Educating IT Professionals for Work in Ireland: 
An Emerging Post-industrial Country

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During the past three decades Ireland has been undergoing a significant societal transformation. It is moving from a traditional society emphasizing farming and domestic markets to one whose economy is heavily dependent on inward investment by multinational information technology firms. As it moves toward a post-industrial society, Ireland has identified information technology education as a key factor in this societal transformation. In order to provide a qualified work force, certain changes in the content and structure of Irish education were necessary. Among these were: making secondary education freely available; establishing technical colleges throughout the country; placing greater emphasis on science, engineering and business in the existing universities; and creating two technologically-oriented universities. To help upgrade the skills of working adults, evening degree programs and government training programs were created. Three recommendations result from examination of Ireland's efforts to educate IT professionals. First, labor force requirements must be monitored against student demographics. Second, the universities must broaden their mission to incorporate greater linkages with industry. Finally, class-based barriers to IT educational attainment must be addressed.
During the second half of the twentieth century, Ireland has been undergoing a societal transformation. It is changing from a traditional, agrarian society with an inward focus to a post-industrial society and a full participant in the world economy. This change is occurring in the context of directed national planning. The plan is based, in large part, upon the development of an employment sector founded upon information technology work and Information services. This is largely being accomplished by attracting foreign industries to Ireland. The long term effects of this effort are still to be felt. But it is already clear that this transformation is affecting not only the Irish economy, but its societal institutions as well.

This chapter examines the role of education in a country that is in the process of transforming its labor force from agriculture to Information work. It does this by first describing the role of education in Ireland’s agricultural society. This is followed by a description of the new industrial policy and the educational changes which are required to make it successful. In doing so, issues and recommendations are highlighted. Finally, the Irish situation is brought into the larger context of international IT education.

The objective of this chapter is to answer two basic questions with respect to countries such as Ireland. The first question is: What are the issues related to educating the indigenous population for work in an information economy? This question is concerned with the educational preparation of individuals for work in the IT sector. It is also concerned with the type of educational infrastructure that must be in place in the country.

The second question is: What are the issues related to educating individuals in advanced industrialized countries for work in countries with emerging information industries? This question is concerned with the knowledge, perspectives and orientations of employees of multinational firms who will be working in or establishing offices in countries such as Ireland. This question extends the educational consideration beyond the borders of the newly post-industrial country to societies which will supply the personnel to establish work sites in these countries.

The data for this chapter are from the results of a study of the emerging Information economy in Ireland. There are two
purposes of this study. One is to document Ireland’s route to a post-industrial society. The other purpose is to argue that information economies are not monolithic. They do not emerge according to fixed, immutable laws. Rather, each post-industrial society is shaped by the cultural, economic, and political factors present in that society. The data come from both primary and secondary sources. Primary sources include interviews with employees and managers at multinational and indigenous IT firms. These interviews are supplemented by interviews with representatives of relevant societal institutions: unions, universities, and government agencies charged with supporting Ireland’s industrial policy. Secondary sources include published books and periodicals, public policy documents, and agency literature.

While the data used in this paper are specific to Ireland, the issues are not. Ireland is representative of a type of society today, one which is "leap fragging" from an agrarian to a post-industrial society by emphasizing work in the information economy. Such countries have traditions and values associated with an agrarian lifestyle, are often post-colonial, and are geographically peripheral to the global economic powers. For Ireland, as for other similar countries, the challenge is not simply one of attracting foreign investors. It is also to establish linkages between the societal infrastructure and the industrial policy. Key among these linkages is education.

THE ROLE OF EDUCATION IN IRELAND'S SOCIETAL TRANSFORMATION

In examining the role of education in the societal transformation of Ireland it is first necessary to consider what the phrase "educating IT professionals" means for Ireland. For an emerging post-industrial society, this phrase has two components: content and infrastructure. Content refers to what future IT workers need to learn. Infrastructure refers to the societal structures which disseminate that content. Since the role of education in agrarian societies is quite different from that of post-industrial societies, the educational infrastructure is likewise very different. Thus, the task of educating a labor force for information technology work is not simply a matter of curriculum design. The larger, and perhaps more difficult, challenge is
that of changing the educational infrastructure. This chapter considers both aspects of the educational challenge.

Traditional Irish Society

Few societies have changed as much as Ireland in the past thirty years. Ireland, prior to its transformation, has been described as "... a rural, conservative and Catholic backwater of post-war Europe." (Breen, Hannan, Rottman, and Whelan, 1990, p. 1). In order to understand the dimensions of the transformation that has occurred, it is necessary to understand the type of society from which the new Ireland emerged. Ireland was one of the first nations to obtain its independence from colonialism in the twentieth century. The Anglo-Irish Treaty of 1921 divided the island into the independent Irish Free State and Northern Ireland. In 1949 the Free State left the British Commonwealth and the Republic of Ireland was born.

Partition of the island resulted in the absence of an industrial base in the new republic. O'Malley (1989) argues that the industrial revolution did not flourish in Ireland for three reasons. First, it lacked many of the natural resources needed to support heavy manufacturing industry. Second, its colonial status interfered with its participation in the industrial revolution occurring elsewhere. Finally, what little industrialization existed in Ireland at the turn of the twentieth century was in Northern Ireland. Hence, the way in which the Irish Republic was established caused it to regress along the agrarian, industrial, post-industrial continuum.

During its early years, the new Irish nation was isolationist. In an effort to reestablish political and cultural sovereignty, economic policies were directed at creating national self-sufficiency through protectionist policies. The operating assumption was that Ireland would prosper by promoting the interests of small farmers and native industry serving local markets. During this period of economic isolationism there was little motivation for involvement in international affairs. In such a society there was also little need for highly developed societal infrastructures associated with an industrialized society such as telecommunications, transportation, and education.

Agriculture was the dominant economic and societal organizing principle. In the 1920's, farmers accounted for nearly half of the labor force (Rottman, Hannan, Hardiman and Wiley,
These farms were family owned, generally small, and passed down from one generation to another. Society was organized around the activities and values associated with a stable, unchanging agricultural society. Land was the basis of social status. One's life chances depended on the prospect of inheriting a family-owned business or farm.

Role of Education

A strong emphasis on learning is part of the Irish character. This is expressed in the value placed on general literacy, language facility and "mental alertness." Until quite recently, however, extensive formal education has not been available to the general population. Since the nineteenth century, primary education has been provided through the free National School system. Until 1968, post-primary education was available in two forms. Free vocational schools were established in the 1930's. Their mission was practical training in preparation for employment in the trades, manufacturing, agriculture, and commerce. The alternative form of post-primary education was the secondary school, a private, academically-oriented institution, generally run by priests and nuns. The role of the secondary school was not to provide a skilled labor force. Rather, the focus was on religious, moral and intellectual construction, and the products of this form of education were (if male) destined for jobs in professional and other white collar occupations, achieved in some cases via third level education. (Breen et al., 1990, p. 126).

Clearly, education beyond primary level was the province of the middle class and wealthy farmers. Formal education was not viewed as a vehicle for enhancing one's position in society, nor was it linked to employment prospects. Rather, it was a refining process for those who were already members of the privileged classes (O'Toole, 1990a).

The Emerging Post-Industrial Society

The late 1950's marked the end of the post-independence search for a national identity and economy based on conceptions of traditional, rural Ireland. The first of several industrial deve-
opment plans to follow (see Endnote 4), the *Programme for Economic Expansion* represented a significant turning point in Irish history. It was a rupture from the past as it reversed the protectionist policy then in place. The assumption that Ireland would prosper by promoting the interests of small farmers and native industry serving local markets was cast aside. It was replaced with an agenda which opened wide the doors to foreign investment as Ireland began to participate fully in the world economy.

There were two key aspects of this new plan. The first was the mechanization and consolidation of farms in order to be more competitive in the European food market. Increased agricultural production at the expense of agricultural employment resulted. Between 1961 and 1981 the number of males employed in agriculture declined from 34% to 17.4% (Rottman et al., 1982, p. 46). The second aspect of the plan was replacing jobs lost in agriculture with industrial employment. This was to be accomplished by attracting foreign export-oriented manufacturing firms to Ireland. A semi-state agency, the Industrial Development Authority (IDA), was responsible for overseeing the implementation of this aspect of the industrial policy. (See Endnote 3.)

In considering which foreign industries to attract, Irish policy makers identified three high growth industries that were not heavily dependent upon the natural resources that Ireland lacked. They are pharmaceuticals, chemicals, and electronics. Electronics meant the manufacture (usually final assembly for the European market) of computer hardware. It was the decision to attract firms in the electronics industry that set Ireland on its path toward an information economy. It is important to note, however, that during the 1960's and 1970's Ireland did not think of itself as moving toward an information economy. To Irish policy makers, the computer industry was simply a form of manufacturing. But the combination of policy decisions and other infrastructural and societal changes resulted in the emergence of a diverse Information economy that has become crucial to Ireland's economic future.

Among the infrastructural changes that were needed to support the new industrial policy was the upgrading of Ireland's telecommunications system. As an agrarian society emphasizing small farming and local markets, sophisticated telecommunications was not an Important priority. But the multinational firms Ireland was courting required the ability to move information
quickly and efficiently. Consequently, during the 1970's and 1980's Ireland significantly upgraded its telecommunications network with the use of satellite and fiber optic technologies. An unintended consequence of this action was the multifaceted information economy that resulted. In addition to computer hardware manufacture, Ireland subsequently identified other employment opportunities which are based upon a sophisticated telecommunications capability. One of these is remote software development. Multinational companies such as Wang Laboratories and IBM, for example, located software development groups in Ireland. By taking advantage of time differences and cheaper real estate, Ireland was also able to develop a third type of information work: off shore data processing. Today, the data entry and information processing activities of many American and European insurance, publishing, and financial services firms are located in Ireland. Ireland currently has a robust information economy which includes technology manufacture, software development and information processing.

This industrial development policy has brought about a transformation in Irish society. Ireland has moved from a being a nation of small farmers to one which emphasizes employment in targeted high tech industries, key among these being the information technology and services sectors. These new industries now account for a significant part of Ireland's labor force and Gross National Product. Nearly a third of the industrial employment in Ireland is accounted for by the metals and engineering sector (Institute of Public Administration, 1989, p. 388). Electrical, electronic, chemicals and pharmaceuticals industries increased output by an average of 15% per year between 1975 and 1990. In contrast, the traditional, labor-intensive, low value-added industries suffered a decline in output of 2%. Ireland is noteworthy within the European Community by having half of its total manufacturing output accounted for these fast growing new technology sectors (Power, 1990).

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The successful implementation of this plan hinges on the availability of a qualified labor force. Thus, Ireland's industrial development policy has been the driving force behind the development and growth of IT education in that country. Examining Ireland's approach to educating IT professionals involves consid-
ertng aspects of the existing educational system which were consistent with the new industrial plan. It also involves identifying those changes in both educational content and infrastructure that needed to occur in order for the industrial policy to succeed.

**Access to Secondary Education.** An important feature of Irish culture which is consistent with a society emphasizing information work is the high value placed upon learning. However, prior to 1968, secondary education was only available from "fee-paying" (private) schools. Therefore, children of poor farming or working class families generally received no more than a primary education. In some cases, they also attended a vocational school.

In conjunction with Ireland's societal transformation, however, greater equality of educational opportunity was desired. It was pursued by making secondary education freely available to all. Religious orders which operated the secondary schools continued to do so in an arrangement whereby the State paid the fees for the students. The influence of nuns and priests has resulted in two noteworthy aspects of Irish secondary education. There is a strong emphasis on a well-rounded liberal arts education and it is carried out in a structured and disciplined environment. The result has led American managers in Ireland to comment on the quality of the overall education and, in particular, the analytical and communication skills possessed by workers who have the Leaving Certificate.

Making secondary education free was a first step toward providing a workforce compatible with the new industrial policy. It ensured the availability of a workers who would be well-educated in a general sense. Free secondary education also opened the door to greater participation in third level education. It has been at this level that the most significant changes in Irish education in support of the new industrial policy have occurred. The concerted effort to provide education appropriate for information technology work has involved five significant changes in post-secondary education.

**Changing the University.** When implementation of the new industrial policy began, the only form of third level education in existence was the traditional university. These were traditional in that their focus was classical not vocational. Courses of study were directed at producing a well-rounded individual, not responding to labor force requirements. Therefore, in order to
have an appropriately educated work force. One area that was addressed was the university itself. Changes were needed in both content and in orientation. They needed to place greater overall emphasis on science and technology, and specific emphasis on computer science, engineering and business. Along with changes in content, universities also needed to change their perception of the role of university education to include preparation for employment and linkages with industry. But no matter how much or how quickly these schools could have changed, they would not have had sufficient resources to accommodate the number of students who now needed access to higher education.

Technical Colleges. In a sense, Ireland has benefitted from not having had a period of traditional industrialization prior to moving into the post-industrial economy. This is because it has not been encumbered by work patterns suited to manufacturing and assembly line work. It also has not been burdened with an educational system oriented toward traditional, heavy industry. Therefore, Ireland could start from the beginning to create educational programs and institutions to support an information economy. One way it did this was by establishing additional types of third level institutions to supplement the universities. Consequently, a series of technical colleges were established. The Dublin Institute of Technology was located in Dublin and regional technical colleges (RTC's) were located throughout the country. In this way, IT education was brought to the people so that they were not forced to come to the quickly growing cities.

New Universities. Besides adding technical courses of study to the traditional universities and creating technical colleges, a third effort was to create two new universities with the specific mission of providing IT education. One was established in 1972 in Limerick; the other in 1980 in Dublin. These schools were originally called National Institutes for Higher Education and did not have full university status. In 1989 that situation was changed. The University of Limerick and Dublin City University have rapidly progressed from being perceived as vocational schools to enjoying the prestige of a full university. They are distinctly different from the traditional universities, however, in several respects. First, their focus is exclusively technical and professional education. They offer degrees in subjects such as computer science, business, communications and engineering. Second, they have adopted the cooperative education model
whereby students incorporate periods of work placement into their courses of study. Finally, these schools have close ties with industry. For example, the managing director of the Digital Equipment Corporation plant in Galway sits on the Advisory Board of Dublin City University and Wang Laboratories is located adjacent to the campus of University of Limerick, a symbolic indication of the close ties between that university and the IT industry. A description of the types of IT education provided by these two universities is provided in the Appendix.

**Government Training Programs.** Technical education provided by the universities and technical colleges was supplemented by the efforts of government agencies which provide training and employment services. In 1988 several agencies were amalgamated into a Single agency Foras Aiseauna Saothair (FAS), the Irish Training and Employment Authority (see Endnote 3). FAS training facilities are located throughout the country to provide specific job training to young people following their formal education and to offer retraining to the existing labor force.

**Adult Education.** The final component of the changed educational infrastructure relates to adult education. While FAS provides technical skills training, working adults also needed access to higher education. As competition for jobs has grown and new entrants to the labor force increasingly have third level degrees, educational credentials have become more important in Ireland. Many individuals who had been able to obtain positions with only the Leaving Certificate now need a third level degree for career advancement and mobility. To provide for this, the universities have begun to offer both undergraduate and graduate degrees through evening school. Some multinational companies have helped further this educational goal by paying the third level fees of their employees.

While evening degree programs are a common occurrence in America where education has long been linked to employment, the development of "night school" represents a significant societal change in Ireland. In this culture, higher education had been the purview of the privileged. It was for young people who had the financial resources to attend school full-time before embarking upon their positions of leadership in society. Therefore, providing evening degree programs to working adults was truly opening education up to the masses.
In the past twenty years the educational infrastructure in Ireland has undergone a transformation no less dramatic than that occurring in the society as a whole. Many more students are now obtaining a third level education. In 1986 25% of those who had obtained the Leaving Certificate entered institutions of higher education. There has been a significant shift from an emphasis on traditional arts subjects like language, history and geography to science and technology. In 1986 41% of new entrants were studying science and technology, and 22% were studying commerce (Clancy, 1988).

**IRISH IT EDUCATION: ISSUES AND RECOMMENDATIONS**

The process of examining the transformation of Irish education accompanying the society's rapid migration from an agricultural to a post-industrial society highlights certain issues. The resolution of some will take place with time; others will be much more difficult to resolve.

**Labor Force Requirements and Educational Preparation**

One significant challenge for both educators and policy makers is maintaining a balance between the kinds of IT jobs available and characteristics of the labor force emerging from the schools. An important motivator for the current industrial policy was to stem the tide of emigration which has long been a feature of Irish society. Historically, the ones who have emigrated were those without employment options, the classic example being the sons who did not inherit the family farm. However, during the 1980's the emigration of Ireland's "best and brightest" became a cause of concern. In 1981, 8.1% of Ireland's graduates had emigrated; by 1987 the proportion had risen to 25.6% (Higher Education Authority, 1988). These individuals emigrate for a variety of reasons. Some want to gain work experience abroad while they are young. Others leave to avoid the high tax burden. However, many leave because there are not sufficient jobs suited to the type of education they have received. A common complaint of electronic engineers is that the multinational companies do not locate the research and development function in Ireland.
thereby limiting their employment prospects following graduation. The country loses out in several respects when its well-educated graduates emigrate. First, Ireland loses the contribution that these young people could make to its IT industry. Second, the return on the investment of money spent by the State on a student is lost when graduates go abroad to work. Finally, many of the scarce spaces in the universities are being taken by students who do not remain in Ireland.

For a country such as Ireland, where the industrial policy and its supporting infrastructure were enacted in the context of an overall plan, it would be consistent to recommend that national monitoring of employment trends and close coordination between industry and academe be undertaken. A further recommendation and one which is currently being pursued, is to attempt to attract firms requiring the kinds of skills that graduates possess. Over the past twenty years, high tech employment has migrated from lower level, minimally skilled jobs to more sophisticated work. This is evidenced in companies such as Intel which came to Ireland in 1990 to produce its newest line of microprocessors.

**Vocational Role of the University**

Part of the problem of matching educational qualifications with available employment has been attributed to the reluctance of the universities to accept their new role as the bridge between education and employment. Several examples point this out. One executive from an indigenous IT firm complained about his experience in trying to recruit engineers from one of the universities. Because of the placement office’s failure to adequately advertise the positions in his firm, all the available graduates took positions with foreign firms not knowing about employment opportunities at home. Irish IT workers have complained that traditional universities didn’t introduce information technology courses soon enough. As a result, some of them had to turn to programs such as those provided by FAS following their formal education in order to acquire the needed skills. Others have commented that they didn’t receive adequate assistance with job seeking such as help with resume writing and interviewing skills.

One Irish IT executive believes that there are enough jobs for graduates with technological degrees. In his view, the prob-
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An insufficient number of young people with both education and experience. His recommendation is to emphasize cooperative education programs which are ideally suited to provide the dual benefit of credentialing. Yet, some of the schools have been reluctant to incorporate what they perceive to be a blatantly vocational element into their curricula.

This same individual, in describing his own work history, told how he had to leave his university position after his startup was established. The concept of the "incubator" did not exist in the early 1970's when he began his company. Such no liaisons between formal education and industrial application existed by universities who saw these linkages as somehow contrary to the educational mission. (This situation has since reversed, as incubators now exist, though usually in the more technological institutions.)

While progress is being made, there is still evidence of resistance from within universities to adopting this broad view of the educational mission. The tradition of the university as the locus of education is a long and cherished one. It would be unrealistic to expect that perceptions and orientation will change overnight. However, the addition of IT and other technical subjects to trite education will be undercut if the traditional universities are not supportive of this effort. The success of the University of Limerick and Dublin City University in providing professional skills within the context of a university education can set an example for the other universities in Ireland.

Class-Based Barriers to IT Educational Attainment

The issues raised thus far are, to a large extent, a function of the special curricula and infrastructure. As such, it can be debated that they will be resolved over time. Indeed, some of the issues that have been cited refer to situations that existed the 1970's and 1980's more than today.

Theory vs. Reality of a Meritocracy. A much more difficult issue to address, and one which is woven into the fabric of society, is the gap between the theory and the reality of a meritocracy. When the multinational IT firms first came to Ireland in the 1970's, the labor force was not adequately prepared for the type of work to be done. Consequently, the firms...
received grants from the State to provide the necessary IT training. Thus, in the early years of the IT industry in Ireland, workers from diverse social class and educational backgrounds were able to obtain IT employment. Today, the situation is much different. A combination of greater competition for jobs and a change in the nature of the work has required formal credentials for employment. At a minimum, the Leaving Certificate is required: for many forms of employment, post-secondary credentials are required. This current situation raises the question of whether there are class-based barriers to equal IT educational attainment in Ireland.

In his classic work on the subject, Daniel Bell (1973) describes the post-industrial society as a meritocracy. In the agricultural society, power and status are largely fixed and out of one's control. This is because they are based upon the ownership of land and characteristics such as birth order and gender. In the industrial society, power is in the hands of those with control over the means of production: the capital and the raw materials. While social mobility is not as fixed as in the agrarian society, a clear division between the managers and the proletariat exists. In contrast to both of these societies, the post-industrial society with its emphasis on meritocracy and credentials allows for greater social mobility. If one believes that intelligence is not a function of family background or income and if educational opportunity is available to all, then theoretically everyone has an equal chance of succeeding in the post-industrial society.

The logical conclusion of this line of thinking is that all workers have an equal chance of benefitting from Ireland's movement into a post-industrial society. Data from a variety of sources, however, suggest that members of the middle class have received disproportionate benefits from this societal transformation. In his study of who attends higher education in Ireland, Clancy (1988) observed that in 1986, 55% of the entrants to higher education were children of professionals, managers, and salaried employees, yet this group accounted for only 30% of the relevant cohort. In contrast, 24% of new entrants came from working class backgrounds despite the fact that they represented 55% of the target population. This data is consistent with the author's field data on the class origins of IT workers. It is further reinforced by O'Toole's observation (1990b) that the social class of one's parents is a predictor of one's own social class
in Ireland more than in any of the western European societies with which it has been compared.

The implication of this data is that children of working class and marginal farming families do not have equal opportunity for success in IT employment. This claim is controversial and not everyone would agree with it. Many Informants have described Ireland as a classless society. In fact, a characteristic of the Irish culture is disdain for displays of class pretensions. Nevertheless, the evidence in support of this claim justifies its consideration among educational issues related to the transformation to an information economy.

**Equality of Access to Higher Education.** The issue is more subtle than simply making secondary or third level education available to all. The argument is that there is unequal opportunity to obtain a third level education based on social class. This issue exists in the context of a very limited number of available positions in the Irish universities. Acceptance into these courses of study is based upon a highly competitive "points system." These points derive from scores on each subject examined for the Leaving Certificate. Degree programs within the universities vary in the points they require and the number of subjects that must be taken for admission. The more prestigious and desirable the course of study and the school, the greater the number of points the student must have for admission.

While it is true that secondary education is freely available to all, differences in secondary schools, nevertheless, exist. First, children of middle class families have the financial means to send their children to "fee paying" schools-private, college preparatory schools which emphasize the subjects in which one must do well to attain admittance to the University. Second, among the state financed secondary schools, differences exist as well. Wide discretion is given to the schools regarding the subjects which are emphasized. This variation affects not only social class but gender as well. One female Informant observed that the computer applications program she wished to enter required having passed the Leaving Certificate exam in Honors Maths, a course of study which many girls schools didn't offer when she was in secondary school. Finally, parents in middle class communities often provide additional financial assistance to the schools. For all of these reasons, one could argue that in light of the limited number of university places, it is more difficult for the underclass to obtain a university education.
Value Placed Upon Higher Education. Another barrier to advanced IT education derives from parental attitudes about higher education. To parents who were able to obtain employment without much formal education, the notion of a child remaining out of the work force until the age of eighteen or twenty-one might seem wasteful, a loss of income to the family. These semi- or unskilled workers have historically worked as manual laborers on farms or in the cities. However, the need for this type of work in Ireland is sharply declining. Children of these workers will be much less likely to find similar employment. Indeed, much of the impetus for a new industrial policy was to respond to this decline. The jobs which are replacing them require brain power rather than muscle power. As such, some form of post-secondary education is increasingly being required.

Symbolic of this change in employment qualifications is the transformation of the Customs House Docks area in Dublin. Long a source of employment for manual laborers, the Docks area is being transformed into a financial services center which emphasizes off shore data processing services for financial companies based in America and Europe. Children of generations of dock workers will no longer be able to look to manual labor on the docks as the source of their livelihoods.

Class-Based Differences in the IT Industry. As a consequence of these factors, class distinctions can be witnessed in the IT industry. In the multinational firms which are primarily engaged in information technology manufacture, there is a wider range of social class background. Though, even here, the minimum credentials are rising. The social class gap is most dramatic, however, upon examination of the labor force in Irish IT firms. These firms tend to emphasize the software rather than the hardware aspects of the field. This is because of the low start up costs, limited capital resources required, and the availability of a young, skilled work force. However, this type of work requires significantly more educational background than assembly work for computer manufacture. Consequently, the workers at indigenous IT firms are predominantly middle class.

It is important to note, however, that attitude as well as credentials plays a role in employment opportunities. Information technology work, insofar as it is skilled, pays well, and requires credentialed, can be defined as middle class work. In America, if one possesses the credentials, he or she is likely to find suitable employment. In Ireland, however, credentials are
often not sufficient. Several informants working at indigenous IT firms reported that while they have university degrees, they had little or no IT credentials when they were hired. The reasons they gave for having obtained IT employment were related to social class: having the proper accent, living in the "right" neighborhoods, having attended a certain school.

Greater opportunities to attend universities will perhaps make it easier for working class individuals to obtain IT employment. But in order to ensure that this occurs, both concrete and attitudinal changes are needed. Characteristics of secondary schools which serve as a barrier to university admission must be addressed. Greater availability of third level courses at night is another recommendation. But changes in the attitudes of some parents and employers must change as well. Working class parents need to understand the relationship between post-secondary education and employment opportunities. The attitudes of some IT managers must also change. In order to overcome the class-based barriers to IT employment, employers need to understand that individuals from any social class are capable of being productive workers in the IT industry.

Making the fruits of the transformation into an information economy available to individuals from all social classes will not be achieved overnight. Assumptions about one's life chances which were fixed for generations will take time and conscious intervention to alter.

INTERNATIONAL IT EDUCATION AND THE IRISH CASE

The final section of this chapter adds the international dimension to the discussion of IT education in Ireland. This is done from two viewpoints. The first concerns the international component of Irish IT education. The second concerns the international component of IT education for students in advanced industrialized countries such as the United States, Germany, and Japan. This is relevant to the present discussion because workers at multinational companies from these countries are the ones who come to Ireland to establish operations there.
We can begin by considering the reasons for including an international dimension within Irish IT education. There are several reasons. Many graduates will be working for multinational companies in Ireland; others will go abroad to work. Those who will work for indigenous companies have equally compelling reasons to have an international orientation. Ireland is a peripheral country within both the European and the world economies. As a country with a small population and market for its IT products, it is heavily influenced by changes in the world economy. Managers at indigenous software firms observed that a start up company in Ireland needs to enter the international market at a much earlier stage of corporate growth than a similar American company because of the small and limited domestic market. For both types of workers, the Single European Market will bring with it greater mobility of workers: from other countries to Ireland and from Ireland to other countries.

Before considering the form that international IT education has taken in Ireland, it is necessary to consider what is meant by the term "international." For a country which is a member of a political or economic unit such as the European Community, does international mean beyond the country's national borders or beyond the boundary of the political/economic unit? Irish education in general (and, therefore, Irish IT education as well) contains components which incorporate both interpretations of "international" into the educational process.

The implementation of the Single European Market contains educational initiatives in which Ireland is a full participant. One is an exchange program whereby students from one European Community country are able to attend universities in other member countries. There are also a variety of European Community programs to foster cooperation and understanding among students from different countries. In addition to participation in European Community programs, there is also a concerted effort within Ireland to place greater emphasis on foreign language skills at both the secondary and the university level. Certain programs are beginning to add the study of a foreign language to the degree requirements. In addition to the formal mechanisms by which the international component is incorporated into Irish education, there is also a significant informal contribution. Because of the presence of so many multinational firms in
Ireland, a significant number of Irish workers at multinational firms have been to countries such as Germany and the United States in relation to work. This provides the opportunity for IT workers to learn first hand about other countries. What these individuals learn from other countries through their work no doubt filters down to their children. Thus, an international orientation begins at an early age.

**International IT Education in Advanced Industrialized Nations**

As with IT education in Ireland, the question can be raised as to the need for adding an international dimension to IT education in advanced industrialized nations such as the United States. The reasons are different but equally important. Simply put, the world is shrinking. The globalization of companies through mergers, acquisitions, and joint ventures makes it far more appropriate these days to think in terms of a global rather than a national IT industry. In addition, American companies seek to have a presence within the European Community. Finally, labor force costs and requirements are causing many companies to seek employees in countries such as Ireland.

Given this rationale for international IT education, the next question is: What do American IT workers need to know in order to physically or remotely work with people in a newly industrializing country such as Ireland? Both Irish and American managers commented that American workers do not have a sufficiently international perspective. One Irish manager observed that because of the geographical proximity of European countries, American multinational firms tend to think of all of Europe as a single culture. For a cultural "melting pot" nation like the United States, it may be difficult to appreciate the cultural identity issues which are very important to other nations. To respond to this problem, one American manager in Ireland recommended that the study of a nation's culture should be a required part of the preparation of all multinational employees working abroad.

International IT education which will prepare American multinational employees to successfully work in countries such as Ireland needs to emphasize cultural, political and legal issues which have an impact on their work. American IT students need to be aware of regulations governing information practices which
are different from those in the United States. Two examples are privacy and telecommunications. American privacy law is fragmented and sectoral (Trauth, 1986). There is no single, comprehensive privacy law. Rather, there are a series of state and federal laws which address record keeping practices in various industries. This is in contrast with much of the world and most of Europe. The Council of Europe, a body larger than the European Community, requires that all member countries enact a comprehensive privacy law. As a member country, Ireland did so in 1988. It is therefore necessary for American IT workers to understand the dimensions of these laws and the impact on the information processing and record keeping practices of companies.

Telecommunications is another aspect of IT which is influenced by state regulation. While a trend toward privatization of telecommunications services is in evidence, most countries are still much more regulated than the United States in this area. This means that an IT worker would need to be aware of the regulatory structure and be prepared to work with the national PTTs (postal, telegraph and telephone companies) in the construction and use of data networks.

But of all the aspects of international education, what is probably the most critical is to acquire an appreciation for cultural pluralism. Interviews with Irish and American workers at multinational firms in Ireland revealed the importance of understanding differences in the work ethic, management style, attitude toward authority, risk taking behavior, and degree of individulism, to name but a few. American IT students need to appreciate that there is more than one way to achieve a corporate goal.

There is clearly a cultural give-and-take when a multinational IT company comes to a country like Ireland, but those which succeed are those which give as much as they take. The implication for the education of American IT workers is an appreciation for cultural differences. One way to accomplish this is to encourage exchange programs between American and foreign schools. Another, for schools with work study components, is to provide opportunities for students to work abroad.

CONCLUSION

This chapter has considered the topic of IT education in the context of a country which is undergoing a rapid transfonnation from a traditional, agrarian society to apost-Industrial one.
Education in general, and IT education in particular are among the key components of the societal infrastructure requiring alteration in order to be compatible with the new industrial policy. Educational changes not only involved additions to existing university curriculum. More importantly, the entire infrastructure for providing IT education was greatly expanded to include new schools, government training agencies, and adult education. Ireland has demonstrated success in its efforts to provide its young people with an education appropriate to an information economy. Nevertheless, the high emigration rate of third level graduates and the influence of socio-economic class on higher education attendance and IT employment are issues which require serious attention.

The topic of international education as it relates to Ireland has two aspects. One is the international component of Irish IT education. It has been observed that IT education in Ireland is inherently international due to its participation in European Community programs and the presence of so many multinational companies. The other aspect of international IT education relates to the education of future employees of multinational companies, those who will be working in a country such as Ireland. The experiences of those who have done so suggest that an appreciation of cultural, political, and regulatory differences and an understanding of their impact on business practices is the key to success.

This examination of the Irish case of IT education can be summarized in two recommendations regarding the future of IT education in the international context. First, for a country undergoing an economic transformation from agrarian work to information work, IT education should be viewed as but one of the many aspects of society undergoing transformation. For Ireland, as for other newly industrializing countries, constructing the proper educational infrastructure is as important as designing the IT curricula. Therefore, to fully realize the benefits of an Information economy, national planners must place as much emphasis on the macro issues related to the educational infrastructure as on the micro issues related to IT curriculum. The second recommendation is that IT workers in both newly and advanced industrialized countries should have an international dimension to their education that reflects their relative positions in the global IT industry. Since the IT industry in countries such as Ireland is heavily dependent upon foreign investment, IT
education must prepare Irish students for careers with non-Irish multinational firms and foreign managers. Similarly, as multinational IT firms from advanced industrialized countries increasingly establish offices and plants in countries such as Ireland, they will need managers capable of working with a foreign labor force and in a different regulatory environment. In both cases, IT workers must be prepared to encounter different value systems, work ethics, and management styles. The successful IT firms will those which can acknowledge and accommodate cultural, political, and regulatory differences in the pursuit of corporate goals.

ENDNOTES

1 The term Information economy is used in this chapter as a loose synonym for post-industrial society. It is understood to be that portion of a nation's labor force which is engaged in the manufacture of information technology, the development of software and systems, and the provision of information services. This definition is based on Porat (1977), who included the manufacture of information processing machines within the category of information work.

2 For a more complete description of the study and its methodology, see Trauth (1991).

3 The main government agencies responsible for furthering Ireland's industry policy are:
   CTT Coras Trachtala (Irish Export Board): established in 1959 to promote and develop Irish exports.
   EOLAS (Irish Science and Technology Agency): created in 1987 from the merger of the Institute for Industrial Research and Standards and the National Board for Science and Technology to develop, apply, coordinate and promote science and technology in Irish Industry. An additional responsibility is to forge links between higher education and industry.
   FAS Foras Aiseauna Saothair (Training and Employment Authority): established in 1988 from the amalgamation of several existing manpower, youth employment and training agencies to provide training and employment programs, placement services, and advice to industry.
   IDA Industrial Development Authority: originally established in 1949, was reorganized and made an autonomous semi-state agency in 1970 to promote industrial development throughout the country by stimulating job creation in manufacturing, and international traded and financial services.

4 The industrial policy of the past thirty years has been expressed in a
non-Irish multinationals, is increasing in Ireland, and foreign labor attraction is viewed as a viable strategy. In some cases, IT systems will be adopted to create higher-level, political, and administrative goals.

The secondary school structure in Ireland is divided into two phases. The Junior Cycle lasts three years and culminates in a series of examinations on specific subjects for which one receives the Intermediate Certificate. The Senior Cycle lasts two years, involves similar examinations, and results in the Leaving Certificate. Attaining certain "points" (exam grades) on the Leaving Certificate is the basis upon which admission to third level education (a university or other post-secondary institution) is determined.

The definition of the middle class in Ireland is somewhat different from that in the United States. Individuals ascribed to the middle class in Ireland would typically be viewed as upper middle class in America.

What is stated in this section about American multinational companies and workers applies to other advanced industrialized nations as well. The United States is used here for convenience and because data collected at American multinational firms has informed much of this chapter.

APPENDIX: IT DEGREE PROGRAMS

Future trends in IT education in Ireland are exemplified in the courses of study offered at the University of Limerick and Dublin City University. Prior to 1989 the two schools were accredited third level institutions but did not enjoy full university status. Before this time their names were the National Institute for Higher Education, Limerick and the National Institute for Higher Education, Dublin, respectively. These two universities...
were specifically established to provide an appropriately educated labor force in support of Ireland's industrial policy. NIHE Limerick was established in 1972 and NIHE Dublin was established in 1980. The importance of the IT sector in this plan is evidenced in the educational emphasis on IT in these two schools.

**University of Limerick**

At the University of Limerick, undergraduate IT education is provided through five degree programs offered in two colleges: the College of Engineering and Science and the College of Business. All of the programs described below are four years in duration and include a work placement component ranging from six to nine months (NIHELimerick, 1988).

**College of Engineering and Science**

**Bachelor of Engineering in Computer Engineering.** This program is designed to provide a broadly based education in computer engineering with an emphasis on software disciplines. It is intended for students who wish to pursue careers in research & design of computer technology and systems, software engineering, computer graphics & computer aided design, and industrial process automation. IT courses required of all students include: Computer Programming; Microprocessors; Electrical Science: Electronic Circuits: Computer Graphics and Simulation: Data Structures and Operating Systems: Microprocessor Engineering and Circuit Design; Signal and System Theory; Computer Hardware Design; Computer Languages; Networks; Operating Systems; Circuit Design.

Specialist courses available in the final year of the program include: Digital Signal Processing; Computer Aided Design; Computer Architecture; Expert Systems and Artificial Intelligence.

**Bachelor of Engineering in Electronic Engineering.** This program is intended to equip graduates for the following careers: research into new electronic devices; design of computer systems, robotics, communication systems and networks; and work with satellite communication systems, industrial process automation, software engineering, computer graphics and computer aided design. Following a broadly based education in electronic engineering disciplines, students are offered a choice
Educating IT Professionals for Work in Ireland

The aim of the following program is to equip students with a range of analytical skills which can be applied to management and industrial problems. Among the careers for which this program prepares students are management information systems, systems analysis & computer operations, engineering or electronics research, and software development. Computer programming is included among the foundation courses for all students in this program. Commercial computing is one of the specializations which students may choose during their final two years of study.

College of Business

*Bachelor of Science in Computer Systems.* This program of study is designed for those wishing to pursue a career in software and systems development. Graduates are prepared for employment in programming, systems analysis & design, knowledge engineering, software engineering, and research & development. The subject matter is covered in the following fashion:

**Years 1 and 2:** Programming; Business Mathematics; Accounting; Engineering Principles; Work Placement (Year 2)

**Years 3 and 4:** Systems and Program Development: Language Processors; Database Management; Computer Graphics; Computer Networks; Industrial Applications: Work Placement (Year 3)

*Bachelor of Business Studies.* This program of study is designed to prepare management specialists in accounting & finance, marketing, accounting & economics, personnel management & industrial relations, and agribusiness. As part of the general curriculum all students study computing in the context of specialization in electronic systems, industrial automation or telecommunications. The common body of material taken by all students includes: Computer Programming; Microprocessors; Electrical Science; Electronic Circuit Design; Signal and System Theory; Computer Software.

Specialist courses available to students in their final year of study include: Computer Science; Telecommunications Systems; Control Systems: Application Specific Integrated Circuits; Computer Vision; Semiconductor Technology; Digital Signal Processing; Robotics; Microwave Electronics.

*Bachelor of Science in Applied Mathematics.* The aim of this program is to equip students with a range of analytical skills which can be applied to management and industrial problems. Among the careers for which this program prepares students are management information systems, systems analysis & computer operations, engineering or electronics research, and software development. Computer programming is included among the foundation courses for all students in this program. Commercial computing is one of the specializations which students may choose during their final two years of study.

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of mathematics. In addition, students may choose Information Technology as their minor field of study. Among the careers for which this degree prepares students are word processing and Information management.

Dublin City University

At Dublin City University undergraduate IT education is provided through five degree programs offered by the Faculties of: Computing & Mathematical Sciences, Engineering & Design, Business, and Communications and Human Studies. All but one of the programs are four years in duration with a six-month work placement during the third year (Dublin City University, 1990).

Faculty of Computing and Mathematical Sciences

Bachelor of Science in Computer Applications. This program is designed to prepare graduates with skills for applying computer technology to the practical problems of business and industry. It does so by providing them with a sound understanding of computer hardware, software engineering, computer programming, techniques of systems analysis and design, and applied quantitative methods as well as emerging technologies. All students take a set of core business courses. The IT content covered in this program includes: Computer Science: Information Systems; Systems Analysis and Design: Programming (COBOL, PASCAL, FORTRAN, Assembler, PROLOG, LISP, C, and a range of fourth generation languages).

Specialization courses in the final year of study include computer applications in accounting, computer real-time systems, and statistics.

Bachelor of Science in Applied Mathematical Sciences. This degree program focuses on the use of computers in the development and application of mathematical models. The emphasis is on the use of these models in business and industry. The first two years of the program emphasize basic mathematical principles and computing skills. During the final two years students focus on either numerical/analytical methods or operations research.
Educating IT Professionals for Work in Ireland

Faculty of Engineering and Design

Bachelor of Engineering in Electronic Engineering. The objective of this program is to respond to the demand for professional engineers to work with computer electronics, telecommunications systems, control systems, and semiconductor technology. Graduates are prepared for careers in: design, production and sales engineering; engineering management, research and development; and software engineering. The program has a core theme of electronic system design which includes circuit and system design, mathematics, physics, computing, industrial design, materials science, software engineering, communications, and control systems. During the final year, specializations are available in: Computer Control; Communications: Signal Processing; Power Electronics; Microelectronic Technology; Artificial Intelligence.

Dublin Business School

Bachelor of Business in Business Studies. This program is directed at providing graduates with management expertise to respond to the demands of Ireland's industrial development growth. Among the overall objectives of the business degree is the ability to understand and use the tools and techniques of business management. Key among these is data processing. Courses in computing are included among the foundation courses taking during the first two years of the program. Business specialization courses taken during the final two years, however, do not include preparation for a career in management information systems or Information technology.

Faculty of Communications and Human Studies

Bachelor of Arts in Communication Studies. This program focuses on information technology as it relates to human communication. Graduates are prepared for careers in media production, public relations, advertising, research, and to work as information specialists. A range of Information technologies are studied, including: radio, video, film, photography, and graphics. In addition, part of the basic curriculum includes computer literacy and information (study of the effects of the convergence of computing and communications technology on organizations and society).
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