PROMOTING NEW TECHNOLOGY-BASED COMPANIES: THE ROLE OF THE IDA ENTERPRISE DEVELOPMENT PROGRAMME

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The long awaited *White Paper on Industrial Policy* (1984) has articulated government industrial policy in a number of important areas – export development, agriculture and resource-based industries, attraction of overseas manufacturing companies and development of small industries. The White Paper, however, has no chapter on technology policy, – no recognition that some very explicit measures are needed to raise the present level of technology in Irish industry in order to achieve the objectives of the new industrial policy. The assumption is that, for the most part, a competitive environment, in conjunction with a major re-focussing of institutional effort, will automatically bring about technical change and "a strong and internationally competitive industrial sector" [ibid p. 6]. The National Development Corporation, when established, will have an ill-defined role in the promotion of an advanced technology sector in addition to its very many other functions.

This article addresses only one issue in the complex and crucial area of a technology policy for Irish industry, namely an understanding of the process by which new firms, which compete on the basis of their technology, come into existence and achieve commercial success.

The Office of Technology Assessment in the United States (1982) defines high technology firms as ". . . companies that are engaged in the design, development and introduction of new products and/or innovative manufacturing processes. . .". In this article we will analyse and evaluate Ireland's achievements to-date in creating high technology companies with particular reference to the Enterprise Development Programme of the Industrial Development Authority.

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New Technology-based Companies

We pause briefly to reflect on the universal enthusiasm for new technology-based companies, to consider their direct and indirect benefits to the economy, and to discuss some models of development for this type of company.

Governments of almost all advanced industrial and rapidly developing countries have numerous programmes, some of them going back over thirty years, to stimulate the creation and growth of new innovative companies. Typical examples are the Small Business Innovation Research Programme in the U.S.A., and the British Technology Group (BTG) in the U.K. The BTG Chairman gave the raison d'etre of his organisation as "to identify technology which has a commercial value and which can help the U.K. economy. . . .and to identify investment opportunities in the newer technologies" [Wood 1982]. West Germany has its "first innovations" programme, which meets 50 per cent of commercial development of promising new technology, and France has an agency to help researchers, inventors and small firms to develop innovations (The National Agency for the Valorisation of Research). Examples of innovation support programmes multiply as countries and regions strive to establish their own cluster of high technology start-ups after the Silicon Valley or Route 128 model.

It is not suggested that Ireland should abandon its traditional industry sectors in the pursuit of glamorous high technology niches. A large proportion of industrial employment for the forseeable future will continue to be in traditional sectors like food processing, metals and engineering and textiles and clothing. Even in the U.S.A., where employment in high technology industries is growing rapidly, the proportion in high technology employment is not expected to exceed 20 per cent of the industrial workforce by 1995 [Riche et al 1983].

Economic Importance: A number of studies show that high technology industries make an economic contribution which considerably outstrips their share of employment. A Library of Congress study found that, in the U.S.A. between 1967 and 1980, the real output of high technology industry grew 61 per cent faster than that of the manufacturing sector overall [Guenther 1983]. Another U.S. study found that employment in high technology industries increased nearly twice as fast as total employment betwen 1972 and 1982 [Riche 1983]. Most commentators, however, highlight the remarkable growth rate of new technology-based firms measured in terms of sales revenues and exports acknowledging technical change as a critical factor in export competitiveness.

The real importance of high technology firms to an economy transcends what can be measured in discrete variables. It has been shown that high technology firms contribute to the overall dynamic efficiency of an economy [Klein 1979]. In their role as innovators and risk-takers, they force larger, more traditional companies to become less risk averse. There is strong evidence to suggest that new technology-based firms introduce a disproportionate share of commercial-oriented innovations, and also that small businesses and individual inventors have produced a significant number of key innovations in the U.K. and the U.S.A. [Roberts, 1980].

The vitality of science and technology faculties at universities and other third-level institutions is clearly linked with the health of high technology indigenous industry. The symbiosis is complete when it results in a flow of entrepreneurial academics transferring their technologies out of universities into industry.

Sources of New Technology-Based Companies: One source of new technology-based companies has just been alluded to, namely universities and higher institutes of technology. The phenomenon of the 'academic enterprise' originated in the U.S.A. where important concentrations of academic companies are now close to many of the major university complexes. The academic enterprise is sometimes referred to as the 'soft company model', because it normally starts off as a high level consultancy/design service to specific clients, before hardening into the production of a design prototype of a component or a complete product. This model is probably the best method of exploiting completely new technologies and there are many current international examples in the fields of genetic engineering and biotechnology. Examples of this type of academic enterprise are regrettably rare in Ireland. The flow of research-based innovation from the university sector is inhibited both by the quality and quantity of university research effort and by administrative policies which have erected barriers to commercial interaction.

A second source of new technology-based companies is the 'industrial spin-off model' where the new company is set up by a team of technologists and managers who leave a large industrial company. They emerge with most of the research and development on a new product or component completed in the laboratories of the incubator company, and are able to pass quickly to manufacturing. The facility to complete a substantial amount of innovation research before set-up is very advantageous in limiting the technological risk, reducing initial capital requirements and shortening the lead time to commercial viability.

Very often, the new venture receives the support of the parent which maintains technical and commercial links through equity participation. Bell Laboratories and International Business Machines are examples of companies which have spawned famous new technology-based companies in this manner.

For Ireland, this avenue to new technology-based firms is virtually closed. Nearly all the existing medium and large industrial companies in technology-related areas are foreign subsidiaries who do not have a research or marketing activity in Ireland, and are unlikely breeding grounds for technolgical entrepreneurs. This is confirmed by a study of the Irish electronics industry which found that only four indigenous firms, with a total employment of 41, had spun off from the foreign-owned sector, and that none of these was truly innovative [Cogan and Onyenadum, 1981]. It is salutory to compare this record with that of the ill-fated Telectron Ltd., the only large indigenous electronics company in Ireland during the seventies, which spun off at least four technology-based ventures.[1]

The new ventures which emanated from Telectron Ltd. might more correctly be designated 'warm garage' start-ups. This is the third and last model of new research-based companies which will be discussed. In this case, the entrepreneurs do not leave with a well-researched new product idea which has been worked on in the parent company. The inventors must develop their ideas after they leave the parent: they progress from research through prototype to final product in a garage-type operation. Their enterprises compound technological and commercial risk to a high degree. They have to carry heavy initial research and development costs and endure a long period without prospect of commercial returns.

This is the model which most Irish technological entrepreneurs must follow. Many are former technologists/managers in technical and commercial public sector organisations, not internationally regarded as a prolific source of new research-based companies. They find it difficult to attract sufficient external finance and must engage in cash generating activities to support their technological enterprise. It is proposed to explore, in the next section, the recent history of IDA efforts to promote indigenous technology-based companies.

Characteristics of the IDA Entreprise Development Programme

The Enterprise Development Programme (EDP) was launched by the IDA in 1978 with the objective of developing native Irish entrepreneurs. The target was professionals and senior managers in the universities,

industry and the public sector. The EDP was set up when a study of the IDA Small Industry Programme showed that, over a ten-year period, the programme had been effective in stimulating projects from the shop floor level of industry, but attracted less than 10 per cent of promoters with a 'professional' background. In addition, scarcely any of the projects approved were technology related. The new programme was designed to remedy these deficiencies. In addition to the normal range of IDA supports, two unique incentives were offered to potential first-time entrepreneurs:

(i) loan guarantees for working capital, and (ii) interest subsidies on loans raised for working capital.

On average, the state grant-aids or guarantees about two-thirds of the total capital cost of EDP projects. This package is so attractive that it was assumed, for purposes of the present study, that the EDP includes virtually all of the IDA-assisted new technology-based companies which were set up by Irish entrepreneurs after 1978. It was decided, therefore, to attempt to identify EDP companies which meet the criteria of technology-based enterprises and to carry out a preliminary evaluation of their performance.

Sample Population: It was decided to include only those EDP companies which had three or more years operating experience because high technology companies take a number of years to settle in. This meant confining the study to projects which were approved between 1978 and 1980 (Table 1).

Table 1: *EDP Projects Approved 1978-1980*

Year	No. of Projects	Jobs	Investment Finance £m	Grants £m
1978	22	897	3.05	1.87
1979	20	892	4.34	2.67
1980	29	1127	9.18	4.25
Total	71	2916	16.57	10.06

The number of projects in the sample was reduced however when thirteen failed to proceed to start-up. The remaining fifty-nine projects are classified by industry sector in Table 2. The predominance of mechanical engineering is very obvious. Electronics is the only other sector to reach double figures.

Technology Level: The next step was to find out how many of the fifty-nine companies could be classified as technology-based. The criteria

Table 2: *Analysis of EDP Approvals by Industry Sector*

Sector	Number of Firms	Employment Approvals
Mechanical Engineering	25	1148
Electronics	10	430
Consumer Products	8	360
Paper and Printing	4	129
Food	3	135
Plastics	3	111
Clothing	2	83
Wood	2	56
Chemicals	1	37
Clay, Glass & Cement	1	40
Total	59	2509

generally used to classify high technology firms are research and development expenditure and the proportion of scientific and technical personnel relative to total employment [Cogan and O'Brien 1983]. It was decided to make the initial selection based on the technical manpower criterion (because the data were available), and to find out subsequently by interview what level of research and development was being pursued.

The cut-off point on the manpower criterion was fifteen per cent of total employment with technical or professional qualifications. This was not regarded as a particularly discriminating selection criterion. The average for the overall electronics industry in the U.S.A. is seventeen per cent professional and eleven per cent technician engineers in the workforce. Based on this criterion, five of the fifty-nine companies in the sample qualified as technology-based enterprieses. The job generation potential of the high technology companies was similar to that of other EDP firms: eighty per cent of both groups had job targets of less than fifty employees.

Financial Structure: Table 3 compares the financial structure at start-up of high technology and other EDP companies. The high technology companies have proportionately less asset backing (33.6 per cent versus 47.3 per cent) and more working capital (37.4 per cent versus 32.8 per cent). This reflects the fact that the emphasis for high technology companies is more on intellectural property than on plant and machinery.

The equity participation in all EDP projects is about twelve per cent. This is extremely low, particularly for technology-based companies. The typical incentive package provided by the IDA accounts for 65 per cent of the total financing requirements of technology-based firms and 60 per cent for other EDP firms.

Table 3: *Aggregate Balance Sheet: High Technology and other EDP Companies Compared, 1978-1980*

	HIGH TECH		OTHERS	
	£000's	%	£000's	%
Promoters Equity	147.4	11.8	2363.5	11.5
IDA Equity	19.6	1.5	116.5	0.6
Retained Earnings	20.0	1.6	77.0	0.4
IDA Grants	291.8	23.4	6604.1	32.1
Leasing	107.3	8.6	1090.5	5.3
IDA Guaranteed Borrowings	391.5	31.5	4386.9	21.3
Non-Guaranteed Borrowings	266.8	21.6	5929.9	28.8
TOTAL Liabilities	1244.5	100.0	20568.3	100.0
Plant & Machinery	417.5	33.6	9727.7	47.3
Site & Building	300.0	24.1	3112.0	15.1
Working Capital	465.0	37.4	6741.8	32.8
Other	62.0	4.9	986.8	4.8
TOTAL Assets	1244.5	100.0	20568.3	100.0

Performance: In order to assess technological sophistication and to obtain information on other aspects of performance, it was decided to investigate the five high technology companies. One of the companies was found to be in financial difficulties and another had not progressed beyond the prototype stage. It was decided, therefore, to interview four additional high technology EDP companies which started operation during 1981 and 1982. Since most of the companies interviewed had completed less than two years trading, the following comments must be treated with caution.

A low level of R & D expenditure characterised most of the companies. One company had no expenditure on R & D and four spent less than £60,000 during their initial two years of operation. It was also surprising to find that most of the companies had obtained no IDA product and process development grant.

The rate of growth of the high technology companies was less than impressive. The two most successful companies each employed about 70 people after four years operation. The average employment in the other companies interviewed was under twenty after two years. Most of the companies relied for revenue during their early years on activities which were not technology-related: manufacture of mature products; agency selling and sub-contracting. At the time of interview, two companies earned most of their revenue from high technology products, but most of the companies earned less than fifty per cent of their revenues from products developed in-house.

Two companies had achieved major success in export markets while four had yet to make a breakthrough in this dimension of their business. All companies were trying to expand into export markets in the belief that this was essential to the long-term commercial viability of their operations.

Comments and Conclusions

1. The number of genuine technology-based companies assisted under the EDP has been small. It is estimated that those still in existence after the first five years of the programme number between five and ten.

It is difficult to find comparative international data because definitions vary from one study to the next. The evidence is strong, however, that innovative research-based companies are not easy to foster, even in industrially advanced countries. An A. D. Little (1977) study of the U.K. and West Germany, covering the period 1960 to 1975, found 93 new technology-based firms in the U.K. and 48 in Germany. A more recent Dutch study found that 50 technology-based firms, many in traditional sectors, were established between 1965 and 1979 [Prakke et al 1980]. An Australian (1983) study put the number of innovative start-ups between 1978 and 1981 as high as 87.

2. The quality and growth performance of the new technology-based enterprises is more important than their numbers. There have been one or two notable successes but the contrast is very great between the growth record of Irish high technology companies and the growth and technological achievements of high technology firms in some other countries. The low research and development invested by Irish technology-based companies is a cause for concern. Irish entrepreneurs do not normally have an opportunity to do substantial research on their projects before start-up. Estimates of the minimum research and development effort needed to make a worthwhile contribution in technology are usually put at ten man-years (about £300,000).

3. The low equity base of Irish high technology companies is also an impediment to growth and to technological risk. Irish venture capitalists have gone outside Ireland for their main high technology investment. Paradoxically, Ireland's most successful indigenous high technology company obtained venture capital from the U.K.

4. High technology companies make an important and unique economic contribution, but they require special understanding, incentives and environmental support. Their requirements are very different from those of the vast majority of EDP companies. They need help to develop

export marketing and strategic management competence. Above all, they must be sustained in their research-based innovative work if they are to maintain their own distinctive and valuable identity. New Irish technology-based companies will probably continue to be relatively few in number and it is suggested that the proposed National Development Corporation should be assigned a very particular responsibility to promote and develop them.

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Note

1. Three of the nine companies interviewed for the present study were set up by former employees of Telectron Ltd.