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Speech by Liam Connellan, Director General, Confederation of Irish Industry on "The Changing Role of Education" at the Annual Conference of the Association of Principals of Technical Institutes held in the Dublin College of Catering, on Wednesday, 26th June 1985 at 9.30a.m.

INDUSTRIAL DEVELOPMENT TRENDS

Ireland is not a poor country by international standards. It has the 32nd highest income per capita of 152 countries in the United Nations. Among the industrialised countries it had, over the last twenty five years, one of the fastest growth rates, but it still has one of the highest rates of unemployment. There has been a major improvement in living standards since the late fifties. We have better housing, more cars, better hospitals and schools. Emigration, which averaged 50,000 per year in the 1950s, was not only halted in the 1960s, but reversed during the 1970s. The population has grown from 2.8 million people in 1960 to 3.5 million this year. Our aspirations are to achieve improved living standards and to provide the opportunity for work and self reliance for everyone.

Our living standards and employment levels depend on the total value of productive output i.e. the output of goods and services which can be exported or used to replace imported goods. In the 1920s when this part of Ireland became independent, the industrial base was very underdeveloped. (Chart 1) Only 13% of the workforce was engaged in industry, of which less than half were in manufacturing. Over half of manufacturing output was agricultural based and the remainder comprised, principally, traditional industries such as textiles and furniture.

The increase in living standards over the last sixty years has been due to the steady increase of output in industry and agriculture. There have been many changes in policy for the development of manufacturing industry. In the 1930s a policy of protectionism was adopted so that Ireland could produce its own requirements of grocery products, furniture, clothing and footwear. This policy proved effective initially and industrial

output expanded. However, the limitations of a small home market and the disadvantages of manufacturing an excessive range of products became very obvious in the mid 1950s when industrial production stagnated and emigration reached massive proportions.

At the end of the 1950s a new emphasis was placed on the encouragement of exports by established firms, and the attraction of overseas industries to set up plants in Ireland to manufacture for the world market. (see chart 2.).Throughout the 1960s industrial output expanded rapidly. In the mid-sixties, the process of dismantling tariff barriers commenced and was finally completed in 1977, when the transition period, following our entry to the European Community ended.

While the growth of industrial output slowed down over the last decade, due to the impact of two major international recessions, the expansion of Irish industrial output compared favourably even with Japan. (Chart 3.)

The distribution of the workforce has moved much closer to that of the rest of Europe, and is likely to continue doing so (see Chart 4.). The main reason for our relatively low living standards in Ireland compared to our continental EEC partners is that the output of the Irish industrial sector is only half that which would be necessary to support continental living standards.

Manufacturing Output and Employment

Industrial output has now become the predominant influence on the development of living standards and on employment change in the economy. The link between the growth of manufacturing output and changes in total employment in a number of EEC countries and Japan in the period from 1975 to 1981 is shown in Chart 5. This link is critical since technological advance may not require more employment in the manufacturing process, but the additional industrial output will create a demand for a wide range of services, including banking, insurance, transport, maintenance, subcontracting, education, health, construction and distribution. Ireland's performance was almost exactly what one would have expected from the experience of other countries. This correlation was also evident from 1979 to 1983, a period of low growth, due to the recurrence of international recession, and a decline in cost competitiveness. Our high unemployment rate is due to a combination of stagnant industrial output during the 1979/82 recession, and the exceptionally rapid growth of our labour force.

Chart 6 shows the close link which has existed in Ireland over the last decade between changes in manufacturing output and changes in unemployment.

In 1975, when manufacturing output began to recover from the recession following the first oil crisis, the rate of increase in unemployment slowed down rapidly. The unemployment level

started to fall one year later. It continued to do so for the next four years. Over this period manufacturing output expanded by about 2 percent per quarter and unemployment fell by between 1% and 2% per quarter. In 1979, the second oil crisis occurred, manufacturing output initially slowed down and fell the following year. Unemployment rose rapidly. The "false start" recovery in 1981 was reflected in a slower rise in unemployment. The relapse of manufacturing output in 1982 caused unemployment to rise more rapidly again. Finally, the lurching expansion of manufacturing output since late 1982, reflecting recovery in the United States, has resulted in a marked slowing down in the rate of increase in unemployment. Unemployment has now almost stopped increasing.

Over the last two years manufacturing output has increased at an annual rate of 10%. Can this high growth rate be sustained? I believe that the answer is 'yes'. The structure of Irish industry has changed dramatically in the last five years. (see Chart 7.) New technology industries such as the electronics, electrical, chemical and pharmaceutical sectors, which accounted for little more than one quarter of net output in 1979 now account for almost 40%; agricultural based industries have shown modest growth; and the share of traditional industries, comprising textiles, clothing, furniture, printing, packaging and building materials has declined. Over the last year, the decline in output of many traditional sectors has halted and some are again beginning to grow.

During this period new technology industries have expanded output by 15% per annum, and I believe that this growth rate can be maintained at least through the remainder of this decade. (Chart 8.) As in the past, the greatest growth is likely to come from the electronics and chemical sectors (Chart 9.).

The employment provided by these firms is of a very high quality. For example, last year industry increased its total recruitment of new graduates by 23%. Two thirds of these new jobs were in the engineering and chemical sectors.

Manufacturing industry has increased its spending on research and development in real terms by 32% since 1979. Electronic firms account for over a quarter of all research and development expenditure in manufacturing industry and have increased their spending in real terms by 131% over the same period. New technology industries accounted for almost half of total research and development spending by industry in 1982. (Chart 10.)

In view of the changing structure of Irish industry, I believe that there is a real possibility that manufacturing output can expand by 10% per annum over the remaining years of this decade. Achievement of this target would have a very favourable impact on employment in the economy. (Chart 11.)

The Impact of Technology

Structural change is not new to Irish industry. Industrial sectors rise and decline over long periods of time. (See Chart 12.). Thus, the 1600s witnessed the growth of the woollen industry; the 1700s the growth of the silk industry; the 1800s the growth of the linen and shipbuilding industries, particularly in the north east; the latter half of this century has witnessed the remarkable growth of the electronics industry, which is likely to be followed by major developments biotechnology in the 1990s.

There are now almost 300 companies in Ireland manufacturing electronic products. They employ about 20,000 people and have an annual output of £2,000 million, most of which is exported. This year Ireland will export over 200,000 computers - 25% more than last year.

The manufacture of micro-electronics and micro-processor based products is particularly suited to Ireland for many reasons. The products are small in volume and high in value. Transport costs are not significant. It is a clean industry with no polluting characteristics. It places a premium on technical knowledge and skill. The technology used in manufacture requires precision in measurement and in process control. The transfer of technology can be of major assistance to older sectors of industry. Technical knowledge within the industry is changing rapidly. It should be easier for a country having a young population structure to make the relevant adaptation to its education and training programmes than for most other European countries which must retrain an older workforce.

Biotechnology is another sector which is expected to grow rapidly towards the end of this decade. It is a relatively new term which is used to describe some of the oldest known processes, as well as many interesting and exciting developments. It describes the application of biological organisms, systems or processes in manufacturing industries. These processes include the fermentation of chemicals such as alcohols, aldahydes and hydrocarbons, which were well known before the advent of the petroleum industry. The cheap availability of oil made a number of these methods obsolete but with oil scarce and expensive, a reversion to fermentation processes is, not only considered desirable, but necessary.

Developments in biotechnology have been particularly successful in the manufacture of high fructose syrups from maize. The cost is substantially less than that of the traditional route from sugar cane or beet to sucrose. The direct harnessing of solar and biotechnical methods for chemical and nutritional energy supplies are being examined. The large scale growth of plant, animal or microbial life has been given the name "biomass". Applications can vary from the growth of forest to supply timber of particularly high calorific value for burning in power generation plants to the possibility of changing the form of natural materials, including timber and sewerage, to give a

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The demand for engineering graduates is likely to rise more rapidly in the years between now and the end of the decade. It is a matter of concern that current plans envisage engineering graduate output rising at only 10% per annum. I would strongly recommend that plans should be drawn up to increase the intake of first year engineering students by 20% per annum over the next five years, and that the position be reviewed annually.

A similar distribution of engineering sub-disciplines should be adopted for degree and sub-degree courses. It does not make sense that there should be such a wide gap in emphasis given to the different engineering disciplines between graduates, diplomas, and national certificate award holders. For example, in 1983 although only 22% of engineering graduates qualified in civil engineering they had much greater difficulty finding employment than those in other engineering disciplines.

The position was much worse at sub-degree level as about 40% of the 80 approved engineering courses were in civil and construction studies. It is not surprising that the unemployment rate was correspondingly higher.

range of products comparable to those derived from petroleum. There are interesting possibilities for making human insulin at vastly reduced cost. Microbes may one day alter the technology of mining by replacing the mechanical techniques in use today.

Many of these processes are still at an early stage of development. The next step will be their commercial exploitation.

The major challenge now facing Irish engineers and scientists is to develop new products and processes which will contribute to the dynamism of both new and established firms and will enable them to expand rapidly in response to the changes in the market place.

Technology is changing production methods in all sectors of industry. Last year I visited a firm near Tokyo, employing 400 people, which manufactures laser machine tools capable of cutting steel to an accuracy of ten microns. Using this equipment a complex press tool can be made in a few hours.

Similarly, the application of robots to repetitive operation is increasing (Chart 13.). For example I am aware of an Irish-based engineering firm which has 4 robots for a workforce of less than 400.

New technology industries offer considerable scope for the development of skilled sub supply firms. The electronics industry estimates that it alone could purchase an additional £100 million of products in this country if suppliers could be found. A National Linkage Programme to stimulate local sub supply to such industries has been established and a pilot programme is being operated jointly by the electronics industry and the IDA.

The recent White Paper on Industrial Policy has indicated that additional incentives will be provided for technology acquisition and marketing activities in industry.

Innovation

There are many indicators of an increasing level of innovative activity in the economy including new industrial investment, links between industry and higher education, and a remarkable increase in research and development projects.

Over 80% of the output of the fast growing electronics, chemical and pharmaceutical companies is produced by new overseas firms. There are now about 850 foreign owned manufacturing firms operating in Ireland. They have been attracted here by a combination of factors including our membership of the European Community, that we speak English, our educated workforce, and our package of financial and fiscal incentives. These firms have brought with them the most up-to-date know how, and access to international markets. There are

unexpected results, such as that Ireland is the top supplier of industrial diamonds to Japan.

These firms are making a remarkable contribution Irish economy. Ireland is fortunate in having established an enviable track record as a desirable location for electronic firms. Chart 12. shows that Ireland is regarded as the second most desirable location of 50 countries by American electronics firms when considering location outside the United States.

New overseas firms, generally, have a very positive attitude towards the development of Irish sub-suppliers. They are frequently prepared to help the local supplier in achieving the stringent quality levels required and to provide engineering expertise.

It is not unusual for a manufacturing company to have as many sub-suppliers as it has employees. The recent agreement of the CII's Federation of Electronics and Informatic Industries with the IDA to jointly fund a high powered linkage executive to seek out new opportunities for accredited Irish sub- suppliers should make it possible to win more of this business for Irish firms. Already many manufacturing companies have over 100 local sub-suppliers.

300 new technology companies, each having 100 Irish sub-suppliers, can provide a rapidly growing market for up to 3,000 Irish sub-suppliers each having 10 major customers. The hundreds of examples of Irish manufcturers who have already successfully met the challenge of supplying products and components to rapidly growing new industries show what can be done. Almost every Irish manufacturing firm can become a fast growing industry by being the best in its own particular field. A commitment to quality and reliability will ensure that success. It will be a long and arduous process to achieve the necessary standard of excellence. The rewards, however, can be enormous.

The following is one example of a successful Irish sub- supply firm:

HITOL: a small engineering firm in Waterford, which operates computer numerically controlled equipment to make components for computers, became the first machine shop in Europe to receive the High Quality "Ship to Stock" certificate of excellence from the Digital Equipment Corporation. This qualifies the firm to quote for the Company's world wide business. The same firm has obtained a 15-year contract from the Ford Tractor Company for the production of spare parts for Ford tractors for world wide distribution.

Close links are being developed between industry and higher education institutions. These include a large number of practical research projects which, in many cases, have resulted in the development of new products, and the improvement of production processes above the level attained in comparable

factories abroad. The National Microelectronics Centre, close to University College, Cork; the Microelectronics Applications Centre, linked to NIHE Limerick; the genetic engineering specialisation at Trinity College; the industrial "incubator" units on the campus of UCG, and planned for UCD; and the University Industry Centre in Belfield funded by industry and by members of the Engineering Graduates Association are examples of this intensifying process.

In 1983 the IDA provided incentives for 637 research and development projects, an increase of almost 50% over the previous year.

Four hundred and fifty small industries have set up or are involved in expansion projects in 1984. The majority of these are in the engineering sector.

Three hundred applications for equity investment have been made to the National Enterprise Agency in 1984. Although only a small proportion of these may be judged commercial, the volume of activity is encouraging.

Eighteen Irish organisations are participating in the EEC ESPRIT Programme for precompetitive research in information technology.

Ninety two Irish companies have expressed interest in the proposed EEC programme for basic research in industrial technology.

About 40 new firms are being set up in 1984 by executives from established Irish companies, who have decided to set up their own firms under the Enterprise Development Programme.

Over twenty joint venture or technology transfer agreements are being concluded this year between Irish and overseas companies.

For example, PLASTRONIX, a precision plastics firm in Dublin started production in 1984 and has a technical collaboration agreement with a Japanese company, and now supplies precision plastics components to five Japanese and two American electronics manufacturers.

These activities provide an impressive set of evidence of increasing innovation in industry.

The 1984 Finance Act introduced a welcome tax incentive to encourage direct investment by individuals in industry. While the blunt fact must be faced that so far there appears to have been very little progress in setting up investment funds to channel this money into industry, the concept is one which is well worth promoting. I would like to see an Ireland where everyone with spare cash would automatically think of investing it in producing more internationally traded goods and services. People who invest in industry will follow their money and ensure that it is used well.

Information Technology

The manufacture of microelectronics and microprocessor based products is only the start. The main growth over the next decade is expected to be in providing services which will enable householders, and organisations to apply computers to everyday tasks and to develop new processes and services.

Chart 13, prepared by the National Board for Science and Technology, reclassifies the traditional structure of employment in the economy to show separately the proportion of total employees engaged in the information services sector, comprising banking, insurance, financial, and professional services, as well as public, administrative, education, and business services It is estimated that 40% of all employees work in the "information services" sector.

Recent developments in telecommunications have opened the possibility of an Information Network System, chart 14. which will link phones, computers, video machines, viewdata terminals, television, facsimile machines and vehicle phones; locally, nationally and internationally. Its more developed form is called an Integrated Services Digital Network (ISDN). The possibilities for the development of new products and services in these areas are almost without limit.

Early last year, the French telecommunications authority distributed computer terminals, with keyboard and display screen, free of charge, instead of telephone directories to 100,000 homes in Britany. The subscribers have access to a wide range of information services, including, of course, a computerised telephone directory. It is intended to distribute 3 million of these terminals to French households by the end of 1986. In this way, millions of families will become familiar with the use of computers, and it is expected that they will seek a wide range of new services, varying from computerised shopping to electronic mail.

The recent proposals to accelerate the development of the European telecommunications system, so that it can compete effectively with that of Japan and the United States, are of vital importance. Ireland must not only be part of an integrated telecommunications network, but be in the forefront of application. A sophisticated telecommunications network which allows voice, data, text, and video to be carried along a single communications link, will dramatically reduce costs and increase efficiency. It will also reduce any perception of remoteness from customers and suppliers.

At present one household in ten in Britain has a home computer and in Ireland, it is estimated that the proportion is now one household in twentyfive. Schoolchildren are learning to programme home computers for different tasks. The computer can be linked to the television set in the home and can also be linked to the telephone network.

Ireland is in a unique position to capitalise on these developments. Ireland and France are the only countries in Europe which will have a digital telecommunications network installed in 1985. This means that Irish industry will be able to use the most sophisticated equipment for the transmission of information.

A survey conducted by the CII three months ago, to which 328 firms responded, indicates the current state of the art.(Chart 17.). Almost every respondent firm has, or plans to have, its own computer within two years; two thirds have, or will have, word processors; over half to access data bases outside the firm; one third have, or will have, have facsimile machines; one fifth either have or plan to have computer aided manufacture, and a similar number to use computer aided design; one quarter were using or planned to use electronic mail; one seventh videotext and almost one firm in ten uses or will use teleconferencing. This is an indication of current practice in Irish industry. I estimate that information technology applications are increasing at an annual rate of 25% to 30%. This is the high growth sector. Its rapid growth will create a demand for thousands of new products and services in industry, in the home, in banking and in retailing. Already there are almost 300 computer software firms engaged in the development of new computer applications in Ireland, employing a total of 2,500 people, but there are also about 20,000 computer service staff employed in the economy.

Chart 18. shows the sectors among one hundred and fifty classifications in the U.S. economy which are expected to show the fastest growth in employment from 1982 to 1995. At least five of the top ten are related to the development of the "computer and communications industries".

The development and use of single items of information technology equipment is only the beginning. The major benefits will come from the adoption of a total information system approach which can make the best use of the interaction of all facilities. As an offshore island on the periphery of Europe, it is vitally important that Ireland capitalises on its advantage as one of the first countries with a digital telecommunications network. This is necessary, not only to improve efficiency and effectiveness within the economy, but also to eliminate the perception of remoteness which, undoubtedly, resides in the minds of our potential customers in Europe's Golden Triangle.

Many people are concerned about the impact of technological development on employment. I would make three points in response. Firstly, if we don't adopt new technologies as rapidly as our competitors our industries will decline. Secondly, throughout the centuries technological development has created demand for a myriad of products and services. Thirdly, higher output is the only way to improve living standards and support higher employment. The main difference between a small Scandanavian country, such as Finland, which

has a living standard almost twice as high as ours with very low unemployment is that the output of the economy is also almost twice as high.

Exports

Irish economic growth depends more than ever upon our capacity to export. Proportionately, Ireland is the third largest exporter in the EEC after Belgium and the Netherlands.(Chart 19.) In the 1960s, Irish exports accounted for 30% of national output. In the 1970s, exports accounted for 42% of national output. This year, there are likely to account for 60% and the recent National Economic Plan indicated that exports are expected to account for 72% of national output over the period of the Plan. The volume of manufacturing exports is expected to increase by almost 20% this year.

The small scale of the Irish economy makes it essential that Irish industry is a strong advocate of free trade, and that it vigorously opposes protectionism. Irish industry must produce a specialised range of products for the large international market. In this way it can compete with industries producing similar products in large countries. Industry favours the full liberalisation of trade within the European Community. It is regrettable that almost twentyseven years after the signing of the Treaty of Rome, it still takes eight hours on average to transfer goods from one Member State to another, and that these delays are estimated to add 5% or £7 billion to the costs of these products to European consumers. The United States and Japan have derived substantial competitive benefits from the availability of a large, open home market. European industry must also ensure that it achieves similar economies of scale so that it can compete effectively. New industries are set up in Ireland because we are part of the large EEC market. We must ensure that it operates in practice.

In recent years there has been a dramatic change in the nature of our exports. (Chart 20.). In 1984, our top five exports were computer equipment; chemicals; meat; dairy products and electrical machinery in that order. These five product groups accounted for over half of all Irish exports. However, they had very different growth rates. New technology exports of computers and chemicals are expanding much more rapidly than food exports.

According to a recent EEC study Ireland now has a greater ratio of high technology exports to total exports than any other EEC country (Chart 21.).

When considering export development, we must also look at our attitudes to learning modern continental languages. The proportion of Irish exports sold to Germany and France is increasing while the proportion to Britain continues to decline. In 1973, Irish exports to Germany were less than one tenth of our exports to Britain, but by 1984 they accounted for

one-third.(Chart 22.). On current trends, Irish exports to Germany could be as great as our exports to Britain within a decade. Chart 23 shows the share of EEC purchasing power between the three largest economies. It supports my contention that Germany will be the most rapidly growing market for Irish products as these will tend to be bought in proportion to the respective purchasing power of the different regions of the Community. It is disappointing that the proportion of Leaving Certificate students studying German languishes at 4%, far below the creditable 61% studying French. (Chart 24.). There has been no improvement over the last decade. Facility with modern languages, particularly German and French, is a prerequisite to attaining the full potential penetration of these key markets.

Since new technology exports are growing faster than any other exports it is vital that technical executives should be proficient in modern continental languages.

Third Level Employment Demand and Supply

Demand

Various studies have indicated that proportionately, Ireland has only one third the number of engineers and technologists compared to countries such as Japan, Denmark, France and the United States. Technical graduates are required, not only in manufacturing firms and technical service companies, but throughout all sectors of the economy. There are very few organisations which do not have direct or indirect involvement with technology. Engineering graduates can be as important to financial institutions, and public policy organisations and departments as to the manufacturing firms. It is essential that a technological ethos permeates our whole society.

An indication of the demand for technologists in the economy is given by an analysis of executive vacancies which is conducted quarterly by Management Selection Limited. (Chart 26.). This indicates that of 3,600 executive vacancies advertised in the national newspapers over the last year, 35% were for production and engineering staff, and a further 17% for data processing staff. A recent CBI survey in Britain showed that over 30% of manufacturing firms in the office machinery, electrical industrial goods, and electronics industries had their growth constrained by shortages of skilled staff.

A recent report by the U.S. Department of Labour forecasting the fastest growing occupations between 1982 and 1995, listed seven technical occupations in the top ten out of a total of 400. (Chart 27.) Five of these were computer related. The top ten also included electrical engineers.

In 1983, for the first time, industry was the largest employer of the new male graduates qualifying from our universities. (Chart 28.).It was the fifth largest employer of female

graduates (Chart 29.). Industry recruited approximately 400 graduates, an increase of 23% on the previous year. It recruited a similar number of other third level award holders.

The greatest demand by industry was for graduates having engineering qualifications, followed by science and commerce. These three groups accounted for 94% of all new graduate recruitment.

Last year, the demand from industry for new engineering graduates increased by 46% to 233. (Chart 30.). The demand for science graduates increased by 10% and the demand for commerce graduates fell slightly. Two thirds of all the new engineering graduates and one third of new science graduates entering employment in Ireland in 1983 were recruited by industry. Of those recruited by industry, in turn, two thirds were taken on by the fast growing engineering, electronics and chemical sectors.

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The position was much worse at sub-degree level as about 40% of the 80 approved engineering courses were in civil and construction studies. It is not surprising that the unemployment rate was correspondingly higher.

There has been a very satisfactory response from secondary schools to the increased demand for engineering and science qualifications (Chart 34). The number of students taking honours mathematics in the Leaving Certificate has doubled since 1980, and there has also been a significant increase in the numbers studying physics and chemistry. The foundation has therefore been laid for increasing the throughput of engineering and science graduates.

Conclusion

Ireland has made dramatic progress over the last twenty years in moving from a highly protected economy to one which can sustain high industrial growth in free trade with the most advanced economies in the world. The impact of the second oil recession from mid-1979 to mid-1982 halted this expansion. The recovery in the United States which commenced in the autumn of 1982 was mirrored by an expansion in Irish manufacturing output, which has now been sustained for two years.

Our industrial structure has a higher proportion of new technology firms than other European countries. This offers the potential for sustaining a rapid growth rate. The challenge facing Irish engineers is to strengthen our industrial base by placing greater emphasis on product and process development, innovation and technical marketing. Engineers and scientists must also spread technological awareness throughout all organisations in our society. The "information services sector" including banking, insurance, financial, and professional services as well as public, administrative, education, and business services; is estimated to comprise 40% of the Irish workforce. Information technology is now the fastest major growth sector. The imminent completion of the digital telecommunications network offers a unique opportunity for Ireland to establish a competitive advantage in information technology.

Depressed living standards, and high unemployment reflect the relatively low output of internationally traded goods and services in our economy. Technological developments can now enable us to increase output rapidly, and take a larger share of the total European market.

It is vital that we should concentrate on thinking and acting positively regarding our opportunities for economic development. There is too much emphasis on the knocking of achievement. There are too many doubting Thomases in our society. We must recognise our strengths and build on them. We have a real opportunity to develop a technologically advanced society with improving living standards and higher employment. We must have confidence in ourselves to achieve these objectives, and take the necessary action to promote enterprise, innovation, dynamism, professional competence, risk taking and hard work. Let us recognise too that risk and innovation encompass occasional failure as well as success. An open and welcoming attitude to change is the surest way of

sustaining expansion.

Jonathan Swift said it all in characteristic pungent fashion two and a half centuries ago when he held that "Whosoever could make two ears of corn or two blades of grass upon a spot of ground where only one grew before would deserve better of mankind and do more essential service to his country than the whole race of politicians put together".

I would conclude by stressing that Irish industry supplies only 1% of EEC demand for industrial products. If that figure were to double quickly to 2% it would be unlikely to cause major turbulence in European markets, but it would have a profound impact on Irish living standards and employment prospects. Our industrial sector is lean, modern and efficient. It has the capacity to grow much more rapidly. The real challenge facing technologists is to make that happen.

END

Chart 1: DISTRIBUTION OF THE THE IRISH WORKFORCE

	1926
Agriculture	54
Industry	13
Services	33
	100

Chart 2: MANUFACTURING INDUSTRY (% Annual Change)

	Output	Productivity	Employment
1958/64	7	4	3
1965/72	6	3	2
1973/82	3	3	0

Chart 3:

TRENDS IN INDUSTRIAL PRODUCTION* BY VOLUME IN IRELAND, THE EEC AND JAPAN (1975 = 100)

* Except the building industry

Source Eurostat

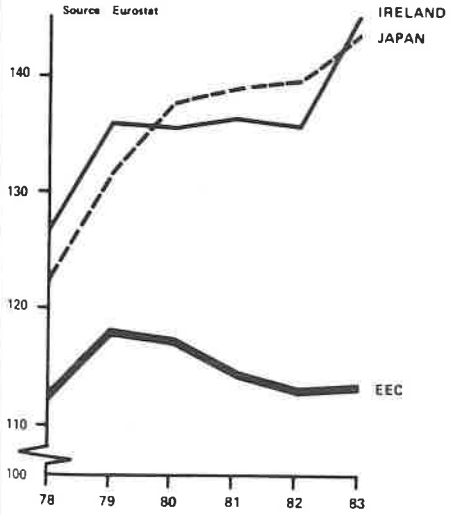
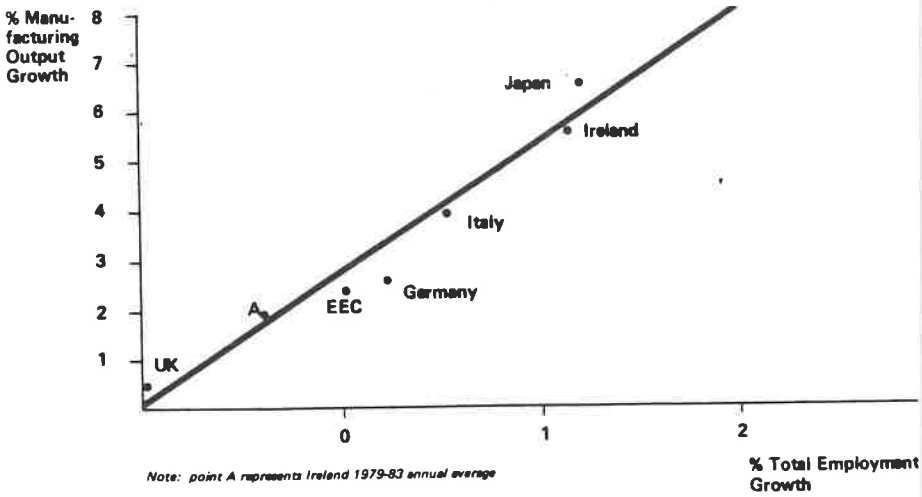


Chart 4: DISTRIBUTION OF WORKFORCE

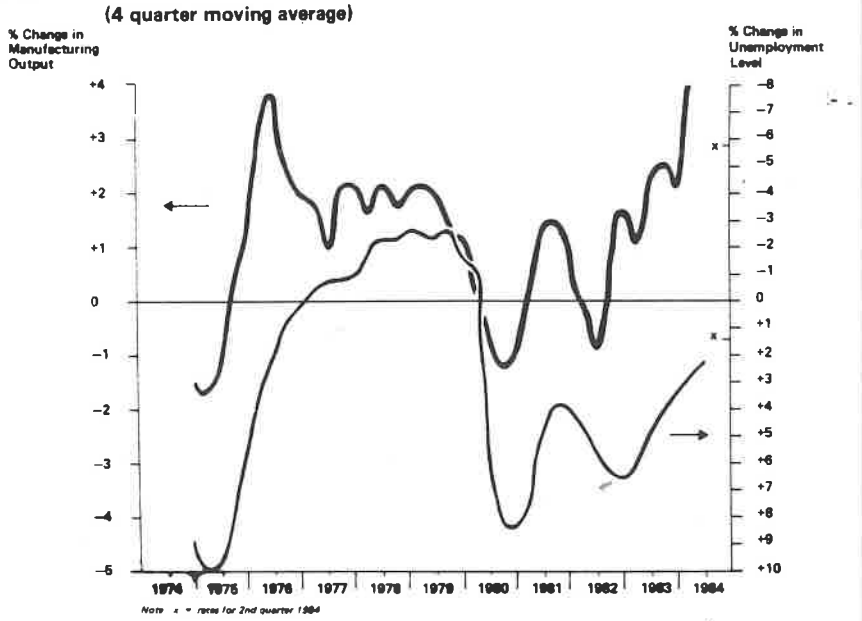
	1983 Ireland	1981 EEC
Agriculture	17	8
Industry	29	38
Services	54	54
	100	100

Chart 5: MANUFACTURING OUTPUT V TOTAL EMPLOYMENT 1975 – 81



Note: point A represents Ireland 1979-83 annual average

Chart 6: MANUFACTURING OUTPUT V UNEMPLOYMENT (4 quarter moving average)



Note x = rates for 2nd quarter 1984

Chart 7: CHANGING STRUCTURE OF INDUSTRY (% OF OUTPUT)

	1979	1984
New Technology	27	42
Food, Drink & Tobacco	30	26
Traditional	43	32
Total	100	100

Chart 8: MANUFACTURING OUTPUT 1979/83

	Annual Change
New Technology	+15%
Food, Drink & Tobacco	+2%
Traditional	−3%

Chart 9: OUTPUT — NEW TECHNOLOGY SECTORS
(Average Annual Increase: 1973/83)

Office and Data Processing	39%
Chemicals	10%
Instrument Engineering	7%
Electrical Engineering	4%
All Manufacturing	4%

Chart 10: R & D EXPENDITURE 1982

New Technology	48%
Food Drink & Tobacco	20%
Traditional	32%
	100%

Chart 11: MANUFACTURING INDUSTRY
(% Annual Change)

	Output	Productivity	Employment
1958/64	7	4	3
1965/72	6	3	2
1973/82	3	3	0
1983/90	10	8	2

Chart 12: GROWTH SECTORS

1600s	Woollen
1700s	Silk
1800s	Linen
	Shipbuilding
1950/2000	Electronics
	Biotechnology

Chart 13: ROBOTS
Per 10,000 Employees Manufacturing 1981

Sweden	30
Japan	13
W. Germany	5
U.S.	4

Chart 14: US ELECTRONICS 1984 LOCATION PREFERENCE 50 COUNTRIES

1	UK
2	IRELAND
3	WEST GERMANY
4	MEXICO
5	JAPAN

Chart 15:

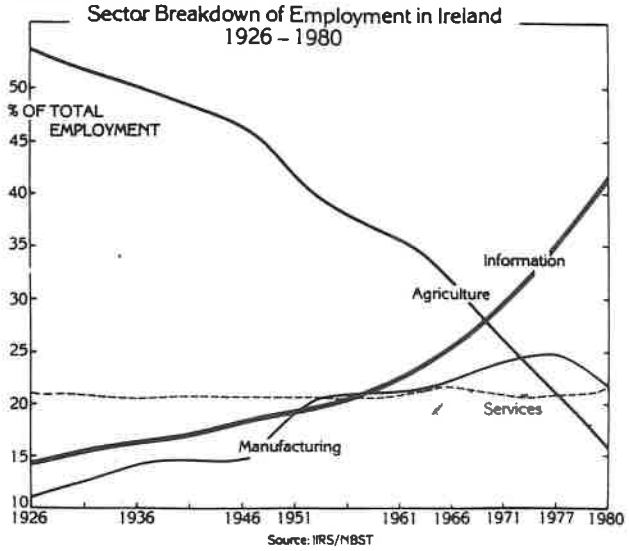


Chart 16: General idea of INS

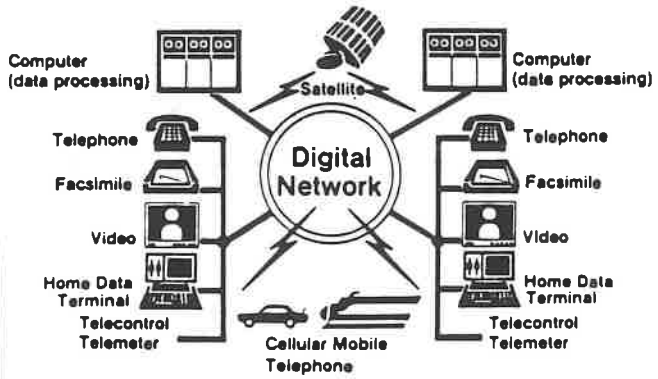


Chart 17: INFORMATION TECHNOLOGY — % (328 Firms)

Own Computer	97
Word Processor	64
Access to Data Bases	51
Facsimile Machines	34
Electronic Mail	27
Videotex	16
Teleconferencing	9

Chart 18: US EMPLOYMENT PROJECTIONS 1982/95 FASTEST GROWING SECTORS (Among Top Ten)

	Annual Change
Medical Instruments	6%
Scientific Instruments	4%
Business Services (Incl. Comp.)	4%
Computer Equipment	3%
R + TV Broadcasting	3%
Electronic Components	3%

Chart 19: EXPORTS

Annual Growth %	of National Output	
1961-1970	8	30
1971-1980	8	42
1981-1983	6	50

Chart 20: IRELAND'S TOP 5 EXPORTS 1983

		% Total Exports
1.	Computer Equipment	14
2.	Chemicals	14
3.	Meat	8
4.	Dairy Products	6
5.	Electrical Machinery	4
	Total	46

Chart 21: EXPORT/IMPORT RATIO

	1979	1983
New Technology	0.8	1.4
Food, Drink & Tobacco	2.3	2.1
Traditional	0.4	0.5
	0.7	0.9
Total	**0.7**	**0.9**

Chart 22. HIGH TECHNOLOGY EXPORTS

	1970	1982
OECD	100	100
EEC	101	87
US	127	120
Japan	72	133
Ireland	42	113

Source: B. Cardiff, EEC Commission

Chart 23: % SHARE OF TOTAL IRISH EXPORTS

	1973	1983
UK	55	37
Germany	5	10
France	6	8

Chart 24:

	% EEC Purchasing Power	% Irish Exports to EEC
UK	20	54
Germany	28	14
France	23	12

Chart 25: % OF PUPILS TAKING LEAVING CERTIFICATE

English	100
German	4
French	61

Chart 26: EXECUTIVE VACANCIES 1983-84 — %

Production and Engineering	35
Accounting and Finance	20
Data Processing	17
Marketing and Sales	10
Other	18
3600/Year	

Source: MSL Ltd.

Chart 27: US FASTEST GROWING OCCUPATIONS 1982-95 (Among Top Ten)

Computer Service Technicians	+97%
Computer Systems Analysts	+85%
Computer Programmers	+77%
Computer Operators	+76%
Electrical Engineers	+65%
Civil Engineering Technicians	+64%
Peripheral EDP Operators	+64%

Chart 28: NEW GRADUATE EMPLOYMENT MALE — %

	1982	1983
Industry	21	28
Health	23	19
Professions	27	20
Commerce	8	10
Education	7	9
Total	86	86

Chart 29: NEW GRADUATE EMPLOYMENT FEMALE — %

	1982	1983
Industry	9	11
Health	38	32
Professions	14	13
Commerce	13	13
Education	11	12
Total	85	81

Chart 30: NEW GRADUATE RECRUITMENT 1983

	No.	% Increase 1983/ 1982
Engineers	233	+46
Science	87	+10
Commerce	85	−2

CHART 31

PATTERN OF INDUSTRIAL RECRUITMENT BY ACADEMIC DISCIPLINE

Discipline	1983	% Share	% Change 1983/1982
Engineering	395	50.4	23.8
Business Studies	159	20.3	18.6
Science	180	23.0	44.0
All Other Disciplines	49	6.3	−48.9
Total Industrial Recruitment	**783**	**100.0**	**16.2**

Chart 32: ENGINEERING GRADUATES OUTPUT

1981	656
1985	969
1989	1330

Chart 33: ENGINEERING GRADUATE OUTPUT

	1983	1989
Electrical	296	409
Mech/Prod./Ind.	226	410
Civil	177	215
Chemical	49	86
Agriculture	15	16
Other	42	194
	805	1330

Source: HEA

Chart 34: LEAVING CERTIFICATE — % 1982

	Boys	Girls
Hons. Maths	32	12
Physics	37	6
Chemistry	33	16
Biology	37	62