

**SYMPOSIUM ON SCIENCE, TECHNOLOGY AND INNOVATION: THE
IMPLICATIONS OF THE STIAC REPORT FOR IRELAND'S ECONOMIC
DEVELOPMENT**

**Making Knowledge Work for Us: Evidence from Europe and North America
on the links between "Intangible" Factors and Growth, Competitiveness and
Jobs**

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The *title* of the Report of the *Science, Technology and Innovation Advisory Council* (Stationery Office, 1995) is a useful starting point for this paper. It suggests that the issue is not so much about of the formation of intellectual capital. The crux of the matter for industrial and business policies is how do we make it work for us to effect economic and business growth. As the Council's report says, knowledge is not transformed into wealth in an institutional vacuum. It happens within a system, a context with many components such as law, industrial policies, tax systems, a culture of enterprise and the economics of particular market domains. The Council also points out that Ireland's third level institutions have not been wanting in ground breaking achievements in science and technology. The development of innovative enterprises is the crucial issue and raises large questions about the quality of corporate management, which, in turn, raises even larger questions about the quality of corporate governance and the types of investor relationships that might be appropriate to a more innovative Irish economy. This, in turn, raises questions about the type of chief executive and senior manager capabilities that we require for the future if we agree that technology is central to business policy and achieving the strategic intent of the Irish State.

While the Council in its report and the recent surveys by Forfás on R&D and innovative capability show that progress has been made, in its depiction of indigenous enterprise, it is hard not to believe that the challenge is a daunting one. The Council recommends the doubling of business R&D by 1999 and the provision of tax and incentive regimes that might encourage this to happen. It acknowledges that the small scale of Irish firms suggests the need for co-operation among small and medium sized firms. An improved venture capital environment, improved business attitude to innovation and relevant training are also recommendations. I would like to return to these and related issues towards the end of the paper.

In 1994, the IMI in association with PIMS Associates in London, was requested by the European Commission to examine the relationships between “intangibles” (i.e. knowledge inputs) and growth, competitiveness and jobs within its extensive proprietary business data bases within the European Union and North America. (Carroll and Clayton, 1994).

Because we defined competitiveness as medium term growth in relative market share within particular market domains, we confined our study to those businesses which had at least four years of data, about 3,100 observations. The measures we had available for the study of “intangibles” included research and development expenditure (split into both product and process), new product sales (both absolute and relative to competitors), the possession of patent advantages, lead time, marketing expenditures (split into sales force and above and below the line media and promotional spend), measures for customer preference, service reputation and image vis-a-vis competitors within the market domain. The data also contained measures of sales, costs, prices and labour productivity. Since we also had available a great deal of data on the environments of these businesses, we also examined the varying impacts of innovative effort within different states of complexity, stability and turbulence.

While we presented our report in somewhat simplified form using simple cross tabulation, in a step-by-step elucidation, we did test the conclusions using multivariate regression analysis. We also drew inspiration from numerous individual cases from consulting projects which added fine grained insights to the results. Large scale statistical analysis such as that usually associated with PIMS, while offering generalizable conclusions, often suffer from lack of such insights.

The Main Conclusions

1. “Intangible” factors are more powerful determinants of individual business growth than the tangible factors we measured.
2. Innovation and intellectual property are the strongest drivers of competitiveness.
3. While there was only a weak direct link between R&D and competitiveness (not statistically significant), there were clear statistical links - varying by market situation - which link R&D, lead times, intellectual property, innovation and customer preference with growth in relative market share, value added and jobs.
4. The association between price, cost and productivity and competitiveness is weak except in the case of market leaders who allowed their costs to get out of control or their reputations to slip. Yet even in these cases “intangibles” were more powerful drivers of share gain or loss. There is no evidence to

suggest that businesses with higher labour productivity were more competitive than those that were not.

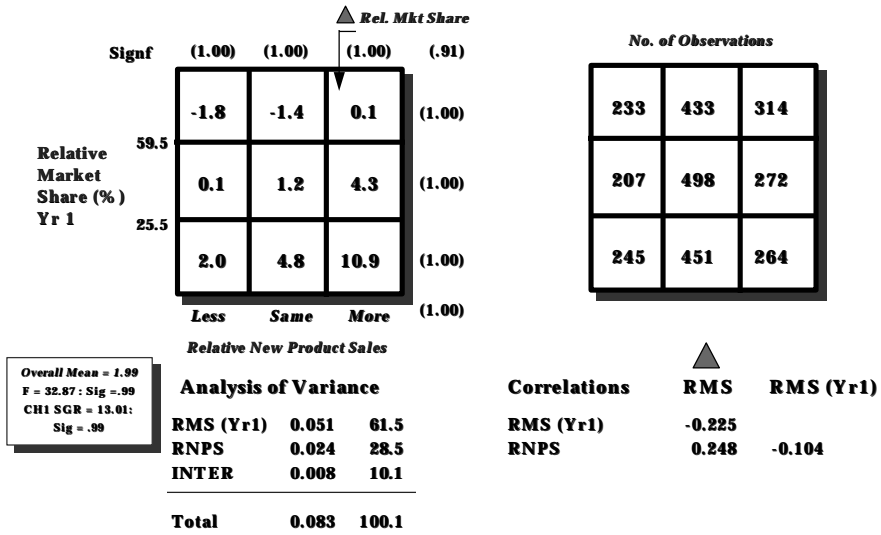
5. Labour productivity gains which are achieved through extensive capital deepening - substituting capital for labour - usually destroy both jobs *and* profits.
6. The propensity of European businesses to create jobs from growth was similar to businesses in North America - where there was growth. However, European businesses were more reluctant to shed labour in declining situations.
7. Complexity and turbulence blunt the effect of innovation on competitiveness. But innovative efforts supported by patent protection is powerful even in complex and turbulent situations.
8. “Challengers” offer better hope for growth and jobs than established players.
9. But “challengers” suffer greater profit penalties than established players when they invest in “intangibles”, if they stay challengers for long. Challengers who have patent advantages suffer less.

I have picked one exhibit to illustrate the findings. In Table 1 I have depicted in a simple crosstable the impact of innovation on competitiveness. The dependent variable, competitiveness, is defined as the average percent change in relative market share over a four year period. Relative market share is the ratio of share held by the business compared to the combined share of its three leading competitors. The independent variable relative market share (B) at year one expressed the degree of market power held by the business at the beginning of the period. The other independent variable relative new product sales expresses the amount of current sales within each business arising from new products introduced within the previous three years compared to its main competitors.

Any interpretation of these data must take into account that leader businesses suffer from a “natural” tendency to lose market share while followers have a natural tendency to gain. Perhaps this is because leaders get complacent and live on past successes while followers try harder. The positive effect of high relative innovation is very powerful in each situation and is statistically highly significant. The “challengers” get a bigger bang for their innovative buck, but it is also clear that if you attain market leadership through innovation in the first place, then you must go on being innovative if you wish to stay there.

Table I

Relative Innovation and Competitiveness



Source: PIMS Data Base 1994

But it is clear that the challengers typically cannot achieve this level of relative innovation without investment in R&D. The data shows that business R&D spend must become substantially higher than one percent of sales if new products sales are to rise higher than 10 percent. The Council's recommendation that the R&D spend ratio must double is minimal if we are to get the desired effect. And because "challengers" suffer profit penalties when they do this, the type of tax and other incentives which might reduce the pressures seem sensible. In our report we place greater emphasis on the efficacy of patents than the Council and indeed the respondents to the Forfás surveys. Yet it emerged as very significant in our study particularly to give the challenger necessary protection from the market power of the established players. Policies that reduce the cost and complexity of securing patents and copyrights and secure greater defensibility of intellectual property seemed to us to be crucial to any national system of innovation particularly in an age of "knowledge capital". They are society's contract with the innovators and inventors that it needs and protect the most important form of property right in the future. As William Kingston of Trinity College reminds us, markets are not structures of the universe but are social artefacts based on positive law particularly as regards property rights.

With such policies in place, however, we are still only at the beginning of the journey of tackling the linkages between the formation of intellectual capital and economic and business growth.

The Council advocates in its recommendations the need for an improved venture capital environment and improved training and skill levels within industry and suggests a number of mechanisms for achieving these outcomes.

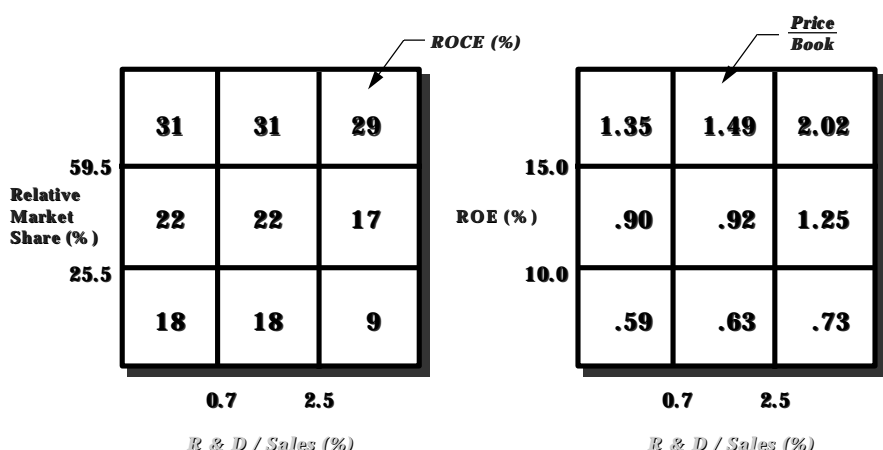
It does seem to me, however, that these recommendations fall far short of what is required, if investment is to be redirected within the corporate sector. In recent history this direction has been towards securing monopolistic rents at home and/or acquisition abroad. Given the marginal position of even large Irish companies, the policy of foreign acquisitions to secure better market platforms abroad always seemed sensible to me even if, inevitably, many were questionable and sometimes too high prices were paid. Having gone thus far, it does seem appropriate now to consider placing greater emphasis on investment in innovation to leverage the strength of these platforms. Such a change of direction requires an active consideration of the risk/rewards of R&D and innovation.

I believe that we must begin with more sophisticated methods of calculating the financial returns to, and the true economic value of, R&D. It is noteworthy that, while in our studies of the PIMS businesses, R&D shows a negative impact on medium term return on capital employed (ROCE) and cash return, especially in follower businesses with low or modest market share, our studies of corporate data bases on both the New York and London stock exchanges show R&D having a positive impact on market valuation, even when current ROCE (or return on equity (ROE)) is poor. In other words, the investor while taking into account recent and current profitability, sales and investment growth and the general trend of the stock market (which respectively accounted for 43%, 17% and 5% of the variation in stock prices, also takes positive account of R&D, and imputes future value to R&D investment made now.

In applying a multiple regression based investment multiple model to specific cases, we have found that, while R&D might depress current returns and cash flows, it amplified the current and future market value of the business so that the combined discounted cash flow (DCF) and the discounted future market value (DFMV) of the business was often greater than the market value at the beginning. Total returns to the shareholder were greater than might be assumed using more conventional measures. This would not surprise investment experts such as Philip Fisher (mentor of Warren Buffett) who, in his “fundamentalist” analysis of investments, placed great importance on R&D “combined with sales and marketing organisation” in his search for “intrinsic” value as opposed to apparent value derived from accounting returns. I think what I am saying here is that Irish companies need financial planning and control systems which specifically apply calculations of total shareholder value to strategic business decisions at the level of product line business units. Measures such as gross contribution or operating return on investment are inadequate, particularly if no capital charge is applied, as is mostly the case, (in other words managers down the line operate as if capital were free). I know of only a few Irish companies doing

this and, as yet, in a rather elementary way. In this respect our management systems are far below world standards.

R & D, Medium Term ROCE (%), and Market Valuation



Source: PIMS Data Base 1994

Source: Compustat (PIMS Study)

Closely related to this issue is the need for a wider and richer debate on our systems of corporate governance and investor relationships. While the venture capital model which the Council recommends is a good one for start-ups, that is not where the major investment funds are. The corporate governance debate which has erupted in the United States over the last decade and was occasioned by the sharp divide between ownership and management, has had no parallel here, except in the form of legal and fiduciary concerns and control/auditing issues. The Cadbury and Greenbury reports in the UK have this flavour and were occasioned by scandals or concern with excessive executive pay. The role of the Board of Directors in re-orienting strategic direction, moulding an innovative corporate culture and harnessing investment resources to this purpose should be the focus of debate. Does an economy like Ireland with a large development gap and much catching up to do, need an investment and corporate governance system based on liquid capital markets for shareholders (as in the Anglo-Saxon model) or a structure based on close board-investor linkages as in Europe and Japan?

I don't know the answer to these questions, but I am very certain that such a debate is crucial to placing technology and innovation at the top of the corporate agenda and in creating any meaningful national system of innovation. It is surely only with strategic change at this level that the quality of corporate management and the

organisation structures and competences necessary to innovative effort can be evolved. A generalised aspiration for technology skills and training within companies and more technically minded people in management will not be sufficient to achieve movement.

For these reasons I am also sceptical of the suggested need for “improved business perception of innovation and enterprise”. If we really believe in the centrality of technology, then surely a more profound reframing of the public and corporate “mindscape” (to use a concept coined by Maruyama, 1981) is needed. This pertains to the “ways of thinking”, the fundamental assumptions and beliefs which, in spite of formal board and management structures and procedures, largely dictate the direction of corporate strategies and the allocation of investment.

Our “picture of the world” must change. And as G. K. Chesterton once said, the essence of a picture is its frame.

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