A Critical Review of the Precursors of the Knowledge Economy and Their Contemporary Research: Implications for the Computerized New Economy

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Abstract

Despite nearly fifty-eight years since the term *knowledge economy* first appears, we are getting nearer in understanding this new kind of economy. The purpose of this paper is to clarify the meaning of the knowledge economy by conducting a critical review of the precursors of the knowledge economy and their major critiques so as to identify the current research implications. We aim to identify common ground in advancing the research of the knowledge economy. In essence, our understanding of the knowledge economy is viewed from a ‘new’ social-economic-theoretical perspective in which the theoretical foundation focuses on the explosion of technology that motivates people to be innovative and possess knowledge in producing knowledge products or be so engrossed with sociability using technology at home. Our finding is that the notion of the knowledge economy must be viewed from some phenomena that have transformed the contemporary economy. Other major findings include the following: (1) we use the term *knowledge economy* instead of the multiplicity of terms to describe this new form of economy; (2) we articulate that the theoretical foundation of the knowledge economy is a branch of social economy where the economy is not based solely on production and consumption but is based more on social values, technology, knowledge and innovation to commercialize knowledge products; and (3) the statistical assessment methodology is delivered through the use of indicators to proxy for the four knowledge economy criteria that makes up the knowledge economy. This has the following implications for economic management, knowledge-induced innovation, computerization of the economy, and knowledge management in the new economy.

Keywords Knowledge economy · Knowledge society · Knowledge age · Information economy · Information age · Social economy

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Introduction

The field of the knowledge economy is receiving tremendous interest. Isenberg (2010) reported that there were 40,000 articles on the knowledge and knowledge-based economies as at 2010 and there is a multiplicity of terms being used to describe similar concepts related to knowledge management (Davenport, 2005; Nonaka & Takeuchi, 1995), knowledge economy (Drucker, 1969; 1973, 1999), knowledge industry (Machlup, 1962; Machlup & Mansfield, 1970), information economy (Porat, 1977; Porat & Rubin, 1977) and network society (Castells, 1997; Van Dijk, 1999, 2006). In view of the hefty of terms used, they can collectively be labelled as the knowledge economy (KE), and their authors are avowed as the precursors of the KE. However, nearly 58 years since Machlup's seminal work on the KE, we are now getting nearer in understanding this new kind of economy. Initially, significant doubts arise as to whether the 'modern economies' are, indeed, 'knowledge economies'. More critically, the current economic meltdown and the Covid-19 pandemic of these so-called knowledge economies are testimonies of false assertion by the precursors of the field, and most recently, the current medical pandemic has cast further doubt on the sustainability that the developed economies are knowledge economy. Such inadequacy occurs in view of the fact that the field has no shortage of writers and critics that advance or reject various avenues of the knowledge economy. So, what actually is 'knowledge economy'?

The objective of this paper is to understand by questioning and reasoning by what the precursors meant by 'knowledge economy' and not on what they have explained in a casual manner. We also want to know whether similar terms like 'knowledge-based economy', 'information economy' or 'knowledge society' meant the same or different things, and even if they were used merely for semantic reasons, is there a common ground for us to specify a research agenda that enables us in the furtherance of the study of the field in a systematic manner? The objective is also to find the implications for economic management, computerization of the economy and knowledge management in the new economy. Therefore, this paper will make a contribution to the literature in the areas of the theory and management of the knowledge economy as it provides a new perspective of the issues in the emergence and operation of the knowledge economy, providing a better understanding of the computerized new economy.

In doing the above, we use a methodology comprising a systematic review, content analysis and critical theory (analysis) in helping us to examine the terms and contents used to describe a knowledge economy. The next section examines what the precursors of the knowledge economy have told us. In ['Commentary of the Precursors of the Knowledge Economy'](#), we critically review what the critics of the precursors have told us, and explain what is wrong with the current reality of the knowledge economy. ['Theoretical consideration in advancing the research on the knowledge economy'](#) is concerned with avenues in advancing the research of the knowledge economy. ['Conclusions and Discussion'](#) reports the findings of the paper and their implications and concludes our discussion of this research.

Methodology

A Systematic Review of the Literature

According to Godin (2010), the works of the precursors of the knowledge economy can be divided into two waves of studies pertaining to the field. The works of Machlup, Mansfield, Drucker, Bell, Porat and Rubin are considered the *first wave of studies* on the knowledge economy, and the second wave started in the mid-1990s that revitalizes the studies in the first wave with a change in emphasis and continues today. The notable works of this *second wave* are Nonaka, Takeuchi, von Krogh, Davenport, Prusak and Volpel, Van Dijk, Castells, United Nations (UN), United Nations Educational, Scientific and Cultural Organizations (UNESCO) and the Organization for Economic Cooperation Development (OECD). Although the works of the UN, UNESCO and the OECD are not really seminal, aspects of their works have merits and, hence, can be considered as precursors of the second wave. This assertion by Godin (2010) is consistent to the *Handbook on the Knowledge Economy* by Rooney et al. (2005).

Since we already know who the precursors are, the next step is to use the surnames of the precursors comprising ‘machlup’, ‘drucker’, ‘bell’, ‘rubin’, ‘nonaka’, ‘takeuchi’, ‘von krogh’, ‘davenport’, ‘prusak’, ‘volpel’, ‘van dijk’, ‘castell’, ‘UN’, ‘UNESCO’ and ‘OECD’ (altogether, fifteen names) to conduct a literature search to find who are the followers and critiques of these precursors. The search criterion for the publication period is from 1980 and 2020 (41 years), but the disciplines of the journals (e.g. management or production) are not set as a criterion for the literature search so as to obtain as many articles as possible. The starting year chosen is due to data availability as most search engines are not able to locate articles prior to 1980 (Choong, 2014). The literature search is based on a systematic review methodology as it is preferred to the traditional literature review because the former is particularly suited in a large literature survey for the gathering, evaluating and analysing of all the available articles relevant to a set of research questions (RQ) (Leseure et al., 2004; Kitchenham & Charters, 2007; Choong, 2014).

All literature searches were conducted using major journal databases such as ABI/Inform ProQuest, Emerald Full Text, Scopus and EBSCO. To be very certain that no relevant articles were left out from the literature search, a search was conducted on the Internet using Google Scholar for any publications pertaining to this research from 1980 onwards. While this procedure did not guarantee an exhaustive collection of all relevant knowledge economy articles, we believe that a large majority of relevant papers were found, and the resulting findings from this research suffice to provide a strong conclusion concerning the topic of the knowledge economy.

Content Analysis

Content analysis needs no introduction as it is a widely used method in social sciences and humanities to identify commonalities (common grounds) for studying and/or retrieving meaningful information from documents (Krippendorff, 2004; Jones, 2019) oriented to the study of ‘mute evidence’ of texts and artefacts (Hodder, 1994, p. 155). Content analysis involves the selection of articles that have a high content of a research question, not people. But no matter how hard one tries, one just cannot analyse content in all possible ways, and this means it is impossible to be comprehensive. Hence, after the analysis, you will usually want to generalize those findings to a broader context—in other words, you are hoping that the issue you selected is a representative sample. Although content analysis is usually used to analyse written words, it is a quantitative method. The results of content analysis are numbers or counts, for example, how many authors use the term ‘knowledge economy’ as compared with those using ‘information economy’. The numbers and counting serve two purposes: to (1) remove much of the subjectivity from summaries and (2) to simplify the detection of trends. These help to aid human judgement in assigning relevance to the content.

Critical Analysis

Critical theory is well suited for this research as writing about the knowledge economy (which is considered a social science) is in many ways subjective where terms are used discriminately, and there is no cohesive body of thoughts (theory) in explaining what this form of economy is about. Critical theory is all about challenging what we have been told; it does enable us in developing a universally coherent study of the field through critical analysis and objective assessment of the content of articles.

In particular, we follow the Horkheimer’s (1982) approach in applying critical theory in structuring our paper. This is because Horkheimer wanted to distinguish critical theory as a radical, emancipatory form of social theory oriented toward critiquing and changing society as a whole in its historical specificity—it provides the descriptive and normative bases for social inquiry aimed at meeting three criteria: it must be explanatory, practical, and normative, all at the same time. Thus, Horkheimer’s approach is most consistent to the knowledge economy/society because it must explain why the knowledge economy cannot fit with current economic and social reality, identify the actors/phenomenon that bring about the change and provide both clear norms for criticism and achievable, practical goals for economic and social transformation.

The Precursors of the Knowledge Economy

Here, based on Rooney et al. (2005), and Godin (2010), we review and summarize the fundamentals of the KE divided into two subsections: (1) the first wave of studies on the knowledge economy and (2) the second wave of studies on the knowledge economy.

The First Wave of Studies on the Knowledge Economy

The first economist to write about the new economic direction of policymakers was the notable Austrian economist, Fritz Machlup (1902–1983). In *The Production and Distribution of Knowledge in the United States*, Machlup (1962) defined knowledge and prescribed the usefulness of knowledge in multi-facet perspective, especially on how it is used in production in creating the knowledge industry. In 1970, with Una Mansfield, they emphasized that education provides important impetus in creating a society that relies on information and knowledge in creating jobs and foster growth and the knowledge sector is increasingly growing in importance. In particular, Machlup's books give rise to a new idea of learning and discourse that could impact an economy, now termed as the *knowledge economy*.

Peter Drucker (1909–2005), another Austrian economist, was quick to capitalize on Machlup's idea when he wrote *The Age of Discontinuity* (Drucker, 1992a) where the term *knowledge workers* was used for the first time. To Drucker, knowledge workers differ from manual workers as the former, mainly work with their heads, not hands, and produce ideas, knowledge and information. Drucker was describing these changes in the US economy during the 1930s when R&D departments were just blossoming in organizations. The emergence of knowledge workers causes changes in social, political and economic factors in the USA, resulted in the emergence of the KE.

The pace of the change in the US economy quickened in the late 1960s and early 1970s where there was a sudden influx of service workers in big towns and cities from rural farms—the most obvious measure of the transition from manufacturing to a service-based economy. To capture this change, Daniel Bell (1919–2011), a US sociologist and a neo-conservative, in *The Coming of Post-Industrial Society* (Bell, 1973), hypothesized that a new form of society, coined as the *post-industrial society*, will emerge in the USA and in other developed countries. This idea is 'primarily' about the change in US society brought about by changes in the economy, nature of work and politics from a nation producing goods to one based on a service economy. He asserted that the post-industrialized economy is not universal as it relates only to those countries that have successfully transformed from an agricultural economy to manufacturing economy. Later, Bell (1979) renamed this concept the *Information Society (IS)*, for which he continued to discuss the significance of information and education in the creation of knowledge.

In 1977, Marc Uri Porat and Michael Rubin, both employees at the US Department of Commerce, wrote a Federal policy handbook that measured and estimated the size of the 'information activity' of the US economy, which is called the *Information Economy (IE)*. They found that the creation, handling and distribution of information were fast becoming a major economic activity for all nations of the world, be they rich or poor, developed or less developed. Porat and Rubin's works have since been used in the USA, several countries and the OECD in describing the information economy.

The Second Wave of Studies on the Knowledge Economy

Nonaka and associates provided a new framework in the study of knowledge as (i) knowing and (ii) valued products produced by knowledge workers (Nonaka, 1991, 1994; Nonaka & Takeuchi, 1995). Nonaka and Takeuchi (1995) conceive that human knowledge can be differentiated between *explicit* and *tacit* knowledge—the hallmark of their thesis. *Explicit knowledge* is ‘knowing that’ knowledge we can express and is contained in manuals and procedures; hence, it is coded and transferable, and *tacit knowledge* is scientifically articulated as ineffable or ‘knowing how’ (knowledge we cannot express) (Polanyi, 1966). Tacit knowledge is learned only by experience, and communicated only indirectly, through metaphor and analogy (Nonaka & Takeuchi, 1995, p. 58–63). Later with von Krogh (von Krogh et al., 2000a; Nonaka & von Krogh, 2009), they hypothesized that successful knowledge creation activities are supported by a *SECI model*, the acronym for *Socialization, Externalization, Combination and Internalization*. The works of Nonaka (1991, 1994), Nonaka & Takeuchi (1995) and Von Krogh et al. (2000a, b) are regarded as the precursors of *Knowledge Management (KM)*.

Davenport and colleagues adopted part of Nonaka and Takeuchi’s conceptualization of human knowledge and indicated that by transferring their tacit knowledge to fellow workers, knowledge workers have a more vital role to play in the contribution of business strategy (Davenport & Prusak, 1998; Davenport & Völpe, 2001; Davenport, 2005). They argued that it is the tacit knowledge that is crucial to management as it is embedded in organizational routines, processes, practices, norms and innovations. As yet, a theory of knowledge management has not been reached (Pawlowski & Bick, 2012, p. 96).

At about the same time, the Dutch information sociologist, Jan van Dijk, defined the *Network Society (NS)* as a ‘social formation with an infrastructure of social and media networks enabling its prime mode of organization at all levels (individual, group, organizational & societal)’ (2006, p. 20). He observed that in the era of widespread use of microcomputers, the Internet and various IT devices link people and organizations together, and that when a society has attained these forms of informational and network structures, society is in a process of becoming a network society. Under a similar vein, Manuel Castells, the Spanish information sociologist, extends the information age trilogy to the NS and emphasizes the importance of networking (Castells, 1997, 2010). He argued that in the information age, the increasing use of networks ‘... constitute the new social morphology of our societies, and the diffusion of networking logic substantially modifies the operation and outcomes in processes of production, experience, power, and culture’ (Castells, 2010, p. 500).

To UNESCO, according to its General Sub-Director for Communication and Information, Abdul Waheed Khan, the concept of *knowledge societies (KS)* is preferable to that of the ‘information society’ because the former includes a dimension of social, cultural, economic, political and institutional transformation: collectively, a more pluralistic and developmental perspective that better captures the complexity and dynamism of the changes taking place (UNESCO, 2003, p.

7–8). Thinking that the term and its expression are perfunctory and have not gone far enough, the OECD changed its inculcation theme by defining it as the *knowledge-based economies (KBE)*. The OECD (1996a, p. 3) defined the KBE as ‘economies which are directly based on the production, distribution and use of knowledge and information’ that represents the emergence of a ‘super’ economy that is knowledge-based which brings in many benefits, and thus, developing countries should utilize knowledge and the creation and sharing of knowledge across countries in order to reap these benefits.

In more recent development, the European Bank for Reconstruction and Development (EBRD) advances the concept of the *knowledge economy* as a part of economic development, in which innovation and access to information drive productivity growth (EBRD, 2019). New trends, such as the Internet of Things (IoT) or digitalization, are examples of key elements of the transition towards the knowledge economy. To measure the discerned knowledge economy, the Bank has constructed the EBRD Knowledge Economy Index, spanning 46 economies (38 where the EBRD invests and eight comparators (members of the Organisation for Economic Co-operation and Development, OECD)) divided into four pillars of long-term knowledge-enhancing activities: (1) institutions for innovation, (2) skills for innovation, (3) innovation system and (4) ICT infrastructure. Among the EBRD regions, Estonia scores highest and Turkmenistan lowest.

In sum, the various terms used and the gist of the writings by the precursors of the knowledge economy/society are depicted in Table 1.

There are eight terms prescribing the knowledge economy/society or variation of such economy/society. For instance, Machlup was discussing about the knowledge industry while Drucker talked about the knowledge economy. Nonaka and Takeuchi and associates centre on knowledge, and knowledge creation within an organization, and when these activities are aggregated on a macro level, a kind of KE emerges. Van Dijk and Castells discussed about the network society. This multiplicity of terms is confusing as they can describe either the same or different things, and this inevitably spur scholars and critics (including us) to question the assumptions and rationale behind the work of the precursors. To us, we want to know whether the various terms are used in a casual manner or there is a serious discourse to refer to the knowledge economy. In our content analysis, we found that 91 out of the 121 articles (76%) in our References use the term ‘knowledge economy’ which confirms our earlier assertion that this term is most commonly used to describe this kind of the new economy.

Commentary of the Precursors of the Knowledge Economy

The First Wave of Studies on the Knowledge Economy

The commentators of Machlup’s thesis of an information and knowledge industry indicated that it lacks traditional economic theoretical foundation (Godin, 2006, 2010) and subjective methodology in formulating models (Apte & Nath, 2004; Connell, 2007). At best, it only provides a crude retrospective approximation of

Table 1 Terms/topics used by precursors of the knowledge economy/society

Terms	Key publications	Gist of their writings
Knowledge industry	Machlup, (1962); Machlup & Mansfield, (1970)	Focus on knowledge & how it creates the knowledge industry. In particular, Machlup's ideas gave rise to the KE
Knowledge economy (KE)	Drucker, (1969, 1973, 1999) EBRD, (2019)	Extremely broad; prescribing role of knowledge workers & how changes in social, political & economic factors in the USA resulted in the emergence of the KE
Post-industrial society, information society (IS)	Bell, (1973, 1974, 1979, 1980)	To capture the change in the US economy in the late 1960s and early 1970s where the service sector begins to dominate the agricultural sector
Information industry, information economy (IE)	Porat, (1977); Porat & Rubin, (1977)	Using Machlup's methodology, they define and measure an 'informational activity' in the US economy and examine how it relates to the rest of the economy
Knowledge management (KM)	Nonaka, (1991, 1994); Nonaka and Takeuchi, (1995); Krogh et al., (2000a, 2000b)	First to advocate explicit and tacit knowledge in organizations. Although not formally expounded, they prescribe how knowledge can be transformed into knowledge commodities in the knowledge economy
Working knowledge, knowledge management (KM)	Davenport, (2005); Davenport & Prusak, (1998, 2000); Davenport & Volpel, (2001)	Adopted in part of Nonaka & Takeuchi's idea; Davenport, Prusak & Volpel focus on human knowledge and knowledge sharing. They hypothesize that knowledge workers with good knowledge management will shape the new economy (KE)
Knowledge-based economy (KBE)	OECD, (1995a, b, 1996a, b, c, d, 1998, 2000, 2004, 2010)	A knowledge-based economy is considered a 'super' economy that brings in many benefits to countries. The OECD encourages non-KBE countries, in particular, developing countries to utilize knowledge in the creation & sharing of knowledge across countries in order to reap these benefits

Table 1 (continued)

Terms	Key publications	Gist of their writings
Network society (NS)	Van Dijk, (1999, 2006)	The network society is built onto the foundations of the information society. The network society is a combination of social and media networks that would change people's way of life and shape the mode of organizations and society
Network society (NS)	Castells, (1996, 1997, 2000a, b, 2010)	The network society is the result of <i>informationalism</i> , a capitalist transformation (transformation of space)—a new technological paradigm,
Knowledge society (KS)	UNESCO, (2003, 2005a)	The term is preferred as it reflect progress in societies attempt to promote the ideas of global changes to seek the harmonization in the fields of social, economic, political development, culture, advancement in science and technology and other fields

modern economies (Ormerod, 1997), and there are scepticisms about data and his analysis (Godin, 2010). More specifically, Machlup's definition of knowledge is ambiguous and his definition of the 'knowledge industry' was extremely wide, encompassing everything from the production of typewriters and filing cabinets to electronic, print advertising and mass media (Godin, 2008, 2010). Arrow (1984, p. 142–3) stated that Machlup's definition of the knowledge/information economy runs contrary (flaw) to the economic 'meaning of information is precisely a reduction in uncertainty', which would exclude 'information producing' activity such as advertising, market research and most reports about the new economy. In our content and critical analyses, while we concur with the commentators that Machlup's works lack theory (including poor definition of the knowledge and its industry), we acknowledge his meritorious work in the advancement of knowledge and its usefulness in production, and this sector is increasingly growing in importance. And this has proven right.

Drucker's writings have been criticized for lacking academic and scholarly content where principles were far from obvious or still not defined (Parkinson et al., 1987; Edersheim, 2007), for being contradicting (Parkinson et al., 1987) and for being cryptic in his pronouncements as his works lack empirically testable propositions (Edersheim, 2007; Sapru, 2008). Drucker portrays knowledge workers as the preferred workers in a society which is akin to 'brains over brawns' in an economy where knowledge, knowledge management and skills dominate (Hadad, 2017). To Drucker, knowledge workers are the key to innovation and knowledge to an organization, and having them would enable organization to generate new products and inventions. In our analysis, although we do find Drucker's writings to lack academic fervour, to be sometimes contradicting and to be apt in making arresting generalizations rather than to offering rigorous arguments in advancing a rationale of what actually is the KE, we do find meritorious aspects of his work, especially with respect to the notion that knowledge workers are the ones that give ideas and knowledge that initiate *R&D* activities in firms in boosting capability and the advancement of an economy.

Bell's writings have been described as wide and to use imprecise terms (Waters, 1996). Gorz (1982, p. 84) argued that the economic activities during the industrial era and Bell's post-industrial economy era are basically the same. Robins and Webster (1999, p. 80) stated that the information society, in fact, 'can be, and has been—achieved on the basis of minimal technological support.' Such assumptions are ideological in nature because they would fit with the view that we can do nothing about change and have to adapt to existing political realities (Webster, 2004a p. 267). Critiques (Gorz, 1982; Giddens, 1990; Waters, 1996; Robins & Webster, 1999; Mackay, 2001; Webster, 2002a, b; Cornish, 2011) argue that the growth of information does not alter the attributes of the overall capitalist structure. Our content analysis indicates that the term *post-industrial society* originated from Alain Touraine (1925–) where many facets of his ideas such as the shaping of a 'newer' form of society through structural mechanisms (management, production, organization, distribution) are not much different from Bell's indication that as wealth increases through incomes generated by workers, new demands arise for 'luxury'; personal services such as hotels, restaurants and entertainment; and the demands for the government to provide for better health and education services.

This, in our view, is a logical extension of economic activities from an industrial society to a post-industrial society, and thus, the terms *post-industrial economy* and *post-industrial society* are synonymous.

The studies of Porat and Rubin have been criticized for the lack theoretical building blocks (Miles, 1990; Engelbrecht, 1997; Wellenius, 1988; Apte & Nath, 2004), use of inappropriate measurement systems (Engelbrecht, 1997; Wellenius, 1988; Apte & Nath, 2004), lackluster categorization methodology (Apte & Nath, 2004), use of unadjusted statistics which may inflate the size of the information economy (Apte & Nath, 2004) and the reflecting of a mixture of information and service-business activities rather than knowledge (Arrow, 1984). Our content analysis confirms these critiques' assertions that the assertion and reported numbers of Porat and Rubin lack measurement theory, and there was inadequate classification between information and non-information activities. Let us elaborate. First, the data reported by Porat and Rubin was obtained from government statistics where the various production and service activities are measured on the traditional value-added basis rather than on innovative or information-based basis. Due to this, actual information activities are not differentiated from economic activities. Second, due to inadequate classification between information and non-information activities, goods and jobs, we consider the actual size of the information economy as advocated by Porat and Rubin to be overstated. Third, we argue that even if we accept Porat and Rubin's classification and measurement methodology, new information activities continually emerge with the advent of new technology, the application varies and the nature and scope of occupations have been continually changing making it imperative that the list of information activities, application and occupations be evaluated and updated regularly. Fourth, we notice that much of Porat and Rubin's ideas are derived from earlier precursors (i.e. Machlup and Drucker) with little innovation of their own, and thus their works do not sit well in rigorous academic research.

The Second Wave of Studies on the Knowledge Economy

The works of Nonaka (1991, 1994) and Nonaka and Takeuchi (1995) have attracted numerous commentaries and relentless attacks for their (1) conception of knowledge and (2) knowledge creation (innovation) and knowledge management. First, critiques such as Jorna (1998), Wilson (2002), Hildreth and Kimble (2002) and Gourlay (2006) have criticized that Nonaka and his co-authors link tacit knowledge to an East-Asian phenomenological epistemology that is heavily influenced by Confucianism, Zen Buddhism and the collectivism culture of East Asia when putting forward their tacit and explicit knowledge arguments in advancing the concept of knowledge for commercialization. Second, Nonaka and Takeuchi's SECI framework is subjected to the critiques that it is oversimplified in catering for knowledge management as the articulation of knowledge appeared to be possible even for tacit knowledge, and their statement that the sharing of knowledge can be achieved through a socialization process seems obnoxious (Jorna, 1998; Choo, 1998; Wilson, 2002; Hildreth & Kimble, 2002; Swan & Scarborough, 2002; Styhre, 2003; Kupers, 2005; Gourlay, 2006).

We consider the criticisms of Nonaka and Takeuchi on both counts to be misguided, myopic and unwarranted in many respects. First, basing on content and critical analysis, the critiques against Nonaka and Takeuchi of using non-Western epistemology in advancing an interesting new phenomenon of firms using knowledge in managing activities that can improve a country's competitiveness are not based on constructive substantiation or hard evidence that there is any fallacy of East Asian philosophy as used in knowledge application. We also argue that the study of knowledge has been heavily undertaken in East Asia for thousands of years where Confucianism, Shintoism, Taoism and Buddhism play a great part in instilling what knowledge is about. We however, recognize that there are differences in the approach between East Asian and Western epistemology, but the outcome is likely to be the same. Based on the prevailing traditional Western epistemologies, knowledge has mainly been gained through observation and reasoning; however, in traditional Chinese thought, knowledge has been understood in a much broader sense (Rosker, 2014). More specifically, Western philosophy is about dialectics which contains thesis and antithesis and how they are resolved through synthesis, whereas in Eastern philosophy, a phenomenon such as KM is viewed as inherently paradoxical where the interrelatedness of the phenomenon in question is in terms of opposites that neither compromise nor repel each other but rather work in the dynamic combination of those dual entities and thereby build a composite whole (Chae & Bloodgood, 2006). They state that knowledge exists in the form of both tacit and explicit and, as such, social and technical, together building one composite whole—the Tao or the 'ideal' approach to KM—implying that in duality, unity is found (Chae & Bloodgood, 2006, p. 7). As a consequent, these critiques fail to see and understand how Eastern countries such as China, Japan, South Korea and Taiwan (China) have successfully managed knowledge in pursuing innovations and inventions.

Second, in retrospect, Nonaka and Takeuchi had indicated that their approach in establishing a workable knowledge-based model is still ongoing and various aspects of work still remain to be done and called for more research to validate his model. Instead, these critiques merely argued that tacit knowledge is difficult to articulate, and hence it is quite impossible to transfer since 'tacit' means 'hidden', and that *tacit* knowledge is hidden knowledge. This testimony is nothing new as it was posited by Polanyi (1958), but these critiques failed to understand that in Nonaka & Takeuchi's thesis, tacit knowledge alone does not suffice, that a socialization process is needed to transfer tacit to explicit knowledge in creating knowledge outcome. Notwithstanding these criticisms, the SECI framework has now attracted many prominent researchers such as von Krogh, Davenport, Prusak and Volpel and they have contributed to the refinement of the framework.

Opponents of van Dijk's network society consider that his form of society organized around global networks of capital, social, management and information through the multiplicity of interconnected tasks to be nothing more than a contemporary society (Fuchs, 2009). There is nothing theoretical about how a society can become a network society besides by stating propositions and facts that are currently in existence (Webster, 2002a, b, 2004). From the writings of critiques, we detected that there are two key issues of the network society as advocated by van Dijk. First, this kind of network society may only be achieved partially as it depends

on high educational attainment and high educational use (see Di Maggio & Celeste, 2004) and is perceived in creating a *digital divide* (see Norris, 2001; Nakata, 2002; Rice & Haythornthwaite, 2006; Abdulla, 2007; Sharma et al., 2008; Allagui, 2009). To us, the reported increasing, widening and thickening of networks in nature and society by van Dijk indicate that networks have become the nervous system of society rather than one that helps to bridge people and society through the application of technology. Second, in view of the first point, even developed countries are not able to develop into a full-fledged network society as advocated by van Dijk.

Our analysis indicates that the content of the network economy as advocated by Castells is nothing more than a rephrasing of the term *information economy* or *knowledge economy* as his assertion has been made before by Bell, Porat, Rubin, Nonaka and Takeuchi, among others. This is nothing more than technological determinism (see Webster, 2002a, b, 2004; Garnham, 2004a). Thus, in our view, networks and the network society are nothing new. If there is anything new, it can be perceived as the microelectronics-based, networking technologies that provide new capabilities to an old form of social organization that characterized the industrial society. That is, the network society is viewed as a *social economy*, and it has very little to do with factors of production or knowledge management.

We analyse the content of the description of the *knowledge society* advocated by the UN and UNESCO, and the *knowledge-based economy* by the OECD. According to Godin (2004, 2006), the writings of the UN, UNESCO and the OECD lack academic rigor and instead they are meant to be rhetoric. Relatedly, Smith (2002, p. 6) indicated that the various terms linked to an economy that is referred to as ‘knowledge-intensive’ or ‘knowledge-based’ are used in a superficial and uncritical way as there is no coherent definition, let alone a theoretical concept to explain their differences from one another. UNESCO led us to believe that lifelong learning can be achieved by uniting the community of scientists, researchers, engineers and technicians, research networks and firms involved in the process of research and production of high-tech goods and services, and so doing will integrate into international networks on production, distribution, use and protection of knowledge (Hadad, 2017). From our analysis, the term *knowledge society* is conveniently coined to tell us that we live in a ‘Shangri-La kind of society’. However, the statistical outcome tells another story. Although both bodies (which are under the same umbrella) use the same data and the same statistical technique, they produce different outcomes and these differences reflect different understandings of what the knowledge society is (see Oxley et al., 2007, p. 17), suggesting that the characterization of the *knowledge society* is flawed.

The term *knowledge-based economy* is rhetorical (Godin, 2004, p. 680, 2006, p. 19), a metaphor ‘often used in a superficial and uncritical way’ (Smith, 2002, p.5), and is a buzzword (Godin, 2004, p. 688). To Godin (2004, 2006), the moves by the OECD appear sinister as they led us in falsehood in believing that the new economy is already in existence or is a paradise we ought to aspire. To Sharma et al. (2008, p. 152), the concept of a knowledge-based economy is nothing more than an information economy except that the former is broader as, in addition to technical knowledge, it also includes culture, social and managerial knowledge. The OECD, being a grouping of developed countries, is often a political tool for member governments in promoting familiar proposals around training, skills and infrastructure and sustainable growth coupled with better education

and wider access to high-speed internet, and yet, the amount of public investment of those activities contemplated is comparatively low (O'Donovan, 2020).

Finally, we evaluate the content of EBRD. The priority areas for EBRD operations and activities are laid out in Article 1 of the institution's founding constitution, which are (1) developing the financial sector through technical assistance to governments and bank officials; (2) supporting the creation of new financial institutions; (3) developing infrastructure, information technology, telecommunications and transportation, improving energy consumption and ensuring a healthy environment; (4) converting the military industry for civilian use; (5) general privatization; (6) restructuring existing industries; and (7) supporting small and medium-sized enterprises (Besley et al., 2020; Shield, 2020). These overlap considerably with the objectives of the IMF and World Bank. Many critiques and NGOs have criticized the EBRD on the lack of progress the Bank makes in its main mission, the 'transition towards open, democratic and progressive market economies'; moreover, they consider some of its funded projects to be environmentally and socially harmful (Neslen, 2015; Bankwatch, 2017). Therefore, the EBRD aims at engaging policymakers and influencing policy debates rather than adopting policies actively provocatively towards a knowledge economy. Moreover, there is a general lack of economy or any theory and relatively little academic analysis of the EBRD, yet it is an institution in the vanguard of development strategies both in and increasingly well beyond Eastern Central Europe (ECE).

We summarize the key commentaries of the *knowledge economy* as advocated by the precursors of the field in Table 2.

In our content analysis, we found that all of the 27 key commentators of the first wave of studies on the knowledge economy were critical of the views of the precursors. The works of Machlup, Drucker, Porat and Rubin, and Bell are closely related, but the definition of knowledge (information) by these precursors is so wide that it is anything but knowledge, and an appropriate statistical technique in classifying information and knowledge is wanting. For instance, when describing how knowledge workers use their heads, not hands, in producing goods and services, Drucker also mentioned that these workers should also like to please the boss. And when he wrote about social, political and economic changes of the 'postcapitalist' era of the 'First World Nations', meaning the USA, ordinary citizens become virtually owners of the great American enterprises, i.e. being owners of the capital in overcoming capitalism—an arresting statement that has little to do with the knowledge economy. Nevertheless, in spite of certain inaccuracies, we regard Drucker's works of merit where he did make a number of accurate forecasts, as well as astute perceptions of 1993 that remain true today: (1) the developed countries will be inundated by a human flood of Third World immigrants; (2) in knowledge work and in most service work, the machine (if any) is a servant to the worker; (3) a severe problem is the diversion of the scarcest resources—trained engineers and scientists to economically unproductive defence work—the malefactor being the USA where over 70% of all money spent on R&D is spent on defence work (affirm by Phillips et al., 2017); and (4) knowledge, knowledge workers and technological progress determine quality of products—the case of Japan being the first non-Western nation in modern times to become a great economic power. According to Drucker (1993), the winners in this new economy will be those who master knowledge about knowledge.

Table 2 Major criticisms of the knowledge (information, network, management) economy (industry, society) in relation to research implications

Terms	Key publications	Gist of their writings
Knowledge industry	Machlup, (1962)	<ul style="list-style-type: none"> • Definition of <i>knowledge industry</i> is extremely wide • <i>Knowledge industry</i> lacks economic theory • Definition of <i>knowledge</i> is ambiguous • Data of <i>knowledge industry</i> is suspect • Market for information is flawed
Knowledge economy	Drucker, (1969, 1973, 1999) EBRD, (2019)	<ul style="list-style-type: none"> • Writings lack academic & scholarly content • Some of the anecdotes are factually wrong • Definition of <i>knowledge worker</i> is suspect • Writings contain contradiction • Financial and political focus rather than on KE • More on policies on specific projects rather than proactively trying to engage in improving the economy
Post-industrial society, information society	Bell, (1973, 1974, 1979, 1980)	<ul style="list-style-type: none"> • Writings are wide and use imprecise terms and stress discontinuity • <i>Post-industrial society</i> is only a label as it does not show logical extension of industrial society and capitalist economy • <i>Post-industrial society</i> shows lack of economic & sociological theories
Information industry, information economy	Porat, (1977); Porat & Rubin, (1977)	<ul style="list-style-type: none"> • Lack theory • Lack valid empirical methodology • Overly reliance on Machlup's methodology • Used inappropriate measurement system • Lack of proper measurement system
Dynamic theory of organizational knowledge creation	Nonaka, (1991, 1994); Nonaka & Takeuchi, (1995); Von Krogh et al., (2000a, b)	<ul style="list-style-type: none"> • Conception of tacit knowledge is controversial • Overlooked learning theory re knowledge creation & knowledge sharing • SIEC is oversimplified in catering for knowledge management • Knowledge management is overfocus on IT

Table 2 (continued)

Terms	Key publications	Gist of their writings
Working knowledge, knowledge management	Davenport, (2005); Davenport & Prusak, (1998, 2000); Davenport & Volpel, (2001)	<ul style="list-style-type: none"> • Knowledge management lacks theory • Tacit knowledge as used in knowledge management is suspect • Difficulty of measuring knowledge management
Network society	Van Dijk, (1999, 2006)	<ul style="list-style-type: none"> • No theoretical basis of network society • Network society is merely a narrative prescription of hypotheses and facts of contemporary society • Notion of digital divide is real and apparent as it is imperative for all to attain the levels of knowledge and resources needed to become one
Network society	Castells, (1996, 1997, 2000a, b, 2010)	<ul style="list-style-type: none"> • There is no tenet of a network society • The network society is essentially an information economy/society • Difficult to commodifying information & measuring output attributed by information • Discourse is normative that lacks valid reasoning in economic or sociological meaning
Knowledge society	UNESCO, (2003, 2005a)	<ul style="list-style-type: none"> • 'Concept' of knowledge society is flawed • Many of the indicators lack statistical attribute • Incompatible outcomes of UN and UNESCO even though both are of same organizational umbrella
Knowledge-based economy	OECD, (1996a, b, c, d, 1998, 2000, 2004, 2010)	<ul style="list-style-type: none"> • Knowledge-based economy is a rhetoric term, a metaphor and superficial, a buzzword • Created falsehood that the knowledge-based economy is a paradise

Of the 33 key commentaries of the second wave, only the works of Nonaka and Takeuchi received some favourable commentaries, and in fact, their notable work on the SECI framework has been embraced by notable researchers. We consider that Nonaka and Takeuchi had initiated a difficult paradigm of articulating tacit knowledge in the conception of knowledge in knowledge creation (management) where, if properly transferred (applied) among knowledge workers, it would lead to the sustaining of competitive advantage of firms and the collective effort of firms would enable the country to prosper in the future. On the contrary, the *network society* expounded by van Dijk and Castells is nothing more than a mere extension of the *information economy*. Third, we rule out the writings of the UN, UNESCO, OECD and EBRD to be scholarly and worthy of research consideration as they not only lack academic rigor but also meant to be rhetoric or myths. Moreover, we see they serve certain government policies and political agendas that are geared towards the West, particularly the OECD and the EBRD.

We feel that one particular crucial aspect both the first and second waves of studies of the knowledge economy have missed out is health matter—to build a strong and progressive society/economy, there must be in place a good health system to take care of not only knowledge workers but also the population in general. Investment in health is not only desirable; it is an essential priority for most societies. This is especially so in view of the current Covid-19 pandemic. Healthcare performance is strongly dependent not only on the economy but also on the health systems themselves: all these are essential to a healthy society (Eissa, 2020).

Theoretical Consideration in Advancing the Research on the Knowledge Economy

Seeking Common Ground in the Furtherance of the Research of the Knowledge Economy

Despite the various issues surrounding the works of the knowledge economy, there are commonalities of thoughts and propositions among the precursors, suggesting that there is a common ground for us to establish some theoretical foundations of the field. First, we need to rationalize whether the terms *economy* and *society* have any significant difference in meaning. The relationship between economy and society and how it is determined is a matter of theoretical debate. The classical economists (including Emile Durkheim, 1858–1917; and Max Weber, 1864–1920) have articulated a new form of the economy (at their time) in a way where people envisage is probable. Durkheim viewed the economy as one of the numbers of social institutions that make up a society, and Weber viewed the economy in part as an extension of social values and religious belief. Therefore, the economy and society are inextricably linked.

Second, in our critical analysis, we realize that the differences in terms used by the precursors of the knowledge economy are partly due to the time factor because the stages of the economy change with time. In the *industrial economy*, an old economic dictum of Adam Smith (1723–1790) existed from the eighteenth

century in which agricultural products and mass-produced manufactured goods were the key components of the economy, and the majority of workers were farmers, clerks or machinists. The *post-industrial economy* (*information society*) is the period from the late 1960s where mass production from the developed countries shifted to developing countries, and the mainstay of economic activities of the developed countries is services supported by technology (mainly computerization) and changes of society (social values).

Nonaka, Takeuchi, Davenport, Krogh, Prusak and Volpel focus on knowledge on the organizational level, i.e. knowledge management, which when aggregated among firms would contribute to the notion of the knowledge economy. This period is around mid-1990s. Despite critiques claiming that there is no difference between an information economy and a knowledge economy, we argue that knowledge is more than information because knowledge is being creative and innovative (i.e. it uses information to make things different from others), thus giving us a competitive advantage. That is, the use of knowledge is increasingly of a greater magnitude and importance in a knowledge economy era (Houghton & Sheehan, 2000; Giddens, 2001; Powell & Snellman, 2004; Roberts, 2010; Garza-Rodriguez et al., 2020). In a study conducted for Mexico, the results show that the impact of human capital on economic growth is almost three times greater than that of physical capital (Garza-Rodriguez et al., 2020). Notice that none of the precursors emphasize on production and consumption. The various stages of economic (societal) development are depicted in Fig. 1.

Figure 1 shows the evolution of the economies (societies) from the pre-industrial to industrial stage and finally to the post-industrial stage. In the post-industrial stage, three variations of economies/societies are envisaged. The information economy (society) is the progression from the industrial economy (society). While there is a progression from the information to knowledge economy, the path of the network society is difficult to envisage as it appears that it is in a stage of a continuum but

Fig. 1 Stages of economic and social development

where it is heading is unknown. It does not mean that once a country/society has attained a high amount of ICT expenditure or economic development, it can be considered a knowledge economy. Take the case of Hong Kong, HK (China), many of its residents and HK specialists regard HK as a knowledge economy, but in actual fact HK is predominately a service economy rather than a capital-intensive technologically advanced economy. Zhu and Chou (2020) indicate that although HK has made improvements in knowledge-induced productivity from 1991 to 2011, it still has some ways to go to meet the requirements of a knowledge economy. There is still an economic gap between occupations that are knowledge-intensive and knowledge-non-intensive, and there are overeducated employees who find themselves unemployable. Unless these deficiencies are addressed, transforming HK's economy from a service economy to a knowledge economy appears unattainable.

What is more important is that, from the study of the various precursors' works, we are now getting nearer in understanding this new kind of economy, i.e. by finding a common ground to show how a society becomes a knowledge economy:

- We estimate the starting point of the knowledge economy to be mid-1990s.
- There is no difference whether the new economy is viewed as an economy or society.
- The knowledge economy is not really an economy based solely on production and consumption by exploiting labour and capital, but it is based more on a social value and structure.
- Extensive use of technology and the ability for us to exploit them for commercial reasons and for personal and organizational enjoyment (i.e. *sociability* or societal benefits).
- Extensive use of innovation to commercialize knowledge (knowledge creation, knowledge management)

Theoretical Framework of the Knowledge Economy and Its Usefulness for Future Research

The discussion from the previous subsection provides us with the theoretical foundation needed to define a knowledge economy (see Fig. 2).

In Fig. 2, the knowledge economy consists of sociability, technology, knowledge and innovation, and knowledge products.

The authors/articles who have contributed to our foundation of the Knowledge Economy/Society are presented in Table 3:

Our discussion of the sub-header will be made in conjunction with Fig. 2 and Table 3.

Social Economy

In our critical analysis, we found that the knowledge economy is not an all-encompassing economy as it cannot address (all) the various aspects of technology, innovation and organizational and people's needs. Moreover, the knowledge

Fig. 2 Suggested key aspects of the knowledge economy that may be considered as the common ground in researching the field

economy lacks a theory. In our search for solutions, we found that this kind of economy that can offer us with good explanations of the radical change in the ways people think and expect in a society, and how organizations (institutions) are utilizing innovation by tapping the power of technology in creating knowledge products in the furtherance of the economic well-being of a society (country), is viewed in terms of the *social economy*.

We found that the idea of the social economy has attracted researchers, governments and non-government agencies especially in continental Europe and Canada (Gueslin, 1987; Demoustier, 2004; Moulaert & Ailenei, 2005). According to these writers, the social economy apparently arises through the progression of time, and its theoretical foundation can only be analysed by combining a ‘history of practice’ with ‘a history of thought perspective’. The nineteenth century ought to be taken as the formative era of the modern social economy as it was characterized by an outburst of ideas, concepts and experiences; cooperative, associative and social awareness; institutional and utopian initiatives and the emergence of social, economic and political liberal philosophies in reaction to the social brutalities (poverty and exploitation), and political indifference (lack of social welfare) of the Industrial Revolution. This assertion is also shared by Le ‘vesque et al. (2001; cited in Moulaert & Ailenei, 2005).

These writers also asserted that the theoretical arguments tend to be recurrent, and that the social economy is not an economic system on its own as there are diverse views of the foundation of this kind of economy. The diverse views may create a magnitude of possible theoretical foundations of what constitutes a knowledge economy. Because of these, it is exceedingly difficult, and probably not scientifically useful, to reconcile the wide world of initiatives and activities connected to the social economy in a ‘one for all’ definition (Moulaert & Ailenei, 2005).

Table 3 Authors (articles) who contributed to our foundation of Knowledge Economy/Society

Authors/articles	Genre (relevant key content)	Knowledge economy criteria
Bell, (1973, 1974, 1979)	Post Industrial Society (Information Society (IS)	Social-economy
Drucker, (1992a, b, 1993)	Knowledge workers, Post-capitalist society	Social-economy Technology (ICT)
Van Dijk, (1999, 2006)	Network society	Knowledge products (commercialization and personal enjoyment)
Nonaka, (1991, 1994); Nonaka & Takeuchi, (1995); Nonaka & von Krogh, (2009)	Tacit and explicit knowledge, knowledge management, SECI model	Social-economy Technology (ICT)
Davenport, (2005); Davenport & Glaser, (2002); Davenport & Prusak, (2000); Davenport & Volpel, (2001)	Knowledge management	Knowledge and innovation (knowledge creation) Knowledge products (commercialization and personal enjoyment)
		Knowledge and innovation (knowledge creation)

In our content and critical analyses, we find that one social thesis that takes into consideration personal needs is the one that has been put forward by the international philosopher, author, poet, composer and linguist, P.R. Sarker (1921–1990). A series of lectures were published in 1959 as *Idea and Ideology*, where Sarkar described a socio-economic theory which he called *Progressive Utilization Theory* (PROUT) (Sarkar, 1959). The PROUT is based on progress, philosophy of life, spiritual belief and utilization of the qualities of practical education (as against academic education), morality and socio-economic consciousness in an economy in order to provide a good standard of living to all people and to see that economic power is not concentrated in the hands of a few.

In some ways, PROUT philosophy is akin to Drucker's (1993) *Post-Capitalist Society*, Bell's (1973) *Post-Industrial Society* or van Dijk's (1999) *Network Society* in which developed societies that have exploited IT successfully will be able to transform from an agricultural economy to knowledge economy—towards a utilization society where there is a good standard of living to all people and to see that economic power is not concentrated in the hands of a few. Bell asserted that his thesis is about the attainment of an industrialized society and is not universal as it relates only to the USA while Drucker's thesis applies only to developed countries such as the USA, Western Europe and Japan, and van Dijk considers that all countries are capable of attaining the network society status if they have successfully utilized IT. Except for van Dijk, the various KE writers are rather biased as they see that only the USA, Western Europe and Japan can become advanced economies. Little did they realise that South Korea, Taiwan (China) and soon China would become advanced technological countries.

It is true that the USA, Western Europe and Japan are wealthier countries than some of the developing countries, and so they can invest in a variety of things notably in health care. For instance, the USA devotes more of its national income to healthcare relative to other OECD countries where the OECD averaged about 8.7% of annual GDP; healthcare spending in the USA, however, stood at 17% while the rest of OECD countries range between 9.0% (Spain) to 12.1% (Switzerland) at 2019 (World Bank, 2020). This compares with 5.08% (Sub-Saharan countries), 7.96% (Latin American & Caribbean countries), 3.48% (South Asian countries), and 6.67% (East Asian & Pacific countries) (World Bank, 2020). Higher healthcare spending can be beneficial if it results in better health outcomes. But looking at the statistics, surely the USA and OECD countries would have spent much more on health and the outcomes ought to outperform developing countries. However, this is not the case. In view of the Covid-19 pandemic, the USA and developed countries fare worse than some developing countries notably East Asian countries like China, Taiwan (China), Vietnam and Thailand. High administration costs including salaries of medical professionals and high medicine costs are among the reasons cited why the USA and OECD countries have higher healthcare expenses in relation to developing countries (Peterson Foundation, 2020). Moreover, pandemic preparedness and response capacity of these countries are less efficient compared with the East Asian countries. Pandemic preparedness is not a new concept as several pandemics have occurred before. For instance, China and Vietnam can plan, mobilize and utilize resources and deploy emergency assets in quick time and they can treat and monitor patients on a sustainability basis. A healthcare system with high costs, inadequate preparedness

and response and poor outcomes undermines our economy and threatens our long-term fiscal and economic well-being. Indeed, the recent pandemic has given a basic message: investments in health and the design of health financing policies should be addressed in terms of the interaction between health and the economy (Eissa, 2020). Just as growth, income, wealth, investment and employment are a function of the performance and quality of the economic system, its regulatory frameworks, trade and political policies, social capital and labour markets, etc., so health conditions (mortality, morbidity, disability, ability to confront pandemic) depend not just on standards of living but on the actual performance of health systems themselves.

Our analyses also reveal other useful findings. In an extensive study of the social economy of Canada, and in particular, Quebec, Ninacs and Toye (2002) articulated that the social economy is not an entirely new type of economy, consistent to the contention of Gueslin (1987), Demoustier (2004) and Moulaert and Ailenei (2005). Instead, Ninacs & Toye argued that the ‘newness’ related to the evolution of the social economy over the past 35 years or so is due to the presence of new types of people who become promoters or members, new stakeholders, new fields of activity, new organizational forms and new internal and external dynamics. Although many aspects of Ninacs and Toye’s (2002) arguments relate to knowledge and innovation, the indicated timeframe of the social economy evolution, which was supposed to arise in 1965, was a bit far-fetched from our posited period (mid-1990) of the formative years of the knowledge economy.

We found Brown’s (2008) work on the social economy relevant. Drawing on a wide range of writings on the social economy, Brown (2008) finds it useful to think of the theoretical foundation of the social economy in the following ways: (1) it is a branch of the economy that is concerned with the relationship between social behaviour, people well-being and economies, and (2) it is not an unorthodox school of economies (e.g. classical or neo-classical theories) and often takes into account subject matters outside the focus of orthodox economic theories. Thus, the social economy encourages people and society to utilize resources to satisfy human and community needs, including humanity, changes of educational and economic development, promotion of thinking and innovation in which human and society can collectively earn their minimum necessities through appropriate work in producing knowledge products. This *economic system* can be regarded as the organizational arrangement and process through which a society makes its production and consumption decisions which society deems desirable, like efficiency, growth, liberty and equality, consistent with what Conklin (1991) had advocated earlier.

In a similar vein, Nasioulasa and Marisb (2011) indicated that the social economy enhances the promotions of social cohesion, innovative entrepreneurship and employment with the help of digital and network technologies, thus sustaining an economy with a rising social need and the demand for uninhibited access to digital content throughout the cyberspace. This invariably is mainly orientated towards the use of computer technology for the creation of knowledge products. Knowledge products require innovation, and the importance of innovation is even more important in recent years as many markets have become mature, and many mature companies have failed to survive as they fail to capitalize on the exploitation of technology to innovate their products (see Lynch & Jin, 2016).

Therefore, in our view, we rule out PROUT to have much relevance to the knowledge economy as the first is too political with a heavy emphasis on the equilibrium of social needs and social and spiritual well-being. We consider that the knowledge economy is a branch of the social economy (as in Brown, 2008) (see also in Gueslin, 1987; Demoustier, 2004; Moulaert & Ailenei, 2005; Nasioulasa & Marisb, 2011) that is tied to social innovation, reliance on knowledge and technology and use of new types of production in churning out knowledge products or exploiting new markets that bring it into the realm of economic innovation. This is brought about by social entrepreneurs (innovators) working in social organizations where these entrepreneurs combine creativity with pragmatic skills in pioneering new solutions to social problems and in doing so change the patterns of society. Thus, the knowledge economy is a social change theory, much akin to Lewin's contemporary social organization and management change model (see Huarng & Mas-Tur, 2016).

Technology (ICT)

In our content and critical analyses, this new kind of economy is made possible through the explosion and exploitation of technology, in particular ICT which begins from the mid-1990s, largely due to the emergence of the dot.com's. From our review of the studies of the precursors of the knowledge economy, technology drives two key dynamics: (1) the improving functionality and commercialization of products and services and (2) the reducing unit cost of supplying them. Industry-wide progress clearly gives rise to products that would not have been possible just a few years earlier, and at increasingly affordable prices. Adapting to technological progress is important because the knowledge economy is a continuously adapting field between the public and private sectors, individuals and organizations in which there exists a rising social need and demand for uninhibited access to ICT especially semantic web and digital content throughout the cyberspace. The development of technology allows organizations and the public in benefitting not only from participating to the availability of many new commercial software but, more importantly, from sharing data and their interpretation of information (Robinson & Bauer, 2011). This includes innovative modalities among content, user and transit such as peer-to-peer networks that have substantially enhanced digital content delivery (Nasioulasa & Marisb, 2011). In Australia, the introduction of the national curriculum in 2013 places high emphasis on the integration of digital technologies throughout key learning areas. There are pedagogical justifications for using ICT across the key learning areas as young children must be made exposed to ICT literacy as it is clear that children learn to use technological devices very quickly (ICTE, 2020).

We found that Drucker's integrative thinking illuminates the special obligations imposed by technology on modern business organizations. From witnessing the early development of technology in industry, Drucker noticed that in organizations, management and society there has been a massive overall change in the nature of technological work during our century—a change in its structure, costs, methods and conceptual underpinnings.

We can connect that the rise of the information society will see the emergence of a network society in which information, computer and technology will enable the formation of networks among users. Essentially, the network society, as Van Dijk sees it, can explain a new type of society where social relations are organised within mediative technologies that form a communication network rather than networks typified by face-to-face social relations. The network is developed in a society that allows for a great deal of information to be processed, exchanged and disseminated to help improve information and communication technologies—that is, it facilitates the globalization of IT.

The technological capability must be harnessed at both the micro and macro levels (Berners-Lee, 2010). For example, firms use serious games (i.e. video games used in a professional context) to make training more exciting and immersive as they take players into virtual worlds where they learn and experience real-world scenarios in a funny and entertaining way (Allal-Chérif & Makhoulouf, 2016). On the macro level, we argue that technological innovation and ICT represent a way for knowledge economic countries to foster economic development, exploit technology (ICT), improve levels of education and training and address social (societal) issues within a knowledge economy, a view similar to OECD (2015).

Technology prowess does not stem from high ICT spending. High ICT spending by a country may have poor IT utilization, as seen in the case of high health spending which may have low health outcome. Following years of growth, ICT spending will remain relatively flat in 2020 due to the COVID-19 pandemic, and in the next 5 years, all growth in traditional tech spending will be driven by just four platforms: cloud, mobile, social and big data/analytics (ZDNet, 2020). For instance, Singapore has been spending heavily on ICT for the past years and the government plans to increase its ICT spend by 30% in its fiscal 2020 (ZDNet, 2020). However, Singapore is not considered a knowledge economy because most of its technology comes from abroad. Wang (2018) found that over 70% of Singapore's private sector R&D expenditure and the bulk of industry patents came from foreign multi-nationals, and there is evidence that innovation is government 'push'. Moreover, she is ill-equipped to handle and maintain technology as seen on 14 October 2020, when a damaged power cable led to a series of events that caused a major subway (MRT) disruption affecting three train lines—an incident which transport experts said could have been avoided (Straits Times, 2020 Dec 16).

Knowledge and Innovation (Knowledge Creation)

We argue that the rise of the interest in the knowledge economy has meant that economists have been challenged to look beyond labour and capital as the central factors of production. More recently, Aghion et al. (2004) have indicated that innovation (knowledge creation) in inducing competitiveness among organizations is considered a third important factor of production. In today's complex, competitive and turbulent environment, the need for innovation in products and processes is widely recognized and organizations are required to apply new technologies and to innovate timely in anticipation of changes in the marketplace rather than as a reaction to business decline (Rahimi, 2017). Although knowledge and innovation have been widely discussed by the precursors of the

second wave of studies on the knowledge economy, there are gaps in their articulation, viz. on how knowledge and innovation can help in transforming an economy to one that is based on knowledge. We will now explain this.

We consider that knowledge is a valuable input that drives innovation, and the output is *knowledge product*. Knowledge products will be discussed in the next subsection. In between input and output is knowledge management. Nonaka (1991) described tacit knowledge as the fuel for innovation but was concerned that many managers failed to understand how knowledge could be leveraged. Organizations are more like living organisms than machines, he argued, and most viewed knowledge as a static input to the corporate machine. Nonaka advocated a view of knowledge as a dynamic mechanism—renewable and changing—and that knowledge workers were the agents for that change. Nonaka and Takeuchi then forwarded the argument that creating knowledge will become the key to sustaining a competitive advantage for organizations in the future. As the competitive environment and customer preferences changes constantly, knowledge perishes quickly and therefore managers and knowledge workers must rejuvenate it. In addition, Nonaka and Takeuchi show that, to create knowledge, the best management style is neither top-down nor bottom-up, but rather what they call ‘middle-up-down’ in which the middle managers form a bridge between the ideals of top management and the chaotic realities of the frontline workers. Thus, knowledge-creating companies, Nonaka and Takeuchi believed, should be focused primarily on the task of innovation.

Innovation can be attributed to various sources, and innovative processes usually involve identifying customer needs, macro and micro trends, developing competencies and finding financial support in order to sell the innovation—a strong motivation for the commercialization, or value creation of knowledge. Businesses must engage customers to develop products that sell. Interestingly, more recently, the casual claim between customers and innovations have been reversed in which customers are the ones that are important in the development of new innovations for commercial purposes (see Lettl et al., 2006; Desouza et al., 2008; Oberg, 2010). The innovation process ends upon the successful transformation of knowledge to innovation, resulting in the creation of value enhancement intellectual capital (IC), or intangible assets (IA) as called in accounting, which can generate future benefits to organizations (see Choong, 2008; Lages, 2016).

Knowledge Products (Commercialization and for Personal Enjoyment)

So what actually are *knowledge products*? The literature indicates a wide range of activities that can constitute knowledge products such as skills, knowledge, know-how, work-related experience, competencies, education, creativity, brand, trademarks, intellectual property (IP), copyrights, trade secrets, work procedures and software, among others. We found that these products are no different from the products of the old economy. There is no clear definition. Drucker attempted to describe knowledge product in a protracted manner. Knowledge workers put knowledge to work and that information is not knowledge. Information must be applied to specific work, and there must have improved performance for it to be classified as knowledge. Drucker emphasized that only human beings with their

brains and/or the skill of their hands can convert information into knowledge. The outcome of which the products so developed are new—i.e., newness determines a product to be knowledge product.

As Nonaka and Takeuchi pointed out, ‘understanding how organisations create new products ... is important. A more fundamental need is to understand how organisations create new knowledge that makes such creations possible.’ Given in today’s competitive market, technological changes, customer demands and revolutionary technologies combine to place pressure on organizations to constantly innovate and provide cutting-edge outcomes. Nonaka, Takeuchi, Davenport and Völpe have indicated that the key is innovation and developing innovative capabilities such as architectural innovation capability enhances firms’ ability to respond to market demands by producing innovative products and services and can have a profound impact on their performance.

For us, knowledge products differ from other kinds of products in that their relevant and useful aspects reside primarily in the *content* that can be *extracted* from them, and as such, any physical manifestation thereof is usually at best a *carrier medium*. It is about talented people, either on their own or through organizations, on how they use their knowledge to innovate ideas to produce knowledge products. Also, they must have appeal so that the products can be commercialized. Thus, the creation of knowledge products creates social benefits to people, organizations and society. From these explanations, we rule out knowledge work (jobs), such as skills, know-how, work-related experience, competencies, education and work procedures, to be knowledge products.

From the literature and our analysis, knowledge products are indeed difficult to define. Hence, we use an illustration to explain what exactly knowledge product is. Take the case of a mystery killer storybook written by an author. The book is a physical item, not a knowledge product, and the knowledge product is the intriguing story of the book, which is the research, innovative and artistic outcome arising from the tacit and explicit knowledge of the author, which are required to make it different from another story. Similarly, let us take a look at the music, dance and song of Billie Jean by Michael Jackson. The CD is a physical item, not a knowledge product, and the music, dance, expression and choreography, collectively, are the actual knowledge product. From these two examples, we explain that the physical element and the intellectual element must be differentiated or else there is no clear boundary between a tangible and intangible item. It can be seen that an intangible item cannot exist on its own right. In fact, both tangible and intangible items are complimentary of each other in the form of a knowledge product. Blended together, they create values and bring competitive advantage to the developers (talented people) and organizations. More importantly, the creation of knowledge products necessitates innovation and knowledge sharing, and the commercial outcome is benefits to people and organizations that use them, i.e. a social-economic perspective. More specifically, Muriel and Serrat (2009) and Rooney et al. (2012) have described *knowledge products* as the outcome of the production of knowledge, much of which represents intellectual capital.

There is no data for knowledge products by country. The closest data we obtained is data for high-technology exports in current prices published by Knoema which compiles data for the world and country level from sources such as the World Bank, IMF and OECD. Knoema defines high-technology products as products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments and electrical machinery. In 2019, Knoema ranks HK (China) to be the largest exporter of high-tech products, follow by Germany and the USA. Mexico is placed seventh and Belgium is placed eight. China, which is recognized as a factory for high-tech products, is not represented in the list which consists of 43 countries. Comoros, a country consisting of several tiny islands with less than a million people off the coast of Mozambique (East Africa), is ranked 43rd in terms of largest export of high-tech products. Ironically, HK (China) and to a lesser extend Mexico and Belgium are not really into manufacture of knowledge products. Surely, Comoros is not into high-tech knowledge products. Therefore, reliance on published statistics is misleading as seen in the case of health care and technology prowess.

The framework of the knowledge economy and the statistical assessment methodology proxied by the four proxies are as shown in Table 4.

‘Apparent’ Knowledge Economy Countries

This is the ultimate work with respect to this research, as there is no precedence or methodology concerning how countries can be construed to be knowledge economies. What is important is to establish the statistical assessment methodology

Table 4 The framework of the knowledge economy and the statistical assessment methodology proxied by the four proxies

Proxies (indicators)	Knowledge economy criteria
Social progress The Index measures social progress using 53 indicators across areas including personal safety, environmental quality, personal freedom and choice, nutrition and basic medical care	Social economy
IT usage Based on communications and connections (esp. the Internet), IT usage, facilities, usage of computers/IT tools from the government needed to promote good lifestyle and requirements of society to enjoy their life. The ranking is based on individual usage, business usage & government usage	Technology (ICT)
Innovation Based on investments in <i>R&D</i> and innovation, innovation quality, output and efficiency. All these are central to economic growth; helping developed countries reinvent themselves in times of economic decline and emerging countries answer their societies’ growing needs	Knowledge and innovation
IP grant and trademark application Rankings are based on the total numbers of applications of patents, trademarks and designs filed by origin, and three rankings will be used in respective order	Knowledge products

for the level of knowledge economy against other type of economies (Rim et al., 2019). They hypothesize the indicators come from two sources: (1) economic growth and the expressions of knowledge-based economy and (2) the statistical assessment methodology for the level of knowledge-based economy based on the first part. From this, we articulate one approach in which proxies (indicators) can be used to measure the four knowledge economy criteria we have thoroughly expounded earlier. They are (1) social economy; (2) technological strength; (3) knowledge & innovation; and (4) knowledge products.

We make use of per capita GDP (nominal) ranking of selected countries in ascertaining how well they relate to these four criteria (see Table 4). Some readers may argue on why we did not use GDP based on a PPP basis. We find that the PPP basis consists of too many inconsistencies as (1) the purchasing power is subjective; (2) the metrics used were not thorough researched; and (3) the purchasing power tends to give a high value to certain countries. We based our analysis on the selected 18 countries because it is beyond the scope of this paper to list every possible country in ascertaining whether or not they satisfy the criteria of the knowledge economy. We proxied social economy with social progress index produced by Social Progress Imperative, USA. Social progress is defined as ‘the capacity of a society to meet the basic human needs of its citizens, establish the building blocks that allow citizens and communities to enhance and sustain the quality of their lives, and create the conditions for all individuals to reach their full potential.’ (Institute for Strategy and Competitiveness, 2020) Technology (ICT) is proxied by the Technology Strength Index which consists of four integrated metrics, three of which serve as standard measures of the availability and prevalence of technology: (1) internet users as a proportion of the population; (2) smartphone users as a percentage of the population; and (3) LTE users as a percentage of the population. The fourth metric we used is a Digital Competitiveness score developed by the IMD World Competitiveness Center. Their competitiveness score focuses on technological knowledge, readiness for developing new technologies, and the ability to exploit and build on new innovations (Global Finance, 2020). Knowledge and Innovation are proxied by the Innovation Index, published by the World Intellectual Property Organization (WIPO, 2020) and as data is not available for Taiwan (China), we use Innovation Index taken from Bloomberg, NY, USA. It ranks 60 countries in terms of its ability to innovate its products and services (Bloomberg, 2020). Knowledge products are products created by knowledge or intellectual capital, and they are at the stage ready to be commercialized for personal enjoyment. They are proxied by two indexes: Patents granted and Trademarks in force. The indexes are published by the World Intellectual Property Organization (WIPO, 2020), Geneva, Switzerland. These indexes are by no means the best, but they are readily available. For instance, Tech-strength Index and the Innovation Index ranked certain countries far too high and certain countries too low. For instance, for Tech-Strength Index, Singapore is ranked eight, way ahead of Germany and South Korea and for Innovation Index, and UAE is ranked eight against powerhouse Japan and Taiwan (China).

We agree that other approaches or methodologies and other proxies may be used in ascertaining a knowledge economy, and this is an interesting avenue to explore. The selected countries illustrating knowledge economies are tabulated used for in Table 5.

Although Qatar has the high per-capita GDP, it does not meet many of the requirements of a social economy (fail to satisfy most of the four elements) and so we exclude it for our analysis. We also exclude some other high-income countries/jurisdictions such as Macau (China), Ireland, Brunei, Kuwait, Bahamas, Malta and San Marino because of its small population. While Hong Kong (China), Singapore, Ireland and Iceland have high income and sufficiently high human capital, they lack knowledge and innovation to generate their own knowledge products, and hence they are not selected for consideration of knowledge economies. Oman, Spain, New Zealand, Poland and Hungary may have fairly high technology usage, but most of their knowledge products are imported. Russia and China are not high-income countries but are included for comparison purposes because of their strength in generating knowledge products. Although the USA has high GDP and certain good

Table 5 The selected countries and their associated indexes that proxied the elements of knowledge economy

Rank	Country	GDP per capita		Social progress		Tech Strength		Innovation		Patents grant		Trademarks in force	
		Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Ran	Value
1	Luxembourg	1	109,602	14	89.56	16	3.4	18	50.84	–	326	–	–
2	Switzerland	2	81,867	5	91.42	11	3.55	1	66.08	–	1,751	21	94,477
3	Denmark	7	58,349	2	92.11	4	3.67	6	57.53	–	615	25	68,705
4	Australia	10	51,885	8	91.29	15	3.4	23	48.34	9	17,010	18	119,932
5	Netherlands	11	51,290	10	91.06	3	3.67	5	58.76	–	1,936	–	–
6	Sweden	12	50,339	5	91.62	2	3.68	2	62.47	–	920	–	17,330
7	Finland	14	48,461	21	87.88	7	3.40	7	57.02	–	505	–	8,234
8	Germany	15	45,466	11	90.56	19	3.33	9	56.55	8	18,255	12	173,410
9	Canada	17	42,080	7	91.40	14	3.47	17	52.26	7	22,009	14	157,397
10	Israel	19	41,560	33	83.62	29	3.13	13	53.55	18	4,197	–	25,306
11	France	20	39,257	18	88.78	22	3.27	12	53.66	10	13,598	4	292,520
12	United Kingdom	21	39,229	20	88.54	12	3.49	4	59.68	17	5,948	7	205,337
13	Japan	22	39,048	13	90.14	21	3.28	16	52.7	3	179,910	–	–
14	South Korea	26	30,644	17	89.06	9	3.55	10	56.11	4	125,661	11	175,261
15	Taiwan	28	26,910	–	–	17	3.37	10*	83.52	5	57,886	–	43,385
16	Lithuania	38	19,883	32	83.97	27	3.20	40	39.18	–	112	–	6,449
17	China	59	10,839	100	66.12	38	2.80	14	53.28	1	452,804	1	6,405,62 ₂
18	Russia	61	9,972	69	72.56	46	2.69	47	35.63	6	34,008	9	193,828

GDP Per capital Nominal 2020 est. International Monetary Fund, Washington DC. Social Progress Index, 2020, Social Progress Imperative, US. Tech Strength, 2020, Global Finance, NY. World Global Innovation Index 2020, World Intellectual Property Organization (WIPO), Geneva, Switzerland. *Ranked by Bloomberg, 2020. World Patent Grants, 2019, Statista, NY. World Intellectual Property Organization (WIPO), Geneva, Switzerland. World trademarks in force, 2019, World Intellectual Property Organization (WIPO), Geneva, Switzerland

knowledge economy rating, it has many social problems such as income disparity between cities, high racialism, high crime rates, poor health care and unequal usage of IT, and hence, it does not meet the knowledge economy criteria. Also excluded are Saudi Arabia and Bahrain (poor social progress, poor innovation and poor IP data). So the apparent knowledge economy countries appear to relate to Luxembourg, Australia, the Netherlands, Sweden, Finland, Germany, Canada, Israel, France, UK, Japan, South Korea, Taiwan (China) and Lithuania. But the inability to control the Covid-19 pandemic has dented some of these countries from being an apparent knowledge economy. Of the countries selected, only China managed to have the pandemic under control but its moderate GDP and low social progress have dampened her to be a candidate of apparent knowledge economy. Therefore, it appears that only Luxembourg, Australia, Finland, South Korea, Taiwan (China) and Lithuania satisfy the knowledge economy criteria.

Conclusions and Discussion

Despite nearly 58 years since the term *knowledge economy* first appears, we are no nearer in understanding this new kind of economy. This lack of understanding is exacerbated as there is no universal acceptance of the definition of *knowledge*, *knowledge creation*, *knowledge economy*, *knowledge society*, *service economy*, *network society*, etc., and various associated terms such as *knowledge*, *knowledge creation* and *socialization*. Thus, as a result, significant doubts are caused concerns as to whether the ‘modern economies’ are, indeed, ‘knowledge economies’. It does not follow that only those countries transformed to servicing industries and to creating ‘knowledge’ in so-called knowledge work (white-collared jobs) will thrive to be transformed into knowledge economies. More critically, the current economic meltdown of these so-called knowledge economies is testimonies of false assertion by the precursors of the field. Such inadequacy occurs in view of the fact that the field has no shortage of writers and critics that advance or reject various avenues of the knowledge economy.

In this study, we have made a thorough examination of what the precursors have written about the knowledge economy and what the commenters have argued to put forward what a knowledge economy ought to be. The notion of the knowledge economy must be viewed from some phenomena that have transformed the contemporary economy, but in our content and critical analyses, none of the precursors has advocated an economic system that deals with the fundamentals of the factors of production and how these factors influence society. We, however, found that the works of Nonaka and Takeuchi received some favourable commentaries and we consider that they had initiated a difficult paradigm of articulating tacit knowledge in the conception of knowledge in knowledge creation (management) which if properly transferred (applied) among knowledge workers would lead to the sustaining of competitive advantage of firms and the collective effort of firms would enable the country to prosper in the future.

This study finds that the study of the knowledge economy is largely speculative where each precursor prescribes what knowledge, information or network ought to be, and suggests a particular economic system (society) that the precursor opines to be appropriate to be used in a particular time period. As such, the field has not been developed into a coherent study of social-economic knowledge, innovation thoughts and technology and knowledge products. Nevertheless, we found the field is interesting and has research usefulness. We achieve three major findings and hence offer these suggestions.

1. We do not need the multiplicity of terms to describe one thing (subject matter); all we need is to use the caption ‘knowledge economy’ in describing the contents of this new form of economy—i.e. by adopting the path of science, we define the field by its theory, not term. We see the term ‘knowledge economy’ and ‘knowledge society’ to be synonymous as an economy that utilizes knowledge to transform work into knowledge products progresses to become a knowledge economy. Likewise, knowledge workers who have successfully developed knowledge products would like to have personal enjoyment.
2. Using the notion of common ground, we articulate that the theoretical foundation of the knowledge economy is (1) a branch of social economy where the starting point is the mid-1990s and (2) not really an economy based solely on production and consumption by exploiting labour and capital, but it is based more on social values, technology and knowledge and innovation to commercialize knowledge products.
3. Using a novel methodology based on proxies, we found that our defined knowledge economy countries are those that satisfy the four criteria: sociability, high-technology adoption, possession of knowledge and innovation to produce knowledge products rather than merely having a high income or apparent high level of social progress, tech strength or innovation. We find tech-strength and innovation indexes wanting, but nevertheless, we include them in our analysis as data to proxy for technology and innovation is hard to come by.

As there is disparity in wealth, employment prospect, social equality, technology availability, innovation, education level and mindset in different countries or regions within a country, our defined knowledge economy can only be found in a few countries.

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