

CHARLES BABBAGE'S INFLUENCE ON THE DEVELOPMENT OF ALFRED MARSHALL'S THEORY OF THE FIRM

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Recently, much attention has been directed toward the early philosophical writings of Alfred Marshall (Rafaelli 2003) in order to gain new insights into his evolutionary economics. The focus has been on the workings of the mind and how Marshall's early foray into psychology influenced his later thought. In searching for the origins of Marshall's conception of the mind, Cook (2005) makes the connection between the mind as a machine and Charles Babbage's Analytical Engine, a concept that is widely recognized as the modern precursor to what we think of today as the computer (Hyman 1982). Cook (2007) takes matters one step further and postulates that Marshall's contention that organization should be treated as a factor of production also emerged from the writings of Babbage and played an important role in much of the development of Book IV of his *Principles*.

Charles Babbage, as Lucasian Professor of Mathematics at Cambridge University, founding member of the Statistical Society, part-time geologist, cryptologist, inventor and active political reformer, was an important and influential figure in the Victorian Era. Solving the mysteries of the Analytical Machine became not only a life pursuit, but also served as a metaphor for the structure of the broader cosmos. One facet of this intellectual exercise was Babbage's attempt to develop a better understanding of "the domestic economy of the factory" contained in his 1832 work entitled, *On the Economy of Machinery and Manufactures*.

It was Babbage's extension of Adam Smith's notion of the division of labor and the subsequent development of the field of scientific management that caught Marshall's eye and subsequently had a strong influence on his own thought. In *Industry and Trade*, where Marshall looks more closely at the structure of the firm, the influence of Babbage is perhaps most readily apparent. However, by looking back from *Industry and Trade* to the *Principles of Economics*, it becomes possible to develop a better understanding of why Marshall considered organization to be a factor of production on par with labor and capital and why the success and failure of the firm rests to such a large extent on the shoulders of the business leader.

To draw these connections between Babbage and Marshall, we begin by looking at the proposition that organization is important to the success of the business

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enterprise. We then explore both the division of manual and mental labor and discuss how they elevate the business leader to an important position within the organization. Finally, we evaluate what this all means for Marshall's theory of the firm and how it relates to his belief that "Biology is the Mecca of Economics" (Niman 1991).¹

I. ORGANIZATION AS A FACTOR OF PRODUCTION

In the *Principles of Economics*, Alfred Marshall begins his discussion of industrial organization by describing the mutual debt that exists between Economics and Biology. This debt comes from a belief that "the development of an organism, whether social or physical, involves an increasing subdivision of functions" (Marshall 1961, p. 241). This subdivision of functions becomes important because it directly affects not only the productivity of participants but also enables a closer match between the requirements of a given job and those specialized skills needed to successfully carry out the associated tasks. While the former originated with the work of Adam Smith, it is the latter that came from Charles Babbage.

For Babbage, the limiting factor for the division of labor was not just the size of the market, but also included the size of the organization. Larger organizations permit a greater division of labor that would enable a closer match between the requirements of a given job and those specialized skills needed on the part of workers to successfully carry out those tasks in the most efficient manner possible. In small organizations, highly skilled workers may find themselves performing both high- and low-skill tasks and yet would be paid at a wage that is commensurate with their high skill level. With a broadening of the division of labor, Babbage believed that the firm would only have to pay wages that matched the skills of work as it was performed rather than how it was organized. Thus effort expended to perform low-skilled jobs would be paid a relatively low wage and high wages would only be paid commensurate with the level of effort actually performed.²

The importance of both elements is summarized by Marshall in the following way: "The economy of production requires not only that each person should be employed constantly in a narrow range of work, but also that when it is necessary for him to undertake different tasks, each of these tasks should be such as to call forth as much as possible of his skill and ability" (1961, p. 265). However, in order to direct tasks in a way that best takes advantage of the differences that are inherent in different workers, some degree of coordination is needed. The importance of this added function leads Marshall to conclude that survival in a Darwinian world depends on

¹This stands in contrast to the view expressed by Peter Groenewegen (2001) where biological analogies surrounding the firm and the organization of industry are asserted to come largely from the work of Herbert Spencer.

²In Babbage's own words:

That the master manufacturer by dividing the work to be executed into different processes, each requiring different degrees of skill or of force, can purchase exactly that precise quantity of both which is necessary for each process; whereas, if the whole work were executed by one workman, that person must possess sufficient skill to perform the most difficult, and sufficient strength to execute the most laborious, of the operations into which the art is divided (1841, pp. 175–76).

both the division of labor *and* the effectiveness of the mechanism used to coordinate behavior.³

Marshall describes the role of coordination in terms of his rendition of Charles Darwin's law of the survival of the fittest in the following manner:

But the law really is that those races are most likely to survive, who are best fitted to thrive in their environment: that is, to turn to their own account those opportunities which the world offers to them. A race of wolves that has well organized plans for hunting in packs is likely to survive and spread; because those plans enable it to catch its prey . . . For almost every increase in power, which any race of men has acquired, can be traced to some social qualities which have enabled that race to overcome the difficulties that lie in the way of obtaining the necessaries and comforts of life; or to overcome its human enemies, or both (Marshall 1919, p. 120).

Survival from Marshall's perspective is not only a matter of being bigger and stronger than a potential rival, but also recognizes that it can be achieved by working cooperatively to overcome the challenges created by a hostile environment. As a result, it is the increased probability for survival that comes from pooling resources and competences that propels organization as an agent of production on par with land, labor, and capital.

II. THE DIVISION OF MENTAL LABOR

The organization of men, machines, and, in fact, entire countries is a central theme that permeates Marshall's *Industry and Trade*. In this follow up to the *Principles of Economics*, Marshall is generous in his praise of Charles Babbage.⁴ For example, he notes that: "Lardner's work is a fitting companion to Babbage's *Economy of Manufactures*, 1832. Each of them set the main principles of an important branch of applied economics with so much constructive genius, that subsequent study has confirmed them, even more than it has enlarged them; while some of their results are often ignored even now" (Marshall 1919, p. 605).

³Because it is widely accepted that Darwin was aware of the division of labor prior to his reading of Henri Milne-Edwards' work in 1852, an interesting question is where he might possibly have gained an understanding of the concept of the division of labor as a coordinating mechanism that would enable an organism to better adapt to a challenging environment. Support for the influence of Charles Babbage on the thinking of Charles Darwin can be found in the fact the Darwin family owned and had read Babbage's influential book on *The Economy of Machinery*, that Darwin's mother and wife were members of the Wedgewood family and thus would have been exposed to a steady diet of business and its underlying principles, and more importantly, Darwin and Babbage were good friends. As Darwin acknowledges in his autobiography, "I used to call pretty often on Babbage and regularly attended his famous evening parties. He was always worth listening to, but he was a disappointed and discontented man; and his expression was often or generally morose" (Barlow 1958, p. 108).

⁴A view shared by Joseph Schumpeter who notes (1954, p. 541, n. 1), "His chief merit was that he combined a command of simple but sound economic theory with a thorough first-hand knowledge of industrial technology and of the business processes relevant thereto. This almost unique combination of acquirements enabled him to provide not only a large quantity of well-known facts but also, unlike other writers who did the same thing, interpretations."

However, Marshall's interest in Babbage's ideas does not end with his interpretation of the division of labor. Marshall is also interested in the benefits associated with what he calls scientific management and how adopting such techniques affect the organizational structure of the firm. Here again he notes the important contribution made by Babbage:

Mr Thompson justly remarks (*Scientific Management*, p. 6) that, though the modern movement in the same direction as Babbage's thought owes nothing directly to him, yet "the extension of specialization beyond manual labour to mental labour, which is at the basis of the Taylor doctrines of functional foremanship and the separation of planning from execution," was suggested in Babbage's well known *Economy of Manufactures*. Reference has been made to the fundamental idea of his famous chapter on "The division of [manual] labour": his less known chapter on "The division of mental labour" ends with a eulogy of the partial system of functional foremanship which already prevailed in mines (Marshall 1919, p. 593).

The principles of scientific management were based on what would later become known as time and motion studies. The idea was to reduce an individual task down to its constituent parts in an effort to determine how to minimize the effort required to accomplish a particular action. Jobs would be designed in a way that minimizes the potential mismatch between individual abilities and the requirements of the job. Within this framework, managers assume more of the mental responsibilities while workers shoulder the bulk of the physical responsibilities associated with a particular job. However, as the relative efficiencies of manual operations are carefully studied, refined, and improved upon, the nature of the work itself undergoes a subtle transformation. Such changes, as they emerge from careful study, are rooted in the belief that traditional methods of work, and especially of manual work, are "excellent servants, but not good masters" (Marshall 1919, p. 240).⁵

While splitting the mental and physical responsibilities associated with a particular job function can be viewed as one more step as the division of labor expands into every facet of an organization, it also contributes to the need for coordination to manage this further subdivision. However, it is important to note that when Marshall references Babbage's example of how responsibilities are organized within a working mine, he is not describing a form that represents a precursor to the hierarchical management structure that became dominant with the rise of the multi-product firm (Chandler 1962). Rather, it reflects a structure steeped in the mechanisms driving Babbage's Analytical Engine.

Babbage's Analytical Engine consisted of a separate store for holding numbers, a mill for working on them, a control to oversee operations and a punch card input/output

⁵Marshall defines Scientific Management in the following way:

For Scientific Management is in the main a method of redistributing and reorganizing the functions and the mutual relations of the personnel of a great business, with the purpose of increasing aggregate efficiency by narrowing the range of responsibility of most of its employees, and bringing careful studies to bear on the instructions given in regard to the simplest manual operations. The chief outward token of the new plan is the elaboration of a system of cards so full, and so carefully organized that the central control shall have a firm basis for arranging the details of its work (1919, p. 239).

system (Hyman 1982, p. 164). Within the context of the factory, these individual components take on a specific meaning. Data from the time and motion studies serve as the store representing the knowledge required to carry out specific tasks in the most efficient manner possible. The worker becomes the equivalent of the mill that acts based on the instructions provided by a foreman who, acting in a manner similar to the input/output system of a computer, directs the various activities that are performed. Finally, the business leader, who orchestrates the entire process, acts as the control by overseeing the various activities and ensuring that they work in concert to achieve a desired goal.⁶

III. THE BUSINESS LEADER

Within the structure of Babbage's Analytical Engine, it is the control that undertakes the task of actually performing the calculations and formulating the final result. The need for a similar type of control within the modern business organization emerged for Marshall with the rise of the factory system and, along with it, a corresponding change in the educational system found in England at the time.

Under the master manufacturer and the apprenticeship system, the education of the worker was based on imitation. With only a few workers assisting, it was easy for the master craftsman to assign tasks to individuals based on their unique talents and abilities. However, the rise of the factory based upon the machine brought with it a new model of education that was more general in nature and less specific in application. In conjunction with the shift to large scale production, it became more difficult to both identify the specific talent of each worker and then place them in a particular job that would make best use of those talents (Marshall 1919, p. 229).

The solution to this challenge lay for Marshall in the hands of the business leader who acts as the "control" over the entire operation of the firm. While the adoption of scientific management practices can lead to a division of labor that maximizes the efficient utilization of resources, ultimately something must identify and place individual units of labor in those functions that makes best use of its inherent abilities. Furthermore, once everything is in place, something must also continuously monitor and direct the actions of the independent components in order to make the whole system work.

This challenge represented a problem similar in scope and importance to what Babbage described in response to Lady Wilton's query about the greatest difficulty he encountered in contriving his Analytical Machine. In response to her question,

⁶The close ties between Babbage's economics and the work on his various Machines is described by Nathan Rosenberg in the following manner:

the relationship of Babbage the economist to Babbage the inventor is a close one. That is to say, the book is, in an important sense, a by-product of Babbage's lifelong preoccupation with the development of a calculating machine. Indeed, the opening sentence of the preface to the first edition of the book states that: "The present volume may be considered as one of the consequences that have resulted from the Calculating-Engine, the construction of which I have been so long superintending." Thus, the book shares a common provenance with the calculating engine. The power of systematic reasoning that Babbage invested in his attempt to develop such a machine is abundantly evident in the ways in which he organizes and classifies his data on the English industrial establishment in this books (1994, p. 121).

Babbage remarked that it was not the sheer number of mechanisms, but rather that the problem arose from “the almost innumerable *combinations* amongst all of the contrivances—a number so vast that no human mind could expand them all” (1864, p. 179).

It is the problem of assembling and then converting a large amount of information into something that makes sense that led Babbage to speculate about how the human mind handles such problems. In doing so, he engaged in a psychological experiment with the Duke of Wellington as his subject. The problem that Babbage posed for his study was: How does the greatest commander prepare for his military triumphs? In describing this preparation process, he came up with the following list:

1. Selects the fittest agents
2. Places them in positions best adapted to their powers
3. Has an intimate acquaintance with all accessories that contribute to the health and comfort of his troops to sustain their moral and physical energy
4. Studies and properly estimates the character of his foe
5. Scrutinizes the secret motives of the opposing government
6. Must be able to quickly ascertain the situation
7. Must be able to foresee future troop movements
8. Must be able to classify and group innumerable combinations
9. Must be able to identify the most favorable combination and act on it
10. Must be able to improvise in the heat of battle.⁷

What makes this exercise interesting is that Marshall constructs a similar comparison when he notes that the head of a business “must have some of the chief qualities that are required of the commander of an army. He is not a “captain” of industry; he is a “general” in control of several regiments” (Marshall 1919, pp. 118–19).⁸ Marshall’s list of qualities describing the business leader is similar in concept and

⁷This is very similar to the list of characteristics described by Marshall in his *Principles of Economics*. In the *Principles*, the head of a business is described as one who:

1. “Must indeed assure himself that his managers, clerks and foremen are the right men for their work and are doing their work well” (1961, p. 284).
2. “Can keep his mind fresh and clear for thinking out the most difficult and vital problems of his business; for studying the broader movements of the markets” (1961, p. 284).
3. “Contrives how to improve organization of the internal and external relations of his business” (1961, p. 284).
4. “Has a “thorough knowledge of *things* in his own trade” (1961, p. 297).
5. “Has the power of forecasting the broad movements of production and consumption” (1961, p. 297).
6. “Is capable of seeing where there is an opportunity for supplying a new commodity that will meet a real want or improving the plan of producing an old commodity” (1961, p. 297).
7. “Is able to judge cautiously and undertake risks boldly” (1961, p. 297).
8. “Understand the materials and machinery used in his trade” (1961, p. 297).
9. “Is a natural leader of men” (1961, p. 297).

⁸Given that we know that Marshall read Babbage’s autobiography (Groenewegen 1995, p. 120), we could either conclude that any connection is mere happenstance, or that Marshall was influenced by Babbage to the extent that he took his conception of the machine and, just as was done by Babbage, attempted to integrate it into “the economy of the factory.”

description with Babbage's understanding of what makes a good military commander. As Marshall tells us:

The chief requisites of the head of a considerable business may be classed as (a) judgment, prudence, enterprise, and fortitude in undertaking and carrying risks: (b) an alert acquaintance with appropriate technique; and some power of initiating advance: (c) a high power of organization; in which system plays a great part, but "always as a servant, never as a master": (d) a power of reading character in subordinates; together with resolution, tact, trust and sympathy in handling them: (e) prompt diligence in assigning to each the highest work of which he is capable, or can be made capable within a moderate time. All these qualities are needed in the head of a business of even moderate size: and, if it is to be thoroughly well administered, all of them are required more or less in its chief officials; for the head cannot be directly in touch with details (1919, p. 231).

Thus, given the important role played by the business leader in Marshall's conception of how firms are organized, it should come as no surprise that his theory of the firm begins with the "able man" who gets a firm footing in the trade, and as his own capital increases, is able to expand the size of his business. With even more growth, the able man "collects around him subordinates" who share mutual trust and work together to expand the business. Increases in the scale of operation will reduce costs and enable the firm to remain competitive in the market. "This process may go on as long as his energy and enterprise, his inventive and organizing power retain their full strength and freshness, and so long as the risks which are inseparable from business do not cause him exceptional losses" (Marshall 1961, p. 315). Success will continue unabated until "nature" rears its ugly head "by limiting the length of life of its original founders, and by limiting even more narrowly that part of their lives in which their faculties retain full vigour." And so, after a while, the guidance of the business falls into the hands of people with less energy and less creative genius, if not less active interest in its prosperity" (Marshall 1961, p. 316).

Characterizing the important role and unique qualities of the business leader does by itself explain why firms are similar to "the trees in the forest" that rise and fall as part of the cycle of life. While leaders may come and go, what makes them different from a unit of capital or a skilled worker on a production line? For Marshall, the answer lay in part with the special skills that are required and the dearth of those who possess them. Marshall believed that a shortage exists of those individuals with the requisite talents to properly run a large-scale business enterprise. As he remarks: "There are many who can manage a million dollars, few who can manage ten million, and next to none who can manage fifty million. The mere work of centralized administration puts a tax on the brains of men who are accustomed to a smaller range of duties, which very few find themselves able to bear" (Marshall 1919, p. 236).

The reason why they are so few in number is explained by Marshall in the following manner:

"The poet is born not made." The original meaning of the word *poet* is "a man who creates": and it is a commonplace in University life, that while the merely able man's success depends greatly on the teachers into whose hands he has fallen, the man of genius is fashioned mainly by himself. In like manner it seems to be true that the

man, who proves to be endowed with business genius, has seldom owed very much to formal education. The peculiarity of his mind does not lie in the power of doing any one thing in particular. He penetrates quickly to the root of each of the many conditions of success in the attainment of a proposed practical end: he coordinates them, moulding and combining them anew (Marshall 1919, p. 233).

The unique characteristics and the important role played by the business leader provides some insight into why the division of labor depends on more than just the extent of the market. While it is true that with a larger market, the firm can grow in size to the point where it can realize the greater efficiencies that might emerge with a broader division of labor; all of this is contingent on the availability of business leadership. As long as some form of control is required to oversee the operations of the various components of a firm, and increases in size adds a level of complexity that goes beyond the abilities of an average person, then the division of labor finds itself bound by an additional constraint (Kaldor 1934).⁹

IV. THE MARSHALLIAN FIRM

Because business leaders are few and far between and success is intimately tied to the abilities and energy of that person, the firm, according to Marshall, is not exclusively defined by the competitive conditions of the market. While less competition may create a more amenable environment for profits, a leader who has lost his vigor or interest may offset any type of market advantage. As a result, profit depends upon more than just the relationship between price and average cost.

What is at issue here are not the rents associated with inputs of differing productivity as envisioned by Lionel Robbins (1928) and more recently discussed by Neil Hart (2003). Rather, it is how the quality of the factor of production (for example, business leadership) changes over time (rather than focusing on the differences that exist at a given moment) that is the fundamental point of difference between Marshall and critics like Robbins.

This difference is perhaps most dramatically illustrated by Marshall's discussion of the stationary state. In contrast to the view shared by John Stuart Mill and others that in the stationary state different components remain basically in the same position relative to one another, Marshall articulates the view that "The increasing command which progress is giving us over the forces of nature is altering the conditions of work and life rapidly and in many various ways. It is altering the character as well as the magnitude of economic and social forces" (1898, p. 42).

Such a distinction forms the difference between how Marshall viewed his ideas and those of the classical economists. While Marshall believed that the approach set forward in his *Principles of Economics* was 'continuous' with the classical tradition, the early chapters are devoted to making the point that:

⁹This is a problem potentially solved with the formation of a hierarchical organizational structure. However, Marshall appears to be unfamiliar with this American solution to the problem created by the multi-product firm as evidenced by companies like General Motors (Chandler 1962).

the past can afford just guidance for the present and the future only when full account is taken of the changes in man himself, and of his modes of life and thought and work; and to sketch some leading features of those changes which are of most importance for the economist . . . The “strategy” of his economic conflict with nature remains nearly the same from age to age, and the lessons drawn from experiences of it can be handed down usefully from father to son. But the “tactics” of the conflict waged by men somewhat different from us, and under conditions widely different from ours, are of little or no avail (1898, p. 44).¹⁰

These changes become particularly challenging to deal with when trying to establish the long period supply price. On the one hand, a particular product might remain relatively unchanged; however the firm that produces the product and those who manage the activities within the firm might undergo substantial changes that may have a profound impact on the structure of the costs associated with the production of each unit of output. On the other hand, the firm may remain relatively unchanged while the product undergoes a substantial transformation as new techniques are developed that substantially alter how the product is produced or the quality and/or the features associated with the product itself. However, regardless of the cause, change creates a problem for the computation of the supply price for a particular good at a specific moment in time. Marshall suggested that the difficulties associated with change could be avoided with the use of two devices.

The first device is the concept of the Representative Firm. Marshall informs us that the concept is “biological rather than mechanical” and that its application represents the transition from the “mechanical view of the composition of forces” to the biological notion of “composite organic development” (1898, p. 50). This distinction emerges from Marshall’s belief that as economics moves closer to discussing phenomena that occur in the real world, it must take into account not only differences that exist at a moment of time, but also must recognize that the differences themselves change over time. Therefore, if an industry can be viewed as a tree that is steadily growing upwards year after year and individual firms are leaves that grow and then decay time after time, a representative “leaf” becomes one where this organic process is held constant so that this additional level of complexity can be eliminated in order for a single supply price to emerge within the industry.

This theme of changes in character, however, extends not only to the lifecycle of the firm, but also includes the process of production in recognition that changes take place in “the appliances, the persons, and the organization from the co-operation of which the flow of the commodity proceed” (Marshall, 1898, p. 51). Thus, Marshall’s second device seeks to consider the normal supply price in relation to long periods of time in order to capture changes that have occurred—rather than trying to incorporate changes that are occurring as part of an ongoing process. In other words, to once again hold changes in the character of things, the missing element from classical economics and the fundamental characteristic that enables Marshall to draw a distinction

¹⁰This distinction between strategy and tactics is discussed in more detail by Raffaelli (2007).

between what he calls Economic Biology and the more traditional concept of Economic Dynamics (Marshall 1898, p. 43), constant.¹¹

While it may be possible to make an educated guess on what the actual supply price may be at a moment in time by holding change constant and thus establish the existence of a competitive equilibrium, once those factors are allowed to continue to change, what is the corresponding process that both identifies desirable changes and ensures that they take on a dominant position in the population? For Marshall, the answer rested in the Darwinian concept of natural selection—“the strongest and most important of economic forces” (Marshall 1898, p. 55).¹²

It should come as no surprise that Marshall would place a great deal of faith and trust in the concept of natural selection given the similarity in terms of the important role it plays relative to that of the business leader within the firm. When change is viewed as an every day process that can have a profound effect on success or failure, something must identify, evaluate, and nurture those changes that will have a positive effect on the competitive position of the firm. It is the business leader who is charged in this role of actively selecting those changes that are beneficial to the firm. However, just as change occurs within a firm, it also occurs within an industry as a growing diversity in the population leads some product variations or firms to be better adapted to the competitive conditions that exist in the marketplace.¹³

By assigning the business leader the role of change agent within the broader context of a process that selects those changes that are of the greatest benefit, progress does not depend on the randomness of chance occurrences, but rather becomes the outcome of concerted actions undertaken by this critical figure in Marshall's framework. Thus it should come as no surprise that the firm for Marshall takes on the characteristics of an organic being that mimics the cycle of life. Nor should it come as a surprise that it is the contribution of the business leader that ultimately determines the success or failure of the firm in the marketplace.

¹¹Marshall recognizes the importance of this distinction when evaluating the material in Book V, where the more traditional approach to statics and dynamics is applied. Here Marshall notes that the “equilibria themselves never appear . . . It scarcely touches the progress of man's nature; and that is, I conceive, the center of the ultimate aim of economic studies” (1898, p. 54).

¹²While the concept of natural selection plays an important role in Marshall's conception of evolution as a process, it should be noted that he was not exclusively influenced by the work of Darwin. His overall evolutionary framework shares much in common with the ideas contained in the diverse and extensive publications generated by Herbert Spencer. This point has been discussed in greater detail by Niman (1991).

¹³It becomes understandable why Marshall would have broken ranks with Adam Smith and the traditional perspective that the division of labor predicated on the pursuit of self-interest not only adds to the national dividend but also ensures the “survival of the fittest.” Marshall expressed the view that this doctrine of natural organization while containing more truth than any other, had found its benefits exaggerated. In his criticism of this perspective in Appendix B of the *Principles*, Marshall contended that the main problem was that Smith and his followers argued as “though man's character and efficiency were to be regarded as a fixed quantity” (1961, p. 764). Yet for Marshall, survival of the fittest depended in large part on changes in character.

V. CONCLUDING REMARKS

It was the important influence of Charles Babbage and his various machines that both broadened Adam Smith's conception of the division of labor and elevated the concept of organization as a factor of production to the same level as labor and capital. While an expanding division of labor might lead to greater productivity, within the business organization, cost minimization requires that workers are only paid for those skills that are utilized, rather than those capabilities that are possessed but only tapped into on a limited basis. To achieve the best match between skills and jobs, some form of control must oversee the matchmaking process.

The important role played by the business leader in the organization stems not from the modern concept of a hierarchical organizational structure, but rather as a control mechanism capable of overseeing the workings of a complex structure consisting of a system of interactions (made simple through the adoption of Scientific Management Principles) between individual components. Just as important, the business leader becomes the agent for change as the development of new processes leads to subsequent revisions in how work is carried out.

By looking more closely at Babbage's influence on Marshall, it becomes clearer why the business leader assumes such a high level of importance within Marshall's theory of the firm. In addition, looking more carefully at the role of the business leader creates a better understanding of how change manifests itself by not only expanding the quantity, but more importantly, altering the quality of those various factors of production and products that contribute to the wealth of the nation.

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