

high failure rate that accompanies the early existence of the former new ventures is therefore not an unhealthy sign.' It suggested that death of businesses are inevitable, bordering even upon the desirable. I have never been persuaded by this point of view since it is often associated with policies that are intended to maximize the rate of new firm formations. I have not seen evidence that supports this theory. This "gung ho" approach to businesses and policy appears to characterize the discussion of business deaths. An illustration of this is that the report says:

... stable businesses are the product of experienced entrepreneurs. Unfortunately most entrepreneurs gain this experience through the school of hard knocks, so many succeed only at their third or fourth attempt. (p. 75)

This has to be contrasted with p. 79 of the document which says that 70 percent of entrepreneurs starting new businesses in Atlantic Canada were doing so for the first time. It also has to be contrasted with p. 117 whereby the survey shows that only one fifth of individuals who went out of business subsequently started another business, and there is no evidence presented that these subsequently become the most successful entrepreneurs.

My contention would be the opposite to that presented in this section of the document. Successful economies are *not* characterized by large numbers of people establishing businesses having only a very short life-span. The success of an enterprise policy *cannot* be gauged by the number of business start-ups. Instead it is the ability to grow businesses which is particularly important. In the context of Atlantic Canada it is observed in the document that the expansion of businesses over a ten-year period contributes significantly fewer jobs than the births of new firms. I would argue that this reflects an unsuccessful, rather than a successful, economy.

My view is that policy makers in this region would, perhaps, be better advised to address the issues discussed in "Small Manufacturing Competitiveness and Performance: An Analysis of Matched Pairs in Nova Scotia and New England," which specifically addresses the competitiveness of firms in these two provinces. It is too easy to simply focus upon the formation of firms, particularly in an area of high unemployment. The much

more significant long term challenge to governments is to generate competitiveness and increasing globalization among its small manufacturing enterprises.

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Manuel Trajtenberg, *Economic Analysis of Product Innovation: The Case of CT Scanners*, Cambridge: Harvard University Press, ISBN 067422540-6.

This is an interesting and important book about an arcane subject, product innovation. The case studied by the author, the CT scanner, represents a giant step forward in diagnostic capabilities. As with the fax machine, the CT scanner was not new conceptually, but a technological innovation dependent upon advances in sensing, storing and processing information. The author's central purpose is to measure the increase in net social benefits, resulting from the introduction, rapid adoption and evolution of this totally new product.

The CT scanner is not an improvement on an existing product, the film X-ray machine, but an entirely new product. As such, it is not amenable to the normal analysis of process innovation conducted by economists. Process innovation fits nicely in the models used by economists because it can be represented as a parametric change in a production function, leading to cost reductions, much the same way as factor productivity increases are represented. Product innovation, on the other hand, is not easily modeled because product innovations are in dimensions other than price and quantity. This is similar to the difference between an LP record and a CD disk. Automobiles are an example of improvements embedded in an existing product, more easily analyzed with traditional techniques such as hedonic price indices, where such attributes as fuel efficiency, reliability, comfort, fit and finish, "feel and handling" can be measured.

The challenge is to analyze the social benefits

which arise not from “more” (quantity), or from “better” embedded in existing products (automobiles), but from “better” embedded in a new product. The author adopts a characteristics approach to products so the desirability (value) of characteristics can be measured. The value of innovation cannot be measured from the input side because an advance which costs more will not necessarily be worth more and *vice versa*. Also, measuring technological characteristics cannot be used to infer the extent of innovation since an improvement in some dimension, while representing a significant technological advance, may not be desirable to consumers. So the approach is to measure the value of innovation directly; how much are the innovations worth; how much consumer and producer surplus is created? Trajtenberg tries to directly measure the demand for changing qualities of a product.

For anyone interested in product innovation, this book is mandatory. The review of the literature is excellent, and the synthesis of rather diverse areas of econometrics, choice and index theory is accomplished quite well. Unfortunately, for many readers, the level of abstraction is high, and the analytical techniques are not transparent. Perhaps this is due to the fact that the book derives from the author's Ph.D.'s thesis. Had the author simplified the material by a judicious use of examples and kept the technical subtleties in the footnotes, the accessibility of the analysis would have been increased significantly without any loss of generality or elegance.

Production innovation in CT scanners has public policy dimensions. First, as in all diagnostic technologies, an improvement in diagnosis may be privately valuable to patients and yet have negligible social benefits in terms of patients' life spans or productivity. It also may be valuable to physicians in the sense that they may be able to practice better “defensive medicine” and reduce the probability of a suit for malpractice and the risk of an extraordinary monetary judgment. The decrease in the expected value of an award provides value to the individual physician but adds little to social welfare. In this case the measured private benefits may greatly overstate the social benefits. In fact,

the rapid spread of the CT scanner (one of the fastest medical innovations) may be due to these strong, private incentives even though social benefits may have been negligible.

Second, the incentives for investment in new technology in the medical field are different than in other industries because of the non-profit nature of hospitals and the for-profit nature of the private clinics run as small businesses by groups of physicians mainly in the diagnostic imaging and medical laboratory segments of the medical care industry. The author points out that, from the very beginning, sales were made to private clinics, and sales to such clinics rose to 33.1 percent of the total by 1984 when DRG's were being phased in as an operational reimbursement mechanism. If, as has been hypothesized by some, purchase of new diagnostic products by private clinics is skewed by differences in reimbursement policies, the distribution of scanners may be non-optimal, and the resulting estimates of social benefits may be overstated.

Finally, the implications for the public policy regarding potential subsidies to alter the time stream of adoption (diffusion) is dependent upon the time stream of benefits from diffusion. The author finds the major social benefits accrue as the technology rapidly improves in terms of the characteristics of resolution and speed. Thereafter, benefits tail off rapidly as further gains are marginal (diminishing returns). The major gains accumulate as improvements change the product from a technological feasibility to a product with enhanced performance characteristics and real usefulness.

The book finishes with a chapter on patents as indicators of invention which could easily have been followed by a chapter summarizing the benefits from product innovation, the CT scanner, itself, and the implications for public policy in the area of advanced medical technology. This is a difficult monograph to work through, with non-uniform rewards, but a must for those interested in product innovation.

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