

X-efficiency: economists and managers view it differently

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Abstract

Leibenstein's X-efficiency theory offers a view of productivity that differs from traditional neoclassical economics in terms of whether inefficiency exists, what causes it, and how to eliminate it. Extensive discussion of X-efficiency has occurred among economists but little has been said by the group that in the theory is primarily responsible for reducing inefficiency—managers of firms—. This article examines the viewpoints of economists and managers on the basic tenets of X-efficiency theory and what the policy implications for firms and society are of these differing views.

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Keywords

X-efficiency — management — productivity — socio-technical theory — economic development

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Introduction

X-efficiency Theory, proposed by Harvey Leibenstein (1966), presented a challenge to neo-classical microeconomics and has created decades of debate about its validity. In reality Leibenstein could be considered one of the pioneers of behavioral economics, a “first generation behavioral economist” (Dean and Perlman 1998). By relaxing some of the basic assumptions of neo-classical theory he was introducing considerations into the theory that had been ignored or explained away as anomalies. His theory of X-efficiency argued that firms did not always operate on their production frontier and that worker motivation mattered for productivity. Implicit in the theory is that management is important to efficiency. Of course, real managers have always believed this. They accept that inefficiency is inevitable in any firm and that a key part of their jobs is to find ways of reducing it. They also believe that worker motivation matters very much to efficiency. Psychologists and sociologists have been arguing this for years and conducting experiments and proposing theories of how to motivate workers. However, there was very little discourse between the micro economists and the psychologists/sociologists (nor with managers either) until behavioral economics began to develop in the 1950's. In this paper I will discuss differences between how economists and managers view efficiency and productivity, and how this relates to X-efficiency Theory, and implications of these differences for how to increase productivity and economic growth.

Economists have traditionally viewed production of consisting of two factors—capital and labor (and land for agricultural production)—. Efficiency or productivity was determined by the combination of these two factors of production. No

other factors were considered relevant for determining productivity in neo-classical micro economics. Harvey Leibenstein (1966, 1979) was one of the first academic economists to question this notion arguing that the correct selection of types of labor and capital, of which there are many variants, and how they are utilized also played a role in determining productivity. He called this idea X-efficiency. Of course, managers in all types of production activities have long realized the importance of proper management to efficiency from Frederick W. Taylor onwards. Some academic research has also supported Leibenstein's X-efficiency Theory. Anderson and Franz (1985) found efficiency differences in a sample of Mexican industrial factories and attributed this partially to management factors. Mefford (1986) added a management variable composed of to a production function and found it was significant in explaining productivity differences among factories in various countries of a global firm. More recent confirmatory evidence is found in the studies that revealed significant X-inefficiency in industries from public transportation to hotels to banks in various countries around the world (see for example, Clark and Siems 2009, Kwan 2006, and Frantz, Churchill, and Mackay 2015). Frantz (2007 and 2017) summarizes the research done on testing X-efficiency.

Strong practical evidence supporting the X-efficiency Theory appeared in the 1980's with the spread of lean production and quality management techniques. Firms with similar resource allocations were found to have vastly different levels of productivity. For example, in the automotive industry firms that utilized a lean or Just-in-Time approach achieved large market share gains by offering higher quality products at lower cost. The Japanese firms Toyota and Honda are prime examples of this and other manufacturers have tried to duplicate

their lean systems. In other industries as well where quality methods were emphasized (Total Quality Management (TQM) and Six Sigma programs) firms like GE and Honeywell rapidly gained competitive advantage. These methods essentially represent a new style of management that yields much better productivity with existing resources of capital and labor. The role of management in bringing about this result is clear. Workers and equipment must be combined in the correct configurations of course, but much more than that is involved. Workers must be trained and motivated to play a larger role in production, to some extent performing management functions themselves (e.g., scheduling work, quality control, process improvement).

Neoclassical economics and efficiency

Neoclassical micro-economics views production as a combination of resources that *always* maximizes profits and minimizes costs and precludes the possibility of inefficiency by its underlying assumptions. These include maximizing behavior by all economic agents, complete knowledge of production possibilities, and a competitive environment that will eliminate any firms that are inefficient. Neoclassical theory also assumes that there are only two factors of production, capital and labor for industrial production, and that these factors are homogenous within categories of technology and skill (i.e. all of equal quality). Their production function is simply $Y=f(K,L)$ where Y is output, K is capital, and L is labor. In other words, managers are responsible only for allocative efficiency. Management is strictly an engineering function of determining the proper mix of inputs; no motivational or other role is assumed. If all of these assumptions hold then, of course, there is no room for inefficiency. Firms are always on their production frontiers although not all firms are on the same frontier due to circumstantial factors, ignorance, or mistakes. Substantial deviation from the lowest cost production function will quickly lead to demise of the firm in a competitive market. Stigler (1976) presents these arguments succinctly. Leibenstein states “In essence, the firm in standard theory is nothing more than a production function run by a profit-maximizing agent” (Leibenstein 1979, p. 16). However, all of these assumptions can be criticized as either not holding all of the time or not at all.

The possibility of maximizing behavior by economic agents (i.e. always doing your best) has been questioned by many who have observed that individuals frequently do not seem to maximize their behavior in an economic sense (Rozen 1985). Profit maximization and cost minimization are seen as the goals of this maximizing behavior by neoclassical theory. Out of habit, lack of information, inertia and other reasons *selective rationality* (Simon, 1959) would seem to be a more appropriate description of the average person’s and firm’s behavior. The neo-classicist reply to this is that individuals may be maximizing other factors besides productivity such as leisure, but they are always maximizing their utility function in decisions. Furthermore, if they maximize other than the

economic goals very often they will soon be driven out of the market by competitive forces. (A discussion of X-efficiency’s critics and the assumption of maximization can be found in Frantz (1985)).

Having full information to make optimal decisions is another assumption of neo-classical economics. Individuals are always rational and have the relevant information to make informed decisions. This assumption is also questioned by many as individuals often seem to make decisions without complete information because of limited attention spans, ability to only process a limited amount of data (bounded rationality), inertia, heuristics, laziness, or other reasons. In addition, managers are assumed to make all of the production decisions regarding how the work is done; the only decision the employee makes is the amount of effort to exert, and this is assumed to be homogenous among employees and in line with maximizing utility. The neo-classical economist would argue that individuals and firms that make less than fully-informed decisions to maximize their utility will be driven out of the market by more rational decision makers.

Another assumption of neo-classical theory is that the factors of production are essentially homogenous; that is machines of the same type are equally productive and workers at the same skill level are similarly productive. Capital and labor are considered the basic inputs into an industrial production process, and it is their allocation according to market prices that determines productivity. Managers would certainly question this assumption as they know that workers differ greatly in their skill and motivation and that some workers are much more productive than others in the same job. Machines even of the same type can also vary in efficiency because of how they are operated and maintained. Managers see their role to a large extent as one of achieving the maximum efficiency from the factors of production available to them, realizing that the same mix of these resources can result in vast differences in output and productivity. In this sense management could certainly be considered a factor of production playing an important role to productivity in not only allocating resources but using them to their maximum potential. Of course management is subject to the same constraints as any other individual including bounded rationality, heuristics, satisficing, lack of full information and the other aspects mentioned above. This introduces another possible source of inefficiency to the production function.

The characterization of markets as being generally competitive and thus eliminating inefficient firms could also be questioned. Some industries both in manufacturing and services are quite competitive but many are not. Even in those that are competitive, there are many constraints on firms exploiting higher productivity against less efficient firms. There are barriers to entry in most industries including financing, regulatory, and inertial factors keeping less efficient firms from being quickly eliminated by their more productive competitors.

Neoclassical micro-economics views the production func-

tion as static at current levels of technology and firms are producing as efficiently as possible. Once the proper allocation of resources is made no further improvements in productivity can occur until technology advances. Most managers would contend that, on the contrary, output can be increased without technology improvements by increasing the efficiency of how the current resources are used; in other words the production function should be seen as dynamic and that output can be increased without additional investment. Of course new technology will be incorporated as it becomes available but the managers' view is that productivity can be, and should be, improved continuously with existing technology.

Of course not all economists accept the neo-classical microeconomics model. To varying degrees they may relax some of the assumptions underlying this theory. Many economists have come to view the production function as $Y=A_f(K,L)$ where A is a constant to reflect multifactor productivity, an amalgam of technical change, economies of scale, and organizational factors. However, the assumptions of maximizing behavior and rational agents and homogeneous inputs are still accepted by most traditional economists. Behavioral economists question these assumptions as well but are not yet in the mainstream of economics. The next section of the paper will expand on the behavioral rationale for X-efficiency.

Most managers operate under a different economic model than the neoclassical one. They see production of a product or service as being a combination of many resources including not only capital and labor but also knowledge, technology, and of course management. They view resources as being very different in terms of efficiency and devote extensive time and effort to selecting the best equipment and employees for their operations, and they try to incorporate their experience and knowledge and the latest technology into utilizing these resources effectively. But they must balance various goals in making decisions including quality and customer satisfaction as well as sustainability in addition to profit maximization and/or cost minimization. They also have their own utility function to worry about and may not always act in the best interests of the owners of the business—the principal-agent problem that arises when the manager is not the owner—. Thus managers would generally not accept the assumptions of neo-classical theory as being valid and instead would believe in a behavioral explanation for productivity differences among firms. Managers also emphasize the importance of motivation to get the highest efficiency possible from the resources available to them. They realize they have a role to play in channeling the effort of employees and creating the organizational culture that will achieve this goal.

Research on industrial plants in Europe, Asia, Latin America, and North America by Mefford (1986) directly tested some of the assumptions of neo-classical micro theory. He introduced a variable for management which was based on the common evaluative criteria of management performance; i.e. output, cost, and quality, into several variants of a production function. Capital and labor were also adjusted for

quality differences. In all cases management was a significant variable explaining a large portion of the productivity differences among these factories. This indicates that managers play an important role in production beyond simply allocating resources. A time variable also was significant indicating that productivity is dynamic, increasing over time due to management actions (since there were control variables for technological change).

Behavioral rationale for X-efficiency

X-efficiency, or the importance of management and the organizational culture to productivity, can be explained as a behavioral economics phenomenon. Orthodox economic theory assumes that labor and capital are largely homogeneous and that to increase production one needs to employ more of either or both with extant technology. It neglects the potential of increasing the efficiency of which they can be used. Labor is especially suited for efficiency improvements, not only in terms of upgrading skill levels, but also in terms of motivation, teamwork, and cognitive contributions through activities like process improvement. To achieve improvements in how effectively labor and capital are used is clearly a responsibility of management. Management has to employ organization and leadership skills to capture the behavioral phenomenon that drive productivity. They view an organization as a socio-technical system that combines technical aspects such as equipment and processes with the human element.

There is an extensive literature in organization development on how to manage workers to achieve higher worker morale and lower turnover and absenteeism. Much of this literature goes back to the 1950's and may have influenced Leibenstein's development of X-efficiency theory. Psychologist Abraham Maslow (1954) proposed a hierarchy of needs that can be satisfied in the workplace and motivation increases as one moves up the hierarchy to the higher level needs (social and self-actualization). David McGregor (1957) postulated two opposite management styles, Theory X and Theory Y, which lead to significant differences in worker motivation and productivity. The Theory X manager is in line with neoclassical theory and has managers making all decisions and workers just carrying them out and views workers as motivated by strictly monetary and security needs. The Theory Y manager, in contrast, involves workers in decision-making allowing them to make many decisions themselves and emphasizes the higher motivators of the social and self-actualization needs. These theories were in the forefront of moving beyond wages and benefits as the only motivators as economic theory has long assumed. In fact, both Maslow and McGregor believed that factors such as recognition, self-improvement, social relations, and creativity were more important than monetary factors in motivating employees. Leibenstein (1977) frames the motivation issues in the psychological terms of "id" and "superego" and their inherent conflict determining the degree of inefficiency.

Issue	Orthodox economist	Manager
The firm	Black-box	Socio-technical system
Production function	Static	Dynamic
Goal	Profit max/cost min	Multiple
Decision-maker	Manager-owner	Manager and employee
Decision criteria	Optimization	Satisficing
Inefficiency	Minimal and short-lived	Extensive
Manager's role	Resource allocation	Productivity improvement
Employee's role	Do tasks as told	Discretion in tasks
Motivational theory	Theory X	Theory Y

Table 1. Views of orthodox economists and managers on X-efficiency

There is an important time dimension to the behavioral viewpoint of organizations. Managers soon or later realize that changing employee behavior takes time. To change an organizational culture from Theory X to Theory Y is literally a multi-year endeavor that takes much effort and patience. This has been a frequent cause of failure for productivity programs such as lean production and Total Quality Management –that is, managers, and firms, give up too soon when improvements are slow in coming–. This is another difference between the economist's and the manager's views of productivity. The economist tends to be more short-run oriented believing markets are quick to react and will eliminate inefficient firm while enlightened managers take a longer-run point of view. Of course many managers are short-run oriented and make decisions for immediate profit gains, but this may backfire in the future if they underinvest in R & D, new technology, worker training and other resource development activities that will only pay off in the long term. Table 1 summarizes the key differences between orthodox economists and managers in how they view X-efficiency theory.

Discussion and policy implications

It is clear that managers and orthodox economists view efficiency quite differently. Managers take a more behavioral view and traditional economists more of a theoretical view of the nature of efficiency; that is, whether inefficiency can exist and if and how it can be improved. Managers generally view improving efficiency as one of their major responsibilities and believe in most organizations that there are multiple causes of inefficiency which they can address. Orthodox economists believe that firms must operate on their production frontiers at all times, and if they do not, competition will eliminate them. Therefore, inefficiency cannot exist, at least for very long, in a competitive industry. To these economists management's responsibility is simply to acquire and allocate resources appropriately.

The policy implications of the two different viewpoints are significant for economic growth and development. The traditional economist would say that economic growth comes

from increased use of capital and labor in production activities and from technological progress. The manager would not discount these methods of fostering economic growth but also sees the potential to increase growth by improving efficiency of existing operations by better use of the current technology embedded in equipment, processes, and worker capabilities. These divergent views suggest different policy recommendations. The orthodox economist would argue for increased investment in plant and equipment to augment the existing production stock and investment in R & D to advance technological progress. The management view would supplement these types of investment with programs to develop managers and transfer effective productivity methods among firms and countries (Mefford 2009). Economic growth could be increased by reducing inefficiency without additional capital investment. Technology transfer, especially of management skills, is viewed as more important to managers than to economists, in general. For developed countries with declining populations, productivity growth becomes particularly important to fuel GDP growth and prevent stagnating incomes. For developing countries economic growth is critical to improve living standards and reduce poverty. Government and NGO programs will naturally have different emphases and direct their funding to different programs depending on whether they subscribe to the economist's or the manager's viewpoint of economic growth.

There are also implications for how firms treat their workers in the two differing views of efficiency and productivity. To the economist worker motivation is unimportant as they are viewed in the Theory X sense of McGregor. Material incentives such as wages and benefits and job security are what matter to this type of workers, and firms should not be concerned about higher level needs in the workplace. Most managers today, at least in the developed countries, view motivation as key to a productive workforce and generally have a Theory Y view instead. This means they will try to create a work environment where employees can satisfy social and personal growth objectives. Managers are much more inclined toward a behavioral perspective of productivity than

the economist. Ultimately if the behavioral view prevails, employees could be expected to find their work lives more fulfilling increasing overall societal satisfaction.

In most developed countries the role of labor unions has been declining. Fewer employees in a wide range of industries and occupations no longer have the “collective voice” (Freeman 1979) at their employer. This has several implications for increasing productivity in organizations. With the union representing them, workers can collectively bargain to protect their wages and benefits and to improve working conditions. Without a union, workers are much more at the mercy of the employer, especially in lower-skilled jobs. Many economists might argue that the de-unionizing trend is a good development as it more closely aligns supply and demand for labor and that wages will adjust to reflect marginal productivity. Some managers, as well as some economists, might contend instead that the higher costs of a unionized workforce compel firms to increase productivity to offset the higher costs. With the declining power of unions, less such pressure for efficiency improvements may result. The de-unionizing trend also has an impact on worker motivation. With less job security, and the corollary trend toward contract labor and self-employment, motivation becomes even more important to raising productivity in the firm and in society. Managers must work even more diligently to motivate a less committed, transient workforce to implement productivity-enhancing methods. It may not be a coincidence the productivity growth in industrialized countries has slowed in recent years along with the trends toward short-term contract work and de-unionization.

The shift to a service economy has similar policy implications to the de-unionizing trend. Of course the movement to a service economy has also contributed to the de-unionizing trend as service firms tend to be smaller and more dispersed than manufacturing ones which makes them much more difficult to unionize. Motivation again becomes critical to increasing efficiency in service firms. Skill levels are often low and turnover high in service industries so managers must struggle not only to retain their employees but also upgrade their skills to make them productive. Workers often have more discretion in how their jobs are done in service industries, especially when dealing with customers directly, so motivation is very important to assure a consistently high level of customer service. The parallel trends of shifting to a service economy, contract work and self-employment, and de-unionization all have increased the importance of management to the economy if it is to continue to grow and increase per capita GDP. Motivation of a diverse workforce to achieve high and growing productivity will be critical to achieving these goals.

Another policy implication of divergent views of efficiency would be on anti-trust regulation. To a neo-classical economist competition is what drives out inefficiency and therefore would generally support strict anti-trust and other competition-enhancing policies. Although many managers also see the benefits of competition, they also could contend that firms in concentrated industries can still be very efficient

due to economies of scale and the resources to devote to productivity-enhancing activities such as R & D and process-improvement and worker motivation. The same arguments would apply to free trade policies. Most economists support free trade as enhancing efficiency. Some managers will fear increased global competition, but the more enlightened managers will be confident of their ability to continue to be competitive through innovation of products and processes and programs such as lean production and Six Sigma quality. These managers will welcome the competitive pressure to keep seeking efficiency improvements (Leibenstein, 1979).

Conclusions

It is clear that in general economists and managers view efficiency quite differently, in fact in almost diametrically opposed ways. Managers question the fundamental assumptions on which neo-classical micro economics is based while orthodox economists defend them as being essential to model how the economy works, even if not always representative of actual practice. Behavioral economics to some extent bridges the divide by incorporating the ideas of Leibenstein’s X-efficiency Theory into microeconomics. Neoclassical economists may reject X-efficiency Theory, but many less traditional economists have accepted it. They realize that management and organizational factors play a role in productivity and that many of the assumptions of neo-classical microeconomics do not always hold. Behavioral economists are in the forefront of understanding of the economic decisions of individuals in a more realistic sense. Managers have always been to some extent *closet behavioral economists* realizing that organizations are socio-technical systems that must combine *hard technology* (plant and equipment) with *soft technology* (motivation and organizational culture) to achieve maximum productivity. They realize from first-hand experience that inefficiency is endemic to every organization, and it is their responsibility to try to reduce or eliminate it. The debate between orthodox economists and managers has some important policy implications for economic growth and development, trade and anti-trust policies, and worker-management relations in a changing economy. Dependent on which viewpoint prevails, quite different policies could result.

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