, was implemented in 1991 and by December 1992 was carrying more than 5 million calls a year, and its volume was growing at a rate of 5 percent per month.

France Télécom is also experimenting with natural language interfaces for Télétel services. The Minitel Service Guide came on-line in 1989 with an interface that allows users to access the guide to minitel services using French, without the need for special commands or the correct spelling. This service averaged around 2 million calls a month in 1992. A new routing capability allows information providers to use several host computers under a single minitel access code. This new routing capability also allows the caller to access another service within Télétel without making a new phone call. Another product is the Télétel "a vitesse rapide" (Teletel fast speed), which opens a whole new series of potential products. It transmits at a rate of 4,800 bits per sec-

ond instead of the usual 1,200 bits per second, thus making possible the transmittal of images and photographs.

With the internal videotex market progressively being saturated and growth slowing down, France Télécom has made the international market a high priority. In 1989, France Télécom created Intelmatique—a division to sell videotex infrastructure and know-how. Recent clients include the Italian and Irish telephone companies. Intelmatique has also purchased 17 percent of the Dutch videotex operator.

Intelmatique markets the Minitelnet service that provides foreign users with access to the Télétel network. Télétel is now available in 27 countries, and the service generated 287,600 hours of traffic in 1992, close to a 100 percent increase over 1990. Italy (42 percent of the traffic) and Belgium (23 percent) are the two major markets (see Table 5). The new service greets foreign users with a personalized welcome in their native language and utilizes the same multi-tariff billing scheme

Table 4. Utilization per Type of Application in Percent of Connect Time and Percent of Calls (1992)
(Adapted from "La Lettre du Télétel," *France Télécom*, December 1992)

	% Time	% Calls
Business Applications	23	19
Electronic Telephone Directory	21	43
"Chat" Services (Messageries)	15	6
Banks/Stock Market/Insurance	11	12
Games/Tests/Astrology	8	5
Recruitment/Training	9	6
Leisure/Tourism/Mail Order	7	5
Transport/Automotive	6	4

used on Télétel. Users have direct access to all the Télétel services, but the utilization of those services differs somewhat from the one in France.

Major efforts are currently being made to export minitel services to the U.S. market. A number of companies (e.g., US West) have established gateways with the minitel system. The Minitel Service Company, another entity of Intelmatique, was set up for the sole purpose of selling videotex know-how in the United States. France Télécom and US West launched a videotex service in Omaha, Nebraska, using French technology and have signed a contract to offer an electronic telephone directory service in Minneapolis/Saint Paul, Minnesota. Finally, US Videotel offers Télétel-based services to minitel owners connected to access points operated by Southwestern Bell (France Télécom, 1991).

There is a broad consensus in France that Télétel is a success from a social development point of view. Its positive impact on the technological literacy of the population is unquestionable. The primary concern about Télétel now is its profitability. But before exploring this concern, this paper describes some of the technical choices and characteristics that made Télétel so far the most successful commercial videotex system in the world.

General Characteristics of Télétel

A comparison between the technical characteristics and policies that were used in implementing Télétel and those of the other commercial videotex systems explains to a certain degree the great success of Télétel and the rather tepid development of the other government-owned systems and the more recently implemented, privately owned American systems. Videotex systems can be compared on four basic characteristics: (1) the terminal design and the strategy of terminal distribution, (2) the system architecture and other aspects of service delivery, (3) the billing system, and (4) the regulatory environment (see Schneider, et al., 1990).

The terminal design and distribution

Two arguments made it clear that Télétel's success was critically dependent on the development of an easy-to-use, dedicated, and inexpensive terminal for mass distribution. The first argument came from the British experience. In Britain, the

Table 5. International Télétel Usage per Country in 1992
(Adapted from "La Lettre du Télétel," *France Télécom*, December 1992)

Country	% of Total International Use
Italy	42.0
Belgium	23.0
Switzerland	9.0
Luxemburg	7.0
Portugal	6.5
Andorra	4.0
USA	3.5
Germany	1.0
Ireland	1.0
Holland	1.0
Other (Spain, Britain, Finland)	2.0

high price of the chosen TV-based videotex configuration was a barrier to implementation. The second argument was that the Télétel investment would be paid back through increased telephone traffic and savings on the production of the telephone directory. The Vélizy experience had also established the need for a user-friendly terminal with an easy-to-use interface. The motto for Télétel became "make it simple"—simple to install, simple to use, simple to manufacture.

In an approach typical of French industrial policy, the government, rather than the consumer electronic industry, decided on the specifications of the videotex terminals. The DAII opened the procurement of terminals to multiple vendors, and the promise of a production run of some 20 million terminals encouraged low bids.

The key decision on whether to distribute minitel terminals free of charge generated intense controversy within the DGT. On the one hand, some senior officers thought that a nominal monthly fee would recover development costs, while counteracting an attitude that "if-it's-free-it-cannot-be-very-good." They also reasoned that once the system was distributed for free, it would be practically impossible to charge for it later without generating intense public resistance.

On the other hand, to distribute minitels on a free and voluntary basis gave it an aura of democracy; those who wished to have a minitel would not be impeded by its cost. It also made it easier for the mass public to try out the device and the services it offered. In what turned out to be a critical decision in the success of Télétel, it was decided that minitel terminals would be distributed free of charge.

The system architecture

Another critical factor in the success of Télétel was the decision to implement the Télétel concept by interfacing the public-switched telephone network with the Transpac packet-switching data network. The subscriber was to be linked to the electronic directory or any other database via his or her telephone through a gateway—called a videotex access point or "VAP"—giving access to the public packet-switched network—called "Transpac"—to which the servers and host computers were to be connected.

This design approach had three basic advantages. First, Transpac charges are based on traffic (i.e., minutes of connect-time) and not on distance. The use of Transpac meant that any provider, independent of its geographical location, had equal access and costs to gain a national audience. Second, it established a common, standard protocol (i.e., the CCITT X.29) making connections to the system straightforward and relatively cheap (FF100,000), which was crucial to attract service providers. Third, the networks were already in place, consisted of the latest technology, and could support a rapid expansion in the number of subscribers and providers.

More importantly, the decision of using the Transpac network kept the DGT from becoming an information provider. With the exception of the electronic directory, the DGT acted as a common carrier and was responsible only for the transmission of information and administration of the network.¹³ This is in contrast to the centralized solution offered by the British and German systems where British Telecom and the BundesPost provided the storage and structure of the databases. In Télétel, the storage and manipulation of information was left to the private information providers.

Building Télétel on a decentralized network and with an open architecture alleviated many of the "big brother" concerns of the press and politicians, and encouraged innovation in information services. With no government interference, a clear set of standards, and easy access to the network, the entry barrier to the information provider market was very low. The number of services exploded.

The billing system

Another critical element in the success of Télétel is the billing system introduced by France Télécom in March 1984. The billing is done by France Télécom and not by the service providers. The system's name, "kiosk," came from the newsstands where a variety of publications can be bought without leaving a record of what was bought or who bought it. The Télétel charges appear on the regular telephone bill as "minitel use" with no reference whatsoever as to what specific service was used.¹⁴

The kiosk works as follows: when the connection to the desired service has been set up through the VAP, the VAP sends charging pulses to the subscriber's meter at a faster than usual rate to cover the cost of using the Transpac network and the cost of the service. The Transpac network keeps track of the connection time and pays each provider as a function of that time. The billing system now allows the service providers to choose from eight levels of pricing.

The strengths of the kiosk concept are that it protects the anonymity of the users (important on both a financial and philosophical level), that it does not require passwords or payments in advance, that service providers do not have to worry about billing and its associated administrative costs, and that it allows differently priced services to be offered easily through a series of different numbers (Dondoux, 1990).

The regulatory environment

The monopoly that France Télécom had in the basic telecommunication services and the fact that it did not have the return on investment pressures of a commercial firm, provided Télétel with the necessary time to mature.¹⁵ Infrastructure-based services like Télétel require a longer time horizon to assess and determine profitability. The regulatory umbrella that shielded Télétel in the early years appears to be one of the critical factors in its success.

Another component of the French regulatory environment that was important to the development of Télétel was the ability of France Télécom to subsidize ventures from its subscribers' revenue. Such subsidies are forbidden by American and British regulations. The subsidies allowed France Télécom to take a long and patient view on Télétel and helped amortize the free distribution of minitel terminals, which amounted to a cost of FF6 billion over 10 years.

There was one specific benefit of this protective regulatory environment (Housel and Davidson, 1991). The ability to quickly implement changes of tariffs without going through a lengthy political process to justify them allowed France Télécom to respond quickly to changing market conditions. For example, there were many services that

Télétel users could access and use without staying connected for very long. The user paid no fee because the tariff allowed free access. Because of the revenue-sharing arrangements with the service providers, however, France Télécom had to pay for each connection. France Télécom asked the regulatory bodies to charge subscribers a small access fee for every connection regardless of its duration. The request was barely scrutinized, and the charge was approved without debate.

Another benefit of the regulatory environment in France was the ability of France Télécom to run the kiosk billing system. The arrangement has come under fire on two fronts. First, the fact that the billing system results in the state (in the form of France Télécom) collecting fees for the distribution of services, which, in some instances, may be deemed pornographic, is seen by some as unlawful. Second, it has been suggested that even if it is not illegal, billing, which could be a very profitable stand-alone operation, should be a service offered by a third party and not by France Télécom. These criticisms have not stopped France Télécom from performing the billing.

The regulatory environment in Europe, with its myriad of standards and protocols, was good for Télétel initially because it served to protect the fledgling service from being battered by competition from abroad. However, that same environment became a barrier to Télétel's penetration of other European markets. Indeed, it took almost 10 years to make Télétel available throughout Western Europe (Greece is the only country with no access). Finally, despite operating in a heavily regulated environment France Télécom pursued an open network architecture and stayed out of the information services business with the exception of the electronic telephone directory.¹⁶

This policy of decentralization and liberalization of services, contrary to the centralization policies in Britain and Germany, led to an explosion of services. Indeed, while in France the number of providers has grown steadily and the number of services today surpasses 20,000, in Britain the number has stagnated at around 1,300, and in Germany the number has not only stagnated but has actually declined to around less than 3,000 (Schneider, et al., 1990).

Evaluation of Télétel

For technologies like videotex, for-profit organizations predominantly use return-on-investment criterion to determine success. However, infrastructure projects like Télétel should not be analyzed exclusively on return on investment. The sociological impact needs to be assessed and evaluated as well (Mansfield, 1983; Mechlin and Berg, 1983). Measures of the success of technological adoption include (1) the rate of diffusion and growth, (2) the impact of the technology (e.g., number of users), (3) user satisfaction with the technology, (4) facilitating the performance of an old task or enabling a new one, and (5) the economic impact of the technology and its return on investment (Edosomwan, 1989; Rogers, 1983; Souder, 1987; Zaltman, et al., 1984). Though measuring the non-financial (i.e., social, educational, and political) benefits brought by Télétel is difficult, the increase in technological awareness and literacy of society, for example, has to be factored in any cost/benefit analysis of the system. The next two sections discuss the social impact of the four criteria listed above and the financial assessment of the return on investment issues.

Social impact

Through its 20,000 services the Télétel system offers information about entertainment events, train schedules, television and radio programs, jobs and classified ads, interactive games, banking services, grocery and home shopping, home banking, comparative pricing, and many other consumer services (Marchand, 1987b; Mayer, 1988; Sentilhes, 1989). Most services follow the same rules and command structures and the same multicriteria search process (e.g., a subscriber deciding on whether to go to the movies can search what films are showing in a given area, on a given topic, or starring a particular actor or actress), making it very easy for users to move from one application to another.

It is hard to assess the impact of Télétel on business because it varies by company size and industry sector. France Télécom estimated in 1990 that the overall penetration of the business sector was at least 30 percent and growing and that the penetration for large companies (more than 500 employees) was 95 percent. Indeed,

some industries have been profoundly affected by Télétel applications. For example, the Telerouting system has influenced the transportation industry in France. Transportation companies have minimized the number of return trips when their trucks and moving vans are empty by posting the schedules of these return trips on minitel and matching them to requests from customers (Marchand, 1987b; Sentilhes, 1989). The impact of these new electronic markets on the efficiency of transactions among firms is profound; these markets are not only restructuring how companies do business but are reshaping entire industries (Malone, et al., 1989).

Almost every single bank has developed its own minitel-based home-banking system, allowing their customers to check the status of their accounts, order checks, pay utility bills, and trade stocks. Most retailers have also developed an electronic catalogue business, and although volumes are moderate at present, they are expected to explode as soon as payment can be done directly with the minitel terminal. Television stations run minitel-based surveys every night. Travel agencies, insurance companies, and consumer products companies have developed Télétel services.

Whether it is to be in greater touch with the client, to increase efficiency in distribution, to gain market share, or to develop videotex products and services, Télétel has become an important component of the business strategy of companies operating in France. Business-related volume represents today more than 50 percent of the overall Télétel volume, and while the overall volume increased by 5.1 percent in 1992, the utilization of professional services increased four times as fast.

From a social point of view, Télétel has had an impact in a wide variety of ways. For example, the success stories of the various Télétel chat services (messageries) range from relatives separated by World War II having found each other to faster matching between organ donors and people in need of a transplant.

The anonymity that the chat services provide has encouraged the sick (e.g., cancer, AIDS) and the troubled (e.g., drug addicts, divorced, abused) to discuss their more intimate problems with others. Also, Télétel has played a role in helping in-

dividuals who have difficulty getting out and around (e.g., the disabled, the elderly) to shop, bank, and make reservations. Universities now use Télétel to coordinate student registration, course delivery, and examination results. Other services give students access to help from tutors at all times.

Télétel services have also been used in the political arena in innovative ways. During the last presidential election, a service allowed minitel users to exchange letters with the candidates. Any voter accessing the service could view the open letters and the politicians' replies. Another example is how the student unrest in December 1986 was followed by using minitel terminals. A service, sponsored by the newspaper *Libération*, allowed organizers to issue instructions to any minitel user to participate in various political activities without the mediation of a third party.

These examples illustrate how broadly Télétel has been used as a decentralized, grass-roots vehicle for the discussion of a variety of societal issues. This utilization is very much in keeping with the original vision of Télématique proposed by Messrs. Nora and Minc in 1978. Today, 34 percent of the population of France has access to a minitel either at home or at work. Furthermore, a recent survey conducted by an independent consulting firm found that 93 percent of all Télétel users are satisfied or very satisfied with the service, that 19 percent of all professionals using Télétel rate it "indispensable," and that 75 percent of users rate it "increasingly useful" (France Télécom, 1993). Based on the number and variety of services being offered (from the original 145 in 1983 to more than 20,000 in 1993), the broad penetration of the service (an installed base of over 6 million minitel terminals and only 5 percent of the ones in homes not being used), the growth in connect time (from 14 million hours in 1985 to 110 million hours and almost 2 billion calls in 1992), and the high level of satisfaction of its users (only 1 percent of users declared themselves "dissatisfied"), one can only conclude that from a social point of view, Télétel has been a success.

Financial assessment

There is a public perception, in part based on the free distribution of minitel terminals, that Télétel

is another Concorde: a high-technology, money-losing proposition. A recent report from the state auditor general has stated that Télétel revenues have not covered its operating, depreciation, and capital costs and that as of the end of 1987 the deficit was FF 5.4 billion (Savattier, 1989). The secretary of the PTT disagreed with that assessment, arguing that the analysis of the auditor took into consideration only the direct revenue generated by the telephone traffic but did not include all the other indirect revenues generated by Télétel (Abadie, 1989; Prévot, 1989).

Settling the argument is difficult for a variety of reasons. First, from a cost-allocation point of view, determining Télétel's share of the costs is a murky proposition. Indeed, it can be argued that Télétel is just a by-product of providing other telephone services, and therefore, little or no cost of the actual infrastructure should be allocated to it. Second, it is difficult to determine the indirect value-added to the French economy (e.g., greater efficiency of electronic markets). Third, France Télécom continuously introduces new products and services that affect previous cost-allocation and profitability calculations. Finally, France Télécom is not particularly forthcoming with the financial data surrounding Télétel.

The total investment in Télétel consists of the cost of the minitel terminals plus the costs of the gateways to the Transpac network (VAPs) plus the costs of ports to the electronic directory network. The following are approximate but non-controversial¹⁷ figures describing the investment of France Télécom in Télétel as of 1989:

Minitel terminals	FF6.2 bn
Electronic directory	FF1.0 bn
R&D directory	FF0.2 bn
VAPs	FF0.6 bn
R&D (Télétel)	FF0.3 bn
Transpac	FF0.3 bn
Total	FF8.6 bn

The official gross revenues from Télétel were approximately FF5.8 billion in 1992. These revenues include fees from revenue sharing with information providers. That amount was close to FF1 billion in 1992.¹⁸ The revenues also include advertising, electronic directory usage above and beyond the free allocation, and rental and sale of minitels. The Transpac revenue generated by Télétel —FF1 billion in 1992—is not included in

the FF5.8 billion. The additional revenues based on value-added tax from products, services, and increased employment spawned by Télétel should also be included but are difficult to calculate.¹⁹ The secretary of the PTT estimated that the total value-added of Télétel amounted to approximately FF6 billion in 1988 (Prévoit, 1989). Documents from a telecommunication consulting firm put the amount at FF5.4 billion (TERSUD, 1989). Finally, the cost savings from printing fewer telephone books (FF147 million) and having less directory assistance operators must also be considered.

France Télécom claimed in 1985 that the break-even point for Télétel would be achieved in 10 years. France Télécom calculations in 1989 showed that the yearly revenue per minitel terminal was FF432 and that the payback period was 5.7 years (Abadie, 1989).

The official version is that Télétel revenues and expenses were in balance at the end of 1989 and the system was expected to start showing a significant return on investment in 1992. A recent audit by Coopers and Lybrand for France Télécom has confirmed that the breakeven point was reached at the end of 1989. The audit pointed out that Télétel will have made a profit of FF4.3 billion from 1984 through the year 2000, equivalent to an internal rate of return of 11.3 percent (Dawkins, 1992).

On the basis of the numbers we have been able to gather and cross-reference (though they are practically impossible to confirm), we can conclude (1) that Télétel has reached an economic break-even point and (2) that from a long-term economic point of view (say 1978–2000) Télétel will possibly make a sizeable profit with an overall return on investment of around 10 percent.

Senior officials of France Télécom view this type of accounting as premature and potentially misleading since Télétel is a major infrastructure project for which profitability should be measured on a long-term basis and should not be the sole criterion of success (Abadie, 1989). Still, France Télécom has become very sensitive to pricing and is adjusting fees continuously to match demand and to create demand for new products.

The sociological evidence (rapid growth and adoption, impact on a large number of users, enabling new tasks to be performed, high user

satisfaction) and the financial evidence (positive internal rate of return, profitable, creation of more efficient markets) supports the notion that Télétel is a French industrial policy success story.

Analysis

The Télétel story is a story about a successful government-directed technological push sustained by political will and technical vision. It is also a story about how, even within a fairly deterministic industrial policy framework, individuals still need to make decisions on the fly to adapt to changing social, political, and technological environments. Télétel offers some interesting lessons that can be generalized to government-sponsored IT initiatives. The lessons from the Télétel story are the following.

Vision, deep pockets, technical capabilities, and understanding of network externalities as enabling factors

Télétel's development is a stereotypical case of the French industrial policy of "les grandes aventures." The uniqueness of the success of Télétel can only be understood by analyzing the industrial policy and political environment of France that nurtures high technology ("technologies de pointe") projects. But are there any lessons that can be learned and applied to other products and services in other contexts? After all, the governments of Britain and Germany, among others, attempted to develop a similar product without success. To answer this question, the critical success factors in the implementation of Télétel must be examined.

On a political level, the will to see this project through was maintained through at least three administrations of different political persuasions and several secretaries of the PTT. This unwavering commitment to "la grande aventure du Télétel" was crucial to overcoming the large start-up costs of the project. The political discourse that addressed head on, and then combined, the need for a computer-literate society with the protection of personal liberties and privacy diffused all sources of resistance. It also led the government to stay out of the information provision business.

On a regulatory level, the monopoly of the basic services and networks allowed the DGT (now France Télécom) to subsidize the start-up costs and free distribution of terminals, to have a long-term perspective on videotex services as an investment, and to be able to create one standard and enforce it. These were all critical factors in the success of Télétel.²⁰ The subsidies removed some of the most pervasive barriers to adoption of innovations, their initial cost to the users (Rogers, 1983; Zaltman, et al., 1984). For example, a study of 11 customer-oriented strategic systems found that those systems that had a small nominal charge were adopted more rapidly than those that charged a larger fee (Horner-Reich and Benbasat, 1990).

On a technical level, the factors that made Télétel successful include the ability to develop and implement (1) a state-of-the-art telephone and data transmission network, (2) an easy-to-use interface, (3) an inexpensive terminal, and (4) a transparent billing system that ensured anonymity. These technical capabilities reduced the complexity of the system and its costs and thus contributed to the rapid adoption of Télétel.

An important element in the success of Télétel was the intuitive understanding by the DGT of the dynamics involved in network externalities.²¹ The DGT created a critical mass by aggressively distributing an easy-to-use terminal at no cost to its subscribers. The DGT also made immediately available a highly useful "trigger" application (i.e., the electronic telephone directory). Also, by establishing clear and simple technical standards, the DGT allowed information providers to offer services quickly and cheaply with very few administrative headaches. These three factors generated a fast-feeding virtuous cycle.

Télétel as an example of successful technological diffusion

The diffusion of technological innovations can be characterized by their relative advantage; their compatibility with the existing values, past experiences, and needs of potential adopters; their complexity; their trialability or reversibility; their susceptibility to successive modifications; and their observability and communicability (Rogers, 1983; Zaltman, et al., 1984). Furthermore, the rate of adoption of an innovation is affected by

the effectiveness of the communication between the owners of the innovation and the target audience. In turn, the effectiveness of communication is affected by the degree of heterogeneity of the audience, the social norms, and the involvement of the opinion leaders (Rogers, 1983). How do these concepts apply to Télétel?

The degree to which an innovation is perceived as better—in terms of efficiency, cost, convenience—than the idea it supersedes is its relative advantage. France Télécom established the relative advantage of Télétel by "selling" it to subscribers as a quick and easy way to get information at no extra cost. France Télécom's information services had a terrible reputation. Most telephone users were aware of how hard it was to obtain telephone number information through an operator. And given the rate of growth in telephone lines, the telephone books were quickly obsolete. This presentation of Télétel was also an effort to sell the system as a response to a specific customer need. Awareness of customer need has been reported as a predictor of fast adoption (Horner-Reich and Benbasat, 1990).

The degree of compatibility with the existing values, past experiences, and needs of potential adopters affects the success of an innovation. Télétel was highly compatible with the values of French society. Télétel was very much part of the government campaign to make France a "first world" power in high technologies. As such, Télétel was, like Ariane, the Concorde, and the high-speed train (TGV), a project intimately linked to the French values of independence and great engineering achievement. It remained so through several changes in government.

The degree to which an innovation is perceived as difficult to understand and use, i.e., its complexity, negatively affects its rate of adoption. The minitel terminals and the first service offered (the electronic telephone book) were purposefully designed to be both easy to understand and use.

The degree to which an innovation may be experimented with on a limited basis, i.e., its reversibility, positively affects the rate of diffusion. The minitel terminals were free and optional. The subscribers did not need to commit to using the system, and if they decided to use it they could stop any time they wanted. They could also use whatever service they wanted whenever they

wanted because there were no subscription fees, and the charges were based on use. This "divisibility" (Zaltman, et al., 1984) led to a faster rate of adoption.

The degree to which the innovation can be refined, elaborated, and modified, as opposed to becoming obsolete because of inflexibility, is positively related to its adoption. The commitment to improve the system (for example, the quick repair of the crash of 1985), the constant wave of new products, and the explosion in services being offered through Télétel establish that Télétel was here to stay and was not going to become obsolete, therefore increasing the attractiveness of adopting the system.

Finally, the rate of adoption is affected by the effectiveness of the communication between the provider of the innovation and the users and potential users of the innovation. A key aspect of that communication is the visibility, clarity, and demonstrability of the results. France Télécom reported through the mass media the number of connect hours, satisfaction of users, and number of services on a regular basis. The metrics were simple to understand: They described how many hours people were using the system and what they were doing with it. Even the tremendous exposure given to Télétel through the "chat" services proved to be a positive push for adoption as was the involvement of almost every important political figure in the debate.

A variable that can negatively affect the effectiveness of communication is the heterogeneity of the target users. France Télécom followed a staged implementation process. It carefully chose the communities where Télétel was to be offered first. The plan was to balance likely adopter areas (e.g., Paris and its suburbs) with representative adopters (e.g., more conservative counties) to ensure that more users felt that Télétel was "for them."

From the process discussed above, one can conclude that France Télécom managed the introduction of Télétel very well. Indeed, France Télécom established the relative advantage of Télétel, aligned it with the political and social values of the time, reduced the complexity and cost of the system, made becoming a user highly reversible, and communicated the results and benefits very effectively. However, we have found

no document where the strategy for implementation was discussed in all its details. The process of diffusion seems to have been started with a sound idea and a clear vision and then managed by continuously monitoring the environment and adjusting to it. Télétel is not only an example of a successful diffusion of a technological innovation but can also be seen as a "gateway" innovation (Zaltman, et al., 1984), i.e., an innovation that has opened opportunities for other innovations and increased their probability of success. Indeed, after the success of Télétel, automated transactions systems (e.g., teller and ticket machines, parking attendants, gas stations, tourism kiosks, etc.) have sprung up throughout the country.

Finally, France Télécom's deep pockets and vision allowed it to enact a comprehensive process of technology assessment without having to worry about the costs. The technological assessment was well-aligned with the national objectives. The comprehensive process matched key strategic national and organizational issues to an appropriate and clever technological solution. This carefully crafted match led to the fast adoption of the technology.

Huff and Munro (1985) in their field study of Information Technology Assessment and Adoption (ITAA) found that the ITAA-related behavior of some firms was driven by the issues deemed to be critical at the moment, while in other firms, the ITAA behavior was driven by a new technology. Though Huff and Munro did not find an organization that exhibited both behaviors at the same time, they commented on the desirability to develop such an ability. They described such a potential scenario as "somewhat idealistic" because of the large costs involved and as "a target model toward which sophisticated organizations may wish to move" (p. 331). They labeled such scenarios as "Normative-Ideal."

We believe that France Télécom's approach to the design and implementation of Télétel—a top-down effort closely geared to the strategic planning process of the country and a thorough bottom-up identification of opportunities and scanning of the technological environment—is a rare example of the "Normative-Ideal" model of ITAA suggested by Huff and Munro (1985). As such, Télétel offers an opportunity to understand the difficult and complex process of building a

successful national information technology infrastructure.

Conclusion

Télétel can be seen as the epitome of an information technology product spawned by government industrial policy. There are few examples of a technology having been introduced so successfully by a government on such a large scale. What can other countries learn from the Télétel experience? The French government made a success of Télétel by: (1) developing a vision, explaining it to the public, and sticking to it; (2) building and maintaining a state-of-the-art network; (3) taking a long-term perspective on return on investment; (4) giving the public gateways to the network free of charge; (5) giving incentives to hardware manufacturers to build a dedicated, simple to use terminal; (6) offering immediately an easy-to-use and useful application; (7) creating an open architecture and a set of standards to simplify communication protocols; (8) enforcing an interface to simplify the use of information services; (9) taking care of administrative details (e.g., billing) to allow information providers to concentrate on services; and (10) getting out of the way to let the creativity of private enterprise drive the system. We believe that these 10 decisions constitute sound strategy to introduce information technology on a national scale.

There are critics that still argue that Télétel is not profitable and that it is mostly a local success because its penetration of the international markets remains modest. People also argue whether the reputation of what was one of Europe's worst telecommunication services, and now is one of the best, has been enhanced or tarnished by Télétel. However, with 34 percent of the overall population being users of Télétel, there is little disagreement that Télétel, as a gateway innovation, has had a substantial and positive effect on the computerization of French society.

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Endnotes

- ¹ This article is partially based on a case study written while the first author was a visiting professor at INSEAD. The study was funded in part by the INSEAD R&D Division, and its support is gratefully acknowledged.
- ² Videotex is a generic term for a computer-based, interactive system to access and selectively view text and graphics on a terminal screen. The content is usually organized into tree structures of pages that are selected from a series of hierarchical menus. Videotex systems typically offer a wide range of information retrieval, interactive and transactional services such as directory and reservations systems, financial reports, home banking, and shopping. Videotex was developed in Europe in the mid 1970s for consumer applications. Because of its consumer origins, videotex excels at delivering information to untrained or casual users. The user may use a dedicated videotex terminal or other access deliveries (e.g., personal computer). The primary objective of commercial videotex systems is the efficient delivery of value-added information and services to a maximum number of users profitably for both the system operator and the information providers.
- ³ The system is popularly known as Minitel. In strict terms, however, minitel refers only to the dedicated terminal itself. Throughout this case Télétel is used when we refer to the whole system and minitel when we allude to the device.
- ⁴ Although the "enemy" has changed and Japan is now the more commonly perceived threat, the policy is still very much in place today as illustrated by the French government's decisions to save the consumer electronic companies Bull and Thomson from insolvency in 1991 and again in October of 1993.
- ⁵ These are very much the same arguments that Vice President Gore is using in selling the idea of a National Data Superhighway (see Markoff, 1993).
- ⁶ Though the exchange rate of the French franc (FF) has fluctuated in the last decade between 4 and 10 FF per American dollar (US\$), its trading "band" is typically between 5 and 6 FF/US\$. The average value over the last decade has been close to FF5.15 per US\$. By comparison, the U.S. government has been predicted to spend only \$1 billion annually of the \$200-400 billion expected cost of the American national data highway over the next 15 to 30 years (Wright, 1993).
- ⁷ The cost turned out to be FF1000. By 1989, the cost was FF1600.
- ⁸ This break-even analysis was very conservative since it did not include the savings of slower growth in directory assistance costs.
- ⁹ By comparison, the British television-based system Prestel had a field trial with 1,400 participants in 1978 and started commercial service in the Fall of 1979. Full nationwide operation was established in March 1980. At the end of 1981,

Prestel had only one-tenth of the users predicted for that time (Thomas and Miles, 1989). The major reasons for this failure have been attributed to the late delivery and high prices of television monitors (Prestel was television-based and needed a connection between the telephone and the television set), uncoordinated marketing, and bad quality of the databases (Schneider, et al., 1990).

¹⁰ Typical of the attacks is the "call to arms" by the political commentator George Suffert. He argued — in an article titled "The fight of the century: Teletex versus paper" published in *Téléqual* magazine in 1979—that it was dangerous to let the DGT have a monopoly on the videotex system. He wrote, "He who owns the wire is powerful. He who owns the wire and the screen is very powerful. He who owns the wire, the screen, and the computer has the power of God" (Suffert, 1979).

¹¹ The chat services are very lucrative since both individuals "talking" pay for the "conversation," unlike a telephone conversation where only one party gets charged for it.

¹² ISDN (Integrated Services Digital Network) is capable of handling data, voice, text, and image transmission on the same line.

¹³ That has now changed. France Télécom decided in 1990 to enter the information provision business by offering what they called added-value services. Most of these services are being offered through joint ventures with privately owned companies.

¹⁴ The lack of details in the bill as to the specific service purchased is to protect privacy. Subscribers that have a question about the billing can either (a) request a detail bill every month at a cost of FF8 a month, or (b) request to check a particular charge on a given month. In either case, the information provided by France Télécom is the connection's date, time, duration, and the rate that was charged for it. France Télécom never divulges the actual service purchased.

¹⁵ France Télécom is directly accountable to the French government for all its ventures and is required to justify its fee structures. France Télécom, more so than other state agencies, is asked to demonstrate the viability of its investments and therefore, is under some profitability pressures, mild as they may be.

¹⁶ Whether France Télécom would have taken such a position without the strong pressures of the press lobbies and consumer watchdog groups is debatable.

¹⁷ The controversy is not about the costs but about the revenues that Télétel has generated.

¹⁸ France Télécom takes a 30 percent fee on the revenue generated by information providers. Payments made by France Télécom to service providers for their share of Télétel revenues increased from FF278 million in 1985 to FF1.3 billion in 1987 to FF1.8 billion in 1989 and reached over FF2.5 billion by December 1992 (France Télécom, 1993).

¹⁹ Keeping track of all the revenues generated by services directly or indirectly provided through Télétel is practically impossible because more and more businesses are using Télétel in a variety of ways. A survey of business users of Télétel showed that 65 percent of the businesses that had developed telematic applications rated them profitable, 20

percent rated them potentially profitable, 8 percent did not know, and 7 percent rated them as unprofitable (France Télécom, "La Lettre du Télétel," 1990).

²⁰ The willingness to take a long horizon perspective on recovering the start-up costs removed the one barrier that has inhibited the development of videotex in the USA. The issue of government being more "patient" with infrastructure investments and therefore more willing, indeed responsible for them, is a very current one. For example, Vice President Gore, in defending government involvement in the National Data Superhighway, has stated that the private sector won't gamble on such a risky investment (Markoff, 1993).

²¹ The value of a network for any member of the network increases with the number of members on the network (Allen, 1988; Kahn, 1971). Also, as the number of uses of the network increases, so does the perceived value of the network. Finally, the more members there are on a network, the more likely it is that uses will be offered on that network. Reducing the entry barriers (usually cost) to the service providers and to users (usually ease of use and cost) starts a virtuous cycle.

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