On Knowledge and Economic Transformation:

Joseph Schumpeter and Alfred Marshall on the Theory of Restless Capitalism

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ENTREPRENÖRSKAPS FORUM

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Swedish Schumpeter Lectures

Incepted in 2011, the Swedish Schumpeter Lecture is an annually recurring series of talks organised by Swedish Entrepreneurship Forum. Contribution to the series provide advanced treatment of scholarship about the entrepreneur, the entrepreneurship function and its role for economic development.

The lecture series is named in honour of Joseph Schumpeter, the scholar who pioneered a view of the entrepreneur as the central driving force of a dynamic economy. The lecture series brings together contemporary contributions to Schumpeterian research themes. Lectures are given by leading scholars, with comments provided by representatives from academia, business and politics.

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Introduction[1]

My intention in this lecture is to delve into the history of economic thought and throw a little light on the question of how wealth is created from knowledge. It is a perennial question, one that occupies the time of governments and of directors of companies and scholars alike and admits of no easy answers. Yet it is of fundamental significance in relation to economic growth and economic welfare, in relation to productivity change, and in relation to the resources to be devoted publicly and privately to science and technology- to provide but three examples.

Why the focus on Marshall and Schumpeter? My rationale is as follows. Their work is distinguished by deep awareness of the changing nature of capitalism that became apparent in the last half of the 19th century and continues to change today. Whatever form of capitalism went before, modern capitalism is distinguished by its restless development, by the commanding position which innovation plays in its operation. In recognising this they went well beyond the thinking of their predecessors who persistently sought to treat capitalism as a stationary system. For Schumpeter and for Marshall modern capitalism has a restless, autocatalytic nature, always on the move, seeking out and acting on new productive opportunities and, in the process, raising the standard of life for countless millions of people. Why is this so? The restless nature of capitalism is due to the growth and application of new knowledge of many different kinds: of the natural world, of human artifice and of human organisation. Moreover, the creation of knowledge is also a restless process as each advance points in the direction of further advances. For this to be possible, our economic, and social institutions must define an open

1. This year (2022) marks the 40th anniversary of the publication of Dick Nelson and Sid Winter's An Evolutionary Theory of Economic Change. That work proved to be a major innovation in the economic study of innovation and it set the terms for research, teaching and debate for countless scholars, myself included. The debt is considerable and lasting. Not least among the pathways they illuminate is the need to take seriously questions of management and organisation in relation to evolutionary competition.

system just as the creation of knowledge is defined by an open system. It does not seem unreasonable to suggest, that when the production of knowledges is properly organised, human knowing has the scope to grow combinatorially fast, way beyond any immediate capacity to capitalise on all that is new.

The role of Schumpeter in promoting such a world view is beyond doubt; his work has induced an entire school of economic writing and empirical investigation that flourishes today[2]. The position of Marshall is less obvious and much of this lecture is devoted to outlining his ideas on innovation and economic development. Along with Schumpeter he was an evolutionist and one who came very close to articulating a variation-cum-selection account of innovation and the competitive process[3]. His is a view of the market process in which innovation, read business differentiation, is centre stage.

During their lives, they witnessed a remarkable stream of innovations and their economic and social consequences, which created a canvas for their thoughts and respective visions. The durability of their writing reflects the fact that the role of innovation is a relevant today as it was in their lives; indeed there are grounds for thinking that capitalism continues to evolve as an innovation generating system. Consider the role of

2. The work of Dick Nelson and Sidney Winter (1982), and the many scholars who have been encouraged to follow in their path, is ample testimony for this view. Their work is manifestly Schumpeterian in spirit and. in my view, it is also deeply Marshallian. This is perhaps no better expressed than in their promotion of the notion of appreciative, as contrasted with formal theorising: the former is directed by an awareness of and engagement with current and historical economic facts and problems, so to uncover the phenomena that are of greatest importance, even though they may be beyond a simple or even a complicated formalisation.

3. Marshall's evolutionism is largely forgotten today and he is remembered as a toolmaker and early formulator of what became the neoclassical viewpoint but otherwise he has been overtaken and is considered rather unscientific in his quaint obsessions with morality, with realism and with his warnings about excessive abstraction in economic reasoning. Schumpeter (1941) In his semi centennial essay, highlights Marshall's evolutionary stance and the fact he" carried his 'evolution mindedness' into his theoretical work". Around the same time, Marshall's pupil, Gerald Shove (1942), recognised that "Marshall's whole conception of the nature of economic change is coloured by what may be called the Biological approach" (p.312). Rafaelli's (2003) deeply reasoned account of Marshall's evolutionary bent, its foundations and its reception, has greatly influenced my thinking for this lecture. Loasby and Whitaker too have enabled economists to see Marshall in a new light as will be clear below from the multiple references to their work

robotics and Artificial Intelligence more generally in transforming modern manufacturing production processes and many service activities, the effect of genetics on agriculture and medicine, the impact of new energy production and storage technologies on ameliorating carbon emissions, each of these developments acting on a global scale. They are of the same substance as the generation of electricity, the aeroplane, synthetic materials and the internal combustion engine in the fifty years from 1870 onwards. Schumpeter and Marshall lived through an incredible period of accelerating technological and economic transformation, they could scarcely miss the implications of these emergent phenomena and they did not.

The importance of innovation as an *economic* problem is I hope obvious. Why some innovations fail while others succeed, how successful ones increase their economic impact over time while others languish in obscurity, how scarce resources are allocated to the innovation process, how the gains and losses from innovations are distributed: these are economic question of the first order. Schumpeter and Marshall had in common an evolutionary perspective on these questions, as reflected in four works which I draw upon today: namely, Schumpeter's Theory of Economic Development (1912), and Capitalism, Socialism and Democracy (1944), Marshall's Principles of Economics (1890 and 1920) and *I*ndustry and Trade, (1919)[4] I shall draw some major similarities in their work and highlight major differences too.

I would sum up by saying that they had complementary visions of capitalism as a self- transforming system not just a self-organising one, although the two aspects are deeply intertwined. Neither is a slave to a narrow rationality; human creativity and imagination play central roles in their respective world views. But, while they painted from the same palette, they expressed their respective visions in very different colours with very different techniques. For Schumpeter the brush is filled with sharp primary colours and articulated in bold strokes but for Marshall the brush is drawn to pastel shades and the colours blend one into the other, so where one mental construct ends and another begins is always

4. I am relying on the second edition of the Theory of Economic Development, based on the Redvers Opie translation published in 1934. The first edition appeared in 1912. All references to the Principles, are to the 8th and final edition published in 1920.

an exercise in qualification. Schumpeter creates sharp boundaries; his rhetorical audacity is breathtaking. Marshall, the ever-subtle pragmatist, uses his deep knowledge of actual conditions to smooth edges, to render boundaries permeable, to qualify and warn of dangers. No doubt his legacy suffered as a result of his persistent failure to nail his colours to the mast, but I want to persuade you that he is an essential complement to Schumpeterian thought. Indeed, in Industry and Trade, he goes beyond Schumpeter In his treatment of innovation and its consequences. It is not productive to treat them as rivals for they have far too much in common.

It might help at this point draw attention to one of the potentially significant differences between their respective approaches and one significant point of commonality. The difference is the problem of continuity. For Schumpeter, the essence of the matter is that innovation induced development is a discrete process marked by discontinuity, by step changes, a new point of equilibrium cannot be reached by infinitesimal steps as he puts it (TED, p64)[5]. In contrast, Marshall is famous for his emphasis on gradualism, development through the continual accretion of small changes summarised by his epigram, *natura non facit saltum*. This difference should not get in our way. For Schumpeter, development is a break with the past, for Marshall, development emerges out of the past. Perhaps these are opposite ends of the same telescope. Every radical innovation, and many of lesser note, is typically a prelude to a series of incremental follow-up innovations that explore the particular design space and take time to emerge and spread. At each stage, the incremental effects are likely to be of small magnitude but cumulatively over time they may constitute the complete transformation of a particular industry. Looking back the historian may identify pre and post innovation worlds and their sharp discontinuities but, in reality they are connected by one enduring process.

Consider next the point of commonality, the matter of equilibrium. Equilibrium is a notion that is deeply embedded in economic discourse and will remain so but it is a slippery construct. As commonly used in economic theory, it simply means that an investigator has posed a problem

5. Schumpeter rejects any reliance on organic metaphor, stating baldy, "It is a fact that the economic system does not move along continually and smoothly". The language is the language of disruption, of setbacks of breakdown. (TED p.216).

and a set of solutions have been found: the equilibria are pencil and paper constructs. This is far from irrelevant, for it provides a basis for changing the problem and comparing the different sets of solutions and we routinely teach our students to do this. But any such comparison of alternative solutions invites the question of movement from one solution to another and an explanation of movement cannot be the same as an explanation of equilibrium. Equilibrium means a state of rest, a state where all the internal sources of change specified within the problem have been exhausted, and here it matters not whether we are talking about an equilibrium position or an equilibrium path. Once in equilibrium one can never escape from it, other than through the operation of external events that alter the operant forces- the "influences from without". In contrast, Schumpeter and Marshall use the word equilibrium in a different way, to capture the meaning of economic coherence, the coordinating balance of forces by which markets clear and an ordered pattern of economic relationships emerges. Their schemes are not at rest they are self-exciting, to use Knight's felicitous phrase, the forces at work establish a coherent real world order but order is not equilibrium. For the very process of establishing coherence gives rise to new knowledge and new ideas beget further new ideas (P, IV, p.271)[6]. The generation of new knowledge transforms the position the system is heading too and the system it came from. They are irreversible developments; there can be no going back to the starting point. This is made abundantly clear in Marshall's claim that, "The world's material wealth would quickly be replaced if it were destroyed, but the ideas by which it was made were retained. If however the ideas were lost, but not the material wealth, then that would dwindle and the world would go back to poverty" (P Appendix C, p.780). It follows that the invention of devices to store human knowing, so it can accumulate and be made available to those separated by time and space from the originators of knowledge, has been of incomparable importance in creating our modern world.

To think of an economic system in equilibrium is to think of a system in which knowledge is in equilibrium, I can attach no meaning to that

6. That is to say, Principles, Book IV page 271. This notation is used throughout.

characterisation of human activity[7]. It is largely for this reason that Marshall made his claims for biological, or better expressed, evolutionary methods of analysis, for economic affairs are an expression of living force and movement[8]. The way Schumpeter makes his evolutionary case is that economic life changes its own data by fits and starts, in his memorable phrase, it leads to development that arises "from within" by its "own initiative", surely one of the most powerful insights in all of his writing (TED, p.63). In each case, the idea of enterprise and its agent the entrepreneur is central. It is not their role to invent, it is their role to imagine a different economic world and then act so as to lead and guide the use of resources into new channels. It is the interplay between creative insight and action that matters, and action means introducing novelty and letting the new exude its magic by displacing the old relatively and absolutely. What is destroyed in terms of economic activity is as much part of the story as what is created.

7. This is powerfully expressed by Foster 1993, who draws our attention to the importance of ideas related to self-organisation as aids to understanding Marshall. There is, of course, Marshalls Appendix H in the Principles, where the irreversibility ideas are laid out.

8. Marshall (1898, p.54) makes it clear that the solutions to economic problems are provisional results of opposing forces, but the solutions (he terms them equilibria) *never appear*. (My emphasis). This is the essence of the theme of living force and movement that permeates his entire work.

Schumpeter's Theory of Economic Development in a Nutshell

The sole purpose of Schumpeter's great work is to elaborate the role of enterprise and the entrepreneur in the process by which capitalism operates as a self-transforming as well as a self -organising system. The focus is on the entrepreneurial role, how it generates new combinations of production, the innovations, to perform existing activities at lower cost or with greater efficacy. The basis for the innovations may be technical, organisational or commercial and extends to the new product as well as the new production process. As a matter of logic, the act of enterprise is distinct from the act of invention and the act of risk bearing and, to drive this home, he makes his entrepreneur a stand-alone individual, the new man without capital who sets up a new business: although, in fact, he is perfectly open to the possibility that the entrepreneur is a salaried employee of an existing business or an inventor or a person with the wealth to fund his own activities. The rewards to successful enterprise are the profits that are generated as a surplus over costs when the new methods are evaluated at the prices and factor payments supported by the existing 'old' methods. Of course, there are minor qualifications but the central thrust is the generation of a species of economic return which can only exist because the system is out of equilibrium[9]. Stage two of the drama, as he puts it, involves the elimination of those profits, they are transient, in a famous passage, they are "the child and victim of development" (TED.p.154). That is to say, profits point the way to a new value system which necessarily means that each innovation changes the prevailing value system and, in so doing, necessarily shapes the future channels of innovation and invention. Moreover, the magnitude of the profits that accrue bear no necessary relation to the efforts and sacrifices

9. For example, in terms of the possibility of serial entrepreneurship, in this case, the innovator using past profits rather than bank loans to fund the project. (TED. p.136)

that were incurred in the process of innovation, they are not determined by any marginal utility calculus.

It is the competitive process that destroys the entrepreneurs profit and it does so in a very particular way, although it is certainly not perfect competition. The insights that underpinned the innovation are not protected property; they are transferable to others who, if they are in a position to do so, imitate and increase the proportion of output that is produced by the new method[10]. The implication is that each firm is a small producer and that the adjustment process is driven by identical new entrants and not by the organic growth of the innovating businesses.[11] The ensuing struggle destroys the old producers, unless they also imitate, and with it the old value system. So a new order is established, where profits are once again zero, although there are no hints as to how quickly this might occur. The overwhelming conclusion is that innovations suspend for a time the traditional laws of value.

The brilliance of this thesis lies partly from his use of the device of the fictitious circular flow as its counterpoint. It was a rhetorical masterstroke to insist that the important features of the development process can only be understood by starting from a position where innovations and their correlated phenomena are absent. One should not explain the process of development in the context of ongoing development, even though in fact all development rests on prior development. This is in sharp contrast to Marshall's method as we shall see.

The circular flow of economic life depicts a fictitious economy-wide pattern of production, exchange and associated prices of goods and of the primary factors of production, land and labour. The point is that it is a system established by tradition where sound experience is the glue that holds everything together and stability is the norm because habit is as firmly rooted in a society as a railway embankment is in the earth (TED, p.84). Any disturbances that do occur arise from outside the circular flow and are adapted to without leading to any change in the nature of

10. Of course, patents are a possibility but the effects are so obvious as to not merit discussion. (TED, p.131)

11. Schumpeter draws explicit attention to the great difficulties of building an innovation around a large business. (TED p.133)

the glue (TED p.40). Rationality is downplayed because a capacity to calculate is an attribute of the entrepreneur, another indication of the way in which Schumpeter draws sharp boundaries. The circular flow, of course, bears more than a passing resemblance to Marshall's stationary state and the point is that neither are an adequate rendering of the economics of capitalism because neither generates novelty. This lifeless device is there to show what modern capitalism is not.

When Schumpeter returned to this theme in Capitalism, Socialism and Democracy (1943) we find an even more forthright statement of his views. The perennial gale of creative destruction implies innovation in the hands of large businesses, an evolutionary process that never can be stationary and which can only be judged by its performance over time. The charge sheet is uncompromising: textbook perfect competition (or indeed imperfect competition as it had developed) makes no connection with capitalism as it actually operates, innovation-based competition attacks not just the profits and outputs of established businesses but their very claim to existence (CSD, Chapter VI).

Such vivid imagery was never within Marshall's scope, yet he thinks of capitalism and the role of innovation in an entirely compatible way. Let me explain.

Alfred Marshall and Four Development Themes

The Principles of Economics was Marshall's great work and it has largely passed unnoticed that it dealt with economic development in no less interesting a fashion than Schumpeter but, as already hinted, you have to work a little harder to extract the core of the argument[12]. Marshall opens his account of economic development by focusing on the nature of the factors of production, Land, Labour, Capital, but then, "Capital consists in a great part of knowledge and organisation" and "Knowledge is our most powerful engine of production", while "Organisation aids knowledge" (P, IV, p.138). In three short statements we have the nub of the matter; economic development is a question of the accumulation of new knowledge and its application through organisation, which, incidentally, is also required to shape the growth of knowledge. How these processes work in the context of markets, industries and firms is the focus of the rest of his work.

After the Principles was well established Marshall turned his attention to a volume that would deal with economic superstructure rather than economic foundations. That work never appeared but some of the ideas fell gradually into the form of Industry and Trade which appeared in 1919[13]. Marshall considered it to be a continuation of the Principles, and it is but in some surprising ways. It brings the latter up to date with its commentaries

12. For Shove (1942) Marshall's work was not an attempt at synthesis between English classical and Austrian modes of reasoning but rather moved economics into a new world. To him, as one of Marshall's leading disciples, it was a monument to ingenuity and a storehouse of information.

13. Marshall's tortured path to Industry and Trade is well covered by Whittaker (1990) and Groenewegan (1995), chapter 19. It is a work of economic history and contemporary analysis more than anything. It relies on the ideas in the Principles but does not develop them. It is rightly seen as a work of applied economics in which Marshall drew together his immense knowledge of economic phenomena: so much knowledge of detail that he found it exceedingly difficult to shape and settle the form of the book.

on emerging processes of industrial development, on the increasing role of scientific research in relation to innovation and the changing nature of the competitive process, and it displays a keen eye for the characteristics of Germany and the United States as challengers to Britain's industrial pre-eminence[14].

In these two works, Marshall developed his evolutionary dynamics of competition and economic development, one that gives the entrepreneur a central role, one that is complementary to Schumpeter's thinking. But it goes further. Our attention is switched to the processes by which an economy adjusts to innovation to capitalise on its potentialities for transformation. Market processes, the formation of prices, investment and the growth of differentiated firms are at the heart of this perspective. The act of innovation alone is not sufficient. If one may, it is necessary to be much more explicit about the second act of the drama.

Marshall's approach is quite complex but the essence of it is to interweave four themes: the nature of competition when it is a process driven by differences between the firms in an industry; the role of managerial behaviour in comprehending why firms are different; the problem of relating costs to prices (the representative firm problem) when the firms have different costs of production; and the significance of the time element in distinguishing between investments in new productive capacity and investments in new fundamental knowledge. These elements form one piece in his evolutionary thinking, they are the core to his dynamics of economic development, they are what made Marshall so different and, indeed, so difficult for his contemporaries to follow. How does this work out?

Marshallian Competition

Competition is another slippery word and there is a serious disjuncture between the way it is used in business life and the way it is used in the economics profession. For the latter, perfect or imperfect competition in

14. It is a complex and not terribly well organised book, as Keynes said of it, "The book is a mine rather than a railway - like the Principles a thing to quarry in and search for treasure."(1924,p.370). But one of its connecting threads is Marshall's response to the mounting evidence that Britain was rapidly losing its economic leadership to its rivals. Perhaps Marshall was thinking of evolutionary competition at the international level?

any industry is a state of rest, defined by uniform firms each earning zero equilibrium profits in excess of the cost of capital. Business competition, by contrast, is a process of evolutionary change; the two perspectives could not be more different because business competition hinges on differences between firms and innovation is a principal source of those differences. As in Schumpeter, innovation generates the differences in profitability to drive the development of an industry.

It is natural to see business competition in terms of contests and races and this suggests that we have to pay attention to the rules that regulate the contest, who may compete and on what terms, the prizes on offer and on what terms they are to be distributed, as well as the terms on which competitors are to be penalised for rule breaking and, in the limit, eliminated from the competition. As in any competition worthy of the name, the distinctive characteristics of the competitors are the key, as is a degree of unpredictability as to outcomes. Uncertainty is an essential part of the process, and it is often predicated on a lack of knowledge of the competitive attributes of rivals, especially in relation to the new competitor[15]. This is the mode of competition that runs throughout Marshall's work and its defining characteristic of the process is the differentiation of the competitors as he puts it, this is a matter of "constant forethought and restless enterprise" (P I, p. 5).

Both Marshall and Schumpeter thought that this type of competition was a characteristic of the modern age and is absent in any society in which the bounds of custom are well entrenched, so what made competition possible is the emergence of some fundamental attitudes of modern life. We can express this most directly by saying it depends on the creation of an open economic system characterised by freedom of industry and enterprise or

15. Knight (1923) captures these ideas with great force, . A good game, he suggests depends on a mix of "capacity effort and luck", p.55. Quoted from the 1935 reprint.

economic freedom. (P.I, p.10)[16] It is the essential characteristic of openness that every activity is liable to challenge from rival approaches and the consequential adjustments that follow. The propensity to differentiate and challenge the status quo gives modern capitalism its distinctive flavour and makes it an evolutionary system notable for the acceleration of change as well as the breadth of change.

Economic freedom alone is necessary but not sufficient to explain the nature of the competitive process. The instituted market frame in which competition is played out is equally important and this depends very much on seeing a market as a device for producing and disseminating information between buyers and sellers of goods as well as the owners of factors of production. Markets need to be open systems too. The degree of perfection of a market is a matter of its organisation and consequent ability to connect together those who wish to sell and those who wish buy. It is not only a set of instituted rules it is also a set of communication processes that enable connections to be made and broken. Thus, throughout the Principles and Industry and Trade, Marshall pays much attention to innovations in transport and communication technologies (printing and the telegraph, railways and the steamship) and for an obvious reason. The spread of timely information increases the geographical scope of markets, while innovations in transport reduce the costs of acting on such information. The result is that the domain of markets becomes larger while their tempo of operation becomes quicker.

At one extreme we find the perfect market, in which information is diffused so widely and the costs of transportation are so negligible that commodities of similar quality sell for identical prices across the market, a rule which applies equally when difference in product quality are factored in. But the distinctive feature of Marshall's approach is that markets are

16. In the case of England, Marshall, dates this change to the end of the 18th century and describes it in terms of mechanical inventions, the concentration of industries and large-scale production for distant markets that broke up the old traditions of industry. (P.I,11) The changes are further elaborated in Appendix A of the Principles, and in Industry and Trade, Appendices B and C. As is well known, Marshall had a well-developed moral position on many economic questions so he is always at pains to stress how the emergence of the free enterprise system had deleterious as well as beneficial effects and he is far too sophisticated to fall back on a claim that all was well because average incomes were rising.

generally imperfect, they are costly to organise and they do not entirely eliminate barriers to communication. This combined with consumer inertia breaks the rule of a uniform price, the 'law of indifference' as Jevons had expressed it. Firms set their own prices but they do so within the limits set by the degree of market imperfection. In a completely imperfect market, every firm is a monopolist and so, as Industry and Trade explores, a firm can set prices limited only by the conditional possibility of new entrants invading the market. At the other extreme, in a perfect market, the latitude to set prices is so circumscribed that all firms set the same price. In between, there is more scope for independent price setting and there is scope for destructive competitive behaviour through the adoption of collaborative arrangement to reduce the strength of competitive action[17]. In this way, Marshall pointed in the direction of the new theories of imperfect completion proposed by Robinson and Chamberlin in the 1930s, neither of whom grasped his idea of competition as a time dependent process[18].

There is a further consequence of imperfect markets in that they give rise to expenditure on marketing activities and this points to an overlooked but important aspect of demand in the competitive process. What matters to a firm's revenue stream is not only how many units of its product its customers buy but rather how many customers it can rely on to buy its wares. A firm's customer base is among its most important assets and firms operating in imperfect markets have to try to connect with customers, actual and potential through marketing activity to protect or expand this base. Marketing expenditure, like product innovation, is a way to capture customers from rivals in no less a manner than a reduction in price. It is a form of investment in the external organisational capital of the firm which may well exceed in value the capital invested in its internal organisation. In the operation of business competition the gain or loss of customers is likely to be far more significant to a firm's revenues than changes in the amounts bought by the individuals concerned.

17. Book III of Industry and Trade is devoted almost in its entirety to the effects of trusts, cartels and other associative arrangements on the competitive process. Business lobbying to change regulatory frameworks to the advantage of (some) incumbent firms is another example.

18. See Hague (1958) for further discussion of imperfect markets and their link to competition in Marshall.

Since the openness of a market depends in part on flows of information it is not at all surprising to find Marshall pointing to the role of technical standards in facilitating competition. As is elaborated in Industry and Trade (pp. 201-202), some standards are *general* and often sponsored through government support, such as verifiable systems of measurement, and others are *particular* to a specific line of trade and are generated largely by the industry in question. The production of standards is to be viewed as a particular kind of external economy, along with the trade press which is open to all firms and may give smaller producers, in particular, access to information that they would not otherwise enjoy[19].

I hope it is clear that Marshall does not write about perfect competition, the notion never appears in his work, rather we have various degrees of the exercise of enterprise entwined with markets that grow at different rates and are so organised as to be more or less imperfect. Competition of this kind gives rise to the relative and absolute growth and decline of individual businesses, to the emergence of new businesses and the elimination of existing ones; it is in its essence an explanation of economic development in an industry and its constituent, differentiated firms.

Since business characteristics and their differentiation are so central to the argument, let us turn to the question of business leadership and its close cousin enterprise.

Business Management and the Entrepreneur

Brian Loasby has suggested perceptively that one understands Marshall more if one approaches him via Adam Smith rather than from the present state of textbook neoclassical economics (Loasby, 1989, p.48). One of Smith's enduring ideas is that of the division of labour as a form of organisation that increases productivity but which is limited by the extent of the market. The division of labour plays a significant role in the Principles, and in Industry and Trade were it is defined in terms of countless forms of organisation and any organisation needs to be managed so that its component parts are suitably constituted and connected. Schumpeter,

19. Schumpeter was ample in his praise of Marshall for pointing the way to a theory of imperfect competition in the 1930s. Unfortunately, this development simply did not address Marshall's model of business competition and the role of innovation within it. See, Loasby (1989,1990) and Shackle (1995) for further elaboration

as we have noted, makes a sharp separation between the economic roles of the entrepreneur and the manager, What does Marshall have to say about this?

Consider first the entrepreneur. You might be surprised to hear that the entrepreneur is a constant presence in Marshall's writing, whether as the business undertaker of old or the modern man of genius who builds a great business, or as the new man who sets the pace or as the bold reformer who transforms firms and industries. Indeed, we are told that we may divide employers and other undertakers into two classes:

> *"..those who open out new and improved methods of business and those who follow beaten tracks" (P VI, p.597)*

It is to the former that we must look for constructive enterprise, the bold and enlightened discharge of which is the principal source of economic progress (IT, p.847). Moreover, the benefits that their inventions and innovations render to society are, in many cases, out of all proportion to their financial rewards, even if they have "died millionaires". (P, VI, p.598)[20]. There is, therefore, an especially important distinction between the direct and indirect benefits that creative business renders to society, it is appropriately rewarded for the former but not the latter consequences of action. Surely there is nothing here that Schumpeter would disagree with.

The establishment of new business firms is not excluded, Marshall is always careful to stress how challenging this can be, but existing businesses too may also be a source of constructive enterprise. In either case, enterprise is to be distinguished from the ongoing management, development and growth with which every business must cope. However, the environment in which these challenges are expressed was changing. A mid-Victorian world of relatively small firms, typically defined by a single business unit and owned and led by a single individual or perhaps a partnership, was rapidly being eclipsed by a world of larger corporations controlling multiple business units, many of them financed and owned according to the joint stock principle. The latter may have an able leader and Board of Directors

20. Marshall. further observes "that there is a far more close correspondence between the ability of business men and the size of the businesses which they own than at first sight would appear probable" (P. IV,p.312)

but the management problem is trusted to a team and its corresponding bureaucracy. Marshall senses danger for his theory of innovation driven competition. In a world of individually owned private firms, the natural span of human life sets natural limits to the growth of a firm, which waxes, grows to a position of strength and then begins to decline. It may be that the younger family members or chosen subordinates can rescue the situation but it is unlikely. The joint stock form of organisation threatened to destroy the world Marshall had grown up in and it worried him, just as much as it subsequently concerned Schumpeter, precisely because of a belief that bureaucracy and the exercise of creative imagination do not coexist easily and so would drain the well springs of enterprise[21].

With the changing size and ownership of firms the problem of managerial leadership becomes quite different. Irrespective of how the business was founded, its continued operation requires organisation and management according to the principles of specialisation. On the one hand, the managers must know their trade, be able to forecast within reason broad movements in demand and in the availability of means of production and be aware of the scope for product and process innovation. On the other hand, in relation to employment and the running of the business, what is required are the qualities to lead and to choose subordinates so as to draw from them whatever powers of enterprise and origination that they may possess (P. IV 298).

We should note that this is a quite different model of how innovations transform industries and markets to Schumpeter's scheme. The process does not depend on a stream of entrants of fixed size but on the growth of the established firms who have undertaken the innovation and those who copy, and quite possibly improve, the innovation. The upshot is that different managerial teams will extract different degrees of commercial success from any innovation and have differential abilities to grow the business.

21. As Schumpeter put the matter, the routinisation and bureaucratisation of the entrepreneurial function would lead to the euthanasia of the entrepreneur and a fundamental change in the dynamics of capitalism, economic and social. See CSD, Chapter XII.

Managerial leadership, what we might call top management, is clearly a cerebral affair and it is the ability to think differently from rivals that ultimately creates the scope for innovation and evolutionary competition[22]. The able leader must be endowed not so much with specialist knowledge but with broad capacities for considered and prompt decision, sound judgement and an eye to the future. In other words, "thought, initiative and knowledge are the most powerful instruments of production (IT, p.593). On this basis the weak are differentiated from the strong. The latter attract the capital necessary to their operations and can grow the business, the former destroy the capital at their command and decline, so that the ultimate effects of managerial differences are reflected in the competitive dynamics of growth and decline. In other words it is to differentiation of management teams that Marshall points in explicating his evolutionary credentials.

One aspect of managerial performance relates to the management of risks and the force of Marshallian competition creates particular trade risks some in the form of inventions and some from the incursions of more able rivals. Thus, the management of a firm has to be alert to new developments for, if not, they risk being "worsted in competition" by others who are bolder and more far sighted; a simple consequence of competition being a struggle for survival (P, VI, p.561 and 590). Indeed, the general rule is that the number of firms that succeed in any line of business is a small percentage of all those who ever operate in that trade (P, VI p.620).

We are told directly that business variation is the "chief source of progress" (P,V,355). No two businesses structure their process in the same way, and so no two firms are likely to owe their success to the same set of advantages (P. IV, 298). Consequently, it will be dangerous from a competitive viewpoint to assume that a rival operates in the same way and difficult, given the complexity of the modern firm, to divine how and why it differs.Beyond generalities, very little will be public knowledge and much will be tacit.

22. When writing about the characteristics of the single owner in less complicated times, Marshall admits that physical tiredness was to be expected at the end of the day, but the owner's brain, "was seldom weary". (P, IV, 292)

Furthermore, no two firms conduct business experiments in the same manner. Business experimentation is a constant theme in Marshall, each business seeks to discover better ways of conducting its operations that is to say adding to its stock of knowledge[23]. Here we find a deeper consequence of a system of free competition, for,

> *"the advantages of economic freedom are never more strikingly manifest than when a businessman endowed with genius is trying experiments, at his own risk, to see whether some new method, or combination of old methods, will be more efficient than the old." (P. V,406)*

Moreover, the importance of business differentiation prompts a question that Marshall poses in true evolutionary fashion, namely,

> *"what are the causes which make different forms of business management the fittest to profit by their environment, and the most likely to prevail over others" (P. IV, 265)*

We might add that "prevailing over others" is an important aspect of his Principle of Substitution which in turn is an example of the Law of the Survival of the Fittest: the better business organisation displaces the inferior business organisation when it offers its services at a lower price. (P, VI, p.597).[24] Marshall is incredibly careful to point out that this process of competition depends on the prevailing selection environment from which the existing firms derive benefit in relation to how they are differentiated. It does not imply that the selection environment is ideal from a wider point of view, because there are indirect consequences of the competitive

23. This relates directly to the principle of substitution which has three forms. First, in relation to efficient use of resources within the bounds of current knowledge, the adjustment of factors in the proportions that produces lower costs of production at the prevailing factor prices. This became standard in textbook economic theory but it is the static part of the trio. Secondly the search for better productive methods that is to say the experimental search for innovations, and, thirdly, the search by purchasers for suppliers that are more efficient and sell at lower prices. (P, V, p.341). Here, substitution is a dynamic question of supply and demand adjustments requiring differences in and changes in business knowledge..

24. "..in a somewhat similar way, society substitutes one undertaker for another who is less efficient in proportion to his charges" (P, V, p.341), see footnote 22 *supra*.

selection process some of which are deleterious, evolutionary externalities if you wish[25].

In all of the emphasis on creative enterprise and the capacity to invest and grow a business there is something of a paradox. Marshall and Schumpeter place their emphasis on the rationality of entrepreneurial decision making on an ability to calculate and weigh the consequences of alternative courses of action. Calculation requires information but, in respect of innovation, that economic information does not yet exist, hence the paradox of rationality without data. No one can know the outcome of any business investment decision before it is implemented and evaluated by the market, especially one that entails innovation. Of course, the prevailing environment, the order as we have called it, provides a datum against which to vicariously assess new business conjectures but it is no more than that, and the greater the radical nature of the innovation, the more it invokes surprise and a sense of novelty, the greater is the difficulty in making calculable choices. That is why entrepreneurs are a different economic breed, a class apart[26].

As a postscript we may turn briefly to a new theme that appears in Industry and Trade. This is in regard to the emergence of the notion and practice of the Scientific Management movement and we should say a little about it. As we shall further explore below, Industry and Trade pays far greater attention than does the Principles to the growth of scientific activity in general and the interplay this creates with business performance. This is a mark of the age when science is revolutionising some industries but what catches Marshall's attention is the scope for developing managerial knowledge in the broad along scientific lines. In part this reflects the growth of accounting practice but more significantly it concerns the movement that came to be called Taylorism: the use of observation, experiment and recording of results to discover the maximum efficiency for each and every part of a business activity[27]. It is a matter of putting aspects of the Principle

25. See also (P, IV, chapter 8) for further qualification.

26. (P, VI, p.663) Disappointment or elation at the performance of an innovation are commonplace. Inventors and innovators are often astounded at the uses to which their innovation is eventually applied. The radio, the telephone and the gramophone are cases in point.

27. See Whitaker (1999) for a detailed treatment.

of Substitution on rational scientific lines. Central to this is the idea of a planning department within a firm that, in the light of the information discovered and recorded, allocates tasks across the workforce in such a way as to extract the maximum of efficiency at each stage of production. I mention this because, it is perhaps not unreasonable to find here a reflection of Marshall's early interest in psychology and his essay on automata that could be said to mimic the human brain, the brain as it were being the planning department responding to sensory signals from the workplace and responding with appropriate instructions[28].

Be that as it may, because the firm is the vehicle through which innovation and competition are realised, it is not surprising to find Marshall devoting more attention to the managerial process than any other major economist that I know of. It led him into treacherous waters.

The Representative Firm

We come then to the great Marshallian difficulty one that flows inevitably from his emphasis on business differentiation. In a world in which firms have different costs of production and marketing, just whose costs can be said to determine market price(s)? Although Marshall focused on cost differences, it is relevant to note that differences in product quality, differences in the desire and ability to grow a firm, including the development of new markets, differences in the desire and ability to innovate, all need to be factored into the competitive dynamic and thus the relationship between costs and prices. This is why Marshall's focus on management and organisation is so important and why his themes are reflected today in the concepts of strategic management including the ideas surrounding routines and capabilities. There is something very up to date about Marshall!

Recall that Marshall's primary concern is the long period where investment in capacity, organisation and improved knowledge of an

28. Rafaelli (2003, chapter 2) provides an absorbing and authoritative account of this stage in Marshall's thinking. This work contains some of the most perceptive analyses of Marshallian thought that I have found, it has influenced me considerably.

incremental kind is the focus of attention[29]. Recall also that his firms are not stationary, some are growing, some are declining, some are innovating, and some are new entrants, while even long-standing producers can be forced out of an industry. That is to say, every industry is in a state of flux and in no way approximates the stationary nature of a zero profit perfectly competitive equilibrium. Everything in Marshall stands against the stationary viewpoint, not least in the attention he paid to making the different cost structures of his firms dependent on the development of the industry in view[30].

It is surprising, therefore, that so much attention has been devoted to the idea that Marshall sort to reconcile economic evolution with economic equilibrium.[31]. This is, I suggest, not the case. He reconciles evolution with the transient market order and has no choice but to do so because business evolution depends on the presence of an ordered structure against which entrepreneurial and managerial conjectures can be formed and tested.

Consequently, the price system is not only directed at reconciling different plans it is also instrumental in stimulating changes to those plans; prices aid self-organisation and they also induce self-transformation, Thus Shackle was right to point out that equilibrium in Marshall is a fiction, "it is an adjustment that *would* be attained if the very endeavour to reach it did not reveal fresh possibilities, give fresh command of resources, and

29. The way he describes this in 1898 is ".those (inventions) which may be expected to arise naturally out of adaptations of existing ideas". p.51.

30. Marshall certainly muddied the waters by linking business differentiation to the idea of increasing returns. Firms growing at different rates would achieve different cost reductions arising from the different changes in their scale of operation, so further altering the pattern of differentiation. It was an unfortunate red herring, which forced his critics to turn against his way of thinking. They had no choice if they insisted on developing a theory of perfect competition which necessarily requires that all firms are operating with constant returns and all firms have identical costs at their point of equilibrium. How else can one eliminate profits over and above the cost of capital? I find it difficult to understand why one would ever want to treat an 'ideal capitalism' in terms of zero profit solutions to the problem of economic coordination.

31. See, for example the thorough discussion in Hart (2003) and Rafaelli, (2003, chapter 6). Prendergast (1992) raises the interesting question of why the economics profession turned away from evolution and embraced equilibrium. As she points out this situation is changing.

prepare the way for inevitable, natural, organic further change"(italics in original).[32]

It is in this context that Marshall introduced his representative firm, which appeared in the 3rd edition of the Principles, and continued through successive editions and on to Industry and Trade. It is the costs of representative firm we must hold in mind if we are to understand the relation between costs and prices in an industry and its markets as a whole (P.IV.317)[33]. In the subsequent reception and re-evaluation of Marshall's work this "innovation" did not turn out well. We should spend a little time exploring why because it involves central aspects of any evolutionary theory of industrial change, especially one that gives high priority to the processes of innovation and differentiation that are found in modern capitalism. Much of the fault is because Marshall was never able to state with any precision exactly what he meant by a representative firm. It is as if he had not quite grasped the full implications of his variation cum selection theory of industrial change. And in this he can be excused because the necessary insights that first emerged in evolutionary biology with the work of R.A., Fisher did not appear until the late 1920s.

In fact Marshall puts forward two explanations of the relation between costs and prices. The first is familiar and I assume uncontroversial. Among the array of producers in an industry (the implication is one operating in a perfect market with a uniform price), each with different costs, we will find one producer whose costs are higher than those of any other rival. In an ordered market, the price will be no lower than the long run costs of production of this particular producer. When the price corresponds to the costs of this 'marginal producer' it will just break even, earning a normal return on capital invested and it will no longer have any incentive

32. Shackle, (1965, p.36)

33. Quere (2003) cuts to the heart of the matter when he states that the specific purpose of the representative firm is "to make compatible a normal theory of supply and demand with a theory of economic evolution"

to invest[34]. Indeed, it will generally be contracting under pressure from the expansion of its more efficient rivals and so its dominant problem is a short run problem; how to recover as much as it can of the capital value invested in the business, not least by disposing of plant and equipment and whatever other marketable assets it possesses[35]. That is to say, even when the market is growing, decline in some producers is the unavoidable consequence of the growth of others (P, IV p.317)[36]. The latter causes the former, they are not just random eddies on the surface of the pond but they mean the coexistence of expanding firms, taking long-run decisions, and contracting firms, taking short-run decisions.

The costs of the marginal producer(s) are the measure of the price in the market but, of course that price depends on, is partially governed by the costs and capacities of all the operating firms: firms which are of greater managerial ability, firms that are earning profits in proportion to the scope of their abilities to organise and manage the capital assets at their disposal. These firms are also taking long-run decisions to invest and grow and, we might note in passing, that their profits are an example of quasi rents, returns that are governed by the circumstances of the moment not by the circumstances that induced a firm to make its particular investments. As in Schumpeter, these profits are transient. they are destroyed by the very reaction to their existence that is the nature of Marshallian competition.

34. The notion of a cost array appears in Appendix H of the Principles, in a diagram of the particular expenses curve, which, because of internal and external economies, can only be drawn for the prevailing level of industry output and its distribution across the rival producers. The curve depicts the differential production advantages of the various producers arraigned in order by their unit costs at a particular phase in the development of an industry. See Silberling (1924) for further development and Salter (1960) for an application to the innovation process that is thoroughly Marshallian.

35. Marshall is very clear that an accumulated investment in internal and external organisation will not be in this disposable category, which rings true but may give rise to exceptions that are often covered by the term goodwill when a business is sold to another owner.

36. It is perhaps worth quoting the relevant passage in full. "When different producers have different advantages for producing a thing, its price must be sufficient to cover the expenses of production of those producers who have no special and exceptional facilities; for if not they will withhold or diminish their production When the market is in equilibrium, and the thing is being sold at a price which covers these expenses, there remains a surplus beyond their expenses for those who have the assistance of any special advantages" (P, V, p.499).

How can one consider the whole picture presented by all the operating firms? Enter the representative firm and Marshall's second answer. It is fair to say that Marshall is less than transparent in his explanation of how this firm is to be defined. Let us take what is said at face value. The representative producer depends on the size of the industry for it is the producer which enjoys a fair share of the internal and external economies available to the industry at that point in its history. As far as these economies are concerned this suggests it must be of average size at any particular date and grow in size at the same rate as the industry grows over time. Less transparently, it is also a firm of normal ability, it is neither a new entrant nor a long-established producer but it has had a long life and fair success. (P, IV, p.317). Quite how this fits together is not obvious but at least we are assured it is an average firm of some kind although the term average may be construed in many ways. In fact, identifying the representative firm is not a matter of statistical precision but of judgement (P, IV, p318).

What Marshall argues is as follows. At each point, the market clears and all but the marginal firms earn positive profits. If we now add to the representative firm's costs (average costs in the industry) its gross earnings of management, the result measures the market price but, of course, those gross earnings are price determined not price determining. Thus the profits of the representative producer are measured by the difference between its costs and the higher costs of the marginal producer and Marshall's two explanations become one[37]. Firm level profit differences are then translated via investment into changes in the outputs of the different firms and an evolutionary dynamic of growing and declining firms. If interfirm profit differences are all that matters in explaining the different rates at which firms invest then, the marginal producers aside, all of the more efficient firms are expanding. Moreover, those that are more efficient than the representative firm are expanding more rapidly than the industry as a whole so their relative importance is increasing, and conversely for the firms that are of lower efficiency compared to the representative firm. Such an approach depends entirely on firm differentiation and it suggests

37. 39 It is then obvious that if we look to the marginal firms to assess the normal rate of return on capital (interest plus the normal net returns to management) in an industry one cannot also say that the gross profits accruing to the representative producer are also normal. It is the expenses of the representative producer which are defined as normal not its profits, which, should, in some sense measure, the average profitability of an industry (P. V, p.497).

that it is average cost behaviour which acts as a (changing) fulcrum around which some firms expand and others contract, new firms enter and some existing ones disappear.

So the heart of the matter is that Marshall's theory of value contains two benchmarks. The Marginal firm is needed to elucidate the self-organising properties of an industry and its markets. The Representative firm is needed to elucidate the process of industry self- transformation. Of course, in constructing the representative firm one must not include in the average measure of costs the costs of the current marginal firm(s). The two notions have independent roles but each one influences how the other changes in the process of industry evolution because self organisation- and self-transformation are one unified problem. But this is not for today[38]. What is clear is that the representative firm captures the dynamic nature of the competitive process, and in saying that we must recognise that the very process of competition will change the nature of the representative firm and the nature of the marginal firm. It goes without saying that innovations too, and the way they are distributed across the industry, have the potential to change the very firm that is marginal or the very firm that we deem to be representative. We should not lose sight of Marshall's way of seeing the world; the need for the representative firm only arises because firms are differentiated and they are differentiated because of the innovative activities of managers and entrepreneurs.

The critics would have little to do with the idea; they judged it to be at best irrelevant at worst internally inconsistent. They were only interested in the self-organising part of the picture and, if we already know that the costs of the marginal firm measures price, why do we need the representative firm? But in fact they had gone further, no form of inter-firm variation can be permitted in perfectly competitive equilibrium, for if perfect competition is to be characterised by zero profits all firms must operate under the same

38. See Nelson and Winter (1982), Downie (1958) and Metcalfe (1996). Steindl's (1952) contribution is also very relevant. These authors build on the idea that evolution is a statistical process (not necessarily a stochastic process) in which the moments that describe the heterogeneity of behaviour dictate the dynamics of change. How phenomena are distributed determines how their present distribution changes into a different distribution and so on, ad *infinitum*.

cost conditions, every firm is as representative as any other[39]. Within a decade the whole edifice had crumbled and with it crumbled Marshall's evolutionary dynamics of value. Fine in its own terms, the reasoning of the critics had nothing to do with firm differentiation, nothing to do with innovation and nothing to do with Marshall; they were simply painting on a different canvas. It is not unreasonable to say that Marshall's deserves some of the blame. Linking the representative firm to increasing returns was an unnecessary diversion for the need for it arises whenever firms are differentiated in their competitive characteristics and increasing returns is only one source of differentiation. Indeed, any kind of innovation will introduce differences between rival firms, innovation is sufficient for the task and in the presence of differentiated producers the representative firm has a central theoretical role to play.

Time and the Periodisation Scheme

We have come to the last of the Marshallian ideas and perhaps the most distinctive of them all, for it is the set of ideas that unifies and focuses his line of evolutionary thinking in general and the importance of managerial decision in particular. We have seen that economic evolution is premised on economic variation and Marshall was well aware that the responses to business variation take different passages of time to achieve their impacts. Indeed, he insisted that different economic forces in general act with different velocities, even though all the forces are in play all the time. But there is a deeper connection, the idea that what can be varied by managerial decision is also time dependent and it is managerial decision that is the source of evolutionary change. In this regard, every economics

39. For an authoritative statement of the relation between costs, profits and perfect competition see Opocher and Steedman (2015). Pigou, (1927) had upended the Marshallian position by introducing the equilibrium firm to get rid of all the rising and falling of firms. In fact, all his firms are equilibrium firms since he was elaborating the theory of perfect competition. What else could he do? For the rest of the debate see Robbins (1929), Sraffa (1930), Robertson (1930) and Shove (1930). For some reason, the critics seemed to think that Marshall's representative firm does not change over time, but how could it be unchanged if it is defined in terms of differentiated firms in a developing industry? This is not to say that all in Marshall is watertight. The critics made some telling points, not least that it is a mistake to identify the representative firm with an actual producer (Robertson, 1930, p.89). Sraffa was even more perceptive when he stated that the representative firm must be a *position* occupied by a firm and that position is an analytic construct (1930, p.91). But just as the representative firm is an analytical construct so is the marginal firm and, at any point in time, no actual firm need be marginal.

student surely knows of the difference between the forces acting in the short- period and in the long-period but they will certainly be less aware of a third class of forces acting over the secular-period.

a) The Long Period

In the short period managers have to work with the firm as it is in terms of its plant, its organisation, its skill base and its trade connections. Their problem is how to use these given facilities and capabilities to the immediate advantage of the business. The short-period is an important part of Marshall's thought but it is the long-period and secular-period forces that take pride of place in his evolutionary picture. Each of these is premised on different kinds of managerial decision, indeed on different kinds of managerial strategy.

Taking the long-period first, this is focused on the decisions relating to investment and the main reason to invest is to develop away from the current situation by expanding capacities to produce. Here Marshall includes investments in new plant, investments in skills, investments in reorganisation and investments in incremental improvements in technology (P V p.460). These are the principal examples and all of them are premised on the expectation that a firm will grow its market to validate the investment. These processes take time to work out their effects and, moreover, differentiation of managerial ability implies that firms will be expected to differ in their capacity to conceive and to manage the various kinds of investment. In modern language, we could express these as aspects of business strategy and the implementation of strategy and recognise that firms differ markedly in their strategic intent and capabilities, along the lines made clear in Nelson and Winter (1982).

We might add that this focus on the investment decision leads to a central plank in Marshall's long run theory of competition, the argument for increasing returns, the argument that so offended his critics. While increasing returns is incompatible with a perfectly competitive equilibrium it is very much part of the evolutionary industry dynamic. The realisation of increasing returns is not the result of a movement down a given cost curve it is a continual shift to new cost curves each one appropriate to the state of plant, skills and knowledge of technique and market at a given point in

time.[40] Expansion takes time and the cost variations are generated over time, which is another reason to recognise that the representative firm is necessarily changing over time[41]. What better sense of development from within could one have?

Nearly the entire focus of books IV to VI the Principles is directed at the long-run forces that link investment to profitability and access to capital and how this shapes the rising and falling, creation and elimination of firms, that is to say business competition is to be understood as being driven by long-period decisions. While the conceptual frame of the long-period allows firms to increase their understanding of their operations this is restricted to those minor, incremental developments that leave unchanged the more fundamental ideas that underpin the firm's existence. Enter the forces of decision making that change that fundamental understanding, that allow for radical innovation and have their impacts over the secular- period. They are the deeper forces at work in Marshall, they are kept in the background in the Principles, and, for this reason, are hardly ever referred to in discussions of Marshall's thought but they play a prominent role in Industry and Trade. These are the secular-period forces that change knowledge in a fundamental way and harvest their effects over extended periods of time. Their importance lies in the fact that they are the ultimate foundation of economic evolution.

40. There is no point attempting to treat the Marshallian cost curve as a statement of conditional intent. it is a quite different, time dependent construct. In Appendix H to the Principles, Marshall suggests that economies gained through expansion may not be lost through subsequent contraction, the emerging theme of irreversibility. Of course, there is no connection here with the idea of a perfectly competitive equilibrium. Hayek (1946, reprinted in Hayek (1948)) captured this when he reminds the reader that to compete is a verb, a verb is an action word but in the orthodox theory of competitive equilibrium there is no action. He further goes on to say " it becomes even more obvious that in real life there will at any one moment be as a rule only one producer who can manufacture a given article at the lowest cost and who may in fact sell below the cost of his next most successful competitor, but who, while still trying to extend his market, will be overtaken by somebody else, who in turn will be prevented from capturing the whole market by yet another, and so on" (p.102). This is pure Marshall and, indeed, pure Schumpeter and it incorporates innovation at its heart. I simply remark that three renowned economists of very different intellectual backgrounds should enunciate essentially a common approach to what we have called evolutionary competition.

41. See Newman, (1960) for development of this theme.

b) The Secular Forces: Technology, Science and the Innovation System
It is in his discussion of the secular period that investment inthe development of fundamental knowledge comes to the fore. Radical new knowledge becomes a powerful foundation for restless capitalism because it is the source of unrelenting innovation.

Moreover, Marshall tells us, the organisation of knowledge production has changed and in the process has changed the basis for business innovation. The innovation process had moved on from Victorian times, new foundations for evolutionary competition were emerging. The single inventor is diminished in importance and replaced by a more collective process of sustained research by large groups of people, specialised students working over long periods of time. Inevitably knowledge generation has become a more capital hungry and drawn out investment process since any invention may need many working models before it is ready for production. (IT, p.96).

Innovation, at least technical innovation, is now such that major advances are seldom completed by a single person, not least because any major innovation opens up a space of opportunities to refine and learn , "each new knowledge being the offspring of others that went before and the parent of many that follow" (IT,p.206) The relative decline of the single inventor, a Kay or a Stephenson, is matched by the growth of the organised production of knowledge based on a division of labour between research students and their masters, as he puts it, a division of labour that needs to be managed and so has its routines to guide the creative process. Enterprise applies to the conduct of science just as it does the conduct of firms and, though there is no formal market system as in the economy, there is a need for coordination and this is achieved through the publication of results in a refined ecology of publishing and interaction. The consequence is that new discoveries "become in effect the property of the world almost at once" (IT, p.204), and are available for practical exploitation such that, "progress made anywhere, quickly becomes the basis of new advances everywhere" (IT, p.609).

Not only does the tempo of advance increase but progress becomes cumulative and depends on shared methods for recording the nature of particular advances and for standardisation of scientific methods. These

methods of organising discovery are akin to the physical capital stocks of the manufacturer because they facilitate the conduct of research. The result is an increase in the rate of growth of science, of technique and of innovation which is entirely modern. Hence today's inventor uses the best results of published scientific research and adds to them (IT p.202). This is what has been argued when Adam Smith first enunciated the idea that the growth of knowledge reflected a division of labour and its efficacy depended not only on the capacities of different scientists but upon how they are connected. To the self-organisation of firms and markets we need to add the self-organisation of scientific activity and both are distinguished by their openness to and stimulation of novelty. Just as an established producer may be undermined by an entrant with different methods of production, so the proponents of a particular scientific view may have their understanding rendered nugatory by some new theory and its results. Science, like the economy, relies on an evolutionary form of competition for its self- transformation.
Any organising process is inevitably concerned with the making and breaking of connections and here, quite remarkably, Marshall outlines what is to all intents and purposes an innovation system. one in which that the resources devoted to the growth of the various kinds of knowledge may prove more fruitful in terms of economic development. Failure to organise systemically means that the productive combination of creative imagination and rational exploitation is dissipated. He begins by identifying developments in the organisation of knowledge production in terms of three classes of research laboratories, each of which must be organised and managed internally as well as externally.

University laboratories are the proper place for fundamental scientific discovery for its own sake. Industrial laboratories set up by giant businesses, are the proper place for the technical investigation of production processes, and where smaller businesses are concerned there should be a resort to cooperative research arrangements. Finally, given the importance of standards to the functioning of markets, there are testing laboratories responsible for the checking of performance, some of which are publicly funded while others are private laboratories concerned with the particular standards of a given line of trade. This threefold division of labour needs to be connected and the scientists would gain by staying connected with industries where pure knowledge may be the basis for their technological

improvement. It may even be the case that some scientists take their knowledge into business ventures; another way to connect pure and practical knowledge. Conversely, the industrial laboratories would benefit by reciprocal contacts with universities and the standard setting and testing laboratories. (IT, pp. 99-103)[42].

These are remarkable ideas for their time, and they show great awareness of a changing ecosystem to promote innovation. Indeed part of Marshall's concern is that the innovation ecosystem in a rival such as Germany may be a superior engine of progress than the one in England. He considers that the former has a University system for turning out more scientifically educated graduates and has industrialists who are more scientifically aware and have more laboratories of the first and second kind than does England. Consequently, it may be necessary for government to intervene and set up better means of generating and communicating relevant research for specific industries. The closest Marshall comes to this is when advocating the public creation and support of cooperative industry research laboratories with partial support from the public purse[43]. Of course, the implication is that such developments add to the external economies available to firms and are of a kind that favours particularly the smaller producer. However, we are warned that the development of the neighbourhood between science and technique cannot be taken for granted (IT, p.205). Today's innovation policy makers would surely agree.

I view Marshall's account as modern and subtle. He is aware that inventions and innovations come in very different forms; that they draw upon and add to multiple kinds of knowing, while those different kinds of knowledge are produced in different organisational contexts with different incentives in play and funding from public and private sources. There is no simple solution to the question of which form of organisation for invention and

42. A specific example is given by the chemical industry, where scientists and industrial leaders share common interests and so work together to invade the "borderland between science and technique" (IT, p.205)

43. In the 1920s the British Government set up the Department for Scientific and Industrial Research along with many cooperative industrial research associations attached to distinct industries such as cotton spinning and weaving, shoe production and steel manufacturing. Research was financed by a levy on participating firms plus a contribution from government. Lessons learnt in WWI were, in Marshall's view, instrumental in setting up this movement. (IT pp. 99 and 180).

innovation is best. Indeed the question is nonsensical; an open invention and innovation system needs to recognise the realty of diversity and differentiation in the sources of progress[44].

Perhaps the more fundamental point, with which to end, is that the production of radical knowledge has to be organised and managed too. It is the managerial problem in all its time frames that is the central puzzle to be addressed in understanding how firms industries and economies evolve and it is the managerial problem that connects the theory of value to the competitive process, inter firm differentiation and innovation. This I believe is Marshall's great contribution as an *economic theorist*, a contribution no less significant than that made by Schumpeter.

44. See, for example, Nelson, Peck and Kalacheck, (1967), Mowery and Rosenberg (1998), Jewkes, Sawers and Stillerman (1969) and Mokyr (1990). Case studies of invention and innovation bear ample witness to the subtleties that arise when deciding who invented and innovated. Thus polyethylene was developed and commercialised by the English company ICI in the 1930s using catalysts at high pressures. A German scientist working in a Max Planck Institute in Germany developed low pressure alternatives in the 1950s. These methods competed in production and illustrate how the same design space can yield different design configurations directed at the same markets. Similarly, oxygen steel making, which had a long history of attempts to develop, was finally mastered by an academic in Germany who associated himself closely with small scale manufactures in Austria and Switzerland. Finally, the hovercraft was invented by a lone English inventor working in his boat building business, with production of full-scale prototypes funded by the British Government. The variety of approaches and contexts are as varied as the inventions themselves. These examples are drawn from Jewkes, Sawers and Stillerman (1969), where many other examples can be found to illustrate the point. One might add that nearly all of these cases illustrate Marshall's dictum that significant developments are long in the making. It is also clear that the nature of the relevant knowledge bases has a significant bearing on outcomes. The differences between industries that are based on chemistry, biology, physics and mechanical engineering, for example, has long been recognised including by Marshall.

Concluding Remarks

My purpose has been to convince you, if that were necessary, that the study of Schumpeter and Marshall's economic writing is no mere exercise in antiquarianism but a valuable complement to any study of modern economic problems. The puzzles surrounding the rate of productivity growth, the challenges of translating fundamental scientific discoveries into useful goods and services to fulfil pressing human needs serve as two very pertinent examples. My discussion has encapsulated their organising frames in a single premise that market capitalism is a self-organising and a self-transforming system such that the manner of self-transformation reflects the manner of self-organisation. Schumpeter and Marshall recognised and built on this premise, whether in terms of the notion of development from within or in terms of the notion of living force and movement. Their conceptual palettes focused not simply on human calculative ability but on the equally if not more important human capacity to imagine and realise different worlds. The ensuing economic, social and epistemic systems are interdependent open systems; they have painted an infinity of pictures of the economic and social world and they will continue to do so.

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