

# 1. Entrepreneurship, Technical and Financial Innovation in a Global Economy

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## 1. Introduction

The Maastricht, NAFTA and Pacific Rim Agreements have (for better or worse) propelled most of the world's economies into the brave new order of globalization. The three critical characteristics of the international system that has emerged, and whose impacts become more far ranging on an almost daily basis, are first: free trade in goods; second, international mobility of workers and financial capital, and third, the capability derived from information technology (*IT*) and the spread of networking which makes it feasible to locate production facilities virtually anywhere in the world without compromising centralized control of production processes. A little recognized aspect of globalization is that it provides a basis for reviving both the concept of entrepreneurship and inquiry into its role as the driving force for economic growth.

The Schumpeterian concept of entrepreneurship has substantially been rendered obsolete by the maximizing models which have come into vogue. Even though the capitalist economies of the West, the UK and the U.S. are dominated by "high tech" megacorps whose production functions have been uniquely capable of generating increasing returns, there are also many new firms, often small and independent, but sometimes satellites of larger multinationals, have shown themselves able to achieve increasing returns to scale which, in the era before information technology methods of production, were accessible only to larger firms.

Their improving success rate is attributable principally to the dynamics of technical change which derives from the application of information theory. The extensive transfer of this power intellectual tool, invented at Bell Labs as a generalization for computing the maximum capacity for transmitting error free information of a communications system (Shannon, Claude, "Mathematical Theory of Communications," *Bell System Technical Journal*, July 1948) has developed into models capable of broad generalization. These have revolutionized the nature and opportunities for entrepreneurship in production activities and places far removed from the U.S. telephone industry. Computers are the most dramatic technological change experienced by advanced economies since the advent of steam power. The implication is that the opportunities created by the information age extend the possibilities for improving investment/proceeds and employment/proceeds ratios in firms which are both relatively

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new, small and service oriented.

While economists have recently directed considerable effort into exploring the so-called “black box” of technical change (Rosenberg 1992, 1994), and its relationship to changes in the size and organization of business firms, they have directed surprisingly little inquiry into the entrepreneurial financing which is also an essential input into both innovation and the process of diffusing new technologies. This focus does not accommodate the changes that have taken place in financial systems over the last two decades, which are major. The scale and success of innovative financial instruments characterized by a high degree of liquidity without “trading off” market rates of interest, implies the tendency toward greater credit availability and (in the absence of countervailing measure of monetary restraint by central banks) lower interest rates. In combination, therefore, technical and financial innovation, both of which are strongly tied to IT, have become driving forces for entrepreneurship and global integration in much the same way as Schumpeter perceived of innovation and its diffusion as the handmaiden of economic development.

### **2. Entrepreneurship Rides Again**

While the term “entrepreneur” was introduced into the language of English political economy by John Stuart Mill (1848), analytical recognition of the kind of pioneering innovative activities associated with entrepreneurship, along with the concept of innovation and the persona of the “innovator”, was not introduced into the economists’ lexicon until the 20<sup>th</sup> century by Joseph Schumpeter (1939, 1951). But its relevance in sparking interest among economists was countered by the rise of the large industrial corporation, which channeled resources into development rather than invention. The advent of the megacorp obscured Schumpeterian themes, so that the role of the entrepreneur has been neglected in recent analysis. It also de-coupled the Schumpeterian theme of the inseparable link between the process of innovation and the necessity for financing its diffusion.

Entrepreneurial opportunity to profit from technical innovations, as Adam Smith recognized as far back as 1776, depends on the extent of the market to be served. Smith attributed the increased productivity deriving from division of labor to three circumstances: first, there is the increase in the dexterity of particular workers who become specialists in particular tasks; second, there is the greater efficiency that derives because division of labor eliminates the need to pass from one species of work to another; finally, division of labor promotes the invention of machines which abridge labor and “enable one man to do the work of many” (Smith 1937, p. 175).

Charles Babbage (1791-1871), who has only recently been credited as the “pioneer of the computer (Herbert Hax, et. al., 1992) took note of a further important

advantage to derive from division of labor. Specifically, division of labor frees employers from the necessity of paying their work-people wages that correspond to the market value of the highest skill level required for the work to which they are assigned. Further, as Babbage put it, “the master manufacturer, by dividing the work to be executed . . . can purchase exactly that precise quantity [of labor] which is necessary for each process” (p. 175-6). The more extensive an employer’s operation reflects the division of labor, the greater the reduction in the time required for a work-person to learn a task, so that his employment generates a profit for his employer. Thus, Babbage’s account of division of labor is considerably richer than Smith’s, notwithstanding the fact that it proceeds in terms of Smith’s pin factory example (which Smith himself borrowed), because it recognizes that technological improvements are connected to the product demands and prices, and views technological innovation as an endogenous response to product demands and the prices of factor inputs. He recognizes the necessity to achieve cost reductions through improvements in machinery and/or factory reorganizations (*Babbage Economy of Machinery and Manufacturers*, 1963 edition, p. 233).

Babbage also recognizes that in order to carry out the principle of division of labor (p. 169) it is usually necessary to utilize specifically designed tools for his specialized needs, possibly for use in a new production facility. He even included a chapter which addressed the problems involved in calculating the cost of new machines (“Inquiries Previous to Commencing Any Manufacturing”, Chapter 35). Specifically, he writes “It can never be too strongly impressed upon the minds of those who are devising new machines, that to make the most perfect drawings of every part . . . of the mechanism to be contrived, [will make] it possible to construct the whole machine upon paper” (p. 261).

Babbage also had remarkable foresight that “the art of making machinery” will necessarily involve testing; i.e., the construction of a prototype which might prove unsuccessful or whose operation is insufficiently conclusive so as to cause the project to be given up. Even if the new technology is successful in principle, the prospects for its commercial profitability are likely to be uncertain in consequence of ongoing technical improvements “by which the same operations can be executed either more quickly or better . . .” (p. 285), so that older machinery becomes commercially obsolete long before it is worn out. Nevertheless, despite the formidable uncertainties relating to the discovery process, the ability of a country to contrive new machinery and of those skilled at executing its design and production may well ensure a country (e.g. Britain) a comparative advantage in manufacturing machinery. Babbage’s specific recommendation for freedom to export new technology is offered along with the further observation that it is needful for English manufacturers to be additionally attentive to achieving organizational changes compatible with large scale manufacturing enterprises

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which are able to achieve the economies inherent in large scale production. The intellectual legacy that antedates Schumpeter's writing thus enlightens us to this very day about the nature of entrepreneurship and its role in the global economy.

Schumpeter's intellectual forbears anticipated not only the necessity for the presence of uniquely talented individuals to serve as the principle agent for embarking upon an uncharted course of change, generally in anticipation of financial gain, but also the uncertainty inherent in learning about differentials in the prices of yet to be purchased inputs to fabricate yet to be produced outputs for buyers yet unknown. Thus, entrepreneurship is meaningfully interpreted as the explanation of attractive opportunities by resource owners who are without knowledge about the behavior of competitors in responses to continuous flows of market information.

### 3. Entrepreneurship as Arbitrage

There is a long tradition in Austrian economics that associates entrepreneurship with the activities of profiting from price differentials. Specifically, Ludwig von Mises perceived of a decision-maker who is a "pure entrepreneur" in the sense that his entire role relates to his astuteness in identifying opportunities not previously recognized by himself or others (Mises *Human Action*, pp. 253-54.)<sup>1</sup> The Mises interpretation of entrepreneurship within the context of competitive rivalry and its relationship to profit is thus in the nature of an arbitrage activity (Kirzner 1973, p.85). The entrepreneur is the first to identify the existence or anticipation of a price discrepancy between a consumption good and the corresponding prices of the factor inputs that are technologically required in its production. This view reflects the Austrian conception of production as the process of "transforming" higher order goods (capital in particular) into "near goods" whose utilities stand closer to the consumer. The unique feature of the arbitrage activity is that the "entrepreneur who judges the future prices of the products more correctly than others do, buys some or all of the factor(s) of production at prices which seem from the point of view of the future state of the market are too low" (Mises, *Ibid.* 257-4). Entrepreneurial actions are thus inherently speculative in the sense that they act on their perceptions that opportunities exist which have as yet not been exploited by others. More specifically, the Mises view of entrepreneurship envisions the rivalry of business men engaged in a competitive process. Indeed, the notion of competition as a market process as distinct from competition as a market "state" (characterized by large number of buyers and sellers of a homogenous good ) has become a key distinction between the modern Austrian and neoclassical interpretation of the nature and role of markets.

The profits enjoyed by Schumpeter's innovator come to him by virtue of a "new combination" which creates a differential between the revenues he is able to generate

by recognizing opportunities which others fail to identify. For Schumpeter (1934) the entrepreneur strides onto the stage as the prime mover in the process of competitive rivalry (and economic development) through his innovative activity. The types of creative and imaginative activities Schumpeter specifically identifies include the introduction of a new good (or improvement in the quality of existing goods), introduction a new method of production, the opening of a new market, in particular, a new export market, identification of a new raw material or a source of supply, and/or the creation of a new type of industrial organization, particularly of those business forms that confer monopoly power.

Schumpeter's entrepreneur is thus a distinct personality type whose vitality directs his energies to ferreting out and exploiting opportunities for profit long in advance of general business awareness that such opportunities might even exist. He is not an inventor nor a capitalist risk-bearer who lends funds. Rather, he is an individual who has a unique talent for acquiring information and who has the soundness of judgment to engage in decision-making about allocating resources into new projects or assets which others undervalue. The variables on which he acts are not merely unknown, but exist only within the imaginations of individuals uniquely capable of bringing their judgments to bear on "News" that has not yet crystallized into knowledge. The Schumpeterian view of entrepreneurship as the successful marshaling of newly available information thus has much in common with the notion of "imagination" as the well-spring for human action. Both J.M. Keynes's (1936) and George Schackle's descriptions (1969,1972) clearly lead away from the simplistic neoclassical view that decision-making is essentially a matter of making marginal calculations relating to given production functions on the basis of the readily available information provided by the price system. Despite contemporary emphasis on optimization analysis, this perspective relates only to the "solution" of well defined problems. It clearly is irrelevant in a global marketplace in which successful entrepreneurship cannot simply be envisioned as maintaining the efficiency of an ongoing process.

All of the knowledge generated by the past cannot afford a basis for generalizing how the strategy of entrepreneurship will or ought to proceed. Because there are no givens (or at least very few) in scenarios yet to be encountered, no algorithm can capture precisely what the content or scope of entrepreneurial activity might be. Baumol (1968) was thus very likely correct in his observation, offered long before the thinking of economists was dominated by the globalization of business, that entrepreneurship is not an activity which lends itself readily to a formal model of entrepreneurial strategy with respect to whatever components of production functions and/or input sets are not yet specified<sup>2</sup> What we can say with assurance is that opportunities for entrepreneurship are liberated from the constraints of the past by major scientific breakthroughs that facilitate increasing returns. Empirical evidence shows that a simple

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one-to-one correspondence between sets of input and outputs (Nerlove 1967) typically does not exist. There is thus an essential relationship between the activity of entrepreneurship and the discovery and realization of increasing returns.

### **4. Entrepreneurship and Increasing Returns**

Contemporary insight into the nature and significance of increasing return derives from the work of Allyn Young (1938), who was the first to anticipate the linkage between increasing return and economic growth that became the center-piece of the growth theory developed by Nicholas Kaldor, who was Young's student at LSE. Kaldor not only appreciated that increasing returns are closely linked to technical progress, but also linked to the construction of larger sized plants.

In practice, by the mid-1920s, large segments of American industry had become characterized by the dominance of a few large firms (Chandler 1990, p.2). This institutional fact tended to marginalize the interest of economists in Schumpeterian style entrepreneurship. As has also been extensively documented (Chandler 1990, Arrow 1983), large firms have tended to concentrate their investments on the development and diffusion of existing technologies rather than on research and invention. Even though small firms tend to have advantages in experimentation in the early stages in the development of new technology, the evidence suggests that larger firms were better able to achieve internal economies. They were better than small firms at effectively spreading their fixed costs over a larger volume of output to achieve lower unit costs. Even more important, their type of production organization at the plant level during the 1950s-1960s facilitated a "speed-up" in the flow of work (Chandler 1977, Chapter 8). The ideal became a continuous flow assembly line which turned out huge quantities of identical units.

Something akin to the sectoral changes envisioned by Schumpeter has become a reality during the several decades between 1950-1980 in the industrial structures of the U.S., the UK and, to a lesser extent, in other advanced industrial economies in West Europe. The advent of cheap micro-electronics and the more expensive energy and material requirements of mass production have significantly transformed the "Factory of the Future" (Economist, May 30, 1978). The ideal firm is now an information intensive productive organization which links design, management, production, quality control and marketing into an integrated system. Firms so organized are extremely flexible in changing their mix of products and services, and are able to achieve increasing returns because they are able to transmit huge quantities of information world wide. Accordingly, computer based capital equipment now accounts for close to half of all new fixed investment in plant and equipment (Sichel 1997). These have enhanced the capability of economies in which firms are availing themselves of new technologies to adjust to the increasing requirement implicit in an open economy to produce tradable

outputs whose quality and cost can compete with suppliers at home and abroad, in addition to the non-tradable items of domestic consumption. These requirements have been accompanied by new concerns about efficiency in the use of energy conservation and reductions in pollution externalities. These concerns have been coupled with the often sad experience that on numerous occasions, despite pioneering work in inventing new technologies products or components by the U.S. and the UK, Japanese firms, for reasons well documented elsewhere (Mansfield 1988), have often become the first to achieve commercial success, such as the application of transistor technology to radios and color television receivers. Similarly, the output of products requiring the coordination of different technologies, such as copiers, FAX machines, personal computer printers, and floppy disk drives are the foundation, along with compact automobiles and electronics, for Japan's export success.

In combination, these information and communication devices have significantly compromised both the Fordist tradition of large scale production technology and the viability of the traditional megacorp and the concentrated industry. There is also greater behavioral diversity among firms within industries with respect to pricing. Thus, evolutionary processes are generating a wide variety of dynamic paths among different firms and industries.

## **5. Entrepreneurship and Finance**

It is the essence of entrepreneurship not only to identify how to significantly reduce the average cost per unit of output, but also to identify the kind of capital investment that is required to achieve the increasing returns to scale that are implicit in technological progress. An entrepreneur may be able to finance himself or rely on a lender instead of relying on the surplus realized from the differences in the purchase and sale of the resources he acquires. The notion that is the function of the credit market to enable individuals (or firms) to shift purchasing power forward or backward in time, thereby altering the timing of consumption and/or production streams from the time pattern of (discounted) earnings, derives from the work of Irving Fisher (1930). This temporal transfer function of capital markets has become as central to understanding the nature of entrepreneurship as it is for establishing the terms on which such transfers take place in the capital market.

Successful entrepreneurship rests not only on innovation in the sense of technical feasibility coupled with a demand for the utility which future consumers anticipate enjoying from new products, but also access to funds to finance the undertaking. It is relevant to note that research relating to technological innovation and entrepreneurship has largely concentrated on technical innovation and economic demand (Rosenberg 1992, 1994), while inquiry into the role of access to finance has been

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relatively neglected except for studies relating to the allocation of funds between basic research vs. development (R and D).

This limitation goes to the heart of two related questions: are companies able to fund their technically innovative business units and, relatedly, are capital markets efficient in transferring funds to sectors exhibiting high prospects for creating and diffusing new technologies? These questions have become increasingly important since the 1970s during which, as clearly noted, there has been a resurgence in the importance of smaller firms who account for some 40% of important innovations (Rothwell and Zegveld, 1985), which have also significantly expanded employment in the small business sector. In turn, these developments have expanded their requirements for external financing.

It is well known that the sources of finance are likely to be quite different over the life cycle of innovation and the process of product development. Apart from the self-financing supplied by inventors, often supplemented by family and friends, universities increasingly facilitate the early stages of entrepreneurship by providing facilities as part of ongoing employment. However, commercialization requires venture capital which is extraordinarily difficult to come by.<sup>3</sup> Venture capitalists use funds from traditional financial institutions, and are in this sense suppliers of financial intermediation services, along with specialized skills in “steering” firms working with new technology, rather than financiers per se.<sup>4</sup> Venture capitalization often involves the input of skills in organizing, managing and developing new marketing strategies with a view to deriving profits from capital gains of dis-investment. As yet, a professional venture capital industry barely exists outside of California, New York, and Massachusetts, where it is focused quite narrowly on semi-conductors and medical technology that has strong university relatedness.<sup>5</sup>

Start-up finance is generally even less available in Europe than in the U.S. However, public funds often supply venture capital, which reflects the rather different mentality of European governments *vis a vis* the U.S. to become involved in business activities.

There is a substantial difference in the extent to which industrial firms in different countries need to rely on long term capital markets to obtain financing (Rybszynki, 1974). Between 40 and 50 percent of firms in the U.S. and UK relied on long term capital markets between 1960-1971 as compared with 25-40 percent in European countries and fewer than 20 percent in Japan. This is no doubt a reflection of the extent to which their respective stock markets put a premium on the short term results of firms' performances. Firms in countries which provide sufficient long term financing through investment banking have been able to gain advantages in global competition. Much of Japan's industrial expansion reflects its abundant supply of low cost financing and loyal capital. Analogously, the involvement of West German investment bankers has been a significant factor in its industrial success when compared, say, to the UK (Rothwell and

Zegveld, 1985). That is, differences in institutional factors among countries may better explain inter-country differences in innovative activity and consequently growth, than do such economic variables as cost of labor and firm size. This institutional characteristic notwithstanding, it seems that Europe lags the U.S. and Japan in producing firms that are based on the information technologies which are necessary to the promotion of job creation and successful competition in international markets.

## **6. Innovation in Financial Instruments**

The process of technological innovation has also encouraged substantial innovation in the process of financial innovation. Once again, it is relevant to distinguish, in the Schumpeterian sense, between process and product innovations. Thus, electronic funds transfers are a process innovation, whereas money market mutual funds is a product innovation in the sense that it is a new financial instrument. Generally, however, the wide-spread computerization of the financial sector (e.g., cash management instruments which permit complete integration with current accounts, mutual fund shares, time deposits, etc.) have rendered new processes and new financial instruments to be virtually inseparable. The globalization of financial markets is accelerating financial innovation in all its forms, especially in light of the fact that new instruments are generally not legally protected (with the exception of the cash management account [CMA] patented by Merrill Lynch in 1977).

The pace, not unexpectedly, in the development of electronic money and payment cards has accelerated most drastically in the U.S., the UK and Canada. France, Italy and Japan are not far behind, having accelerated their reliance on such instruments since the 1970s. Surprisingly, given their level of technological advance, Germany and Switzerland have lagged in the field of financial innovation, which is attributable partly to the practice of “universal” banking and the control by the Bundesbank over financial institutions.

The main impact of new financial instruments has been to reduce the trade-off between liquidity and market returns, which is a combination that J. M. Keynes could hardly have envisioned in 1936, anymore than he could have anticipated a transition to the Euro as the common currency of Europe.<sup>6</sup> New computer hardware and software is reflected not only in the internationalization of markets, but also in “around the clock” trading of financial assets. Clearly the advent of information technology has given new relevance both to Schumpeterian views of technological innovation and the modern Austrian interpretation of entrepreneurship as arbitrage.

## **7. Concluding Thoughts**

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The pressure for change and deregulation in financial markets reflects the spread of entrepreneurial attitudes into the financial markets. The pressure for change in financial markets has caused governments in all countries to re-examine the present relevance of traditional constraints on the functioning of financial institutions and markets. The transition to the Euro as the common currency of Europe is a prime example. Apart from the impulse of political unity which may derive from a single currency, the plan for European unity is to create a production capability and a goods market that is as formidable as that of Continental America.

One can only infer that these macroeconomic developments reflect the entrepreneurship driven microcosms that underlie them. There is very much a world of uncertainty in which entrepreneurs seek out opportunities for profitable ventures. The market is no longer an institution which accomplishes a static allocation of resources. Rather, it is a mechanism for the discovery of new methods of producing new products to satisfy new wants. It does not seem an overstatement to say that the unique combination of politics and technology that spawned the deregulation and privatization of the Reagan-Thatcher era have overtaken Europe and much of the rest of the world to create, for better or worse, the present integrated global order.

### **Notes**

1. Mises refers to the “imaginary figure” of the “pure entrepreneur” as a “methodological makeshift”.
2. It is, of course, also the case that entrepreneurship “visions” have a “feedback” role in determining the research agenda of science (Rosenberg, pp. 19-23).
3. An OECD study (1985) established that in excess of seventy percent of hi tech venture capital applications were rejected. It has further been inferred that only two out of ten business ventures based on new technology became viable businesses (Dizard 1982, Goultier, 1982).
4. Leading companies in the U.S. are Merrill Lynch Venture Partners, Fidelity Technology Fund, twentieth Century Ultra Alliance Technology Fund, and Constellation Growth Trend. In the U.S. there are also numerous small business investment corporations (SBICs) licensed and regulated by the U.S. government, and subsidiaries of large corporations (General Electric, Xerox, 3M, Exxon and Olivetti) who have organized subsidiaries to promote internal markets in capital technology and skills to support high technology. They also provide some financing to outside projects that are relevant to their own technological projects.
5. It is relevant to note that other large university cities, in particular Chicago and

Philadelphia, have not developed a significant venture capital industry.

6. Baumol also reminds us that Thorstein Veblen's critique (1919, pp73-4) of the notion of the economic man as "a lightning calculator of pleasures and pains" who "oscillates under the impulse of stimuli" but "is not a prime mover" has essentially the same bloodless persona as the entrepreneur.
7. Keynes was short sighted in his neglect of the future role of technical changes in production.

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