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Digital literacy and knowledge societies: A grounded theory investigation of sustainable development

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ABSTRACT

With a structurally entrenched digital divide on the one hand, and increasing ubiquity of the Internet in a techno-centric world on the other, the imperative to exploit information and knowledge for development remains a significant driver for equitable growth. It is posited that the silver-bullet for reducing this gap lies in increasing digital literacies within a society in order integrate segments who may be marginalized into the inclusive mainstream. In enabling greater and wider participation of digital citizens in their countries' socio-economic activities, the opportunities of a sustainable economy arise. This article is a study of ICT policies, applications and the resulting transformations in five mature economies committed to the vision of knowledge-based development with high levels of digital participation among their citizens. Specifically, using a multi-dimensional scorecard derived from prior work, we conduct a grounded theory investigation of how the five societies have applied digital literacies in knowledge-intensive public services such as education, healthcare and e-government, to derive best practices as well as lessons learned.

1. Introduction

With the emergence of the knowledge economy and the ubiquity of the "Internet of Things" in today's techno-centric world, digital competencies and literacies have become indispensable tools for the aspirations of people globally (Castells, 2009). Yet millions of people are denied full access to many of these tools (cf. Eshet-Alkalai (2004), European Commission (2006), Hargittai and Walejko (2008), Hilbert (2011), Mansell (1999) and Tyner (2014)). As a result, while globalization and technological developments have opened more pathways for digital information flows, knowledge as a competitive asset may not have reached their rightful beneficiaries. Knowledge is the basis for growth, development and wealth accumulation (Piketty, 2014) and one of the greatest challenges in Information and Communications Technology for Development (ICT4D) has been in the study of how to reduce this digital divide. A key challenge, therefore, is to facilitate greater knowledge flows to areas of the world where such knowledge is most needed (UNDP, 1996). Proponents of the developmental approach have envisioned a system that liberates and empowers users with access to information and knowledge, bridging disparities and bringing about more equal digital opportunities for all (cf. Keiner and Stoll-Kleeman (2009), Lankshear and Knobel (2008), Lips (2012), Martin and Rader (2003) and UNDP (1996)). The main argument of this view is that knowledge would create a "flat world" with transformation from the mire of deprivation, and therefore, serve as the basis of growth. Others

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have suggested that digital competencies and literacies are inextricably intertwined with development, progress and sustainability issues (cf. Benkler (2000), Bennett (2003), Doyle (2002), Poore (2011) and Pradhan et al. (2014)). Thus, exploiting digital opportunities is an imperative pressing upon societies across the development spectrum.

There is considerable agreement across disciplines that knowledge is a key driver of sustainable development (cf. Sharma, Iqbal, and Victoriano (2013) for a review). In the context of current research, we adopt the definition of the World Commission on Environment and Development (1987) that sustainable development "meets the needs of the present without compromising the ability of future generations to meet their own needs." The challenge of sustainable development is that it should result in the ideal of equitable opportunities for value creation across the community at large. Equality of socio-economic participation and well-being is one of the key ideas of justice as espoused by the philosopher-economist Amartya Sen and echoed by Piketty (2014). The research described in this paper attempts to understand the rich linkages between access to knowledge, its diffusion through society, and society's ability to apply such knowledge towards sustainable development. In this era of the Internet and new media, a critical mass of such activities take place through digital exchanges of codified information shared across networks and applied in order to create value. Understandably, the United Nations has declared access to Internet services to be a basic human right (Mossberger, Tolbert, & Franko, 2012). The inclusion and participation of a given population in such purposeful activities has hence attracted much scholarly interest. More specifically, digital participation has now become synonymous with active, engaged citizens – a public good referred to as digital entitlements (Mansell, 2004).

The fundamental research question addressed in this paper examines how digital literacies, inclusion and participation will lead to sustainable development. There are a large number of richly documented studies (cf. UNDP (1996)) on the various policies, programmes and strategies that governments and their ICT regulatory authorities have implemented in several parts of the world as nations seek to showcase their development credentials. However, to our knowledge, there is no comprehensive evaluation of best practices and lessons learnt that would support a theoretical justification for the role of digital literacies in sustainable development. The research reported in this paper attempts to address this gap by an iteration of grounded theory investigations into knowledge societies and how they have exploited digital literacies in order transform segments who may be marginalized into the inclusive mainstream. In facilitating greater and wider participation of these digital citizens in their countries' socio-economic activities, the opportunities of a networked economy arise. This article is a study of the resulting transformations in economies committed to the vision of knowledge-based development with high levels of digital participation among their citizens.

The remainder of the paper is organized as follows: the next section introduces the notion of knowledge society and digital literacy and their role in sustainable development. Following this, we review some of the seminal research in the area and put forth the three research questions. Section 3 outlines a field research methodology based on the Grounded Theory approach. In Section 4, in order to assess the efficacy of social and institutional investment in digital infrastructure and literacies on sustainability outcomes, we perform a qualitative content analysis of socio-economic narratives from five societies with consistently high Human Development Index (HDI) rankings. Finally, in Section 5, we present a discussion of our findings using a multidimensional knowledge scorecard as a framework for the assessment of best practices as well as lessons learnt. The paper ends with a generalization of the postulates that link knowledge societies to sustainable development.

2. Review of background literature

2.1. Research on digital literacy

Scholarly interest in literacy (digital or otherwise) and its developmental benefits is not new. The term "literacies" emerged as researchers began to refer to different ways of using language and different systems of representation in social practices. Literacy as a process of decoding and encoding cannot take place without consideration of the complex nature of reading, writing, and the intentions of individuals as they engage in such practices (Pahl & Rowsell, 2005). Tyner (2014) probes deeply into some elements of a postmodern interpretation of literacy, both related to what she terms 'tool literacies' which imply possession of the necessary skills to be able to use the technology, and 'literacies of representations', which relate to knowledge on how to take advantage of the possibilities that different forms of representation give users.

A definitive report of the International ICT Literacy Panel defines digital literacy as encompassing the ability to use digital communications tools and/or networks "to access, manage, integrate, evaluate and create information" (ETS, 2002) in order to function in a knowledge society. A similar definition was proposed by Tonero (2004, p. 29); "the acquisition of the technical competence for using information and communication technologies, understood in a broad sense, in addition to the acquisition of the basic practical and intellectual capacities for individuals to completely develop themselves in the Information Society". Both these definitions emphasize the importance of an individual's development in a knowledge or information society. Digital literacy as "skills, knowledge and attitudes in using digital media to be able to master challenges in the learning society" Erstad, Klovstad, Kristiansen, and Soby (2005) is a broader definition than the one from Gilster (1997, 2008), which suggests a more active process-oriented perspective on society, thereby relating learning to both the ability to operate technological applications, as well as to use technology to accomplish personal and collective needs. In a similar vein, Jenkins (2006) identified twelve "new media literacies" as necessary for a full participation in today's diverse

media environment: play, performance, simulation, appropriation, multitasking, distributed cognition, collective intelligence, judgment, trans-media navigation, networking, negotiation and visualization.

Based on the above, we define digital literacy as the ability to use the Internet and new media in order to access and critically evaluate different formats and types of digital information so as to participate in the socio-economic activities of a community through digital content creation, communication and exchange. In other words, digital literacy requires an understanding of how information needs may be fulfilled systematically, as well as an evaluation of the various types of media that convey that information.

Digital literacy is deeply entwined with the notion of digital divides. Without the former, the latter will persist. From a policy-maker's perspective, digital literacy allows the members of a society to partake in the opportunities provided by its intellectual wealth, and would ostensibly lead to more sustainable growth and development. Hilbert (2011) introduces four key variables of *who* (divide between individuals or countries), *what kind* (income divide or divide based on age or geography), *how* (divide in access or adoption) and *to what* (mobiles, Internet, or digital television) as an aid to understanding the digital eco-system. He argues that, while different permutations of these variables contribute to distinct manifestations of the digital divide, the definition of what constitutes a digital divide may not be commonly held among policy makers. As such, Hilbert suggests that instead of a one-size-fits-all solution to the digital divide and digital literacy programmes, a situation-specific approach may be more effective.

2.2. Digital inclusion and participation

There is also considerable agreement among scholars that digital literacies that enable inclusion and participation in an information and knowledge communication platform are a key driver of sustainable development in that, taken together, they form the basis of a society that is able to learn and apply knowledge for economic benefit (cf. Bawden and Robinson (2002), Eshet-Alkalai (2004), Funtowicz, O'Connor and Ravetz (1999), Hargittai and Walejko (2008), Hilbert (2011), Leiner and Stoll-Kleemann (2009), Martin and Rader (2003), Martin (2006) and Poore (2011)). According to the path breaking report of the Brundtland Commission entitled “Our Common Future” (Brundtland, 1987), sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs. Moreover, Leiner and Stoll-Kleemann (2009) explain that for sustainability to work effectively, people need to be involved in making conscious choices. This is where digital literacies become highly relevant. Using a qualitative approach by way of content analysis of wikis, blogs and podcasts, they found that users actively download, share insights and opinions, and make recommendations based on personal views and experiences on a wide range of socio-economic topics, underscoring the general optimism that lies behind the role that digital literacies play in knowledge societies. To cite an earlier theoretical work, Levy (1997, translated by Robert Bononno) called this aggregate power of the community “collective intelligence” and explained that because “no one knows everything, everyone knows something, all knowledge resides in humanity.” Such collective intelligence refers to the ability of cyber communities to participate and leverage on the combined expertise or tacit knowledge of their members. Since knowledge distribution is necessary for a sustainable knowledge society, as such it is necessary that all segments participate in these activities and contribute to collective intelligence.

Key to understanding digital inclusion and participation is the emergence of the ubiquitous Internet, which over the past decade has transformed from a medium for information dissemination, into a platform where content is created, shared, altered and reproduced through Web 2.0 devices, services and applications (Dwivedi et al., 2011). Although Web 2.0 has its imperfections in terms of security and availability, its underlying features emphasize flexibility of access, interaction, mobility, multimedia capability, participation, informality and feedback (Hargittai & Walejko, 2008). Central to all of these perspectives is that although as a platform it has a gravitational core, its architectural system is ultimately designed to decentralize the activities that drive the growth of the platform. Web 2.0 does not require a central controlling agent; rather, it is designed to be “self-switched” to allow users to participate in numerous, independent ways, thereby allowing them to network over time and space constraints (Castells, 2009). The Web 2.0 platform is an intuitive fit for effective exploitation of knowledge as economic commodities through Wikis, Online Communities of Practice (CoP), Weblogs and a myriad of mobile apps that have allowed a critical mass of people across advanced, as well as developing economies to participate digitally (Schaffert et al., 2005 cited by Dwivedi, 2011). The impetus for the aggregation of information and knowledge that emerged from knowledge management research resulted in strategies, tools and techniques for creating, storing and transferring both tacit knowledge from domain experts, as well as explicit knowledge contained in knowledge repositories (cf. Ichijo and Nonaka (2000) and Nonaka and Konno (2005)). Essentially the basic ethos of today's Internet is that it encourages individuals to freely create, annotate, comment upon, index or share, mix, remix - trends that bypass traditional models of editorial control, centralized publishing and professional indexing (Abbott, 2010; Dwivedi, 2011).

2.3. Four pillars of sustainable knowledge societies

In proposing criteria and indicators for a sustainable knowledge society, Spangenberg (2005) concluded that digital literacies drive countries to achieve sustainability by transforming what was initially an information (efficient) society into a knowledge (effective) society. In Spangenberg's view, there is “a normal tendency” in a pluralistic society which embraces individual freedom of expression - a precondition for any open and democratic society. The information society itself, he cautioned, cannot lead to sustainability as it lacks context or meaning. However, a knowledge society could; regardless of

whether such a society is built within a neo-liberalist framework of individualism, or is based on an institutional framework that supports collective security and wider welfare. As a knowledge society is, in essence, based on the need for knowledge distribution; access to information and skills to transform information into knowledge become "critical success factors". Knowledge distribution, based on the ideals of equity and non-discrimination, justice and solidarity, are therefore a necessary precondition for its sustainable exploitation (UNDP, 1996). The increasingly global production and consumption of digital information and the emergence of knowledge networks are key contributions of the Internet as an affective medium within the networked society (Castells, 2009). Dragomirescu and Sharma (2009) have adopted the ideas of Spangenberg (2005) in developing a research framework that captures the efficacy of a sustainable knowledge society. A brief discussion of their four-pillar model and multi-dimensional scorecard follows.

2.3.1. Education and training

It is intuitive to suggest that education would be a significant theatre in the digital literacies. Several scholars have questioned, from the policy perspective, whether it would be possible to achieve the emancipator visions and desired outcomes of digitalizing universal access to education – a key ingredient of literacy (Mosco, 2004; Webster, 2014). Livingstone (2008) cautions that in the field of education, investments in ICT may not have produced the desired outcomes. Specifically, in the 2008 study involving the meta-analysis of extensive, published research on online learning, she found that Internet content and communication alone are insufficient. While online learning was found to be beneficial, the positive effects were greater for blended learning styles, involving people-to-people interactions of learners and experts. She concludes with a quote from Wellington (2004) that "there are inherent difficulties in evaluating the effect of any learning intervention and attributing cause-effect relationships in education".

We may infer that it is difficult to assess the effectiveness of different learning technologies. Policy-wise, making ICT available to the young is a starting point, however, practically ensuring their productive usage is another. For example, one difficulty is realizing continuity between school and home. Visions of learning anywhere, anytime depend not only on the state's provisions for online learning in schools, but also on parents' provisions for internet access at home. Another difficulty is that educationists still conform to traditional scholastic aptitude testing systems that filter out the broad skills that ICT inspires in learners; skills pertaining to exploration and learning for fun, and being imaginative, creative and fluid in thinking. Consequently, this pillar spawns several aspects of interest in the investigation of digital literacies as a contributor to sustainable development.

2.3.2. Innovation systems

The innovation system pillar involves research and knowledge networks which interact in order to create value. In an advanced knowledge economy, the role of innovation – both its creation as well as diffusion – is a key contributor to growth and development (Hargittai and Walejko, 2008). In the digital context, the creation of content and applications, their distribution and consumption via social networks, and the resulting diffusion of knowledge is an example of such an innovation cycle. The level of participation is determined by the networks that promote both access and contribution. There is a global trend to promote such cyber innovation and enterprise by means of regulatory ICT policies. Public grants encourage university-industry research & development (R&D) centres in advancing the frontiers of innovation and place them in the digital commons. Promoting R&D activities may further create a cluster of spin-offs and downstream outcomes that enable knowledge sharing and discovery. The innovation pillar therefore is a composite of additional dimensions worthy of field investigation.

2.3.3. Information and communications industry

The macro-economic study by Pradhan, Arvin, Norman, and Bele (2014), while affirming an important interactive effect between telecommunications infrastructure and economic growth, also showed that the development of telecommunications infrastructure was not a statistically significant causal factor in attracting investments in capital, labour or technology. Thus, policy-makers wishing to promote long-run economic growth through telecommunication infrastructural investment must pay additional attention to the development of the telecommunications industry alongside other macroeconomic variables.

The research literature is replete with attempts that measure quantitative outcomes of ICT investment in global, country or industry-specific studies (cf. Benkler (2003), Bauer (2003), Hilbert (2011) and Pradhan et al. (2014)). As the information era gives rise to knowledge economies, reliable statistical data and indicators regarding ICT readiness, use and impact are increasingly required by policy-makers and regulators (e.g. ICT Qatar (2013) and Qatar (2013, 2014)). Such 'smart data' and indicators can help policymakers formulate effective strategies for ICT-driven economic growth, and to evaluate ICT-infrastructure and skills investments. There is a growing need to explore new emerging trends in policy, examine best practices for digital literacies and sustainable development and identify the underlying dimensions and their inter-relationships. Such a research stream may uncover more granular ICT policy dimensions for sustainable growth.

2.3.4. Economic and institutional regime

The economic and institutional regime refers to laws, policy making bodies and how to react to changes in circumstances in order to promote the well-being of society. Government intervention, through regulatory policies which were designed to bring about greater digital inclusion and participation, may result in less intervention in other distributive policies. Bauer

(2010) points out that a growing number of countries are re-examining telecommunications policies in search of approaches that better support investments and innovation in advanced communication networks and services. Consequently, it is imperative for regulators be mindful of the effect that these regulatory policies and the broad range of fiscal and industrial measures may have on both regulated and unregulated firms in the ICT eco-system. There may be serious ramifications for the different proclivities of the various stakeholders in terms of trade-offs between short-term and long-term benefits, and the aggregate performance characteristics of the eco-system. As such, how policy-makers 'tune' or calibrate the policy mix is of great importance. For example, in the realm of telecommunications, a stringent regulatory approach may encourage the entry of service-based competitors, more short-term benefits for consumers, and lower levels of investments into networks and services. A less stringent approach will most likely generate more competitive turbulence, a lower rate of service-based entry, and a higher rate of innovation and investment as well as greater long-term benefits.

3. Methodology

The research objective of this paper was to explore the role of digital literacies in supporting the sustainable development in knowledge societies. Building on the review in the previous section, our research questions may be more specifically stated as:

RQ1: What are the significant policies that are currently implemented to promote digital literacy, digital inclusion and digital participation in knowledge societies?

RQ2: How do digital literacy policies lead to sustainable development?

RQ3: What best practices and lessons learnt have emerged from a field study of sustainable knowledge economies?

Our research questions seek to investigate the extent to which digital infrastructure and digital literacies may create an inclusive, equitable transformation of society. Although such field investigations have been reported in the scholarly literature by Jenkins (2006), Mosco (2004), Pradhan et al. (2014) and Spangenberg (2005) and various United Nations reports (cf. UNDP (1996)), there is as yet no general theory that links digital policies to sustainable development. Hence, we adopt the Grounded Theory (GT) approach that will enable the development of such a theory that is grounded in the systematic analysis of evidence from the field. In an early description, Martin and Turner state that GT is "an inductive, theory discovery methodology that allows the researcher[s] to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations" (cited by Urquhart, Lehmann, and Myers (2010), p. 357). Typically, GT studies proceed as follows: rather than beginning with preconceived hypothesis, our first step is exploratory field observations through mixed methods. From these, the key discoveries are marked with a series of codes, which are extracted from these observations. The codes are then grouped into similar concepts in order to facilitate analysis – a process known as *memo-ing*. From these concepts, underlying structures and categories are to be inductively obtained, which may form the basis of developing a general theory of digital literacies, inclusion, participation and sustainable development.

We believe that the GT approach is an appropriate methodology for our empirical research as its primary purpose is to "propose theories that are primarily and strongly connected to data collected in a substantive field" (Urquhart & Fernandez, 2013, p. 22). A GT study shall reveal structures and categories that are immanent or latent within the rich data, thereby making emerging categories better fit with the incidents which they represent. In addition, as data changes, the structures will also change to represent the new ground realities.

There are two different theoretical approaches to GT. The disagreement is over whether the GT researcher should use a well-defined coding structure (such as the one we use from Dragomirescu and Sharma (2009)) and look systematically for causal connections, or whether theoretical codes are extracted as they emerge in the same way as substantive codes emerge as part of the *memo-ing*. The Glaserian[1] approach emphasizes induction or emergence with the individual researcher's creativity within a clear frame of stages, whereas the Straussian[2] approach is more interested in validation criteria and a systematic protocol known as the coding paradigm. A debate ensued between proponents of the two approaches on the philosophy behind GT which has not been resolved to date. However, there is consensus among researchers that a grounded theory is never right or wrong; it just has more or less fit, relevance, workability and modifiability (Bryant & Charmaz, 2007).

Bryant (2002) has applied a constructivist approach to GT where neither theories nor data trends are discovered, but are instead, co-constructed by researchers and participants; influenced by the researchers' perspectives, values, privileges, positions, interactions, and geographical locations. This position takes a middle ground between realist and postmodernist positions by assuming an "obdurate reality" at the same time, as it assumes multiple realities and multiple perspectives on these realities. A key skill is in how to use prior research findings in a constructive and data-sensitive manner without forcing it on data.

Our empirical research employs the Constructivist Grounded Theory (CGT) approach for three main reasons: (i) we wish to avoid research "bias" factored into our findings; (ii) we are interested in neither the induction, nor the protocols to the exclusion of the other; and (iii) the CGT approach has proven itself to be effective in a number of field studies involving ICT

[1] Glaser, B. (1992). Basics of grounded theory analysis. Mill Valley, CA: Sociology Press.

[2] Strauss, A. (1987). Qualitative analysis for social scientists. Cambridge, United Kingdom: Cambridge University Press.

and its qualitative impact (cf. Bryant (2002) for an early review). Hence, beginning with a structure comprising eight dimensions of a knowledge society, we investigated the digital literacy policies of five distinct cases in order to draw some best practices and lessons learnt from the ground.

We have also adopted the guidelines for GT as applied in the domain of information systems. Urquhart et al. (2010) prescribe a set of five research design parameters in order to "raise the quality and aspirations" of GT studies:

i) constant comparison: frequent checking of data instances that have been labelled as a particular category with other instances
ii) iterative conceptualization: building the grounded theory iteratively using theoretical sampling and focusing on the relationships among categories
iii) theoretical sampling: deciding on analytic grounds where to sample from next in clarifying the research questions and scope
iv) scaling up: grouping high-level categories into broader themes in order to relate them to competing theories
v) theoretical integration: putting the grounded theory into the context of other theories in the field

In the conduct of our CGT study, we visit each of these design parameters as an ex-poste means of attesting research rigor.

More recently, still in the domain of ICT, Urquhart and Fernandez (2013) suggest that in order to derive a high degree of conceptualisation and theory scope from GT, four "key misconceptions" must be addressed.

i) The researcher is a 'blank slate' who launches into data collection without first looking at the literature: a pre-study literature review to define the problem domain and the appropriate methodology, followed by an integrative review in which the researcher compares the emergent theory with extant theories leading to theoretical integration.
ii) The field method is sometimes seen as inflexible and difficult to apply: GT, like any other research method, must be applied flexibly and knowledgeably with due regard to the foundations as well as established research practices.
iii) The resulting case-based reasoning produces low-level theories that are not generalisable and hence useable: by using exemplars from the discipline to show theoretical sensitivity and then integrating with the extant literature, GT research leads to contributions to a body of knowledge in that area.
iv) The approach per se is inherently positivist: depending on its underlying epistemology, any qualitative method can be positivist, interpretivist, critical or constructivist; and it is good practice for researchers to state their epistemological position at the onset (as we have with our CGT).

Table 1
Multidimensional scorecard as categories for theoretical coding.

Pillars	Dimensions	Proxy indicators
Education and training		Public spending on higher education; tertiary education attainment; tertiary graduates in mathematics, science and technology; GDP share invested in higher education Lifelong learning participation
Innovation systems	Research and development	Patent intensity; citation impact of country's scientific output; scientific publications highly cited in patents; receipts of royalty and license fees; R&D employment; Creativity Index
	Knowledge networks	International trade in core cultural goods; international trade in ICT goods; technology balance of payments; share of trade in high-tech products; international mobility flows of foreign tertiary students; net migration of skills traffic of broadband networks; university-industry R&D centres; academic spin-offs; R&D consortia; research sub-contracting; patent citations co-patents and co-publications; fairs, exhibitions digitized cultural heritage; household expenditure on civic amenities (culture, entertainment)
Information and Communications Industry	ICT accessibility	Network Readiness Index; B2B and B2C sales in e-commerce; broadband Internet subscribership; hosts and websites on the Internet; Internet domain name registrations
	Role of new media	Accessibility; voice and accountability; press freedom
Economic and institutional regime	Rule of law consistent with international norms	Corruption Perceptions Index; Global Peace Index Human Development Index; Index of Personal and Economic Freedom; EIU Democracy Index
	Political vision and strategy	Country's Project Maturity Index; political stability; regulatory quality; government effectiveness
	Business environment that rewards innovation	High-tech companies benefiting from early-stage venture capital investment; venture capital investment for private R&D; Index of Economic Freedom; Business Competitiveness Index

Hence, our CGT investigation shall proceed, not with a blank slate, but with the benefit of a scorecard that will serve as the framework for obtaining insights from the field and in the tabulation of memos. These observations will be generalized into best practices and lessons learnt using examples from the field an integrating them back to prior research findings. Since, we seek both best practices as well as lessons learnt, our constructive approach is both positivist and critical.

Table 1 (adapted from Dragomirescu et al. (2009)) summarises the significant pillars and dimensions of the scorecard that captures the efficacy of a sustainable knowledge society. Essentially, the thirteen dimensions were subject to the fit-relevance-workability-modifiability criteria and condensed into eight areas - Higher Education, Research and Development, Knowledge Networks, ICT Infrastructure, Impact of New Media, Rule of Law Consistent with International Norms, Political Vision and Strategy, and Business Environment that Rewards Innovation. These eight dimensions formed the categories of "theoretical coding" for our GT study of the five knowledge economies. This contributes to understanding relationships among the significant facets of the theory and results in iterative documentation of memos (Urquhart et al., 2010). For the purpose of "scaling up", we also narrowed our focus to three knowledge-intensive domains of public services – Government, Education, and Healthcare – as these comprise a significant contribution to the development of a sustainable knowledge economy (Funtowicz et al., 1999).

As a first step in the GT study, socio-economic data from a dozen or so knowledge societies were obtained from authoritative sources such as the United Nations and World Bank databases. These selected cases were found to be leading examples of countries which have profited from knowledge-based development; in other words, high Human Development Index (HDI) economies which have achieved such indicators of growth as ranked by the annual United Nations Development Programme (http://hdr.undp.org/en/content/human-development-index-hdi). To varying degrees, they also have track records of ICT policy and governance. Considering the availability of secondary information sources and the convenience of access, five cases - Finland, Hong Kong, Qatar, New Zealand and Singapore - were selected by the research team. In the parlance of Urquhart et al. (2010), the analytic grounds for GT data probing is known as "theoretical sampling". Table 2 provides a summary of sources for the theoretical sampling.

In order to provide a basis for "constant comparison", we limited the GT analysis to three knowledge intensive public sectors - education, healthcare and government for memos. It was evident from the information scan that the five selected cases represent a range of economies combining natural resources, foreign investments and intellectual capital assets. The common thread is that they are all emerging knowledge economies with strong track records of sustainable development over the past decade. The governments of these selected societies also display a serious commitment to ICT-led development, evident in their rollout of a vision for the digital transformation of major sectors of the economy and administration, and in their efforts to raise the digital enablement of their citizens.

In the initial environmental scan, content analysis of information sources was conducted over three passes. First, country-level descriptive analyses on the five cases of interest were developed (see Appendix A). This was to provide a consistent backgrounder to the research team as they undertook the memo-ing. Next, "desk top" field research involved the research team examining online materials from authentic and authoritative sources such as the national agencies responsible for government, education and health services (as shown in Table 2). We have consciously avoided a meta-analysis of scholarly, empirical work because we seek fresh, exploratory perspectives. To establish face and construct validity, input was sought through interviews with the economic or commercial *attaché* of the diplomatic mission of each of the five countries or, in the case of Singapore, a public-policy think-tank. Finally, three graduate assistants (one for each domain) coded the high-level memos into the structure of the eight dimensions across the five knowledge societies of interest. Details of each of the passes are given in the following two sections.

To summarise, using Spangenberg (2005) framework of the core elements of sustainable knowledge, we derive a multidimensional scorecard that provides the means of "constant comparison" (Urquhart et al., 2010) of outcomes in key social, economic, environmental and institutional dimensions (Dragomirescu et al., 2009). In the CGT analysis, we intend to narrow our focus to the domains of information intensive public services. Using "theoretical sampling" of websites and related social media identified with the guidance of an initial input with domain specialists, three graduate assistants with no prior bias, were tasked to encode memos from examining online reports, documents, policy papers and civic discussions. This was voluminous and the process was tedious, involving Web search tools, crawlers, coding and memo-ing. The iterative and

Table 2
Data sources for theoretical sampling.

Country of analysis	Government	Education	Health
Finland	http://web. eduskunta. fi/Resource. phx/parliament/index. htx	http://www. stm. fi/en/frontpage	http://minedu. fi/OPM/? lang=en
Hong Kong SAR	http://www. ceo. gov. hk/eng/index. html	http://www. edb. gov. hk/en/index. html	http://www. dh. gov. hk/eindex. html
Qatar	http://portal. www. gov. qa/wps/portal/homepage	http://www. sec. gov. qa/En/Pages/Home. aspx	http://www. sch. gov. qa/home-en
New Zealand	https://www. govt. nz/	http://www. minedu. govt. nz/	www. health. govt. nz/
Singapore	http://www. egov. gov. sg/	http://www. moe. gov. sg/	https://www. moh. gov. sg/content/moh_web/home. html

Table 3
Summary of socio-economic indicators of the five cases.Source: www.worldbank.org 2012 and (2007) data.

	Finland	Hong Kong SAR	Qatar	New Zealand	Singapore
Land area in km²	303,890 (304,090)	1042 (1042)	11,610 (11,610)	263,310 (263,310)	700 (695)
Population	5,413,971 (5,288,720)	6,972,800 (6,783,500)	1,564,082 (720,383)	4,315,800 (4,087,500)	5,312,400 (4,588,600)
GDP per capita in US$	45,694 (46,538)	30,697 (24,928)	62,528 (44,052)	27,474 (25,195)	52,052 (38,763)
Annual % GDP growth	−1 (5)	−2 (9)	12 (19)	1 (4)	1 (9)
Net national income in US$ millions	206,274.1 (208,201.9)	266,647.1*	64,751.7 (16,934.9)	99,729.2 (83,015.3)	222,780.3 (136,790.9)

*http://www.censtatd.gov.hk/home/index.jsp.

collaborative effort led to an increase in the abstraction of how digital literacy related to the knowledge society ideals of digital inclusion, participation and opportunity. The coding of memos from five knowledge societies categorized under the eight key dimensions of the scorecard is given in Appendix B. The "scaling up" of the memos that were generated and the "theoretical integration" of ground-level observations to existing theory is discussed in the next section.

4. Analysis of grounded theory memos

As part of the initial scan, descriptive statistics were collected covering the following socio-economic factors: land area in square kilometers, population size, GDP per capita (current in US$), GDP growth (annual %), and net national income (current US$) are shown in Table 3. This was also the starting point for the writing of case narratives to be used in the CGT (presented in Appendix A). As the narratives indicate, while the five cases are geographically and culturally distinct, they are instances of successful economies that have evolved their unique knowledge advantages.

The essentially qualitative examination allowed the determining of the structures and patterns that have emerged from policies in digital literacies and, more significantly, the utilization of such skills in knowledge-intensive activities such as government, education and health in support of sustainable development. Hence, our empirical analysis of the five cases sought to determine whether digital literacy policies had an impact on sustainable development. As noted in the previous section, all five economies have actively pursued inclusive and sustainable growth with digital policies and initiatives. At a high level, the GT study will codify how these cases have performed across the three domains of interest, the strategies they have adopted, and more importantly, how effectively they have exploited ICT to achieve growth and development. In our CGT exercise, we have coded the initiatives taken up by each knowledge society as memos using the four pillars and eight dimensions of our knowledge scorecard as categories and concepts for constant comparison. The theoretical coding of memos from which the discussion below arises is given in Appendix B.

4.1. Education and training

The "Higher Education & Training" pillar reveals findings that integrate with existing theories on knowledge societies. Not only do the five cases demonstrate the primacy of higher order, knowledge and technology-based investments in education, they have also elevated social capital for the process of education in the form of respect and rewards. Poore (2011) argues that a well-educated society secures higher levels of collective intelligence. In three of the five cases – Singapore, Hong Kong SAR and Finland, teachers are well-respected and remunerated. Educational attainments command an inside track into desirable opportunities for both training and employment. The promise of new technologies in the classroom is increasingly well understood as a competitive advantage (cf. Barbules and Callister (2000)). The five societies also placed a high emphasis on the introduction of computers and the Internet to schools at an early age, as highlighted in the following excerpts from the memos:

> "Educational investments include exposure to new media from a young age. Public-private partnerships for promoting the use of ICT are encouraged with funding for schools. Deploying technologies with high speed internet connections, digitized content and a host of custom developed apps for a variety of public sector services support lifelong learning." (Finland)

"ICT has been in curriculum of secondary level education since 1982." (Hong Kong SAR)

Pahl and Rowsell (2005) and Tyner (2014) have suggested that in the digital era, such an exposure as "natives" (rather than "immigrants") provides a competitive advantage for the economy. For instance, this same segment of society can be expected to engage in "web-enabled self-help" for health-care, e-government or life-long learning. However, content, applications and adult-supervision are equally necessary. There is a caveat or lesson to be learnt; distributing "one-laptop-per-child" for a "bring your own device" approach does not equate to learning, particularly at a young age. One entry in our memos typified this approach with a mixed outcome: .

"Schools as ICT-rich learning environments: The Notebook Valley project (2001–2003) that provided free laptop computers and Internet connections to schools."(New Zealand)

A report from the OECD (2015) concludes that standardized testing scores such as those from the Programme for International Student Assessment (PISA) have not increased in parallel with the use of computers in the classrooms.

4.2. Innovation systems

The second pillar aggregates two second-order casual dimensions: Research & Development and Knowledge Networks. The analysis of each dimension and how they scale up to a category reveal a nuance about innovation in the digital age.

4.2.1. Research & Development

"Research & Development" draws on the advantages set by high-quality education. It is also well known as a direct driver of the knowledge economy (Lawson & Lorenz, 1999). Across the five cases, public policy-makers encourage private-public-people partnerships in priority areas (with smart cities and intelligent nations being currently in-vogue). Significant emphasis placed on this dimension develops human capital capacity for innovation, as highlighted in the following:

"Government of HK provides a Composite IT Grant that can be used for purchasing equipment, software or content. $250 million had been allotted in 2011 for this purpose." (Hong Kong)

ICT projects in education, health, and government seemed to be commonly adopted "flagship" proofs-of-concept that would later diffuse to other domains. Invariably in a modern economy, cutting-edge research also attracts global talent and relationships. This will be addressed within the analysis of the next dimension. In short, there is a symbiotic relationship between the dimensions of R&D and Knowledge Networks. However, the caveat here is that while new research initiatives are widely publicized for benchmarking and promotional purposes ostensibly to attract further international investments (examples ranging from smart schools to electronic health records initiatives all over the world), very rarely are the lessons of failure shared as openly. Several quotes from our memos illustrate this - placing a positivist view of the activities undertaken by these governments towards creating a knowledge society:

"The government spends up to 2% of its GDP on industry-linked research through statutory boards such as the National Research Foundation (NRF) and the Agency for Science, Technology and Research (A*STAR)." (Singapore)
"Government intends to pursue a strong digital service culture and world's smartest system. Healthcare expenditure amounts to EUR 16 billion. This is equal to 8.9% of the budget and approximately EUR 3000 per capita." (Finland)

Although these memos present positive practices carried out by the respective countries in the field of research and development, it is not clear whether they led to positive or negative returns. Suffice to say, it is a widely held belief that promoting R&D activities has the potential to create a cluster of spin-offs, down-stream investments and knowledge activities.

4.2.2. Knowledge Networks

The second dimension, "Knowledge Networks", refers to the inflows and outflows of strategic intellectual assets including patents, skills and brands. Most commonly, they are communities of practice that span formal as well as ad-hoc structures, as illustrated in the memos below:

"The NZ health technologies disseminate over 30 health solutions across the globe and attracts around $NZ800 million in export revenues per annum." (New Zealand)
"Healthcare data warehouses provide planning and management of medical resources." (Qatar)
"Diverse and disparate initiatives include the more formal National Research Institutes (eg I2R, ICMB) and think-tanks (eg IPS, ISEAS). These are exclusively government-funded with some amount of endowment money from trusts." (Singapore)

Prior research by Sharma et al. (2013) suggests that access to the global knowledge pool is clearly a major driving force in the development of the five knowledge societies. Each has benefitted from net inflows of structural, human and social capital. This was augmented by policies for indigenous capacity building. For example, in both the "Education" as well as "Research" dimensions, a commitment to attracting high-quality talent (especially with regard to graduate students and

research scientists) and technologies was complemented by the involvement of domestic agents. The specific policies implemented differed across the five cases, but there was a notable commitment in terms of agenda setting, investments and an open immigration climate. This is important for later participation in institutional communication and the exercising of civic and citizenship rights is similar to the notion defined by Bennett (2003) as networked politics.

Another characteristic of the five cases was that while these societies open to experimentation and trials, they were also keen to learn from the failures of others by collaborating in international initiatives. Some memos illustrate this:

> "Qatar's 'National Vision 2030' is a roadmap to craft a knowledge-based economy. The National ICT Plan targets an adoption rate of 90% for ICT by 2015. The ICT Plan 2015 is allied with the Qatar's National Vision 2030, and its specific programmes are associated with Qatar's National Development Strategy 2011–2016" (Qatar)
> "The government's emphasis and determination that the country and its citizens will not lose out on digital opportunities has led to an expansive rollout of both connectivity as well of e-services in the e-gov domain" (New Zealand)

4.3. Information and Communications Industry

The outcome of a society's efforts on both ICT Infrastructure and New Media content fall under the third pillar - Information and Communications Industry.

4.3.1. ICT Infrastructure

Investments in "ICT Infrastructure" are seen as necessary starting points to develop the digital characteristics of a sustainable knowledge society (Bauer, 2010; Pradhan et al., 2014). Mobile broadband and Web 2.0 technologies and platforms, especially social media, have pushed the consumption of ICT infrastructure and applications in most of these societies, revolutionizing economic activities (Hilbert, 2011). Today, most governmental as well as private, business and institutional portals communicate with citizen-customers through e-means such as websites, emails, short messaging services and chat programmes (Dwivedi et al., 2011; Leiner & Stoll-Kleemann, 2009).

> "83.47% of Finland's population use the Internet regularly. The emergence of the digital economy is reflected in the steep rise in digitalization of production and services. The big impact of social media is projected to continue." (Finland)
> "In March 2011, ict QATAR declared the formation of the Qatar National Broadband Network Company (Q. NBN), to implement a FTTH network thus creating a more accessible society for the masses through ICT." (Qatar)

The memos quoted above corroborate a similar finding by Lips (2012) in New Zealand that public administration powered by Web 2.0 technologies was key to inclusion and participation. The easy availability of smart phones and the widespread availability of "Wi-Fi" are also indicators of the ubiquity of ICT accessibility in some of these countries. All five cases exhibited a commitment for regular government interventions (Singapore's IT2000 plan a pioneer and Qatar's 2015 one, more recent). However, it was also understood that ICT although necessary, is still an insufficient condition. As Abdul Waheed Khan, the UNESCO general sub-director for Communication and Information, stated: "*Information society is the building block for knowledge societies. Whereas I see the concept of 'information society' as linked to the idea of 'technological innovation', the concept of 'knowledge societies' includes a dimension of social, cultural, economic, political and institutional transformation, and a more pluralistic and developmental perspective*" (UNDP, 1996). An example memo illustrates how societies do not see ICT as ends in themselves but a means to creativity and innovation:

> "Classrooms being fully e-enabled, connectivity with other students via multimedia have spawned many new collaborative projects." (Hong Kong SAR)

An alternative interpretation of a knowledge society that promotes sustainable development is that the social, cultural and political transformation could be reflected in the rise and impact of new media. An Information society is based on infrastructure, while a knowledge society builds on this to encompass participation and hence inclusion.

4.3.2. Impact of New Media

The "New Media" dimension has unleashed disruptions in traditional, developed economies all over the world. For years, political economists have raised the alarm of traditional media domination (through vertical and horizontal structural integration) in research literature (cf., Albarran and Moellinger (2002), Bagdikian (2004), Doyle (2002), Herman and McChesney (1997), Herman (2000) and Klaehn (2002)). The erosion of the public sphere in many societies has been the result of the regulatory regimes of new media (Benkler et al., 2003). In the five cases studied, these disruptions were embraced and turned into points of strength, as highlighted in the following memos:

> "Finland's mobile communications industry has been very successful where innovation meets outstanding technology and has a good market price and high profit ratio. Currently, Finland offers a world class venue for game and application development and culture." (Finland)
> "New Zealanders have unrestricted Internet access to news and other media content. The mass adoption of IT by public health planners, hospitals and clinics is an instance of how professionals embraced ICT when they see its value." (New Zealand)

While there is no common "best practice" prescription across the five cases, new media has been regularly used to address inherent disadvantages. In New Zealand, Internet applications serve to bridge the vast territories and especially, to enable the disadvantaged Maori population. Qatar's Al-Jazeera's outreach to the region and the world is mainly through the Internet. In Singapore, community social networks have opened up new channels for political discourse independent of the government-controlled mass media. Finland has better connected its sparsely populated but vast country with Internet applications, especially in the areas of education, health and government. The vibrant, but elite-focused, information flows in Hong Kong have been disrupted by "cyber-actors", whom the HK Police believe are the greatest threat to the territory's traditional way of life. To illustrate:

> "Mainstream mass media are exclusively government controlled and international media are tightly regulated insofar as content pertaining to politics and religion are concerned. This has given rise to a vibrant social media community. Cognizant of this, the government has hastened to engage its citizens online" (Singapore)

4.4. Economic and Institutional Regime

The last pillar of knowledge society, Economic and Institutional Regime, comprises three second-order dimensions: Rule of Law, Political Vision & Strategy and Business Environment that Rewards Innovation.

4.4.1. Rule of Law

In the context of our CGT analysis, the "Rule of Law" dimension speaks to the set of regulatory policy tools consistent with international norms at the disposal of the state. One significant development is the growing monopolistic tendencies of global conglomerates and the necessary anti-trust actions undertaken by governments all over the world. Coincidentally, this aspect has been less effectively pursued by the three largest markets – the United States, the Peoples' Republic of China, and the European Union. There are ongoing policy debates on equal digital opportunities, cyber-crimes, digital property rights and data protection acts in the developed world. In the five cases, it was not clear what "best practices", other than property and data protection laws, were implemented as a matter of policy. It appears that more compact societies permit greater enforcement.

> "Society is trying to find the middle ground in the dilemma between the promises of e-Government initiatives - quality and quantity of e-Government services, and the minimal acceptance of e-Government services across OECD-countries. Fears of data privacy and lack of proper protection remain in the minds of people as they collectively take safeguards against abuse. These same measures stunt widespread deployment of public services." (New Zealand)
> "For a compact society, size has its advantages." (Singapore)

4.4.2. Political Vision and Strategy

"Political Vision and Strategy" is a theme that was common across the five cases as an active policy consideration. All five cases, the development of a national ICT plan was an activity of considerable effort (cf. Qatar (2014)). In short, this dimension was the key driver of infrastructure investments and demand management. Unsurprisingly, all five societies had invested in making their cities Internet-enabled with high speed connectivity in many areas of education, health and public administration, with access to latest technological applications such as cloud computing:

> "The government encourages the growth of the Technology and Innovation industry by identifying potential high impact projects and funding them from the Innovation and Technology Fund (ITF), Research and Development Cash Rebate Scheme, Business incubation programmes. This is a rare intervention for an avowed minimal government society." (Hong Kong)
> "Qatar's 'National Vision 2030' is a roadmap to craft a knowledge-based economy. The National ICT Plan targets an adoption rate of 90% for ICT by 2015. The ICT Plan 2015 is allied with the Qatar's National Vision 2030, and its specific programmes are associated with Qatar's National Development Strategy 2011–2016."(Qatar)

"Smart cities" and "intelligent nations" are keywords that are now regularly used in public pronouncements as necessary steps to stay ahead of the curve. Special attention is also given to the possibly disenfranchised; establishing trust in the system with assurances of privacy and promoting international collaborative ventures. A key question was that whether or not a national ICT vision succeeded in its lofty objectives. In participative democracies, the commitment of political and financial capital requiring the buy-in of the communities they serve.

There is a view that a knowledge society may be misused as a political weapon in perpetuating a system that ensures not social progress, but concentration of wealth and power (McChesney, 2004; Milliband, 1969; Mosco, 2004; Piketty, 2014). Spangenberg's critique of neo-liberalism is at the heart of implications for the sustainability designs by governments, and an alternative approach would promote a different developmental trajectory (Grossberg, 1995). This can be seen from the following example memos.

> "A member of the European Union and hence government by such rights and regulations. Noticeable ICT proliferation for smart and personal inclusion, consumer health informatics, and personal guidance systems." (Finland)
> "Economic and other central planning exercises have been the hallmark of effective governance in Singapore. Evolving

from Soviet-style 5-year planning cycles, the government has been adopted ad-hoc visioning and strategic exercises (e.g., The Next Lap, Restructuring the Economy, Our National Conversation) to interact and build consensus with its people." (Singapore)

4.4.3. Business Environment that Rewards Innovation

The "Business Environment that Rewards Innovation" dimension includes initiatives that have spawned digital entrepreneurship (which result in value enhancement and job creation) in these five societies. Across the five cases, governments have pledged to deliver on varying levels of long term support for digital enterprise. All five societies have made public their digital road-maps and strategies for implementation, including budgeted financial resources for the rollout of these road maps. To illustrate:

"An award winning e-governance portal: Hukoomi', Qatar's e-Government Portal is "best of breed" for government e-content in the Arab region. Hukoomi is the official government web portal of Qatar." (Qatar)

The key debate among policy researchers today is the presence of two conflicting "best practice" models to promote media innovation and enterprise (Doyle, 2002). The fundamental schism between the American market driven norm and the European mixed system bears scrutiny. The dispute is essentially ideological: the American perspective is driven by a belief in market supremacy and unadulterated individual freedoms which determine future trajectories for technology and societal applications (Benkler, 2003; Bettig & Hall, 2003). In contrast, the European perspective draws a difference between economic optimization which is defined by market interests of profit, and policy orientation which is decided upon by an institutional framework supporting participation (Mansell, 1999, 2004). To some extent, the Asian economies mapped a middle road that seeks successful public-private-people partnerships, considering that neither the Grameen model nor the One-Laptop-Per-Child initiative have been successfully replicated as a "best practice" in enterprise and innovation. As such, there are more "lessons learnt" to have emanated from such ventures. Here are some illustrative quotes from the case evidence:

"HK public sector initiatives yielded them accolades in the world of technology - Gold award in Web accessibility Recognition Scheme, Ruby Award in Web care, rated as "outstanding" in the category of Government Websites. Surprisingly these Best Practices have been slow to be taken up in the private sector for export." (Hong Kong SAR)
"Both the Global Innovation Index and Business Competiveness Index rank Singapore very highly, presumably because of its open, transparent and business-friendly application of regulatory policy." (Singapore)

Based on the theoretical sampling conducted in our GT, we may "scale-up" our framework of four pillars and their associated dimensions to themes such as: ICT infrastructure, regulatory policy and governance, human capital development, and creating an innovation-based economy. These are the complexities of the digital knowledge economy, and as such, the sustainability paradigm must reflect the interaction of multiple complex, dynamic, non-linear, self-organizing systems under conditions of irreducible uncertainty (Funtowicz et al., 1999). Knowledge within such a society can no longer be considered the property of the privileged few, but become a common, public good, giving all equal access to such information and knowledge. The ideal of a sustainable society is to empower all its members to make informed decisions, become participative and take a stake in society's well-being. To put it tersely, the knowledge society extends far beyond the technical means of communication and uses this as an over-arching principle in information and communications policy. The final section theoretically integrates the empirical evidence that have been discussed above with established theory.

5. Towards a general theory

We conclude with a discussion of our understanding of the nexus between digital literacy, their links to a knowledge society and their contribution to sustainable development. Whereas, as suggested by Suddaby (cited by Urquhart et al. (2013)), theoretical concepts have been presented upfront in the literature review, the concepts that we now propose as a general theory have been gleaned from the GT study.

As theoretical integration of the categorical findings from the CGT field study, we draw the following three conclusions. First, it is overly simplistic to suggest that the provision of ICT infrastructure via public-private-people partnerships will result in digital literacies, and consequently, also secure digital inclusion and participation and lead to equal opportunities and sustainable development. From our CGT analysis, it was clear that a strategic vision which was widely shared within the society was a necessary starting point. In each of the five cases, there was social capital towards ICT adoption that enabled that community to exploit digital opportunities for growth and development as part of the government's compact with citizens (Sharma & Mokhtar, 2006). As a result, policy and governance led to digital inclusion and participation with network effects.

Second, there are no "low lying fruit" or "quick wins" insofar as digital entitlements are concerned. In the five cases, we did not observe a fast roll-out of scores of simple applications. Rather, there was always a pattern of active consultations, pilots and openly declared roadmaps for impactful transformations. In other words, the five cases aimed for the significant few rather than the trivial many. As such, while health, education and e-government services are not necessarily universal

best practices, they do serve as use-cases of domains that have come to provide useful lessons learnt. One exemplar is the proliferation of mobile, web and social media technologies which provide evidence that there is demand for simple content and applications that can be accessible and usable across the wider socio-economic spectrum, beyond complex systems.

Third, digital literacies initiatives were not pursued as ends in themselves. Rather, they were seen as synergistic with the prevailing structural, human and social capital of a society which are conducive to the creation and exploitation of digital opportunities (Leiner & Stoll-Kleeman, 2009; Lips, 2012; Martin & Rader, 2003). To generalize this into a best practice: the effective adoption of ICT skills for sustainable development follows from the establishment of social capital that rewards innovation, as well as an open business environment, with education, research and mass media being intervening dimensions.

At this point, we state one overriding limitation to the findings above. As the field research was based on the content analysis of online government and international bodies, there is an inherent positivist bias (Bettig & Hall, 2003). Despite an earnest attempt at embracing factors of history, policies and practices, and cultural value systems, we are not able to claim multiple perspectives that emerge from standard but tedious interviews of experts, users, policy-makers and the like. Moreover, qualitative research suffers from the classical question of reliability in the sense of repeatability. Hence, the findings from our field analysis may neither be replicated nor free from anecdotal-ism, despite our attempts at providing an eight-dimensional structure to the CGT memos and the involvement of a team of five researchers.

We also caution that a sustainable knowledge society is not one that is filled with a myriad of digital technologies alone but rather one that collectively infrastructure, applications and literacy (Sharma & Mokhtar, 2006). Civic participation, an important factor in democracies, is greatly facilitated when digital literacies and new media are in place (Jenkins et al., 2006). Despite state-of-the-art ICT infrastructure in several (resource-rich) states, the lack of digital inclusion and participation has stunted growth and development. Positivism about the power of the Internet and its underlying technologies to liberate and transform lives is counteracted by an opposing phenomenon – digital divides and hegemonic behavior of the elites resulting in uneven participation in the public sphere and by implication, frustrating sustainable development (Eshet-Alkakri, 2004; European Commission, 2006; Hargittai & Walejko, 2008; Tyner 2014). Several scholars have warned about the dangers of information and media concentration (Albarran & Moellinger, 2002; Bagdikian, 2004; Doyle, 2002; Herman & McChesney, 1997; Herman, 2000; McChesney, 2004). It follows that it must be a primary role of the state to provide such digital entitlements that would prevent an oligarchy.

To put the above discussion in perspective, several scholars had formulated notions of a sustainable knowledge society as an emancipative vision. A notion that is not prescriptive, but a normative concept that encompasses economic, environmental, institutional and social imperatives. Spangenberg (2005) was by no means the first to argue thus. As part of this body of research, Benkler (2000), Castells (2009), Funtowicz et al. (1999), Hargittai and Walejko (2008), Heine et al. (2008), Hilbert (2011), Levy (1997), UNDP (1996), and Webster (2014), among others, have suggested that the fundamental nature of a digitally literate and connected society is that it breeds the ideals of digital entitlements as a means to egalitarian growth that is sustainable. Access to digital technologies and services is only the first step. This vision is particularly relevant to the field of inclusive and participatory platforms (Doyle, 2002; Hargittai & Walejko, 2008), an important tool of sustainability. All five cases displayed varying degrees of commitment to near-universal digital inclusion and participation as a public good, as well as for a common good; what an entitlement inexorably should mean. Leung (2009) terms this “psychological empowerment” which stems from a civic attitude and behavior governing online participation. It therefore follows that the pervasiveness of ICT technologies, skills and applications could lead to positive socio-economic outcomes if inclusion and participation are actively promoted.

Mansell (2004) found that within the core of the information society and their applications, there is increasing reliance on market exchange and a reluctance to prescribe policy or regulatory measures that might intervene in the ‘free’ workings of the Internet. Benkler (2000, 2003) had similarly argued that private interest in profit serves as a benchmark against which many developments in Internet activities are judged in relation to their contribution to society. Mansell also warned that hegemonic ‘empire building’ tendencies and overwhelming profit interests of a few firms have implications for erosion of public spheres and sustainability designs and are therefore cause for concern. Spangenberg (2005) unravels a deeper, perhaps even insidious, agenda in this neo-liberalists’ thinking: in recognizing that knowledge is the most valuable factor of production, neo-liberalists had put the onus on the individual to make good the opportunities presented to him, thereby circumventing the importance of social conditions or collective security systems.

Scaling up on the arguments above, we theorise that digital literacies can form the basis of sustainable development in that such capabilities afford equal access to opportunities emanating from Castell's (2009) notion of a networked economy. A key ideal of the networked economy is the notion of digital opportunities, which encompass economic, social, and ecological perspectives of conservation and change. It can be seen as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony. These factors enhance both current and future potential to meet human needs and aspirations.

This also resonates with Hilbert (2011) four key variables of *who* (divide between individuals or countries), *what kind* (income divide or divide based on age or geography), *how* (divide in access or adoption) and *to what* (mobiles, Internet, or digital television) as an aid to understanding the digital eco-system. He argued that, while different permutations of these variables contribute to distinct manifestations of the digital divide, the definition of what constitutes a digital divide may not be commonly held among policy makers. He further suggested that instead of a one-size-fits-all solution to the digital divide and digital literacy programmes, a context-specific approach may be more effective. His policy framework comprised:

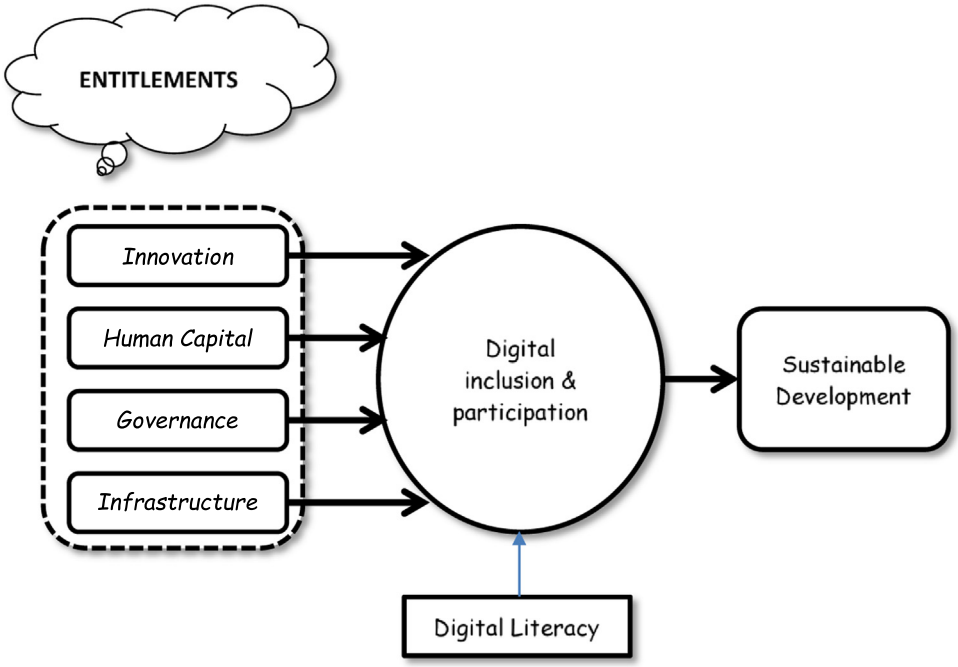

Fig. 1. Digital literacy, knowledge societies and sustainable development.

type of technology (technology for transmission, communication, storage, computation, analytics etc.), choice of subject (citizen, organization, community, industry, country etc.), attributes of nodes and ties (income, geography, age, ethnicity etc.) and level of digital connection (devices, networks, services, etc). But, in our view, this does not go far enough to encompass digital inclusion and participation as entitlements in a sustainable model for knowledge societies.

From a policy perspective, the notions of digital inclusion and participation are deeply entwined. Inclusion is an effort by the state to reach out to its citizens (Milliband, 1969), be it through a physical or virtual public sphere. Participation is when this outreach (presumably in the form of access, content and applications) is useful and usable. Even so, inclusion and participation must embrace economic, technical, and socio-political feasibility. Fig. 1 thus conceptualises what we propose as a general theory of digital literacies, knowledge societies and sustainable development. Specifically, ICT infrastructure, governance in terms of policy implementation, human capital development, and the creation and endorsement of a culture of innovation are a set of digital entitlements that would promote inclusiveness as well as participation in opportunities for growth and development. Digital literacy skills are "contingency factors", i.e. they are acquired and applied by citizens when there is a value proposition. Such an interaction, we posit, ultimately leads to sustainable growth and development for the respective society.

We further suggest that the general theory conceptualized in Fig. 1 may serve as a "best practice" framework for fledgling knowledge societies. A necessary caveat is that the term "best practice", when applied globally, is a misnomer as each economy has its own context. Hence, best practices may at times produce negative results when replicated elsewhere. As Funtowicz et al. (1999) suggest, standardization of development policies will create its own set of challenges such as rejection by the members of that society, diverse educational backgrounds, political constraints and other socio-cultural factors. With such a caution, this section synthesizes at a high level some of the commonalities of policies and some of the precautions that were taken. These are what we declare as the theoretical integration of our GT study with prior, digital literacy research on best practices and lessons learnt.

As a suggestion for further research, as well as a follow-up to this exploratory study, we would like to conduct a series of ethnographic studies where we observe and interact with citizens (users) as well as policy-makers (developers) of a set of twenty "digitally inclusive and participative" societies in order to determine their attitudes and behaviors with respect to digital literacy, and study how such psychological empowerment (Leung, 2009) enables a knowledge society to secure socio-political benefits pertaining to sustainable development. The more focused research questions that have been derived from this exploratory research may be revisited: (1) How is the governance of digital economic policy-making and regulatory regime central to the evolution of a knowledge society? (2) What are the significant digital entitlements required for the exploitation of digital literacies that lead to sustainable development? (3) How may best practices and lessons learnt be effectively shared for the purpose of diffusing digital inclusion and participation? With readily-available authoritative databases (United Nations, World Bank, World Economic Forum, etc.), analytical modeling may reveal high-level correlations, dependencies and interactions. To probe further, a series of longitudinal use-cases could reveal how knowledge societies normatively set out to deliver such services to their citizens so that there is equity in access, opportunity and development.

By providing narratives or "rich pictures" (Checkland & Poulter, 2006) of the ICT policy interventions that worked (best practices?) as well as those that did not (lessons learnt?), we may seek to track the evolution of digitally literate, knowledge societies and provide insights on investment and policy. We believe that such a research agenda would indeed be a contribution to a general theory of digital literacy, knowledge societies and sustainable development.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.telpol.2016.05.003.

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