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Chatterjee, Sidharta

School of Economics, Andhra University

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Theory Of Social Knowledge

A PRIMER ON SOCIAL KNOWLEDGE

BY SIDHARTA CHATTERJEE

Visiting Researcher
School of Economics, Andhra University
Visakhapatnam, India

Email: sidharta123@yahoo.com

This study is meant to propagate knowledge and stimulate interest among the researchers working in the field of Economics of Knowledge management.

August 2017



In memory of

Kenneth Arrow

(August 23, 1921 – February 21, 2017)

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A Primer on Social Knowledge*

BY SIDHARTA CHATTERJEE[†]

Visiting Researcher

School of Economics, Andhra University
Visakhapatnam, India

Email: sidharta123@yahoo.com

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Abstract

The purpose of this study is to elucidate and appreciate the growing importance of *social knowledge* in economic systems. It is thoroughly evident that socially available information as a variable is being employed in economic modeling—and, social concepts and principles are being increasingly employed to model economic systems. Despite the growing importance of social elements in economic theory and modeling, there appears to be a general lack of appreciation and understanding effected by fallacy of about what constitutes *social knowledge* in particular, and *social information* in general, and then, why there should be social elements included in economic systems. The goal of this paper, therefore, is to undertake a formal analysis of the theory of social knowledge based on Kenneth Arrow's (1994) paper, and to explain why this is so relevant in modern economic systems. This study, therefore, attempts to demonstrate understanding of the concept of social knowledge in its present context—the digital age, with the aim of advancing knowledge in this field. Finally, the study also provides general knowledge about the subject of social knowledge in the context of economic growth.

Keywords: *Social knowledge, knowledge externalities, social information, innovation*

JEL Classification Code: A14, D62, D83, O10

1 Introduction

There appears to be a growing influence of *social knowledge* on the economic systems in a manner that is consistent with the growth of economic activities. The idea of social knowledge has long been a topic of discussion and debate, and it is now increasingly been seen as a recognizable form of knowledge in society following the rise and evolution of digital social networking. Today, social knowledge is being used increasingly to make personal and business decisions (Roff-Wexler, Donovan and Rasa 2011). Also, the collaborative process of socializing knowledge now seems to have a positive effect on innovation growth (Gordon 2011). The rise of information technology has changed the ways and means of how social knowledge is conveyed. The evolution of social media with the rise of social networking as a

*. This study is a first of a series of studies on the topic *social knowledge* which is meant to propagate knowledge and stimulate interest among the researchers working in the field of Economics of Knowledge management.

Disclaimer: Views expressed in this paper are those of author's, and do not necessarily represent the views of Andhra University or any other entity.

[†]. Corresponding author.

new mode of communication mechanism has led to an increase in social knowledge sharing among workers (Hentschel and Haghirian 2011). The purpose of this study, therefore, is to elucidate, examine and appreciate the growing importance of *social knowledge* in economic systems. Besides, this study also attempts to demonstrate understanding of the concept of social knowledge in its present context—the digital age, with the aim of advancing knowledge in this field. It also attempts to explain what constitutes social knowledge, how it is acquired, and why it is important. It is evident that socially available information as a variable is being employed in economic modelling (Arrow 1994). Further, social concepts and principles are being increasingly employed to model economic systems. However, despite the growing importance of social elements in economic theory and modeling, there appears to be a general lack of appreciation and understanding effected by fallacy of about what constitutes social knowledge in particular, and social information in general, and then, why there should be social elements included in economic systems after all. I would say that such a fallacy must have its own reasons. The goal of this paper, therefore, is to expound upon Kenneth Arrow's (1994) exposition on the theory of social knowledge, and to undertake a formal analysis of the concept to explain why this is so relevant in modern economic systems. This study, therefore, aims to demonstrate understanding of the concept of social knowledge and the related ideas which have been explicitly considered to justify the research goal, and the findings advances knowledge in this field. Finally, the study also provides general knowledge about the matter-of-subject of social knowledge in the context of economic growth.

The cardinal focus of this study, therefore, is to understand what social knowledge is with respect to its implications for modern economic systems. So this paper is structured accordingly as follows: Section 1 begins with an introduction to this study. Section 2 discusses about the social knowledge of today, and why it would seem relevant, to undertake such an initiative to critically assess the importance of social knowledge in current economic perspectives. In Section 3, we provide general definitions of social knowledge and discuss the scope and implications of social knowledge in economic contexts. This is followed by Section 4 wherein we discuss about the importance of social knowledge with a background consideration of Kenneth Arrow's paper on this particular theme. Section 5 deals with the issue of knowledge externalities as well as how it is related to economic analysis. In Section 6, we discuss the three main aspects related to this research; (i) How knowledge is acquired and transferred, (ii) mechanism of knowledge acquisition in general, and social knowledge in particular, and (iii) a brief analysis relating knowledge to the economics of externalities. This is followed by Section 7 wherein we discuss the implications of social knowledge in economic modeling. Finally, we conclude in Section 8 with a concluding summary and scope for further research on this frontier.

2 Social Knowledge of Today: Social Technology

How do we characterize social knowledge of today? Before characterizing social knowledge, I think, it warrants a short discussion about its theoretical underpinnings. Much of social knowledge originated from social beliefs as well as from actions that are modeled and shaped by tools and technologies of the times. The foundational basis of the theory of social knowledge, in fact, has many underpinnings; e.g., theory of social belief, theory of actions, theory of social power, etc. However, according to Corlett (1996), theories of social belief alone are not sufficient to explain the theory of social knowledge, nor are theories of actions and social power adequate to explain such. It is social epistemology, according to Corlett

(1996) that might help explain the theoretical underpinnings of social knowledge, for it traces within itself the knowledge of society in much broader sense. Social epistemology puts forth plausible conditions to explain what social knowledge is—and not about *how* to know it. It is though arbitrary it however, is pertinent to the reticulated individualistic and collectivistic approaches to social knowledge. Because knowledge could be held individually as well as collectively—unlike it has been in the past which stressed more importance on the knowledge of individuals only, it is hence essential to give more import to collective knowledge in context (Jovchelovitch 2007). Modern technologies, particularly the internet technologies, are reshaping social actions and human behaviors. And it provides a *fair* ground for collectivistic approach toward study of and understanding of the underpinnings of social knowledge. Since information is being shared, it no longer remains an individualistic notion. Collective knowledge is forcing us to think collectively and more *distinctly*. Despite all these developments, SOCIAL KNOWLEDGE of today does not *seem* to be much different from the one that was defined by Thorstein Veblen (1919); “*the common knowledge of ways and means, the accumulated experience of mankind...*”. Indeed, social knowledge is the common, general, community knowledge of culture, society, and social practices being held in a society which is different from being the one that is methodical, scientific knowledge. The current view of social knowledge, however, is much varied and inclusive; it is the knowledge beyond ethnography. It includes in it the knowledge of and about lifestyles, tastes, habits, diets and nutritional status, demography and health statistics, and other social variables e.g., crime, schooling and education, child development, art, cinema and the social media, employment or occupation, urbanity, *savoir faire*, and, knowledge of stereotypes (Madva 2015).

The inclusion of technology as a variable of social knowledge repertoire stems from the fact that the extension of technology could be explained in terms of tools like computers and smartphones that are used for social communication. The emergence of SOCIAL GADGET¹ is an example which is characterized by development and use of tools for social purposes. I prefer to use the phrase *Social Technology* (Henderson 1901, Leibetseder 2011) instead, as it entails a broader view of scientific/technological knowledge that is being used for social purposes. The concept of social technology was pioneered by Henderson and Karl Menger, among others who sought to clarify and develop methods by which the science of society was to be studied. They were searching for better means and methods as practical procedures of social science (Henderson 1901) to deal with the then existing social issues. The systematic applications of data for practical procedures correspond to the social dimensions of scientific and/or technological knowledge. Social technology, from its definition itself, corresponds to the adoption of scientific mechanisms for the best interest of the entire society. Social technology—according to Leibetseder (2011) has two different aspects; social and technological, but covers many other terms in social sciences. The social aspect employs social science theories whereas the technological aspect involves the use of *expert* knowledge of techniques and technologies to deal with social problems and issues. Nonetheless, it shall be kept in mind that the *expert* knowledge embedded in social technology is nothing but that of *technology*. Its utility lies in its adoption and in its value as scientific methods and theories to obtain logical and systematic explanations of social phenomena. There may be social processes (or techniques), strategies or tactics in existence in isolation, but when it corresponds to a *technology*, it must incorporate scientific know-how and instrumentation (a physical tool). Given that, social knowledge in *isolation*, therefore, have been largely, for practical purposes—overshadowed by the

1. The origin of the word *gadget* is ubiquitous, whereas the term *social gadget* is found tersely dispersed across the internet.

preponderance of scientific, industrial and technological knowledge. And, it was Veblen (1919) who identified socially held technical knowledge as a main determinant of economic activity (Arrow 1994). So stated by Veblen (1919), the usefulness of scientific knowledge should rest on the technology into that which such knowledge is being transformed;

“...*This employment of scientific knowledge for useful ends is technology, in the broad sense in which the term includes, besides the machine industry proper, such branches of practice as engineering, agriculture, medicine, sanitation, and economic reforms.*” (vide p. 28).

This provides us with a clear representation of the value embedded in scientific and technical knowledge which is so true even today. It has been remarked that this body of knowledge—*technical knowledge* is distinct from the one which we know as the knowledge of culture, society and social practices. Even after following our entry into the digital age, the common knowledge that is still being generated in societies might have evolved but it is nothing more than the knowledge of the current social contexts. Therefore, the present view of social knowledge—so far as one can comprehend in terms of its epistemology, seems to be *different* from the one that we knew as “the accumulated wisdom and experience of the ancient”². I said *different* because social knowledge has indeed evolved from being the knowledge of medieval bigotry, folklore and savagery, into one that is now characterized by post-modern ideology and individualism. It is indeed the knowledge derived from the general science of society. But there have been noteworthy developments that characterize social knowledge of today; i.e. to the tune that it so far has seen the inclusion of a *technological* component in it. Nevertheless, the post-modern view of social knowledge in this digital age, though distinct from the one in exposé by Veblen (1919), constitutes a body of knowledge generated and shared by individuals through the social media and through social networking—culminating in social knowledge networking (SKN)³. This is accomplished by using shared arrangements managed by a set of connections across regions and borders. Social networks influence the flow and quality of information (Granovetter 2005). Yet, the basic concept of social knowledge—including its design and idea, has remained unaltered following our entry into the age of information and technology (IT). Only the mode of transmissibility or dissemination has evolved. Therefore, it is still the knowledge that is generated individually or collectively (locally) and shared socially (globally) which include common beliefs and ideas as well. Hence, it is a form of collective wisdom of the (digital) crowd. The birth of the web and the emergence of IT have also provided us with an opportunity to gather and understand social knowledge in a new way. But, social knowledge today faces the challenges of verifiability from the sceptics and the scientific community, since the knowledge generated by social phenomena are so varied and moot that it requires close evaluation to be supportable. It would follow, that if the understanding of social life and economic decision-making, which have become even more complex, is to be studied objectively, it can only be possible by including some relevant social variables in economic analyses. Because, despite the preponderance of technological factors, the social forces in action do have some bearings on the functions of the economy. Likewise, the contribution of social factors to growth of knowledge in society has been well recognized in the past, whereas the role of social factors in economic outcomes has been well documented as well (Granovetter 2005). Therefore, these developments leave us with little ground for evading the issue of the importance of social factors in economic analyses.

2. See for instance, Kenneth Arrow’s paper “Arrow, K. J. (1994). Methodological individualism and social knowledge. *The American Economic Review*, 84(2), 1-9.”

3. See Rangachari, P. (2014). Using social knowledge networking technology to enable meaningful use of electronic health record technology in hospitals and health systems. *Journal of Hospital Administration*, 3(6), 66.

3 Social Knowledge: Definition

After almost a quarter century has passed since Kenneth Arrow published his motivational paper titled “Methodological individualism and Social Knowledge”, perceptions about *social knowledge* has undergone substantial transformation. This transformation is due to the emergence of digital *social networking* which has transformed the way social information is shared or communicated. It is factual that individuals develop social knowledge through interactions with others in the society: Social knowledge is *socially* derived (Turiel 1983). It is also like an historical but anecdotal repository of humankind’s experiences as well as the knowledge of different cultures and societies. It is, in other words, knowledge of consciousness similar to an anthropological archive (Camic, Gross and Lamont 2012). Let me quote Kaplan Bert’s words to get an eloquent idea about its systematic nature; “*a rich resource of primary data in anthropology and in psychology, which otherwise might be lost or destroyed, and which might be of research significance in the future*” (from Camic, Gross and Lamont 2012). The foregoing definition gives a broad-spectrum depiction of social knowledge in the making. In essence, the nature of social interaction has been continuously evolving. And the nature of embodiment and transmission of social knowledge have changed dramatically ever since the advent of the social media and the internet. The mode or mechanism of social networking has evolved as well since the last decade, and it offers new opportunities to gather social knowledge in innovative ways. Indubitably, vast amount of social information is being generated everyday thanks to the rise of digital social networks which allows rapid sharing of information. Communication technologies now play a greater role in interaction and propagation of information and knowledge. Nevertheless, it shall be pointed out clearly that social knowledge has an antecedent, and that it is not just *the* knowledge generated by the social and the digital media. It is a collection of social ideas, including knowledge of culture and custom, and thoughts and beliefs of the common people who share among them the *wisdom* of crowd⁴. Therefore, it seems appropriate to have an acceptable *definition* of social knowledge before we venture any further to analyze the nature of human knowledge. So, what is social knowledge? And how do we define it? Is social knowledge simply knowledge of culture and custom? Or is it simply the knowledge of humanity?

A colloquial definition of social knowledge one can derive from the social media (internet) may be presented as—

Definition 1. *Social knowledge is a body of collective knowledge held by a society.*

However, we shall not confine ourselves to this definition of social knowledge derived from the internet. So we may construct or search for another pragmatic definition of social knowledge: In fact, social knowledge can be defined in many ways depending on what orientation the user takes. Some may take a knowledge management perspective, while others may take an IT orientation to the definition. Whatsoever orientation one might take, it all boils down to a common connotation of *knowledge* with the word ‘society’.

Definition 2. *The knowledge that is embedded in societies is what we may call “social knowledge”.*

4. See Surowiecki, J. (2005). *The wisdom of crowds*. Anchor.

Following Veblen, the definition that is reflected by Arrow (1994, vide p. 6) reads as “...*the accumulated wisdom of squaws, the technology of their economic situation*”. This definition very closely reflects the meaning and purpose of the term suited to the situation as exposted by Veblen who was referring to a specific context; a band of California “Digger” Indians. In its modern adaptation, if we modify it, it can be read as “...*the knowledge of technology of our economic contexts and situations*”. There is nothing wrong with such an intention to attempt to explain a term to suit its current silhouette. Given the above two definitions of social knowledge, the latter concerning Veblen’s one seems to include a technological viewpoint in it.

Social knowledge varies across cultures and it is more easily transmittable than Scientific or Technological knowledge from which it must be differentiated, because the former is distinct from the latter. Social knowledge tends to be heterogeneous; a collection of diverse knowledge communicated by narratives, which however, in the light of analytical epistemology is not a *justified* true belief. It is more or less traditional knowledge. Few exotic examples citing historical antecedent of social knowledge include gothic, roman-flueve, fiction or fantasy etc. It is a fact that the age prior to the age of Enlightenment was characterized by Traditional knowledge (Alan 2010) and the idea of progress developed only in the age that followed Enlightenment. *Traditional knowledge*, according to Alan (2010), is the knowledge embedded in the society from long periods of time and it is only valid if it stands the test of time, whereas the validity of modern knowledge rests on empirical grounds. This brings us back to analytical epistemology. So, the knowledge in purview of analytical epistemology is, therefore, justified true belief (Radder 2017). Nevertheless, various arguments have been hurled both in favor and against the usefulness of social knowledge in economic life. Referring to Kant’s theorem, “Concepts without percepts are empty...”, it is indeed imperative to relate this to examine social knowledge since most of it is narrative and without percepts. In his book “Ideology and Social Knowledge”⁵, the author Harold J. Bershady (2017) has attempted to do much justice in explaining in the light of Parsons ideas and notions, the issues related to the accretion of social knowledge. To my belief, most of the Social (or traditional) knowledge—as I have said before, is so moot that it seems to have very little chance to get validated when subjected to empirical validation employing modern scientific methodologies—and some would like to disagree with this assumption as well. The reason behind this is obvious. Scientific knowledge being *expert* opinion, should be valued more than knowledge of the commons—social knowledge per se. But why? Not because it is just an “expert” opinion, but because scientific knowledge must satisfy several conditions for validation and proof subjected to empirical substantiation. Scientific knowledge is therefore substantive—but social knowledge is *not*. Furthermore, social knowledge should never be a complement to scientific knowledge since the former may too often be biased. It is because scientific knowledge leaves little ground for scepticism and doubt once the principles are well established and the hypotheses are proved, the reason that scientific knowledge is highly valued. Indeed, scientific knowledge and research has definite effect on human life and social relations. The recent trend, however, seems to be pointing to an attempt to advance, improvise, and establish the basic principles behind social phenomena using scientific methodologies. It is because social phenomena are highly unpredictable, and they are often obscured by other vague components. As I have said, social knowledge is not “substantive”. So any *such* knowledge, should they undergo critical empirical validation, might hardly be able to pass through Popper’s radar. That is to say, in the words of Isaac Reed (2011), how social science should become more like natural sciences. Indeed, it is a fact that many social phenomena are poorly understood, lack formal explanations, and are deficient in scientific rigor. This also applies to traditional

5. Bershady, H. J. (2017). *Ideology and social knowledge*. Routledge.

knowledge as well. So, any belief based on *traditional knowledge* is nothing but *disbelief* unless proved otherwise. Scientific decisions those related to medicine, therefore, should not be based on traditional knowledge unless proved otherwise. It is because knowledge when derived from unsystematic study of such phenomena may only generate flak. When such social phenomena could be well understood in the light of systematic and methodical frameworks, only then would they further be considered for inclusion as “variables” for analyses of economic events⁶. A simple definition, therefore, cannot solve this problem of social knowledge. This would perhaps call for a definition to include in it a robust technological and/or scientific component; proper it will be, therefore, to merge the above definitions and derive one that suits the modern criteria, which is likely to include the aspects of social knowledge networking (SKN). Nevertheless, it affords an exposition that knowledge (and information) has social as well as individual characteristics. It shall be mentioned herein that knowledge is as much a property of individuals as it is of groups. This is true of actions as well, because actions are either individual or collective. Thus, summation of individual actions have reactions that may have either beneficial or harmful effects on the society (or on individuals) since, by the way, all social actions are nothing but interactions among individuals. The society must seek for beneficial outcomes out of these reactions by leaving aside the undesirable consequences to be dealt with normative judgments and actions.

4 Importance of (Social) Knowledge

There are different forms of knowledge held in societies. These can be categorized into disciplinary knowledge and social knowledge (Rata 2012). According to Elizabeth Rata (2012), both disciplinary knowledge and social knowledge are important, and each for its own reason and purpose. Technical/technological knowledge belongs to the disciplinary category. Socially held technological knowledge is one that is considered as an important factor of productivity and economic growth. We have here to discuss about the form of knowledge that is one of the primary determinants of economic activity in the post-modern society. But, which form of knowledge it ought to be? In fact, there are various factors that shape the rate of economic growth—and knowledge being one of them. Also, we consider the re-emergence of social knowledge as a recognizable form of knowledge that may have some economic significance. Knowledge—as we view it, has many forms; e.g. academic, epistemic, abstract, technical, esoteric, common and general knowledge, social knowledge, cultural knowledge, scientific knowledge and tacit knowledge. All these could be categorized into two principal types (See Rata 2012). With the existence of the very many forms of knowledge—each must have its own utility and usefulness to a diverse populations in a society. Knowledge has *value* embedded in it—it may be as a *product*, it may be as information or idea. The value embedded in a product is the result of labor embodied in it. In a knowledge-driven economy, knowledge has its value—the value of which (i.e. technological knowledge) is determined by its utility and usefulness to the society (Hayek 1945). As we have already mentioned that there are various forms of knowledge in existence in the economy, we will be content with the discussion of two important forms of knowledge here; social knowledge, and socially held technical knowledge. In modern societies, it shall be acknowledged that knowledge is also a form of input to production (Lucas 1986, Romer 1989). It is a capital good⁷. And it is also a product—in the form of *new knowledge*. New

6. For practical purpose, let us consider most of the economic events as logical (or methodical), since economics deals with facts (data) and therefore, it deals with reality. However, dealing with *data* does not raise a domain to an evolutionary scientific threshold since there still remain many poorly understood economic events that demand formal analyses.

knowledge in the form of technological innovation is an externality. The mere existence of a new product by itself is an externality (Arrow 1994); but, what do we mean by the term *externality*? We will come to discuss about this term later. For now, let us concentrate on the importance and value of social knowledge.

Social knowledge—as elucidated by Arrow (1994) following Veblen’s review of John Bates Clark’s work is the accumulated wisdom and experience of mankind transmitted through generations—and which is still being transmitted though its importance has been overshadowed by the predominance of industrial and technical knowledge. But, can we include technical knowledge as a modern component of social knowledge? Let me keep this idea open for debate. Although it may be regarded as that the origin of *scientific thinking* has social constructs, that the study of science is a social activity, and that the relation between science and society is entwined, scientific knowledge—unlike social knowledge is impersonal and objective (Longino 1990) in contrast to the latter which is personal (Cooley 1926). However, Longino (2017) mentions about the importance of social dimensions of scientific knowledge which encloses various normative implications of the effects of technological outcomes on human life and social relations that lead to the emergence of social movements (i.e. environmentalism). Nevertheless, by tracing the roots of (social) knowledge, C.H. Cooley categorised it into knowledge of *things* and *persons* with the former requiring instruments of precision for extension and refining whereas the latter requiring human mental attributes like emotions, instincts, drives etc. The one requiring instruments of precision is the spatial knowledge that characterizes the exactness of science, whereas the other—personal or social knowledge, need more than instruments the processes of narration, arbitration and communication. But by what means social knowledge is conveyed? The manner by which social knowledge is conveyed is the central mechanism of narrative (Linde 2001). However, as Cooley (1926) asserts that, it is by the aid of *senses* that all knowledge—scientific or social reaches us, and gets internalized so that we can comprehend the differences between the two. For further analysis of distinction between scientific processes and nonscientific instruments of refining, the reader is referred to the works of Karl Popper and Thomas Kuhn. So, in a nutshell, scientific knowledge is *not* social knowledge, and judging the claims of science requires scientific reasoning, sound explanations, and satisfaction of certain criteria as scientific truth. Although knowledge in any form is the result of social interaction, observation, and learning and experience, it is difficult to categorize technical knowledge as a form of social knowledge—with some reservations. This is explained in the following sections.

Alfred Marshall considered technology as an *externality* and he implied the importance of innovation. Technical knowledge is a specialized form of substantive, material knowledge. It has relevance to Scientific knowledge which is the knowledge of experience from observations of nature and natural phenomena. Both technical and scientific knowledge are reproducible and replicable: There cannot exist in any form a product (technical knowledge) which cannot be replicated. This concept is of vital significance since it involves reducibility, reproducibility and reverse engineering. A new technology of a firm in essence is new information, and within a short span of time, it becomes available to other firms because firms learn from each other, and information is difficult to be kept private for long. This particular issue about information externality had been pointed out by Marshall (1920) as well (vide p. 164);

“...And that the most important improvements in method seldom remain secret for long after they have passed from the experimental stage.”

7. For a detailed discussion on the consideration of knowledge as a social capital, see for instance, Gunnar Eliasson’s (2000) excellent paper titled “*The Role of Knowledge in Economic Growth*”.

Information leaks; and this emphasizes the function of information externalities. This phenomenon does account for diffusion of technological knowledge through societies (Rogers 1962, Mansfield 1968). However, technological knowledge is not everything, and economics is not all about resource allocation: e.g., it concerns growth, development, consumption, investments, decision-choice and almost every other measurement of human activities and their outcomes. Economics is about making decisions, taking policy actions based on knowledge about different functionalities of the economic systems. But to make decisions, agents need information. To allocate resources efficiently, agents need information. The value of (social) information as variables could be invaluable if properly employed to render policy making. Indeed, efficient allocation of resources have become the hotbed of contention because of the reason that natural resources are scarce and demand for it keeps increasing with the increasing population demanding a fair share for its own survival. These make the knowledge and the process of allocation costlier. This, furthermore, calls for the relevance of knowledge to resources and its efficient allocation more significant than the pure form of social knowledge—that is wisdom of the ancients. This, however, is not the entire. Therefore, we may throw out a question as if, why knowledge is socially important, and which form of knowledge is more imperative? And why is it so?

5 Knowledge Externality

The modern theory of economic growth emphasizes the role of information externalities to explain the dynamics of growth momentum in advanced and emerging economies. It was since Alfred Marshall (1920) that the importance of *externalities* has been recognized, and currently the concept refers to social interactions not mediated through the markets. It extends to those events that are external to markets as for example, environmental issues, global warming, pollution etc. To cite an example of negative externality, consider global warming. And to consider an example of positive externality, we may refer to the benefits of R&D and innovation accrued by others beyond the owner of such initiatives; i.e., the society. The concept of knowledge externalities might be explained in terms of innovation as an engine of growth dependent on the diffusion of new knowledge or ideas (Peri 2002) that determine productivity. In simple words, the information embedded in capital goods is technical knowledge. New ideas as technical knowledge transformed into capital goods have dual benefits: social benefit and private benefit. If the social benefit of an idea is much larger than what could have been the private returns from such inventions, then there remains a possibility for existence of knowledge externality. The contribution of new ideas to productivity frontier must be assumed to measure externalities. New ideas contribute to the existing knowledge pools. Ideas may contribute differently to the owners of capital; e.g., new ideas may lead to increase in productivity or efficiency, accrue capital gain or new products or simply, innovation in existing products that may lead to higher private returns (Peri 2002). But in fact, the existence of a new product is by itself an *externality*—as much as the existence of a capital good which is nothing but technical knowledge although technical knowledge by itself is not an externality, save conditions. It all matters how far this technical knowledge is transmitted, how fast it diffuses, and how efficiently it is captured and utilized for collective benefits. There perhaps cannot exist any technology which is “impossible to replicate or reproduce”. Only thing is that the information about its existence is important. If it exists—it is an *externality*. This is vital, for it determines whether if such an externality is held privately so as to forbid the use of information by others or if it is held for personal gain. In a way, this phenomenon pertains to individualist viewpoint of knowledge hoarding. This is so because the benefits of knowledge externalities could be reaped by private firms or it could be translated into social benefits in magnitude

much greater than (when compared with that from) private returns. We can explain this using a simple model of externality consisting of a system of equations:

$$y_g = \alpha_0 + \beta x + \beta x_2 \times (\Delta \iota / s_1 - p_1) + \beta x_3(\kappa_x) + \epsilon \quad (1)$$

We shall follow by differentiating on two types of knowledge: Exogenous and endogenous knowledge denoted by βx_2 and βx_3 respectively. By differentiating on x_2 , we derive;

$$\frac{d}{dx_2}(\alpha_0 + \beta x + \beta x_2 \times (\Delta \iota / s_1 - p_1) + \beta x_3(\kappa_x) + \epsilon) \quad (2)$$

$$\frac{\beta \iota}{s_1 - p_1} \quad (3)$$

Again, by differentiating on x_3 , we derive;

$$\frac{d}{dx_3}(\alpha_0 + \beta x + \beta x_2 \times (\Delta \iota / s_1 - p_1) + \beta x_3(\kappa_x) + \epsilon) \quad (4)$$

$$\beta(\kappa_x) \quad (5)$$

Wherein, the variables are defined as follows: α_0 is a constant, βx is denoted as the level of social interaction where $x = 1$ or 0 respectively, $\Delta \iota =$ rate of change in innovation (no. of patents), $s_1 \wedge p_1$ social and private gains from knowledge spillover, βx_2 and βx_3 growth in exogenous and endogenous knowledge respectively, $\kappa_x =$ externality, and ϵ is the error term. The dependent variable y_g is the economic growth momentum. Let me explain the significance of equation no. (4) by plotting it which shows that when the level of βx (social interaction) is insignificant (<0.5), knowledge spillover effect will be relatively constrained. On the other hand, when the level of βx is significantly high ($\simeq 1.5$), the value of κ_x that is externality will be high and overflowing. At this given condition, when all other things remaining unchanged, there will be a high degree of spillover effect and the value of $\kappa_x \geq 2$ will exceed its maximum and knowledge will start to spill over and generate externality.

Externalities, therefore, could be defined as knowledge spillover that affects endogenous growth and R&D productivity (van Stel and Nieuwenhuijsen 2004). Knowledge has been considered to fuel endogenous economic growth in the way of human capital accumulation and technological input (Lucas 1988, Romer 1989). What matters most is the quality of knowledge required to stimulate growth. Externalities as knowledge spillover positively affect growth but the strength of such a spillover is an important determinant. Consider a simple illustration; suppose that after having ordered a glass of milkshake, you are being served a brimming glass of it; the glass full of milkshake contains an admixture of sugar, cocoa, some butter, and honey. It is almost overflowing, and it gets spilled over when it is being served to you. The spill over, in essence, is similar in composition and quality to the original but in quantity. Therefore, it is not possible to quench your thirst from the spill over, but it is possible to have an *idea* about *what* is being served. This *idea* is knowledge about the *given*. As Peri (2002) explains, not all innovations are codified. Among those that are codified, not all get patented, and even if those that get patented they are not always effectively protected owing to copyright infringements and piracy. Considering the role of patents in valuing and protecting new technological knowledge Peri (2002) mentions that a society also benefits from the private value of a patent since some knowledge leaks from the uncoded or patented innovations and benefits the society. What I suspect is

that, advanced economies impose a greater protection of property rights while they have far better access to information for generation of new ideas. And this is true. Contrariwise, it is more or less opposing in the less developed or developing countries where protection of innovation and intellectual properties is insufficient. However, it is still undesirable that this idea of *partial* benefit should be acceptable, but for the reason that something is better than nothing! My point of contention is that, it would be preposterous to consider a society to survive on knowledge leaks (or spillovers) while the owners of new knowledge would reap the full benefits leaving the leftovers for the rest of the society. However, I would like to have a different viewpoint on this particular issue. Some scholars like Kenneth Arrow held the view that information generated privately is hard to be kept concealed for long since it tends to leak. This is due to the fact that people have the propensity to learn from others which is so prevalent in our society. The leakage of private information, therefore, is a derivative which gets added to the social pool and it is used in turn as an input to production and generation of new knowledge. But again, as *new knowledge* which is generated gets patented, it is also prevented from being replicated by others (i.e., competitors), and so the cycle continues. It creates a monopoly market for the patent owner (proprietor of new technological knowledge) and prevents further externalities from such protection beyond the market for the time being. Hence, the society (or an individual) may choose to make this knowledge “social” or keep it private. Perhaps *individualism* or individual preferences do come to play a significant role in this context. Certainly, individuals have a place in the social order. An individual is also a unit in a social order, and they have beliefs and preferences, and it is necessary to respect their autonomy, privacy and self-respect (Lukes 1973). For these very reasons individuals may wish to protect their hard-earned rights of new knowledge using fair and legitimate instruments like patents. The importance of patents was recognized by Alfred Marshall (1920). Let me quote from his book (vide p. 162):

“...But even here he cannot get the full benefit of his invention unless he patents it; and sells the right to use it;...”

And then, Marshall went on to mention about the freedom of individual choice:

“and the ridicule which would be poured on any one who should set himself up to be wiser than his ancestors. But many little changes would occur to the bolder spirits; and if they had been free to try experiments on their own account, changes might have grown by small and almost imperceptible stages, until sufficient variation of practice had been established to blur the clear outline of customary regulations, and to give considerable freedom to individual choice.” (vide p. 417)

Indeed, provision of individual freedom enables individuals to think and choose independently. Now, several questions recur due to the tune of things that has been said above; Does a patent forestall generation of technical externalities? How to weigh the benefits of exclusive rights vis-à-vis the benefits of free access? The reader is referred to Barnes (2007) for a more detailed analysis of the subject matter.

Now, the question of positive externality will probably arise if information leaks, and when there are new knowledge that exists after all. Anyway, without delving into further complexities of confirmation holism⁸, I may simply choose to refer to this as an *ontological* nature of informational externality since the existence of information (or technical knowledge) varies across regions. Of course, its existence may be questioned on the basis

8. The reader may wish to refer to Christensen, D. (1992). Confirmational holism and bayesian epistemology. *Philosophy of Science*, 59(4), 540-557, for a more subtle analysis of the subject matter.

of objectivist account of confirmation, however. But, with the existence of perfunctory barriers that prevent efficient spread of technological information it may be simply assumed that such information exists if it is somehow known to exist, say for instance, on account of surveillance or from the social media. Then, it is a knowledge leak. And further, the advantages of its ontic characteristics might as well be exploited for private gain or social benefit, or both. The reason for this is that, technical knowledge (which is a *specialized* knowledge) is transmissible, and reproducible. This is one of the fundamental values *embedded* in (technical) knowledge. Of course, there exists forms of knowledge other than technical, and it is rather implausible to attempt to establish their externalities when compared to that of technological knowledge.

6 Acquisition and Transmission of Knowledge

6.1 What it Means to Acquire and Transfer Knowledge?

Knowledge is information and skill, or understanding of a subject, topic or theme. It is a prime component of intangible capital. It is in the form of information stored in books, periodicals or other retrievable means which can be recovered and reused. University libraries and scholarly repositories are as well good sources of specialized information. Pamphlets, magazines and newspapers also disseminate information. In similar tune, computers are an extension of the artefacts of efficient storage and retrieval of information whereas the internet is a further extension of all these, including rapid access to and sharing of information. But, are these modern means of digital workspaces a substitute for learning and literacy? Indeed, they evidently augment the process of acquisition and transfer of information. However, Jack Goody (1998) has regarded “...*I am disregarding the computer, which I see technically as an extension of rather than a substitute for literacy*”. Well, part of this statement is true, because digital learning cannot complement traditional classroom-based learning, but when we speak of modern computer (digital) literacy (Gilster 1997), then it becomes not just an *extension* but rather a *proxy* for such literacy. There is a real impact of digital revolution on literacy (Railean 2016), and it further aids in rapid dissemination of the knowledge created in the society. So if information technology is used, then it is necessary to oversee how well IT is used to support learning. The knowledge about this technology that is embedded in society is what we may call “*social knowledge*” (See Definition 2 above). And this brings us back to the definition of social knowledge originally proposed by Veblen and that which may be reframed as “...the knowledge of technology of our economic situations”.

It is also the result of the accumulated experiences of individuals and organizations which gets embedded in the society and passed onto generations as *social knowledge*. Indeed, the concept of *social knowledge* has been much clearly elucidated by Kenneth Arrow (1994) building on the works of his predecessors like John Bates Clark, Thorstein Veblen (1919), Hayek (1945) and others. Just about a few centuries back, knowledge as information was accessible to the few who could afford it, and the ways and means of transmitting knowledge were not well developed. Before the industrial revolution, community knowledge, knowledge of belief and faith, and folk knowledge were the predominant forms of knowledge in society. Following the industrial revolution, the importance of knowledge about *technical* information had overshadowed the preponderance of commonplace knowledge—also known as community knowledge (Arrow 1994). The dawn of technological revolution has placed more stress on scientific and technological knowledge (together known as *reproducible* knowledge) as well as on the knowledge being held by individ-

uals—*tacit* knowledge. Although a good deal of technological knowledge is transmissible to others, *tacit* knowledge is not easily transferable since most of this knowledge cannot be explained by words (Polanyi 1966). However, as Polanyi has mentioned in his book *The Tacit Dimension*, that some tacit knowledge may indeed be explained in words provided adequate means needs to be given to express ourselves. In contrast, any transmissible form of *technical* knowledge is reproducible and so must it be transferable to others. However, in the past, the modes and mechanisms of information transmission were still limited by the limitations in technology for transmission. Such means and mechanisms of knowledge transmission were sluggish and time-consuming. And, there were very little means of expressing our thoughts as well. Therefore, a need for faster accessibility to and transmissibility of information and knowledge was felt. The information technology (IT) revolution was the answer to this problem. Evolution of IT has brought in with it a new form of knowledge capital—*digital capital*⁹, which is easily transmissible and can be codified and hence, it is transferable (that it is explicit). IT by its virtue has greatly improved the ways and means of mobilizing and transmitting knowledge across boundaries. The ways and means of transmitting and transferring knowledge in society has evolved over time (Goody 1988), and therefore, following the digital revolution, there has been a tremendous explosion in knowledge related activities in organizations owing to the rapidity and easiness of transmitting information across boundaries. This has largely made it possible to acquire information among individuals across borders using the internet that has tremendously contributed to knowledge sharing process. Web-enabled IT-based solutions have made it possible to transmit and share information quickly and more efficiently, augmenting the access to information, and enhancing knowledge acquisition. It should be emphasized that today, information is quickly accessible to the majority more easily than what it was a hundred years back. To simplify matters, the problem of knowledge transmissibility has been resolved. So, let us now explore the mechanisms of knowledge acquisition.

6.2 Mechanism of Knowledge Acquisition

Knowledge is acquired by various means and ways: i.e., observation, education, learning from others, and inference. It is also acquired through learning-by-doing (Arrow 1962); practical experience. The nature of knowledge acquisition is determined by the degree of openness to the sources of information, that is—how much of it is accessible to the society. For instance, the US economy is characterized by extraordinary access to information (De Long 1999) that fuelled her economic growth. Therefore, it is of prime importance to the society to have unrestricted access to basic and fundamental knowledge and information. This is what the debate revolved around in the past few centuries regarding how knowledge ought to be held; whether it should be concentrated in one place (as in socialist economies) or, dispersed widely across regions for the greater benefit of the society (Hayek 1945). Technology also plays a significant role in the dissemination and diffusion of knowledge across societies. Transmission of technological knowledge and its diffusion into societies play an important role in the generation and acquisition of new knowledge (products). Diffusion of technological knowledge (Everett 1962) allows reverse engineering; when new knowledge is generated by one firm, it becomes available to other firms within a span of few years (Mansfield 1985). To be acquired, however, knowledge must at first be accessible to an agent; if it is held centrally, its diffusion across the society would be low. This is particular of socialists who tend to hold knowledge centrally (Hayek, 1948). Even though this might be the case, is it true that they *prevent* access to it?

9. I borrow this term from the book written by Tapscott, D., Lowy, A., & Ticoll, D. (2000). *Digital capital: Harnessing the power of business webs*. Harvard Business School Press.

Prohibition of knowledge acquisition to learners is a social evil, and perhaps it is one of the most malicious of all evils, just as the deprivation of food is often the most severest of all punishments¹⁰ to be rendered to someone who is hungry. On the other hand, if knowledge in society exists but it is not accessible to others, then it becomes a major problem. For the reason that there must be existing barriers preventing access to it—the knowledge what we call *social*, and that if it is inaccessible, diffusion of such knowledge does not occur. Therefore, the ways and means of transferring and transmitting knowledge are as well one of the major determinants of its diffusion across societies. When barriers exist to prevent access to information, diffusion of knowledge across societies is restrained. Consequently, *any* form of knowledge then truly becomes contrary to being *social*—such knowledge becomes *private*. Diffusion facilitates acquisition of knowledge by making it available to the society instead of concentrating it at one place. Diffusion of knowledge also generates externalities if it positively affects innovation (Peri 2002). In similar tune, diffusion of technology is an essential aspect to support the necessary condition of spillover as an enabler of new growth economics (Eliasson 2000). It is because technology is nothing but (new) information, and diffusion of new information (innovations) is one of the key factors that drive economic growth. For diffusion to occur there must exist means of communication channels. According to Everett Rogers (2010), diffusion is a special mode of communication which is concerned with new ideas. The use of internet technology supports rapid diffusion and dissemination of new information as it embodies a number of communication technologies including e-mail, databases, chat rooms, video-conferencing, social networking sites and others that facilitates rapid correspondence (Carr 1999). The role of social networks, and its density, as well, affects the rate of diffusion of information across the society (Bakshy *et al.* 2012). The denser a social network becomes, more likely it is for information to diffuse through more unique paths. The greater density allows ideas and information to be encountered repeatedly and discussed frequently (Granovetter 2005). This could be put forward as an analogy to a physicist’s theory one similar to Paul Samuelson’s comparison of competitive model of the economy to increasing density (Samuelson 1963, Arrow 1994) which suggests that increasing density increases interactions of atoms.

6.3 Knowledge, Economic Growth & Externalities

Let me now attempt to establish simple linkages between knowledge, economic growth and externalities from past and contemporary studies related to the economics of endogenous growth. As mentioned previously, it has always been a contentious debate on how knowledge should be held (Hayek 1948), if it is to be held at all (save military knowledge). Nevertheless, the utmost priority should be to enable social knowledge flow smoothly across the society. For the growth of new knowledge, and for the growth of economy based on new technology, access to information should be unrestricted. We may consider knowledge as *goods* and *assets* or intangible or intellectual capital (OECD 2011) since value can be created from such assets (Bismuth and Tojo 2008). Knowledge is, in fact, an intangible good (asset). Therefore, knowledge is also a means of exchange as well as a store of value. Exchange of knowledge is essential for idea generation wherein ideas are considered the engine of growth (Lucas 2002); it facilitates creation of new knowledge (*goods*). New knowledge and new technological specializations are among the major determinants of economic growth (Romer 1987). It is created as a result of the economic processes. New

10. See *The Edinburgh Review*, Vol. LXX, Page 173, 1840.

resources are invested to produce new knowledge (Romer 1990). The outcome, therefore, is an externality; a new product is created which exist in the society and it adds to the social pool of information. Investment, therefore, is a process, whereas new resources are considered as assets and knowledge produced is considered as *goods*. Lack of increase in knowledge may lead to diminishing rates of growth (Arrow 1994). Sustained economic growth, therefore, requires continuous supply of new knowledge to the economy which is possible when supported by sustained dissemination of new information. In other words, growth can be sustained if new knowledge and human capital as inputs that generate positive externalities could be continuously accumulated (Grossman and Helpman 1994).

7 Social Knowledge in economic modeling

The analyses of economic phenomena require observation, information and data. It is here where the importance of knowledge about social variables is most essential. Social variables, as *attributes*, can be derived from social realities; e.g., norms, values, habits, beliefs, behaviors, practices, routines and conventions. People in societies have individual characteristics, with each individual having a blend of different types of these attributes or a combination of several of these that define an individual within a social context. The knowledge held by individuals are also distinct and varied, and the individual actions and decisions vary as well across societies, so do norms and values and beliefs and habits. It is the individual members of the society who build its realities (Sandru 2010), and so there are both *ideological* and *individualistic* elements that contribute to social realities. Social knowledge, therefore, is a reflection of social realities. There are various ways and means of acquiring social knowledge, and as Sandru (2010) elucidates, at the individual level of social knowledge process, there are various degrees of systematization of the knowledge acquired. However, under different opinionated systems, members will have a differentiated access to social information, and under some, there will be *limited* or very little access to information and knowledge. It may be either due to restricted access to information, or inefficient ways and means of acquiring new knowledge. When the ways and means of acquiring new knowledge is limited, and further investiture to such knowledge becomes sticky, it unconstructively impinges on externalities beyond the market. Information may also be limited about the socio-economics processes due to lack of insights and observations about social phenomena. In the former case, transparency and openness may overcome such limitations, whereas in the latter, it will require deeper investigations and astute observations to generate new knowledge about the social systems. However, since social knowledge is so moot, it would require adoption of scientific methodologies, tools and techniques to validate the information so generated. And here lies the need to maximize the role of scientific and technical knowledge which were so reluctantly acknowledged by Hayek (Arrow 1994). Scientific knowledge, methodologies and tools are also required to refine the crude knowledge derived from behaviorism—observation of psychosocial attributes. In economic perspective, it shall, however, be acknowledged that information is necessary to make optimal individual economic decisions like consumption and investments, since it modulates agents' expectations. Expectations are mental constructs about future possibilities. The very prospect of future possibilities breeds human expectations. So, what knowledge is necessary to model future human expectations?

One of the major functions of an economy, besides allocating resources, is to dynamically integrate the actions of individuals and reactions of social agents who make decisions about consumption, savings and investments. In fact, individual decisions and individual

differences in decision making (Appelt *et al.* 2011) can form a complete set of explanatory variables that may help explain the behaviour of economic systems. But what are these decision variables that could explain the behavior of economic systems? Well, the individual decision variables could be either social or economic that depends on individual decisions which may be social or economic, or both. Individuals interact socially and economically within a given frame of reference. Individuals act on information, they use information, and generate knowledge which is reprocessed and recycled for various purposes, either for private or social benefits. This contributes to exogenous growth of knowledge in society. I should also add, that it is not only necessary to acknowledge exogenous or endogenous knowledge growth, but it is also vital to recognize that such growth in knowledge pertains to its usefulness in advancing the evolution of societies. Since knowledge has got many roles to play in society (Hayek 1945), what kind of knowledge or information is socially and economically more relevant today? Of course, it is scientific or technological knowledge that predominates in importance than most other forms of knowledge. However, in social contexts, behaviors, habits, tastes and preferences do play significant roles in modeling economic systems. Knowledge derived from such social processes can be valuable aid to model economic systems.

7.1 Social Knowledge of Price

Price or pricing has always been a subject of socioeconomic concern whether historical or contemporary. In the past, price volatility often led to riots and revolts. We may assume the social significance of price—it is a signal. Then, what about the social knowledge of PRICE? Although price is an *economic* variable having much social significance, I would like to explore the *social* dimension of price and the knowledge it gives to consumers about economic contexts. Not that it hasn't been attempted before (see for instance, Beunza, Hardie, & MacKenzie 2006). Price is, in fact, a determinant of many social decisions. It is an indicator of cost to a buyer (Monroe 1971) and provides information about supply and demand. It gives us information about the *value*; and, of *quantity* of products and services being available (or produced) in an economy. It also reveals *scarcity*. And it may reveal *quality* as well (but not always) of products and services being available in a market. That being said, it is as well important to understand how consumers *perceive* price (Heda, Mewborn and Caine 2017). In market economies, the information content of price (Monroe 1971) is a significant indicator of economic (trade?) events (Milgrom and Stokey 1982). But how much valuable information does price reveal? And what information prices actually do not reveal? So what knowledge do we need to seek to uncover the information that prices *do not* reveal? What other variables could explicitly and more correctly help explain the behavior of price? Since price is a reactionary outcome of agent behavior which is determined *on* the market, what social variables could help explain economic behaviors of social agents? Well, it is easier to ask questions than to answer them. In fact, the importance of social knowledge might rest within some of the above mentioned queries. Since expectations are influenced by social factors, individual preferences might have some influence on price. But again, there is no explanation given about how individuals affect price formation (Arrow 1994) since it is determined on the markets, and markets must have sellers and buyers to function and so it is the result of social interactions between the agents (buyers and sellers) that *affect* price. So, value is determined on the market—and by the agents. I do not want to drag further, so once again, I leave the former questions open for investigation, while I shall attempt to answer one final question (on the effect of social knowledge on economic growth) before concluding my study on social knowledge.

7.2 Social Data for Economic Models

What kind of knowledge does economics require to explain the *growth* of growth or lack of it? In social context, it requires factual data about the population, demography and their interactions and measurements of essential (socio-economic) variables that define economic events and their outcomes. Economy needs data about human wants and desires and information about consumption (social) habits and preferences. These may well include lifestyle variables, personality constructs, psychological variables, educational, occupational, individual or group-level attributes (see above in Section 2). But how far data collected/derived from survey, sampling, poll and census statistics accurately reflect the true dynamism of the economic systems? Because social data are often skewed and vulnerable to bias, how can such methods of data collection be further refined (Saaty and Vargas 2012)? Systematic analysis of such data using models to establish “how far” they accurately reflect or help explain economic phenomena provides evidences about how ‘good’ the information can be exploited, and in essence, how “good” or *factual* the data ought to be, however, is itself a topic of great debate. Suffice it to say that, the underlying data required to model economic systems should be of good quality, and should include as variables what it seems necessary to explain how the economy functions. The role of social variables cannot be undermined because social data may tell *tales* when economic data may fail to do so. Data selection method should be sound enough to explain socioeconomic phenomena which is nevertheless, a big challenge to economists as well as for sociologists trying to explain human behaviors that have bearings on the economy.

8 Concluding Statements

Let me wrap up with an easy summary. However, I would not like to rush to make a rash conclusion. Therefore, in concluding this article, I would like to mention several implications of this study on social knowledge. First, let me recall that this study was aimed to reassess what social knowledge is—including its definition, and whether it can be more useful to explain economic phenomena; that is, what implications social variables have on economic systems. This study sheds some light on the ongoing evolution of social knowledge that has bearings on the economy. This is relevant to the growing importance of socially held technical knowledge, and the knowledge being generated and shared via social networking. In the background, I have also attempted to expound on the thoughts of Kenneth Arrow regarding social knowledge and its implications. In doing so, I think, I have justly elucidated the modern concept of social knowledge within the current socioeconomic contexts. That is, how social knowledge ought to be perceived today. Drawing inspiration from the previous works of many scholars in this field, I have attempted to include and explain *price* as a social variable, and therefore, underpin its importance in making social decisions. While considering this notion convincing, I feel I may have done some justice in explaining *social knowledge* in its modern attire in being able to elucidate that it is *distinct* from technological knowledge to which it has lost its import. However, in considering the recent emergence of social knowledge networks that corresponds to the present economic context, it may be said that social forces (including knowledge) may have some genuine implications on the functions of the economy. In attempting to uncover such knowledge, I have reiterated based on previous studies that knowledge in the form of positive *externality* have definite impact on economic growth, and then, it becomes important when such information tends to be scarce and private. Of course, this study asks several questions, attempts to answer a few of them, and leaves several other queries to be dealt with in future studies on this frontier. Summing up, I wish to reverberate on the tune of Arrow’s conclusion that social variables are necessary to study economic systems where information and knowledge forms an essential component of social systems.

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