
The Possible Development of Telecommunications and its Effects on the Telecommunications Industry

D. Elias

Phil. Trans. R. Soc. Lond. A 1978 **289**, 19-28

doi: 10.1098/rsta.1978.0043

Email alerting service

Receive free email alerts when new articles cite this article - sign up in the box at the top right-hand corner of the article or click [here](#)

To subscribe to *Phil. Trans. R. Soc. Lond. A* go to: <http://rsta.royalsocietypublishing.org/subscriptions>

The possible development of telecommunications and its effects on the telecommunications industry

BY D. ELIAS

Bundesministerium für das Post- und Fernmeldewesen, Adenauerallee 81, 53 Bonn 1, Germany

The lowering of the cost of electronic technologies will not only result in a decrease of the costs of systems for traditional telecommunication services – seen relatively – but also in the opening up of new fields of application for such technologies. As the development of data processing in recent years has shown, this may lead to the coming into existence of new forms of telecommunication. In view of the technological development to be noted in the field of office technique, we may assume at present that text transmission will expand considerably in the future.

Numerous and varied problems will result from this for the telecommunications industry. The demand for existing telecommunication services, in particular private telephone stations, will run along a higher level in the industrialized countries in the next few years than originally expected, so that the state of full development of the telephone network will be reached at an earlier date. For the national telecommunications industry this will necessitate the opening up of new markets.

New forms of telecommunication in business are characterized by close relations between the processing of information and the transmission of information. On the one hand, this enlarges the range of the telecommunications industry but, on the other hand, it makes it necessary for the telecommunications administrations and the conventional telecommunications industry to develop the services they offer in conformity with the requirements of data and text processing.

This year the telephone is celebrating its one hundredth birthday. Although not the oldest child of telecommunications, it seems to us today the most important, as almost 400 million sets can be found in all countries of the world. If we retrace its history, we shall not only come across figures giving evidence of its enormous distribution, but we shall also come across names: names of persons who were present at its birth, for instance, Bell; names of pioneers such as Strowger; but also the names of technical systems that have shaped telephone engineering for decades and continue to do so; and finally, the names of those – few – firms that have produced and produce these technical systems and that are inextricably linked with the history of telecommunications.

If we take a look into the future of telecommunications, it would seem as if telecommunications had lived in contemplative peace for the last hundred years, as if the establishment of a worldwide telecommunications network, accompanied at times by the most violent set-backs caused by war, was a mere trifle in comparison with the developments which will take place in the field of telecommunications in the coming years and decades. The reasons for this are manifold. I should now like to try, on the basis of the further development of telecommunications, to explain these reasons to you from a subjective point of view, and in particular to indicate the attendant problems for the telecommunications industry.

1. THE PRESENT-DAY SITUATION

Before turning my attention to the 1980s and after, I should like first of all to comment on the situation of the telecommunications industry today.

1.1. *The telecommunications market*

In 1975, about £18750 M was invested in telecommunications throughout the world. North America and western Europe accounted for almost two thirds of these investments, Japan for some 14 %, the Comecon countries for 11 %, and the 'rest of the world' – South America, Asia, Africa and Australia – for less than 9 % of all telecommunication investments.

This is even without the inclusion of China. We may therefore say that the telephone is almost exclusively a concern of the highly industrialized countries. And not only the telephone itself, but also the production of telecommunication equipment, or, expressed in another way, the telecommunications industry, is very unevenly distributed. Scarcely more than 20 firms – excluding the Comecon countries – compete on the world market, and between them they produce 90 % of all equipment.

Continuing our analysis, we very quickly realize that this market also has its giants. In 1975, Western Electric and I.T.T. together produced a third of all the telephone exchange equipment that was installed in the world. It should, however, be mentioned in this connection that, to date, Western Electric has made its equipment almost exclusively for the North American market and has rarely appeared as an export company.

So much for the existing telecommunications market. However, besides this quantitative breakdown, there seem to me to be three other characteristic aspects.

The first concerns the development of the telephone networks in the Western industrialized countries. We in western Europe have scarcely given a thought in past years to what attaining a level of development comparable with that of, for instance, the Swedish or U.S. networks, would mean. At least we in Germany were too occupied with solving the problems posed by short-term development of the networks. Now, however, we have reached the point where complete development of the networks is within sight.

By approximately 1985, almost every household will have or will be able to have a telephone station at its disposal. The effects of full development – and here I am looking at the situation in my own country – are already becoming clear and painful to the telecommunications industry.

Whereas in 1972, 1973 and 1974 the Deutsche Bundespost still invested about £1500 M annually in the development of the telephone network, in 1977 the amount will be just about £1000 M, a decrease of one third. We had in 1976 about 1.4 million new subscribers and we expect about 1.6 million in this year. This is in spite of a record demand for telephones. In the next ten years, too, the volume of investments will decrease rather than increase because the costliest part of the telephone network, the cable network, largely exists already.

Of course, we shall still have to invest in our telecommunication networks in ten and twenty years' time as, first, there will not be zero growth, and secondly, the useful life of all technical equipment is limited. The growth remaining after complete development and the capital expenditure on replacements for telephones will, however, in all probability be substantially less than the investment sums made over to the telecommunications industry today. The national markets of the traditional telecommunications industry will shrink and the resulting excess capacity will necessitate more export-orientated thinking.

But there are two other reasons for the necessity of the telecommunications industry to export. The first is that, viewed in the medium and long term, it will be primarily the demand of the countries which today are not so highly developed that will determine the worldwide growth of telecommunications and hence the sales chances of the telecommunications industry. Not only the position of the industry in the domestic market but – even more so than before – its position on the world market will be decisive.

The second reason for the necessity to export is an economic one. The development of new telecommunications systems, of switching systems in particular, entails ever greater costs, all the more so as – and I shall explain why in a moment – the useful life of these systems appears to be diminishing rapidly, as the pace of technical progress renders them quickly obsolete. The development costs cannot, however, simply be absorbed in the price of the switching systems, for the telecommunication companies have some hard calculating to do when introducing new systems.

The telecommunications industry is thus obliged to find as many buyers as possible for its products in order to achieve a better distribution of the development costs. In view of the falling demand on the home markets, this can only be achieved by the industry increasing its efforts to export.

The effects of this development, as I am repeatedly told by circles of the telecommunications industry, can already be felt today. A raw wind is blowing on the export market. The success or failure of rival firms is not always determined by the quality of their products alone: sometimes the respective national governments provide support for their telecommunications industry on a considerable scale. This is a subject, by the way, which also appears significant to us in view of European harmonization endeavours.

1.2. *Technology*

I now come to the second aspect, characteristic of the situation today. The technological development of semiconductor components is progressing at breathtaking speed. As pleasing as it is that these components are becoming more and more efficient and relatively less and less costly, the effects on the telecommunications industry – yes, on the telecommunications industry – are serious.

To illustrate this, let me give you the example of the electronic switching system which the Deutsche Bundespost is in the process of introducing. Development of this system began a good ten years ago. At that time, processing intelligence and storage capacity were still relatively expensive, as was hardware altogether. As a consequence, a great many functions of the system were incorporated into software. The starting point in switching technology, just as in data processing, was the large central computer, surrounded by a periphery without its own intelligence. Control and monitoring functions were all taken over by the central computer.

Now the costs of a logical function have, thanks to the progress made in the integration of components, decreased by a factor of 10^3 . Hardware has become inexpensive and micro-computers have opened up completely new possibilities with regard to system construction, and they also help solve software problems that at times seemed incapable of solution.

Technological development has not of course simply passed by the electronic switching system without leaving its mark; the technological plan of the system was frequently adjusted during the developmental stage to correspond to the respective level of technology. Precisely this gives rise to a serious problem, for it is not the exclusion of technical innovations which

leads to difficulties, but their constant inclusion, which makes it hard to bring development activities to an end.

The telecommunications administrations and the telecommunications industry alike are thus required to be courageous enough to call for a 'technical deadline', as it is better, to put it in a greatly exaggerated form, to *sell* the second most modern system than to have the technologically most modern *in the laboratory*. Probably we shall have to say that a combination of the two is best.

The development of a telecommunications system in the future will presumably be a continuous process, not as in the past. The innovation cycles of thirty and more years with which we were acquainted in switching technology have become outmoded. I believe, however, that we shall have to redefine the term 'system'. In our previous understanding of switching engineering, the system and the technology of the system were largely regarded as homogeneous; a major technological change, for example, a change of selector, also led to a change of system.

The pace of technological progress forces us today to understand by the term 'system' the framework of what can be achieved, rather than its technological implementation, just as in telephone transmission engineering, for instance. Within one and the same system we have technological variations and further developments of the original system. The telecommunications industry is therefore obliged to have permanent capacity for development available and to be able to offer further developments within short spaces of time.

I am well aware that this is more easily said than effectively done. The telecommunications industry is naturally interested in maintaining an appropriate balance between development and production, and the telecommunications administrations also incline away from too rapid technical development for operational reasons. Nevertheless, I consider technological flexibility indispensable, not least in view of the competitive ability of the telecommunications industry on the world market.

I regard it as one of the tasks of the telecommunications administrations to help improve competitiveness. We shall have to find suitable ways and means of doing so and I hope that this will soon happen. In the technological race, the telecommunications industry of Western Europe is faced with particular problems caused by our inability, despite all our efforts, to catch up with the U.S.A. and Japan. The technological lag behind the U.S.A. has repercussions on the development of our systems: the shorter the innovation cycles regarding system technology become, the more critical this lag will be.

I will close this section on technology by drawing attention to a problem whose actual effects on the telecommunications industry I am not yet able to assess fully.

The integration of semiconductor components to ever greater functional units is leading to a shift in know-how from the manufacturer of the equipment to the manufacturer of the components. The more functions are combined in one chip, the more functions necessary for a particular device are incorporated in the component, the less the knowledge that is required to produce the finished equipment. The know-how required for a pocket calculator or for a digital watch is not to be found in the case but in the component, which is (for the most part) not produced by the manufacturer of the finished article. This applies equally to the field of telecommunications: if, in the future, entire functional units are combined in one or a small number of highly integrated components, components which are not delivered by the telecommunications industry but by other parties, the result will be not only the shift in know-how

that we have already mentioned but also completely new correlations and competition from other quarters. Moreover, the loss of production depth consequent upon this development will confront the telecommunications industry with additional problems in respect of the safeguarding of jobs.

1.3. *Terminal equipment*

The third characteristic aspect of the situation today is the development in the field of terminal equipment for telecommunication networks.

Until quite recently, the function of terminal equipment was perfectly clear: terminal equipment served exclusively as input and output equipment for communications to be transmitted by electrical means. It was equally obvious that it fell within the competence of the telecommunications administrations and was of course produced by the telecommunications industry.

This was changed when data processing began to discover and to exploit telecommunications. Data teleprocessing posed entirely new problems for all concerned: the telecommunications administrations were forced to realize that the main task of the computer connected to the telecommunications network did not lie in performing general telecommunication duties but in processing communications; computer manufacturers were obliged to admit that they had a new, often highly disagreeable, interlocutor in the telecommunications administrations, while the telecommunications industry was faced with completely new rivals who were not afraid to question popular ideas on the set-up of telecommunications.

The clash between the two fields, communications processing and communications transmission, was violent, and it required an intensive period of learning on both sides before the awareness of the problems common to both had reached the point where the two sides were able to think and work constructively together.

I consider this partnership extremely important. The strict separation of communications transmission from communications processing, the taking over of processing tasks by the telecommunications administrations, the taking over of transmission tasks by e.d.p. users: none of these can in the long run lead to economically viable solutions. I believe that in the last few years the advantages of a real partnership have become obvious to all, and this pleases me very much.

To return to the telecommunications industry, the tendency which may be observed in data processing towards the decentralization of processing and towards the discovery of new applications means on the one hand that processing is moving closer to the working place and is producing new, important communication requirements, and on the other, that the number of jobs required by data processing systems is increasing.

Thus other instruments of communication are appearing in addition to the telephone, whose manufacturers do not, however, come from the 'classical' telecommunications industry, or, at least, the majority do not. Expressed in other terms, the circle of telecommunications firms is growing larger. The danger facing the 'classical' telecommunications industry is that it will not catch up with the newcomers and will be ousted from the field of terminal equipment.

2. POSSIBLE NEW TELECOMMUNICATION SERVICES

In the Federal Republic of Germany we have made considerable efforts in the last three years to fathom the darkness surrounding the future of telecommunications. But perhaps I had better not use the word 'darkness', because the communications paradise on the horizon appeared only too bright and promising when we began analysing what seemed possible and desirable in the telecommunications of the future. By 'we', I am referring particularly to the Commission for the Development of the Telecommunication System (KtK), which for two years examined the future development of telecommunications in the Federal Republic of Germany. The Commission's work was accompanied and supplemented by market studies, the aim of which was to clarify telecommunication requirements.

The result of the Commission's work was not able to inspire great optimism, for it soon became obvious that financial reasons would prevent rapid progress towards a telecommunication society, quite apart from the question of desirability.

The results are nevertheless fascinating, if not quite as much for the journalists as for the specialists. The number of possible new forms of telecommunication capable of implementation without any major preparations having to be made by the administrations is astonishing. I should like to illustrate this with some examples, and here it would seem appropriate to distinguish between those forms of communication which are primarily intended for business use and those which are chiefly designed for private use.

2.1. *Business communication*

If we consider the field of business communication first of all, we shall see that the tendency, already described, towards the extension of data processing, will continue in an intensified way. We expect data processing, as text revision and text processing, to become part of general office duties in the next few years. Today's typewriter will be replaced by a machine which has electronic storage and which can correct and edit in addition to drawing up texts. These machines will be capable of communication, so that they will be able to have direct access to higher, internal text processing devices and also to other machines via internal and public telecommunication networks.

Last October we began drawing up standards for a text communication service. As all the important producers (including I.B.M. and Rank Xerox) are cooperating with us, we are hoping before too long to achieve concrete results which could also be useful as far as world-wide standardization is concerned. Development in the office will go, I believe, a step further than the development that we have been able to observe to date in the field of e.d.p.

Data teleprocessing systems have so far always been communication and processing systems geared almost exclusively to application for groups of users; closed systems whose incorporation in the open communication systems of the public telecommunication networks gives rise to considerable difficulties.

Text communication has been regarded from the very beginning as an open system of communication in which every partner must be able to reach every other partner regardless of the type of equipment he has. Comparable on the other hand to the development of e.d.p. is the fact that terminal equipment is not chiefly communication equipment – quite different from, say, the telex machine today. The terminal equipment is fundamentally an office typewriter; in other words, it belongs to office machines with all the resulting consequences. It is

very important, I think, to realize this, just as much for the telecommunications administrations as for the telecommunications industry.

In addition to text communication, facsimile transmission will probably become an important part of business communication. Here, too, we are making great efforts to continue the work on standardization begun in the C.C.I.T.T. in order to create a basis for a general communication service. I have the impression that a similar development may be observed here, a development leading to a combination of copying machine and facsimile transmission equipment, so that we will have terminal equipment which does not serve communication purposes exclusively.

According to the market forecasts I have on hand – which seem very optimistic to me – 150 000 pieces of text communication equipment and 150 000 of facsimile transmission equipment are predicted for the Federal Republic of Germany by 1985. Requirements for Europe could be estimated at approximately half a million. At a unit price of about £3750 and £1500 respectively, a not unrealistic price for terminal equipment within the foreseeable future, this would amount to a sum of approximately £750 M to £875 M for the Federal Republic of Germany alone.

Whether electronic mail will be of high significance in the not too distant future, I still doubt at the moment, even if this is a subject which concerns me very much because of our great difficulties in the postal sector. It is to be expected that the (in my opinion) absolutely necessary inclusion of private households in such a system of electronic mail will present insuperable financial problems for many years to come. However, there would seem to be interesting openings in the market for partial solutions, similar to your service in Great Britain, and extended to international traffic relations.

In addition to these new forms of communication, the telecommunication services which have already been introduced will, of course, continue to develop for business communication. Complete development of the telephone network will indirectly affect the field of business too. As more and more people can be reached by telephone instead of by letter alone, greater use can be made of the telephone for business purposes than previously. Furthermore, technical progress in the field of telephone extension engineering has made possible new solutions allowing flexible adjustment of private branch exchange characteristics to the individual communication requirements of a particular business. Data traffic will continue to grow in line with the increase in data teleprocessing systems. Thinking of Euronet or Swift, these will really be matters for the telecommunications administrations and not for the telecommunications industry.

It is still too early to predict the extent to which the development of text communication and of facsimile transmission will affect telex traffic. As long as text and facsimile transmission are primarily performed as individual national telecommunication services, I see no serious danger for the telex service.

Summing up the developments in the field of business communication, the outlook for the telecommunications industry appears as follows:

The extension of communications processing to serve general office purposes as well is opening up new possibilities in telecommunications.

Communications processing and communications transmission are increasingly becoming complementary functions of internal organization and the fulfilment of tasks.

The telecommunications industry is faced with the fact that data processing and office technology will mainly form the basis of this development.

So in this new branch of communication, too, the industry is finding itself confronted by competitors who are vastly superior as regards know-how and the range of products in important sections.

It should try to introduce its communications know-how on a partnership basis in order to be able to retain and later consolidate its position.

2.2. *Private communication*

Predictions of the development of telecommunications for private use are surrounded with even more uncertainty than are predictions of the development with regard to business use. Whereas in the business sector one can be reasonably certain that economic reasons will decide either for or against the introduction of new forms of communication, and hence that the future development of telecommunications follows calculable criteria, economic factors are only of limited value in the private sector.

If we find it difficult today to determine exactly why, for example, the demand for telephones in the Federal Republic of Germany was on such an unprecedented scale last year, and to know how long this demand will continue, then any forecast on the demand for new telecommunication facilities can only be speculation. Market research is still seriously lacking in knowledge and instruments. Even field tests in which new telecommunication facilities are introduced and their acceptance investigated, only seem suitable to a limited extent as forecasting instruments. If we imagine the results that a field test with the telephone would have had a hundred years ago I doubt that it would have been introduced; nor do I know what echo that prophet would have found who dared to say that one day there would be a telephone in every household. We do not know what wishes man will have in the year 2000, we do not know what will be important and what will be unimportant for him – yet the plans we are making in telecommunications today extend beyond the year 2000. I am not saying all this just so that we can adopt a ‘wait and see’ attitude but to make it plain to you that I believe that all our plans are built on shaky ground. We are still more or less dependent on our intuition, and perhaps especially so at the present time.

I have already mentioned the approaching complete development of the telephone network, by which we understand the installation of a telephone in every household. I do not think that we are in a position today to be able to judge properly what the achieving of this aim will mean for the future development of telecommunications. For when every household has access to the telephone network, this does not only mean that it will be possible to telephone from every household, but rather that every household will form part of a wide network of telecommunications. Every household will be able to participate in virtually every system of non-physical communications transmission.

The only exception to this is moving-picture transmission. But even without the transmission of moving pictures, a whole series of new applications are conceivable which could create entirely new conditions for the organization of many fields of our public and private lives. I believe that we should think very carefully about utilizing our existing networks before building new ones, as for cable television, for instance. I consider the Viewdata system which the British Post Office has developed a most promising step in this direction, and am delighted about the close cooperation which this will hopefully produce between the British Post Office and our administration. Viewdata offers the private subscriber, and of course the business user too, the possibility of obtaining access to information and data processing systems at

relatively little expense. This would, for example, be a way of closing the gap between the data processing systems in public administrations and the citizens who were only able to benefit indirectly from these systems in the past. But here, too, we must ask ourselves whether and to what extent the individual citizen is and will be prepared to make use of the possibilities offered him. I am afraid that we will not be able to expect any immediate success; we shall have to be patient and let the citizen grow accustomed to these new forms of communication.

Viewdata comprises a variety of services, ranging from mass communication to individual data teleprocessing. A number of these services goes beyond the original task of telecommunications, namely to transmit communications. That is the reason for my assuming that all the tasks involved in Viewdata cannot be dealt with by the telecommunications administrations alone but that the organization of a number of services will be left to other social groups or to institutions. Services in the field of data teleprocessing, for example, could be offered to Viewdata subscribers by external e.d.p. organizations whose computers would be given access to the Viewdata system. A similar separation of tasks is possible, I believe, in the transmission of information relating to publications, because here the special legal and political conditions of the media have to be taken into account.

If we try to estimate the effects of Viewdata on the telecommunications industry, we shall find some interesting perspectives. Assuming a lively interest in Viewdata on the part of the public, it will be necessary to install additional equipment in virtually every telephone exchange to transmit and store information. It remains to be seen whether this equipment can be incorporated into the modern telephone exchange systems or whether Viewdata facilities will have to be installed separately, but in every case the technical capacity of the switching system will have to be extended. The terminal equipment of the Viewdata subscriber is not as interesting for the telecommunications industry as for the television manufacturers, for, as you know, the television receiver will also be used as a Viewdata display unit.

Viewdata could, however, indirectly have other effects on the telephone network and thus on the telecommunications industry. The duration and frequency of use of the telephone station will be substantially increased by Viewdata as opposed to telephony alone. The probability of finding the station engaged will consequently be greater, the telephone subscriber who also uses Viewdata will be more difficult to reach, and – expressed cautiously – disputes may arise within the family as to use of the equipment. This in turn could give rise to the desire for a second telephone station.

A second telephone station in private households, even without Viewdata, is not, I believe, in the long run, such a remote possibility as it may seem today. As can be seen from a recent Dittberner Study, great progress is being made in the U.S.A. and in Canada as regards equipping private households with extensions, and extensions are more and more the result of the Americans' pleasure in communicating. If we consider the lead the U.S.A. have over western Europe with regard to new developments, we may expect to reach a comparable situation in ten years' time. This would keep growth rates at an interesting level, even after complete development of the telephone network has been effected – interesting, that is, for the telecommunications administrations in view of the employment situation for their technicians, but also interesting for the telecommunications industry.

There has been a lot of talk in the last few years about broadband communication in general and about cable television in particular. It sometimes seemed as if cable television would determine the entire future of telecommunications. In the meantime, much of the excitement

has died down, discussions have become more objective, and interested parties know more about the possibilities, but also about the limits, of cable television. In the Federal Republic of Germany the Commission that I mentioned earlier has devoted considerable attention to this subject. Their pronouncements clearly show the main problem involved.

No one today can say with any certainty whether there is wide enough interest on the part of the public and, if so, in what communication services of cable television, to justify the expenditure of some £6250 M that a cable television network for the Federal Republic of Germany could be expected to cost. The Commission has therefore proposed that, to begin with, the public's interest be investigated by means of pilot projects and that at the same time various organizational forms of cable television be tested.

Cable television poses one very great problem for the telecommunications administrations, and one which has also been encountered with Viewdata. The demand for cable television does not depend on the quality or degree of development of the cable television network but on the range of programmes which a subscriber connected to the cable television network can receive. The telecommunications administrations, however, are not responsible for deciding on the programmes to be offered; on the contrary, we shall probably have to assume that it will be a conscious policy not to allow the telecommunications administrations any sort of influence with regard to programmes.

I am wholly in favour of this strict separation of responsibility for the network and responsibility for programmes. One must only be aware of the fact that the telecommunications administrations can thus scarcely contribute decisively to the success or failure of cable television. On the other hand, it is they who bear the considerable risk of investment. For the moment I see in cable television a possible telecommunications service, but one which is in no way to be expected with certainty. I hope that the pilot projects will give us clearer indication of the public's interest in cable television.

The construction of cable television networks could solve or at least simplify for the telecommunications industry many of the structural problems which are becoming apparent today. Given the demand, I think that the employment situation in the industry would be guaranteed for approximately twenty years. Furthermore, the path could be paved for new technology, such as the glass fibre, so that by the end of this century we could have technical means available which would make it economically worth while to think again about picture telephony.

3. CLOSING REMARKS

Telecommunications is in a process of change. It is developing more and more from being an attribute, an additional, extremely fast means of communication, into a fundamental part of the infrastructure, replacing previous means of communications and making possible new forms. As this change is effected, more importance is being attached to the partnership of communications processing and communications transmission.

The telecommunications industry is confronted with rising demands. Rapid changes in technology, the approximation of telecommunications and e.d.p. technology, the contraction of the market and the arrival of new competitors necessitate a high degree of flexibility with regard to planning and products.

The telecommunications market continues to expand, yet it will require considerable efforts on the part of the industry to maintain the position on the market which it has obtained for itself. This is especially true of the telecommunications industry in western Europe.