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By Terry Dodsworth, Industrial Editor

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The world's telecommunications industry is currently enjoying a period of dynamic growth which looks set to go on for at least the next decade. During the 1980s, the market for telecommunications equipment has expanded rapidly, and the rate of growth has recently accelerated. In 1986, the total worldwide market for telecommunications equipment is estimated to have been around \$83bn. This figure rose to about 98bn in 1988, and is set to increase to \$113bn in next year. Forecasts suggest that it could jump to \$180bn by the end of the century, with growth rates slowing down in the first five years of the decade and speeding up in the last five.

There are three main factors behind this boom in sales. First, there have been a series of technological breakthroughs that have put pressure on telephone operating companies to modernise their networks. These technology changes revolve around the shift from analogue to digital signalling - handling

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telephone calls as a series of electronic digits rather than sound waves. New telephone exchanges are being installed to replace the current generation of mechanical switches. This is being accompanied by big investments in fibre optic cable, which has much greater capacity than the present generation of copper cabling.

Second is the issue of deregulation. Throughout the developed world, Governments have been following the lead of the US, Japan and UK in opening up the telephone industry to new competition. This has meant reducing the monopoly powers of the big telephone companies, which are usually State-owned, and have traditionally had the right to control virtually every aspect of telecommunications. In some countries, new operators owning their own telephone cables are entering the market. In many others, the handling of data traffic - as opposed to normal voice conversations - can be done by private operators over lines leased from the telephone companies. Elsewhere, value added services, in which some form of unique information is added to the standard call, are springing up. All of these demand

additional investment.

Deregulation is also opening up the exciting new area of mobile communications. This is a market with great potential for the last decade of this century, with big new investments already afoot in Europe and the US, and likely to spread rapidly to the Far East as well. The ramifications of growth in mobile communications are by no means clear as yet, because of the mix of technologies that can be used, and the different markets that can be tackled. But equipment manufacturers undoubtedly see this area as a major target for expansion.

Finally, equipment sales are also being driven by economic considerations. The development of the use of computers, the growth of multinational business, and the market advantages yielded by swift exchanges of information have all led to an increasing need for efficient communications. In recent years, the integration of financial markets, particularly the stock and money markets in London, New York and Tokyo, have also demanded big investments in telecommunications.

At the same time, telecommunications investments are increasing in both the developing world and the State-controlled economies of the Soviet Union, Eastern Europe and China. Expenditure in some developing countries, where there is an acute shortage of both investment capital and skilled workers, is being helped by World Bank financing.

~~By the end of 1985, the total investment in telecommunications services, computer equipment and computer services as well.~~

Market trends.

The manufacturing side of the telecommunications industry is part of the rapidly-expanding information technology sector. This can be seen as including telecommunications services, computer equipment and computer services as well. In its entirety, the IT industry amounted to sales of around \$500bn in 1985, and is expected to reach almost \$890bn in 1990, with by far the biggest volume of sales being generated in telecommunications services at about \$290bn in 1985 and an estimated \$450bn next year.

This growth in the volume of telephone traffic

lies behind the increasing demand for equipment. Old systems are being replaced by the latest technology, and new markets are being opened up geographically. The balance of these different markets can be judged fairly accurately by the installed base of main telephone lines, which is now approaching 40 per cent of the population in developed countries. The US, for example has around 122m installed lines, followed by Japan with 46m, and the Soviet Union with 29m. West Germany, where telecommunications policy has been directed since the late nineteenth century towards making a reasonably-priced telephone available in every household, now has 26m lines, and France 24m. The UK follows on 22m and Italy on 18m.

Given these figures on telephone installations, it is no surprise that the biggest single market for telecommunications equipment is the US, which in the early 1980s accounted for about 40 per cent of world sales. In 1982, out of a total market of \$46.9bn, measured in constant 1979 dollars, North American sales (including Canada) accounted for \$19.9bn, or about 42 per cent. Europe generated \$12.5bn of

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equipment sales (27 per cent), while Asia accounted for \$11.8bn (25 per cent). The rest of the world lagged far behind these three large developed zones, with Latin America spending only \$1.4bn, Africa \$0.4bn, and other areas \$0.9bn.

The US remains in the dominant position, although Europe is currently going through a spurt of investment that is giving it a greater share of total sales. In 1986, the US accounted for sales of \$24bn, well ahead of Japan on \$7.1bn and West Germany on \$5.9bn. The Soviet Union, however, was the second largest spender in the world, with sales of \$2.4bn - although most of this equipment was supplied from within Eastern Europe, with very few orders percolating through to the Western world. France's spending amounted to \$4.5bn, followed by Italy (\$3.9bn) and the UK (\$3.1bn).

Production.

Output has responded to increased demand by leaping ahead. Telecommunications manufacturing facilities are concentrated, like the industry's markets, in the developed countries, though within these, Japan has steadily been capturing an increasingly large market share.

Like all areas of the telecommunications industry, the statistics are open to considerable distortion because of the problem of drawing a clear distinction between telephone equipment and other electronic products. But an indication of the growth is given in figures published by Benn Electronics on output in 14 European countries - Austria, Belgium, Denmark, Finland, France, Irish Republic, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and West Germany. Production in these countries amounted to \$14.1bn in 1985. In constant dollars, after adjusting for inflation,

output rose in the following year to \$17.8bn, reaching \$18.6bn
in 1987, and \$20.3bn last year. 6

In the US, where the manufacturing industry has been under great pressure from imports over the last few years, the market has nevertheless been strong enough to support strong advances in production. Output grew to \$34bn in 1988 from \$31bn in the previous year, and is set to expand to \$37.5bn in 1990. Japan, the second largest national producer in the world, with four strong companies in Hitachi, NEC, Toshiba and Fujitsu, has an industry about half the size of the US's, with output in 1987 of approximately \$15.4bn. This is forecast to rise to around \$18bn by 1991.

~~By: Tony Dodsworth, Industrial Editor~~

Trade.

Trade in telecommunications products has become a significant issue over the last few years because of the sudden surge in Japanese exports and the comparative imperviousness of the Japanese market to imports. The main target in this process has been the US, which has seen its trade deficit in telecommunications rise to well over \$1bn a year. Foreign companies have flooded into the market in the wake of deregulation, taking the lion's part of sales for low-cost items such as telephone handsets, where there has been a distinct manufacturing advantage in the cheap-wage countries of South East Asia. Japanese producers have also had a big impact in other specialised areas such as land-based satellite equipment.

To a certain degree, Europe has also been hit by a similar drive from overseas, with the UK's

deregulated markets coming under particular

attack. Like the US, the UK has also slipped into deficit on its telecommunications products, moving from a small surplus in 1983 to a deficit of about \$200m by 1986. Other European countries have also been affected, so that the region overall has seen a fall in its surplus on telecommunications trade. But most of the leading producer countries are still generating more than enough exports to cover the inflow of products.

In West Germany, for example, telecommunications imports rose from \$747m in 1985 to \$937m in 1986, but in the same time imports were held down to only \$163m and \$235m. In France, imports rose from \$87m to \$102m in the same period, but exports advanced from \$462m to \$482m. Sweden has also maintained an exceptionally strong position: its imports jumped from \$150m to \$200m between 1985 and 1986, while its exports in the same period stood at \$962m and \$968m respectively. Belgium has similarly maintained a strong export record, helped by foreign producers who use it as a convenient base. Its overseas sales jumped from

\$191m to \$336m between 1985 and 1986, while its

imports rose from \$106m to only \$143m.

Britain was the main deficit country partly because of its failure to generate exports as strong as those of West Germany and France. The UK industry's overseas sales in 1985 amounted to only \$310m, rising to \$321m in the following year, but in the same period its imports jumped from \$413m to \$534m. Italy, similarly, had imports of \$192m in 1985, increasing to \$235m in ~~the~~ 1986, a period in which its exports spluttered haltingly from \$168m to \$219m. Spain, which is in the process of expanding its telecommunications sector quite aggressively, was also in deficit, with imports rising from \$72m to \$128m, while exports rose from only \$25m to \$36m.

Both West Germany and Sweden are shown by these figures to be among the largest world telecommunications equipment exporting countries. But Japan is by far the biggest, with overseas sales of about \$2.9bn in 1987, on an actual rather than inflation-adjusted basis. The US had exports in

the same year of just under \$1bn, while the fastest growth was concentrated on two South East Asian countries: South Korea reached exports of \$460m in 1987, and Taiwan registered \$400m worth of overseas sales.

Because telecommunications is such a large industry, the sudden strength of Japanese exports, combined with the problems that the US and UK have had in containing imports, has led to increasing sensitivity over trade imbalances. The problem has been partly caused by the moves to market liberalisation, which have made it possible to attach more and more products to the public telephone network without the direct intervention of the telephone authorities - traditionally, many of the public telephone groups had a monopoly on installations, and frequently on the equipment supplied as well. When these controls were abolished in the US and the UK, the way was open for a battle based essentially on prices.

Similar shifts could occur elsewhere if some of the liberalisation plans being hatched by

Governments all over the world come to fruition.

In the European Community, for example, the Commission in Brussels has driven through a new rule saying that small attachments to the network will be opened to the competitive market place. It is also moving towards a more open policy on procurement for the large exchanges and other infrastructure equipment which control the telephone system.

These trends will give opportunities to new competitors, just as they already have in the US, but both the US Government and the European Commission have made it clear that if the trade balance swings too far in the disfavour of domestic companies, there could be retaliatory action against the overseas companies benefiting from the policies of liberalisation. Hence the situation is delicately balanced between further opening of markets and retaliatory protectionism.

~~Product sectors.~~

Product sectors.

One of the statistical problems in dealing with the telecommunications industry is the wide variety of equipment that goes ~~up~~ into the makeup of a telephone network. In calculating trade flows, for example, it is difficult for reporting agencies to know how to treat semiconductors, which move relatively freely across trading barriers today, and which now form a crucial element in switching equipment. Even without problems of this sort, the industry is complex, and it is becoming increasingly complicated as new technologies develop. Today, for instance, the world is in the middle of an explosion in mobile telephone technology, which is spawning new products virtually every day.

The largest single area of sales is in the public switching market - the large telephone

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exchanges which lie at the heart of telephone networks. Expenditure on this equipment has been strong since the early 1980s, as the telephone companies swung into a period of modernisation with the advent of digital switches. In the world's 50 largest markets, which account for about 97 per cent of the world's total investments in telecommunications, spending on this sort of equipment amounted to \$22bn in 1986, or some 27 per cent of total capital expenditure ^{ON TELEPHONE EQUIPMENT} in these countries.

Transmission products which handle the signalling in the network are the next largest area of sales, accounting for \$18.9bn worth of manufacturers' revenues in 1986, or just over 23 per cent of the largest 50 markets. Spending on cable amounted to \$7.4bn, or 9 per cent, a testimony to the rapid acceleration in the installation of new fibre optic cables throughout the world. The strength of revenues in this sector underscores the importance now attached to new cabling, because the dramatic fall in fibre optic

cable prices is forcing the industry to run much

harder to stay still in financial terms.

Customer premises equipment - telephone handsets, telexes and facsimile machines - also accounts for a large slice of the industry sales, generating revenues of \$7.5bn, or 9.2 per cent of the overall market. Not far behind are office telephone exchanges, from the large central equipment to key systems that sit on the desk, which generated sales of \$6.3bn in 1986, or a 7.7 per cent market share. In this field there is also a significant technology change, as companies change increasingly over to the much more flexible and larger capacity exchanges that have become possible with digitisation.

The data communications area is about the same size at present, but growing very rapidly because of the growing needs for sending information around large corporate networks. Sales amounted to \$6bn in 1986 (7.4 per cent), but are expected to jump to \$10bn (9.5 per cent) by 1990.

The other main identifiable sectors of spending

are satellite ground equipment, amounting to \$2.7bn (3.3 per cent), and mobile communications products, generating spending of \$5bn (6.2 per cent). This sector too is expected to show very rapid growth over the next few years, increasing its share of telecommunications sales in the main world markets to 8.5 per cent by 1990.

Mobile communications, indeed, are set to provide manufacturers with the strongest individual growth market in the telecommunications industry over the next few years. This expansion is being driven by a number of factors. In the US, sales have taken off in the last 12 months with a shakeout of marginal businesses, consolidation by the leading companies in the market, and the development of interstate mobile systems, which will break down the present fragmented market structure.

At the same time, Europe has now reached lift-off point, and is planning the development of a new digital pan-European system that will allow conversations from mobile handsets throughout the

region. Several producers are investing heavily in research and development expenditure to break into this promising new area. Another inducement to join the mobile bandwagon is the buoyancy of demand for this type of equipment in the Far East. Indeed, UK executives working on the proposed new telepoint system in the UK - a mobile system which allows customers to make calls connected by radio link to the public telephone system, - believe that the next major market for the product may be in the Far East.

Some forecasts suggest that sales in the mobile industry will shoot up by around 80 per cent - admittedly from a low base - by 1990. Data communications is likely to ^{BE} the next fastest area of expansion, growing at a rate of about 14 per cent a year, and moving up to sales of \$9.8bn by next year. Growth in this sector is being headed by the US, where the liberalised market has encouraged the development of large corporate data communications networks. Japanese spending is also increasing rapidly under the influence of similar

deregulation policies, and is expected to reach

\$930m by 1990 from \$637m in 1986.

Office exchanges fill the number three position in terms of expansion, with a forecasted average annual growth rate from 1986 to 1990 of 7.6 per cent. Spending in this sector reached \$6bn in the 50 largest world markets in 1986, and is undergoing a cyclical upswing as companies increasingly take advantage of the latest digital technology.

~~Telecommunications in developing economies.~~

Telecommunications are expected to play an increasingly important role in developed economies over the next few years as companies become increasingly dependent on information processing to run their businesses and gain competitive advantage. In the European Community, for example, it has been calculated that the telecommunications industry contributed about 2 per cent to gross domestic product in 1981. This is expected to increase to 7 per cent by the year 2000, and by the early 1990s, the telecommunications sector is expected to be as large as motor manufacturing in the Community. Investments in the industry have also been calculated to have a big multiplier effect on the level of economic activity in general - the expenditure of \$1 is estimated to

bring about a total increase in activity of \$1.5.

The spread of telecommunications is similarly a crucial issue in the growth of the less developed economies. It is important because of the role of communications in the supporting infrastructure for industry; and it could also have a direct impact on industrial activity if countries could establish telecommunications manufacturing industries.

Studies of the growth of telecommunications networks have indicated that they have a major impact on the economic activities of countries at the stage of increasing industrialisation. At this point, effective telephone communications replace other and slower forms of communications such as postal services or travel. This allows increasingly efficient commerce and industrial transactions because of the availability of up-to-date information. Markets become more efficient because they can no longer be skewed to the interests of a few information-rich individuals.

is underscored by the example of the fast-developing Far Eastern economies of South Korea, Taiwan and Singapore. In 1986, South Korea was the world's tenth largest investor in telecommunications systems, with a budget of \$1.4bn. This put its investment only just behind that of China, despite the immense difference in the size of the two countries and their populations. Taiwan, similarly, was the twentieth largest investor, with spending of \$640m, while Singapore was thirty-first with \$302m.

South Korea has developed its telephone networks with a deliberate, Government-led policy of expansion through two State-owned authorities, one of which competes in data transmission. The country already has 7.7m lines (not far behind Spain's 9.8m), and has an aggressive plan for a further 5.6m over the current five years. It intends to replace its present system with a digital network by the year 2,000. It is notable that Korea has managed to break into the

telecommunications manufacturing business while in the process of this expansion, partly because of its creation of an electronics industry through big investments in semiconductors. In 1987, Korea's exports totalled \$460m, largely built on sales to the US for low-cost telephone handsets.

Taiwan has also developed rapidly from 1m lines in 1975 to 5m in 1985 and plans for 10m digital lines by the turn of the century. Along with South Korea it is the only country from outside the established post-war industrial world that has managed to break into the list of the top ten exporters, with sales overseas in 1987 of \$398m.

Elsewhere, developing countries are plagued by a lack of resources in the development of their telecommunications networks and manufacturing industries. The problem is deeply entrenched. At the financial level, it is hard for the over-stretched Governments running the telecommunications systems to find additional funds for expansion. It is equally difficult to find the skills needed for what

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is increasingly becoming a high-technology industry,
requiring software development as much as hardware.
And there are institutional blockages because of the
way network provision is tied up in Government
agencies and frequently involved in political
decisions.

In trying to break through some of these problems
there has been an increasing emphasis in aid
policies in recent years on more flexible
structures. This trend reflects the movement towards
market deregulation in the main industrialised
markets of the US, Japan and Europe. At the same
time it echoes current
thinking on the importance of bringing private
capital into growth industries in these developing
economies.

Several developing markets are now at an
interesting stage of development. India, for
example, recently formed two new corporations to
handle domestic and overseas telecommunications. It
also proposed a development plan to modernise and
expand its basic network, while privatising the

country's terminal equipment manufacturers. The country is negotiating a contract for the supply of main telephone exchange technology - Alcatel of France had been hoping to win the contract - although it is now facing potential competitor from a local production consortium.

Brazil, which has a network of around 7.2m telephone circuits, has also recently pledged to develop its highly congested system with the addition of a further 1m lines. The country spent \$1.3bn on equipment in 1986, and produces around 300,000 terminals a year. It has put a great deal of effort into the development of its telex network of 1,800 connections.

Mexico, with 3.8m lines, has a \$6.5bn development programme underway at present aimed at expanding the network. It aims to be spending \$1.3bn by 1990 compared to \$850m in 1986, and wants to have 28 telephones available per 100 people by the year 2,000 against 8 per 100 in 1986. Telmex, which runs the telephone service and supplies equipment, manufactures all the key electronic components

Indonesia is aiming to increase its investment programme from \$640m in 1986 to \$876m in 1990 with the aim of extending the telephone service to rural areas, while installing new telexes and data switching systems. Siemens, the West German company, is involved in manufacturing in the region and is producing equipment for large-scale expansion programmes in some of the main population centres.

Argentina has around 2.8m lines at present, and is aiming to expand at about 8 per cent a year. Spending in 1986 amounted to \$630m, and future investment is earmarked for a variety of new areas, including rural centres not yet connected with the main network, satellite services, and a microwave network.

Colombia, with 1.8m lines, is also trying to improve its rural connections - at present well over 90 per cent of the country's telephone network is concentrated on 40 cities. Jeumont Schneider of France is closely involved in the development of the system.

Venezuela is intending to lift expenditure from \$416m in 1986 to \$482m by 1990, increasing the number of lines from 1.3m to around 2.2m. Ericsson of Sweden has a close relationship with Venezuela, where the telephone operating company also manufactures some of its own equipment.

Pakistan is in the middle of a \$1bn development programme, as the country mobilises to expand from almost 500,000 lines in 1986 to 1.2m in 1990. The country is heavily reliant on imported equipment, but is intending to establish indigenous manufacturing for switches, cables and some spare parts. It wants to establish more comprehensive dialling facilities within the country, while improving the telex and data transmission services.

Egypt is the largest telecommunications user in Africa, but still has only a little more than 1m lines in service. Spending is running at over \$200m a year, financed by debt, bilateral aid and supplier loans. The country is building new microwave transmission links, but is barely keeping pace with the demand for new telephone and telex services.

states in the Caribbean and Pacific, have opted to use outside contractors to run their telecommunications systems. In the West Indies, for example, Cable and Wireless of the UK has several operating contracts. It is shortly planning to run a new fibre optic cable down to the region to connect it with the transatlantic cabling system.

Several common features run through most of these investment projects. Many of the countries concerned are still heavily dependent on agriculture, with large rural populations where the telephone service is sparse or non-existent. Connecting these areas is therefore one priority. Another is to create genuinely national systems that can be accessed throughout by direct dialling rather than through operators.

At the same time, these developing countries are struggling with the issue of integrating themselves more closely into the international system. This is also a key issue because of the need to attract international investment and trade ~~an~~ international

markets. Hence the desire to install international direct dialling and sophisticated data transmission networks, systems which are dependent on the latest technology if they are to be fitted efficiently into the ~~the~~ overall international telecommunications network.

In addition, developing countries are looking at novel ways of solving some of their problems. Mobile telephone technology, for example, has changed so rapidly in recent years that it has become flexible and cheap enough to present alternative ways of connecting outlying areas to the fixed backbone system. Microwave communications are also being used increasingly. Thailand, for example, has recently reached agreement with Cable and Wireless of the UK on a microwave system linking major buildings to run a data transmission service around the country separate from the public telephone network.

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Companies

The world telecommunications industry is dominated by 10 major suppliers, all of which are located in the three main industrialised zones of the US, Europe and Japan. Although there is some manufacturing outside these areas, much of it is under licence from the leading companies, or under joint venture arrangement. The main exception to this rule is the Soviet bloc economies, which meet a large part of internal consumption with local production. But China, for example, is now beginning to expand its telecommunications industry very much in co-operation with Western companies willing to invest in the country in joint projects.

The relative strength of the big ten companies is not easy to gauge. They come from countries with widely different industrial and financing TRADITIONS, SO THAT THEIR FINANCIAL RESULTS ARE

...trading, so that their financial results are

not strictly comparable. The Japanese and Continental companies, for example, normally carry much more debt in their balance sheets than the British and North American groups, which are more reliant on equity funding.

Profits also tend to be understated in the Continental European and Japanese companies compared to their Anglo-Saxon rivals. The Continentals and the Japanese run a negligible risk of takeover on grounds of low profitability, and their funding is more dependent on understanding banks than critical shareholders.

The most commonly-used measure of size and market position is the position of the different companies in the public switching market for large telephone exchanges. This equipment is the most crucial part of any telephone network, and the companies that have a strong position in this sector tend to have a firm base for growth because

of the long-term nature of the investments involved - once a telephone company has decided on

A PARTICULAR TECHNOLOGY IT CANNOT EASILY CHANGE

for many years.

This part of the market accounted for about \$19bn of sales in 1986, with American Telegraph and Telephone of the US showing a clear lead over the rest of the industry with a 25 per cent market share. Alcatel, the French company was the next largest, with 18.5 per cent, followed by Siemens of West Germany with 13.2 per cent, and Northern Telecom of Canada on 10.5 per cent. The other six were Ericsson of Sweden (8.3 per cent), NEC of Japan (6.3 per cent), GPT of the UK (5.1 per cent), Fujitsu of Japan (4.6 per cent), Telettra/Italtel of Italy (3.9 per cent) and GTE of the US (2.3 per cent).

Many of these companies are not only producers of switching equipment. They also manufacture other key items that go into telephone networks, such as the transmission equipment which sends signals along the telephone lines, and the cables themselves. Some also produce radio equipment, which is increasingly being linked into telephone networks. This comprises

TRANSMISSION AND RECEPTION PRODUCTS, MICROWAVE ITEMS

and both satellites and satellite earth stations.

About 90 per cent of the total market in all of these products is provided by 27 companies, most of them multinationals with interests in a diverse number of countries.

Of these, nine groups are based in the US, one in Canada, 13 in Western Europe, and five in Japan.

Apart from the big switch producers mentioned above, the most important groups are IBM, the American computer producer which also has extensive telecommunications interests, Motorola of the US, which has become one of the most important suppliers of mobile equipment, Nokia of Finland, which is another big mobile communications company, and three Japanese companies - Hitachi, Toshiba and Fujitsu.

STC, the UK group, has also established itself as one of the leading cable and transmission companies, and world leader in the developing market of underwater cables. In addition, Philips, the Netherlands-based group, is a strong player in Europe with its office systems.

*TAKING TELECOMMUNICATIONS PRODUCTS AS A WHOLE,
Taking telecommunications products as a whole,*

not just switching systems, the two world market leaders are still unquestionably AT&T and Alcatel - the latter having jumped to its present place in the world league by purchasing the telecommunications interests of ITT of the US in early 1986. It is difficult to break out precisely the level of telecommunications activities in their production divisions, because both make other equipment - Alcatel, for example, makes check-outs for subway systems, and AT&T produces computers. But after allowing for this ancillary equipment, AT&T's sales amount to around \$13.6bn, and Alcatel's to \$13bn.

Hitachi of Japan is the next largest, with sales of \$6.6bn, followed by Siemens, the West German company, on \$6.3bn, and NEC of Japan on \$5.8bn. Toshiba, the Japanese group, has sales of \$3.4bn, just ahead of Ericsson of Sweden and Northern Telecom, the Canadian group, which both have sales of about \$2.9bn. GPT is next with sales of \$2bn, followed by Philips of the Netherlands, which has sales of about \$1.7bn. Both GTE of the US and Italtel of Italy have about \$1bn of revenues. Motorola, which is one of the world's leading semiconductor

COMPANIES, ALSO HAS SALES OF ABOUT \$2.9bn in
 companies, also has sales of about \$2.9bn in

Companies, STET has sales of about \$2.7bn in

telecommunications, although it has concentrated on radio and mobile technology rather than public switching.

Given the enthusiasm with which companies have pursued this market in recent years, it is surprising that profits are not much higher than they are at present. Alcatel, for example, made a return of only 3.1 per cent on sales last year, with net profits of \$400m. Alcatel's excuse was that it had considerable reorganisation costs to absorb after the acquisition of the ITT activities. Similarly, AT&T, which is also going through a restructuring phase, actually lost money last year, declaring net losses of \$1.7bn on total sales of \$35bn, after a big write down for modernisation.

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Restructuring.

The main reason for depressed profits at present lies in the bout of restructuring that is now sweeping through the industry. This is leading to costly write-offs, plant closures and disruptions as new enterprises are formed or old ones merged. It is also forcing many companies into a costly effort to break into new markets.

One factor pushing the industry towards greater concentration of resources has been the escalating cost of research and development. In the last decade or so, telecommunications has become one of the industries most deeply affected by the revolution in microelectronics and data processing. It has moved from the mechanical age to the era of electronics, and with this shift has come a big escalation in the costs of research to

keep up with the constant evolution of this new technology. As networks are digitised, switching systems are becoming highly dependent on software.

This means that products are changing rapidly and that life cycles are shortening dramatically.

Consequently the cost of revisions and changes is mounting all the time.

Coinciding with this shift to a software-based industry is the beginning of work on the next generation of switches. Most research work at present is being directed towards a revolutionary system of using light to conduct messages within the switching system, an idea which is also being examined by the computer and semiconductor industries. Costs of developing this technology are being estimated in the range of \$2bn, against the \$1bn or so which most companies spent on the move into digital switching. This is further argument for manufacturers to try and offset their costs against larger markets.

These pressures have coincided with the wave of deregulation and internationalisation of markets

in such a way that it has been much easier than in the past for companies to cross boundaries and reach agreement with foreign groups.

Traditionally, these sort of transactions have been difficult within the developed industrial countries because telecommunications manufacturers have been regarded as national industrial champions that needed to be protected by Government policies. This mode of thinking has not disappeared, but it is crumbling, and has led to several significant deals and market changes.

These include:

* Northern Telecom, the Canadian group, has managed to enter the US market and build a strong position in the digital exchange sector.

* Alcatel's purchase of ITT's telecommunications activities in Europe allowed it to expand out of France into Germany, Spain and other European markets.

* Ericsson's purchase of CGCT in France, along with its move into the UK, where it now has about one-third of the market, has allowed it to become

a major Europe-wide supplier.

* The merger of the telecommunications activities of Plessey and GEC has allowed rationalisation of manufacturing in the UK with the formation of GPT.

* The proposed merger of GPT with Siemens of West Germany could create the third largest telecommunications manufacturer in the world.

* Northern Telecom has established a foothold in Europe with a share of 28 per cent in STC of the UK.

* AT&T has moved into Western Europe through a collaboration agreement with Philips and a deal to develop manufacturing in Italy in partnership with Italtel, the leading Italian switch producer.

* AT&T has also concluded an agreement to absorb GTE in the US over a period of several years.

* The Europeans have begun to move into the US. Ericsson has established a strong position in mobile switching, while Siemens has begun to sell its public switches, and GPT has control of Stromberg-Carlson, a Florida-based producer.

* Motorola has moved strongly into Western Europe

operations.

This wave of amalgamations may be followed by a period of consolidation. Companies will need time to adapt themselves to multinational operations.

Nevertheless, some industrialists argue that there will have to be still more mergers over the next decade to create companies with sufficient size to weather the economic conditions created by new switching technology. Producers will need to be able to market to a much larger number of telephone companies to spread their costs. It is argued, in the way that is common today in the computer industry. The industry could well slim down to around half a dozen world class players, similar in structure to the mainframe computer sector following the flood of mergers that has engulfed it over the last decade.

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 the breakup of the industry which allowed ITT to operate
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 overseas in the wake of deregulation. Japanese companies,
 however, have been advancing fast in the Pacific region and
 South America. NEC has been the most aggressive, establishing
 a strong position in several of the smaller markets, and
 muscling into the larger ones like Brazil alongside the
 Europeans.~~

~~By David Southworth, Industrial Editor~~

Manufacturing in Developing Countries.

The current round of restructuring in the industrialised countries may be followed over the next few years by renewed attention to telecommunications in the developing world. In the

LAST FEW YEARS, THERE IS NO DOUBT THAT THE LARGE
 last few years there is no doubt that the large

manufacturing companies have concentrated their attention on their domestic markets and the possibilities of expanding elsewhere in the liberalising markets of the US and Western Europe. Most of the new technology they were developing was also aimed initially at these countries. With the new technology established, however, and the initial reorganisation wave complete, companies are beginning to turn their attention towards developing countries.

The potential in these developing markets is enormous. Five years ago, for example, the number of telephones per 100 inhabitants was estimated at just less than 70 in North America and almost 40 in Western Europe. But in Central and South America, the figure stood at only 7, and in Africa at less than 2. The problems in selling in these markets are well known, ranging from foreign currency shortages and payments problems, to shortages of skilled resources and restrictive attitudes to foreign investment.

SOME FOR EMERGING COUNTRIES HAVE MADE PROGRESS
 SOME FOR EASTERN COUNTRIES HAVE MADE PROGRESS

by a mixture of indigenous development and co-operation in the most technology-intensive area of large public switches. In South Korea, for example, Samsung, the large industrial conglomerate, has an agreement with Alcatel (inherited from the days before the French group took over ITT's telephone operations) to make large switches in the country. But at the same time, South Korean industry has expanded rapidly into telephone handset manufacturing, where it has established a strong niche position in export markets as well as at home.

Alcatel is also present in Taiwan, where its System 12 digital switch is again made under licence. Taiwan is another country which has developed its telecommunications manufacturing in other areas, becoming in the process one of the world's largest exporters of this equipment.

In addition, Mexico has developed manufacturing on the basis of the Alcatel System 12 technology.

The group's Indetel plant, in which Alcatel has a

40 PER CENT DIRECT STAKE AND OTHER INDIRECT

shareholdings, also makes transmission equipment.

In Turkey, the Teletas group, 40 per cent owned by Alcatel, makes System 12 along with a variety of telexes, handsets and multiplexers.

Alcatel's other main link with the developing world is in India, where the company's E10 digital switch is made under licence. Attempts to develop further contacts through an additional deal, however, have recently run into problems, highlighting the issue of the dependence of countries like India on foreign technology. Local industrialists have claimed that they could develop and market a switch more cheaply than what Alcatel has on offer, and the Government is currently considering this proposed alternative.

Whichever way the decision goes, it is clearly important to the country's future, because the ambitious plans to develop the telephone infrastructure depend upon effective switching technology. And if local industry is developed successfully, there are healthy prospects of exports.

Siemens is another company with a strong position IN THE DEVELOPING WORLD, DESPITE THE MAIN FOCUS OF

its expansion in recent years on North America. The company has a plant in Indonesia, where it is currently involved in an ambitious expansion programme for the local telephone system. Siemens is also well-entrenched in South Africa, where it installed one of the first digital networks in the world, and has links with South America. The company has sold its EWSO digital switch in well over 20 countries throughout the world, including Argentina, Brazil, Chile, China, Colombia, Libya, Oman, Paraguay and Taiwan.

Ericsson has also developed a large overseas business, largely because the Swedish market is too small to support a major manufacturing group. A great deal of this growth has been through foreign manufacturing plants to provide employment, or joint ventures and licencing agreements. It has established a particularly strong position in Central and South America, where it has a total of 9,000 employees and links with Mexico, Brazil and Columbia; overall, it has production facilities in 35 countries.

Ericsson has its largest Latin American operation in

MEXICO, WHERE ITS MEXICO CITY PRODUCTION FACILITY HAS A 60 PER CENT SHARE IN THE MARKET.



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cent share of the public telephone exchange market. The group is the majority shareholder in this business, which is quoted on the local stock exchange. In Brazil, Ericsson claims about 35 per cent of the market through its local factories in Manaus and San Paulo, which also export elsewhere in Latin America. Its main competitors are NEC of Japan and Siemens, which both have around 30 per cent, and Alcatel with 10 per cent.

The group makes a variety of equipment in Brazil, including switches and telephone terminals. ^{IN ADDITION, IT} ~~It also~~ manufactures cable, which it also produces in Argentina and Columbia.

In Africa, Ericsson's only facility is in Algiers, but the company is better represented throughout the Middle and Far East. In Malaysia, where it has its own production plant, it has about 40 per cent of the market in competition with NEC, which has the rest. In India it has a licencing operation to make telephone handsets, while in South Korea it has a joint venture manufacturing plant - Otelto - with about 14 per cent of the market. Alcatel has 34 per cent and AT&T of the US 26 per cent.

Ericsson also has plants in New Zealand and Australia -

WHERE ITS AXE EXCHANGE DOMINATES THE MARKET - AND IS CURRENTLY

setting up a facility in China to make its large office telephone exchange.

The European companies have a lead over producers from other countries because they have been active overseas for longer. AT&T was confined to the US market under the terms of the breakup of the industry which allowed ITT to operate overseas; hence AT&T is only just beginning to break out overseas in the wake of deregulation. Japanese companies, however, have been advancing fast in the Pacific region and South America. NEC has been the most aggressive, establishing a strong position in several of the smaller markets, and muscling into the larger ones like Brazil alongside the Europeans.

~~By Terry Dodsworth, Industrial Editor~~

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Component supplies.

Unlike basic industries such as steel, or intermediate technology sectors like motor components, telecommunications equipment manufacturing is becoming an increasingly high technology business. For this reason, it is not an industry which lends itself to outsourcing of components in areas of low-cost labour. Hence established manufacturers in the industrialised world are unlikely to invest very much in supplies of parts from developing countries on economic grounds alone.

On the other hand, penetration of many of these markets is conditional on establishing production facilities, and often tied to aid packages to help

in establishing plants. Companies like Alcatel, for example, find it convenient that they have tentacles throughout Western Europe, because each of their national businesses can pursue sales opportunities overseas with the backing of aid from their local governments. This process of tying orders to local production financed by aid is helping manufacturers win orders, and developing countries to build up their manufacturing base to some degree. But at the same time there is an economic cost, because many of the plants are much smaller than producers would ideally like to install to achieve the most efficient scale.

For this reason, some manufacturers are seeking ways of achieving economies of scale by developing inter-dependent plants in different countries.

Ericsson, for example has been pursuing the idea of modular product development, so that each factory makes a unit that can be used in the local system, but which can also be exported to other plants for assembly into their networks. This

approach is easier with the new digital technology than in the past, because modern switches are constantly being expanded, adapted and refined. But there could be a long term disadvantage for the country in which the component units are made to the extent that this type of technology transfer would not give them a base for establishing a full-scale ~~switch~~ ^{switch} manufacturing industry.

In the semiconductor area, however, there is now exceedingly buoyant trade in special integrated chips for the telecommunications industry. This interchange involves the big industrialised countries - Japan above all, but also some of the newly industrialising nations of the Far East - which have the engineering facilities and human skills to develop chip manufacturing.

~~By Terry Braden, Industrial Editor~~

New technology.

One telecommunications issue which is of great concern for both the developed and the developing world is the relative importance of the switch manufacturing sector in the next generation of equipment. Telecommunications is now advancing so fast that new niche markets are springing up every day, allowing smaller producers a role outside the ambit of the big switch manufacturers. Indeed, the industry is beginning to move towards the structure of the computer business, with a decreasing number of established, traditional companies that are capable of bringing the capital to bear for the big mass-market infrastructure projects, and a large number of smaller producers developing specialist products. Some of these newer technologies may provide an opening for

The problem for developing countries is that many of these products are mixtures of hardware and software. Some of them are highly technical, and most demand a fairly high level of available skills in electronics engineering. It will therefore take time to build up the expertise necessary to exploit these areas, although some countries such as India, which produce significant numbers of electronics experts, have the foundations for launching development programmes.

Among these developing product lines are:

Multiplexers. Multiplexers are units which fit to the end of telephone lines, controlling the traffic over the lines in a way that allows the capacity to be used to the optimum degree. They are capable, for example, of judging traffic so that a line that has been used for voice conversations during the day can be converted to data transmissions during the evening.

There is one school of thought in the industry which argues that devices such as multiplexers

market, because they allow intelligence in the telephone network to be located close to the end user. In other words, users - particularly large businesses - can thereby exert more control over their telecommunications operations and expenditure. Specialists in this technology include STC, the UK group which dropped out of the new generation of switch manufacturing in the early 1980s, but which has since become a pioneer in multiplex techniques. AT&T in the US is also a leading manufacturer, but there are several other smaller American manufacturers as well.

ISDN. The most vaunted new technology is Integrated Systems Digital Networks, a switching device which allows the public telephone network to treat voice and data traffic without distinction. Data networks tend today to be separate from voice systems, and where they are not, data transmission requires elaborate conversion techniques. ISDN would allow the same

It is still not clear whether ISDN will make the impact which has been predicted for it, because installation of the systems will be highly expensive. Moreover, many large businesses have already made the investment in systems to handle both their voice and data traffic. But this is a technology which would help the public telephone operators to retain control of their systems, and is therefore being promoted by them.

VANS. Value Added Network Services are characteristic of the trend towards new telecommunications products which depend on software as much as hardware. Vans are essentially information services carried over the telephone system, helping customers with advice, or giving them data of various kinds. They require sophisticated computers and switches to handle the transmission of the information, and this is often provided through private lines leased from the telephone companies.

launched up to now is Electronic Data Interchange (EDI), a method used by some big companies to order products, and then invoice them electronically.

Under these systems, no paper changes hands. Orders are made out on a computer screen and then despatched using special coding devices to the supplier over the telephone wires. ^{THEY ARE} ~~It is~~ received by

another computer and can then be processed on another computer screen. Later, the supplier can despatch ~~bill~~ bills using the same electronic process in reverse.

EDI has required an enormous amount of work to set up because it ^{DEMANDS} ~~requires~~ the use of standard systems between different companies. Ordering and billing formats have to be put in a common language for the computers to deal with them. But the advantages in terms of reduced paper work, greater accuracy and lower costs - electronic messages cost a fraction of a letter and stamp - are such that the technology is beginning to take off. So far, the main growth has been in national markets, with the

the deregulated telecommunications environment. But the approach is steadily being adopted more widely, and EDI is beginning to be used internationally. As it becomes more common between multinationals, it is one technique which is likely to make an impact on the developing world.

Mobile Communications. Telephones that can be carried around with subscribers, whether in their car or on their person, have been dreamt about for decades. But they are now becoming a reality for more and more people, establishing the area of mobile communications as the most exciting field for telecommunications development in the last decade of this century.

The mobile sector depends upon radio technology which is usually blended into the wired telephone network in some way. It has come of age mainly because of developments in semiconductor technology which allow increasing sophistication in the way that signals are handled. The reduction in size and

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enabled manufacturers to shrink products and make them genuinely portable.

The industry is still developing fast and new approaches to mobility being adopted. But several sectors have already established themselves. These include:

* Radio paging, which allows subscribers to carry a small device that makes an audible signal when someone is trying to contact them. Used initially in small enclosed environments such as hospitals and building sites, radio paging has since been expanded to cover regional areas and countries. Even broader coverage is being developed, such as a Europe-wide system.

* Radio telephones, used by taxis, the police and large fleet organisations, have been around for many years. But the latest technology allows the limited number of channels released for radio telephone use to be much more efficiently used and re-used. This is leading to a big expansion of these systems.

* Cellular mobile telephones. The big explosion

advances in technology have made it possible ^{to} bring together radio and fixed link telephone technology in an affordable manner. Cellular phones work by dividing areas into cells. Within these cells, people can make and receive calls carried over a radio link to the centre of the local cell, where the signals are linked into the normal telephone system. The system is capable of carrying a large number of subscribers with a relatively limited radio wave spectrum because each cell can use the same wavelengths, which are tailored so that they do not interfere with each other.

This process depends upon computers which are powerful enough to track the car-born handsets wherever they are, so that calls can be linked through to them. The system then has to be capable of handing over the radio signals from one cell to another if the car driver passes between cells.

Introduced initially in populous areas to be used by businessmen, cellular mobile telephone systems have been one of the fastest growth industries

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anywhere in industry. Usage has quickly expanded from senior directors to salesmen in many companies, and in some markets subscriber lists are doubling every year. Expansion is being boosted by the falling price of joining the system - handsets have dropped to as low as \$200 a unit for some models in the US, a fifth of the price five years ago.

Growth can be judged by the fact that more than 60 countries have now installed cellular systems, while only five years ago mobile telephony was an infant product struggling to establish itself in three main markets in the US, Scandinavia and Britain. Today there are about 4m handsets in use around the world, and it is estimated that a further 2m will be sold in 1989.

Cellular technology has created markets for three main kinds of products - special switches for connecting into the public telephone network, base stations and transmitters which send the signals to and from the handsets, and the handsets themselves. Up to now, the market for the infrastructure equipment has largely been grasped by a handful of companies, including Ericsson, Motorola and AT&T.

producers, including Panasonic and NEC from Japan, Nokia from Finland (which claims to be world leader) and Motorola.

The industry is in such a state of flux, however, that a number of new producers are throwing their hats into the ring to become involved in the next phase of the cellular revolution, when digital systems are introduced. The idea behind digital technology is that it will give much greater capacity to cellular systems - the present analogue networks are due to begin running out of space in about two years' time in densely populated areas. Digital will also provide the opportunity for new co-operative ventures, such as the decision of Western European telephone administrations to opt for a pan-European network that will allow the same mobile phones to be used throughout the region.

In developing countries struggling to establish a basic telephone service, cellular telephony may seem like an expensive diversion. But the technology can have some significance in rural areas, where large

cells can be created to cover surrounding areas. In some cases, this can be a viable alternative to investment in a fully-wired system, relatively quick to install and maintain. Few countries, on the other hand, could justify manufacturing such equipment.

Meanwhile, mobile telephones are set to move into other new fields as well. These are techniques which are similar to the car phone system, but which would either be cheaper, or more adapted to genuine mass markets because of the greater capacity. The first of this new generation of technologies is being launched in 1989 in the UK. Known as telepoint, it will allow users to make outgoing calls from selected places but not receive them.

The idea of telepoint is to create certain points in open, public places, where people can make calls with extremely light pocket phones that transmit over a distance of about 200 metres to a black box in a wall. The phones could be employed, for example, in railway stations, or certain stores and petrol forecourts. As in cellular phones, the signals will be carried over a radio link and then

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be to a registered home telephone number.

Even before telepoint has started, however, Governments and technologists are talking about a more flexible form of personal communications which could bring portable telephones within the reach of anyone who wants one. By selecting very high frequencies for the proposed system, engineers believe that they can make very large quantities of capacity available to the public. It will also be possible to put cells very close together so that callers can make - and probably receive - calls wherever they are. A great deal of work still has to be done on semiconductor and radio technology to make such a system viable, but there is some confidence that it will be practicable by the end of the century.

Prospects.

The prospects for telecommunications manufacturing over the medium term is for more of the change that has begun to sweep through the industry in the last decade or so. This will probably mean further consolidation in some parts of the industry, particularly the traditional business of switch production, where there will be a continuing need to achieve more effective economies of scale.

At the same time, this area of the industry is likely to see a slackening of activity from growth rates of over 7 per cent at present to about 4 per cent up to 1995. Producers are currently enjoying the peak of the replacement cycle as telephone operating companies modernise their networks, but the most urgent part of this work may be completed in large areas of the developed industrial world by the early 1990s. In the final five years of this century, however, spending is likely to pick up to around 8 per cent a year again as investment accelerates in new data services, ISDN and the expansion of the mobile telephone industry worldwide.

A further question mark could be raised by a general

back into recession induced by high interest rates. Indeed, it is notable that the fast-developing cellular mobile industry has never had to cope with a downturn in economic activity - it has expanded in a period of general economic growth when businesses have been willing to invest in new ideas for sustaining their market share.

The telecommunications industry, however, ought to be able to weather any general economic problems better than most. Telephone operating companies are highly cash generative, typically earning good returns on sales. In the 1980s they have been regularly enjoying growth rates of 8 to 10 per cent a year in call volumes, a level of activity that has given them reserves that should enable them to maintain a steady rate of investment.

The burst of new technology that has engulfed the industry in recent years is also going to open up fresh markets. With the real cost of a great deal of equipment declining, and likely to continue in a downward direction because of improvements in semiconductor technology, more sophisticated products are coming into the range of a greater number of people. Small businesses should be helped by the advent of

elaborate data links as well as voice communications, while the general public will be able to afford mobile telephones with the introduction of pocket handsets.

One of the major questions for the industry will be how effectively developing countries manage to increase their spending on telecommunications. Many of these nations have ambitious plans to install new systems. But it is not clear whether they will be able to find the finance to meet their targets, or the degree to which they will be able to encourage investment in domestic industry.

What is clear is that actual and latent demand for telephones will not be met over the immediate future. Large parts of the world have only a minimal telephone infrastructure at present, and to construct an adequate system would probably require tripling expenditure in the lesser developed countries. Given the importance of telecommunications in economic development, this shortfall may well become a focus of attention in the next few years.

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CELLULAR SUBSCRIBERS WORLD SUMMARY (END DEC 1988)

CELLULAR PROTOCOL	SUBSCRIBERS END DEC 1988	PER CENT OF TOTAL
AMPS	2,273,350	56.0
NMT 450	656,510	16.2
TACS	551,800	13.6
NTT	208,350	5.1
NMT 900	155,800	3.8
C450	101,600	2.5
R2000	97,500	2.4
CVK	17,950	0.4
TOTAL	4,062,860	100.0

ESTIMATED WORLD CELLULAR MARKET 1989/90

CELLULAR PROTOCOL	ADD-ON PORTABLES	ADD-ON MOBILES	TOTAL ADD-ON
AMPS	179,550	807,200	986,750
NMT 450	18,600	137,350	155,950
TACS	117,950	209,850	327,800
NTT	15,000	60,900	75,900
NMT 900	59,575	142,925	202,500
C450	25,200	56,800	82,000
R2000	6,500	58,000	65,000
CVK	0	1,800	1,800
TOTAL	422,375	1,475,325	1,897,700

World Outlook and Forecast

Top 20 telecommunications equipment exporting countries 1987

Rank	Country	Value US\$ millions	% of top 20 countries
1.	Japan	2,948.5	29.7
2.	West Germany	1,114.5	11.2
3.	United States	964.5	9.7
4.	Sweden	851.1	8.6
5.	Canada	543.5	5.5
6.	France	487.4	4.9
7.	South Korea	459.5	4.6
8.	Belgium	411.3	4.1
9.	Taiwan	398.3	4.0
10.	United Kingdom	350.9	3.5
11.	Hong Kong	263.6	2.7
12.	Netherlands	210.8	2.1
13.	Finland	209.8	2.1
14.	Italy	198.6	2.0
15.	Singapore	129.0	1.3
16.	Switzerland	122.9	1.2
17.	Norway	87.7	0.9
18.	Denmark	71.5	0.7
19.	Austria	58.2	0.6
20.	Spain	50.6	0.5
Total		9,932.0	100.0

Source: Government statistics

remarkable that the U.S.A. had the highest import ratios in the middle of the 1980s.

Customers premises equipment (CPE) plays a dominant role in the development of U.S. imports. Telephone sets are by far the largest import product category and five of the major nine import products definitely belong to CPE (Table 4). Assuming that telephone sets, telephone answering machines and facsimile belong to line equipment, at least two thirds of U.S. imports of line equipment consisted of CPE in 1986.

Table 4: Key U.S. import product categories (million dollars)

Category	1986
1. Telephone sets	963
2. Telephone answering machines	278
3. Cardless Telephones	229
4. Cellular telephones	104
5. Facsimile	212
6. Telephone switching apparatus	408
7. Radio apparatus / parts	567
8. Telephonic apparatus	253
9. Transceivers	212
1. - 5. CPE	1 786

The development of U.S. imports mainly reflects structural changes of the U.S. CPE market. Liberalization of the telecommunications sector has been an important factor in this. Starting with the Carterphone decision in 1968, the CPE market has been liberalized

World Outlook and Forecast

Telecommunications equipment expenditure by lesser developed countries 1986

Bulgaria	108.90
Libya	106.10
Malaysia	99.80
Philippines	98.00
Romania	91.90
Vietnam	89.10
Thailand	88.90
Kuwait	80.80
Ireland	74.70
Peru	71.80
Chile	59.40
Kenya	58.10
Qatar	54.10
Puerto Rico	53.10
Ecuador	48.10
Costa Rica	42.30
Zimbabwe	41.70
Cuba	37.30
Nigeria	37.00
Morocco	34.70
Ivory Coast	33.90
Tunisia	30.20
Bahrain	30.10
Panama	27.60
Lebanon	27.00
Dominican Republic	25.20
Tanzania	21.90
Nicaragua	21.30
Bolivia	20.90
Cyprus	17.90
El Salvador	17.90
Jordan	17.80
Guatemala	15.60
Virgin Islands (US)	15.40
Afghanistan	14.80
Ethiopia	14.60
Zambia	13.20
Bahamas	12.80
Reunion	12.10
Uruguay	12.00
Jamaica	11.90
Paraguay	11.80
Uganda	11.50
Sudan	11.20
Ghana	10.80
Mozambique	10.30
Burma	10.10
Luxembourg	9.90
Sri Lanka	9.50
Namibia	9.00
Yemen North	8.90
Cameroon	8.00
Senegal	7.90

World Outlook and Forecast

Major world telecommunications markets 1986 - 2000 (US\$ millions)

Country	1986	1990	Per cent change	1995	Per cent change	2000	Per cent change
United States	24,009.00	27,191.30	13.25	29,900.00	9.96	41,800.00	39.80
Soviet Union	8,400.00	13,402.00	59.55	20,300.00	51.47	26,400.00	30.05
Japan	7,080.00	8,456.00	19.44	9,200.00	8.80	13,300.00	44.57
West Germany	5,888.00	7,684.00	30.50	8,600.00	11.92	12,900.00	50.00
France	4,482.00	6,161.00	37.46	6,800.00	10.37	9,600.00	41.18
Italy	3,916.00	6,734.00	71.96	7,400.00	9.89	9,500.00	28.38
United Kingdom	3,146.00	4,718.00	49.97	5,100.00	8.10	6,500.00	27.45
Canada	1,885.00	2,321.00	23.13	2,600.00	12.02	3,200.00	23.08
China	1,448.00	2,050.00	41.57	2,900.00	41.46	3,600.00	24.14
South Korea	1,422.00	1,919.00	34.95	2,100.00	9.43	3,100.00	47.62
Spain	1,403.00	3,000.00	113.83	3,300.00	10.00	5,200.00	57.58
Switzerland	1,360.00	1,393.00	2.43	1,600.00	14.88	2,400.00	50.00
India	1,308.00	2,282.00	74.46	2,700.00	18.32	3,300.00	22.22
Australia	1,204.00	3,000.00	43.85	3,300.00	9.70	4,100.00	24.24
South Africa	964.00	1,511.00	56.74	1,600.00	5.89	2,200.00	37.50
Brazil	872.00	1,024.00	17.43	1,100.00	7.42	1,800.00	63.64
Mexico	851.00	1,307.00	53.58	1,500.00	14.77	2,300.00	53.33
Sweden	845.00	1,144.00	35.58	1,300.00	13.64	1,900.00	46.15
Austria	786.00	1,080.00	37.40	1,200.00	11.11	1,700.00	41.67
Taiwan	685.00	913.00	33.28	1,000.00	9.53	1,500.00	50.00
Indonesia	640.90	875.70	36.64	889.00	1.52	1,100.00	23.73
Argentina	632.00	772.00	22.15	795.00	2.98	1,100.00	38.36
Saudi Arabia	550.80	770.20	39.83	885.00	14.91	1,400.00	58.19
Netherlands	544.70	786.50	44.39	840.00	6.80	1,300.00	54.76
Hong Kong	521.40	705.40	35.29	745.00	5.61	1,200.00	61.07
Norway	499.00	643.00	28.86	702.00	9.18	1,100.00	56.70
Belgium	468.00	519.00	10.90	628.00	21.00	990.00	57.64
Colombia	460.00	649.00	41.09	387.00	-40.37	640.00	65.54
East Germany	426.40	601.90	41.16	710.00	17.96	900.00	26.76
Venezuela	416.40	481.90	15.73	676.00	40.28	900.00	33.14
Singapore	313.20	427.70	36.56	625.00	46.13	900.00	44.00
Finland	302.10	363.60	20.36	465.00	27.89	720.00	54.84
Pakistan	296.50	539.60	81.99	651.00	20.64	830.00	27.50
Greece	286.50	502.90	75.53	692.00	37.60	1,100.00	58.96
Turkey	268.70	402.80	49.91	592.00	46.97	970.00	63.85
Denmark	259.80	370.40	42.57	547.00	47.68	850.00	55.39
New Zealand	241.10	367.50	52.43	497.00	35.24	820.00	64.99
Iran	234.00	410.00	75.21	587.00	43.17	850.00	44.80
Poland	227.50	304.90	34.02	538.00	76.45	710.00	31.97
Bangladesh	211.60	317.30	49.95	386.00	21.65	480.00	24.35
Egypt	210.40	280.00	33.08	521.00	86.07	750.00	43.95
Hungary	197.50	252.30	27.75	528.00	109.27	750.00	42.05
Israel	197.00	215.00	9.14	255.00	18.60	370.00	45.10
Iraq	178.60	283.00	58.45	339.00	19.79	550.00	62.24
Yugoslavia	161.40	249.60	54.65	467.00	87.10	625.00	33.83
Czechoslovakia	144.70	273.90	89.29	572.00	108.84	790.00	38.11
Portugal	121.40	227.90	87.73	429.00	88.24	720.00	67.83
Algeria	109.40	203.00	85.56	375.00	84.73	590.00	57.33
Syria	104.20	158.30	51.92	211.00	33.29	300.00	42.18
United Arab Emirates	102.40	152.30	48.73	202.00	32.63	307.00	51.98

Source: Telecommunications Research Centre and Government statistics

EUROPEAN TRADE IN TELECOMMUNICATIONS EQUIPMENT

Countries	EXPORTS		IMPORTS	
	SM Telecomm-unications		SM Telecomm-unications	
	1985	1986	1985	1986
Austria	30	43	54	83
Belgium	191	336	106	143
Denmark	48	68	70	110
Finland	69	97	65	81
France	462	482	87	102
Irish Republic	113	141	81	83
Italy	168	219	192	235
Netherlands	145	172	188	276
Norway	52	72	116	184
Spain	25	36	72	128
Sweden	962	968	150	200
Switzerland	82	114	70	118
United Kingdom	310	321	413	534
West Germany	747	937	163	235
TOTAL	3404	4005	1827	2512

SOURCE: BERN ELECTRONICS