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디지털 디바이드(Digital Divide) 연구경향 분석

김 성 욱*

요 약 1990년대 이후 인터넷 등 정보화기기의 급속한 발전 및 보급으로 디지털 디바이드(Digital Divide : 정보격차)는 정보화 사회의 주요 정치, 경제, 사회적 이슈로 떠올랐다. 또 정보격차 문제를 규명하고 이를 해결하기 위한 많은 정책적 노력과 학문적 연구들이 진행되어 왔다. 이에 본 연구는 지난 2000년부터 2011년까지 약 10년간 진행된 정보격차와 관련된 다양한 연구들을 체계적으로 정리하고자 했다. 이를 위해 Engineering Village 2(EV2) 데이터베이스를 활용, 정보격차와 관련된 기존 연구들에 대한 자료를 수집했으며 연구자가 설정한 기준에 따라 이를 분석하고 분석결과를 정리했다. 20여년 간의 관심과 지속적인 노력에도 불구하고 정보격차는 여전히 현재진행형인 이슈로 기존의 연구경향을 분석 정리한 본 연구는 향후 정보격차에 대한 후속연구에도 도움이 될 수 있을 것으로 기대된다.

주제어: 디지털 디바이드, 정보격차, 인터넷, 정보화사회

Past and Future of the Digital Divide: **

A Bibliometric Analysis and Review

Sung Wook Kim

Abstract The digital divide (DD) has been recognized as one of the most serious social and public policy issues to emerge from the rapid growth of computing facility, particularly in regard to Internet capabilities, over the past decade. In order to identify DD research trends and contributions, this research has adopted a bibliometric approach to quantitatively assess the research trends of the DD and also utilized information from related literature in the EV2 database from 2000 to 2011. The results show that the most frequently documented type of publications are journal articles, making up 55.2% of the total database of literature. English is the primary language (96.7%), and USA researchers have made the largest contribution (17.0%) to DD literature. Tokai University (Japan), Tilburg University (Netherlands), and Arizona State University (USA) rank as the top three author affiliations. Information technology, the Internet, and economic and social effects are the three top key words that appear in the related DD literature. The results also revealed various regional evidence, main topics, perspectives, frameworks, and solutions that were introduced in DD publications.

Keywords: digital divide, Internet, information Society, bibliometric analysis

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* 서울여대 언론영상학부 전임강사(swkim@swu.ac.kr).

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Ⅰ. Introduction

Many discussions on the definition of the digital divide (DD) have been reported with the empirical evidence of its components (Chen, et al., 2003; Compaine, 2000; Cooper, 2002; DiMaggio, et al., 2001; Fryeet, al., 2008; Hargittai, 2002; James, 2007).

Although no clear consensus has emerged regarding a concrete definition of "access," most attention has been focused on explaining the gap between people who have access to information and communication technologies (ICT), the web, and other Internet services and those who do not (Servon, 2002). Specifically, digital equity is related to the goal of social justice, of ensuring that all students have access to information and communication technologies for learning, regardless of socioeconomic status (SES), disability, language, race, gender, or any other characteristics that have been linked with unequal treatment (Judge, et al., 2006). The existence of the DD not only implies a lack of opportunities but also discloses the existence of poverty, the lack of fundamental literacy, as well as some other serious social problems (Bridges.org, R., 2001).

Countries worldwide have expended great effort and proposed numerous strategies to reduce the DD. However, has the phenomenon disappeared? In Taiwan, for instance, Yu, et al., (2004) reported that the DD in Taiwan included the gap between metropolitan and rural areas, the gap between different levels of education, the slow development of the information technology industry in poorer countries compared to countries such as Korea and other more industrialized countries. Despite many attempts to change the status quo, reducing the DD still remains the most important issue and concern in information inequality.

This study has explored the DD research trends and forecasts by means of a bibliometric analysis and reviews of related historical literature from 2000 through 2011 in order to identify the DD research trends in various contexts, to understand the offerings that the DD makes to organizations, and to forecast or predict areas of continued growth in the DD research.

This article is presented as follows: The next section describes research materials and method. Findings and implications are presented in the following section. The final section provides results and discussions.

Ⅱ. Materials and Method

All documents used in this study were accessed from the Ei Compendex (also known as Engineering Village 2, EV2), which is supported by Elsevier Engineering Information, U.S.A. Elsevier Engineering Information is a leader in providing online information, knowledge, and support of the highest professional relevance for research and industrial practitioners in applied sciences and engineering. This is the reason that EV2 was chosen for this study. For the bibliometric analysis, the EV2 was

systematically searched for DD-related materials the DD in the title, abstract, subject, or key words were selected. published from 2000 through 2011. Documents that included the DD in the title, abstract, subject, or key words were selected. The parameters analyzed included authorship, journal, language, document type, publication year, country, author affiliation (institution), source title, and subject category. An historical review was also performed. Historical phenomena are rich and complex, and we can gain a better understanding of the time(s), place(s), and context(s) in which events occurred and developed by reviewing historical publications. For a longitudinal literature review, this study employed a bibliometric analysis and historical review methods to explore the DD research trends, and from this review, attempted to forecast possible future developments in the DD research.

Ⅲ. findings and implications

1. The DD Historical Analysis

The key word "digital divide" was used to search in EV2 databases. A total of 340 papers produced from this search was analyzed. The findings are discussed in the following paragraphs.

1) Distribution by Publication Year, Document Type, and Language

Table 1,2,3 shows the number of the DD-related publications by year, document type, and language. The number of the DD publications has increased gradually since 2000 except a little decrease in 2009. In the EV2 databases, journal articles comprised the majority of published the DD document types. As for distribution by language, as seen in Table 1, the majority of the DD

〈Table 1〉 Distribution by Publication Year

Year	NP	%
2000	6	1.76
2001	27	7.94
2002	26	7.64
2003	23	6.76
2004	23	6.76
2005	36	10.58
2006	33	9.70
2007	33	9.70
2008	45	13.2
2009	28	8.23
2010	43	12.64
2011	17	5.00

NP = Number; % = Percentage

〈Table 2〉 Distribution by Document Type

Document Type	NP	%
Conference Article	148	43.52
Journal Article (Article)	188	55.29
Conference Proceeding (Proceeding Paper)	4	1.76

〈Table 3〉 Distribution by Language

Language	NP	%
English	329	96.76
Chinese	9	2.64
Japanese	2	0.58

research is written in English. This evidence, gradual increase in the DD research since 2000, makes it clear that the topic of the DD is becoming and constantly important and interesting to scholars.

2) Distribution by Country/Territory and Institutional Origin

Table 4 displays the distribution of publications by country and territory. The United States, Italy, China, the United Kingdom, Japan, Spain, Taiwan, India, France, and Netherlands are the top ten countries publishing DD articles. The listing of publications by their institutional origin in Table 2 shows that the Tokai University,

〈Table 4〉 Distribution of Country/Territory and Institution Name (Top 10)

Country	NP	%	Author affiliation	NP	%
United States	58	17.05	Tokai University, Fukuoka Junior College	7	2.05
Italy	17	5	Tilburg University	5	1.47
China	17	5	Arizona State University	3	0.88
United Kingdom	15	4.41	Rockefeller College of Public Affairs and Policy, University at Albany, Sunny	3	0.88
Japan	15	4.41	University of Redlands, School of Business	3	0.88
Spain	13	3.82	Dipartimento Di Automatica E-informatica, Politecnico Di Torino	2	0.58
Taiwan	12	3.52	University of Washington	2	0.58
India	10	2.94	Dept. of Management Information Systems, National Chengchi University	2	0.58
France	10	2.94	Dept. of Information Management Overseas Chinese University	2	0.58
Nether Lands	9	2.64	Biomedical Engineering Research Centre, Nanyang Technological University	2	0.58

NP = Number; % = Percentage

Fukuoka Junior College in Japan, the Tilburg University in Netherlands, the Arizona State University in USA, Rockefeller College of Public Affairs and Policy, University at Albany in USA, and University of Redlands, School of Business in USA are the top five DD research institutions.

3) Distribution by Source Name

Table 5 shows that the Annual Hawaii International Conference on System Sciences (HICSS), ITU News, and Telecommunication Policy are the sources of the greatest number of publications on the DD.

4) Distribution by Key Vocabulary

Table 6 shows that "Information Technology," Internet," and "Economic and Social Effects" are the three most frequently used key words and phrases appearing in the DD publications.

〈Table 5〉 Distribution of Top 10 Sources of DD Research

Source Name	NP	%
Proceedings of the Annual Hawaii International Conference on System Sciences	15	4.41
ITU News	10	2.94
Telecommunication Policy	9	2.64
ACM International Conference Proceeding Series	8	2.35
Computers and Education	7	2.05
Lecture Notes in Computer Science	7	2.05
Journal of Information Science	5	1.47
Information Economics and Policy	5	1.47
Telecommunication Journal of Australia	5	1.47
Geojournal	5	1.47

NP = Number of Publications

〈Table 6〉 Distribution of Vocabulary and Listing of Top 10 Authors' Contributions

Controlled Vocabulary	NP	Author	NP
Information Technology	97	Sasaki, Hirofumi	8
Internet	77	James, Jeffrey	7
Economic and Social Effects	30	Yahara, Mitsutoshi	7
Digital Arithmetic	29	Fujimoto, Kuniaki	7
Technology	24	Ferro, Enrico	3
Social Aspects	23	Samori, Carlo	3
Students	22	Azari, Rasool	3
Public Policy	20	Razak, Norizan Abdul	3
Rural Areas	18	Qureshi, Sajda	3
Education	18	Pellerano, Stefano	3

NP = Number of Publication

〈Table 7〉 Distribution of Classification Code

Classification Code	NP
Computer Applications	124
Telecommunication; adar, Radio and Television	114
Computer Software, Data Handling and Applications	87
Information Science	81
Impact of Technology on Society	75
Education	58
Telephone Systems and Related Technologies; Line Communications	54
Optical Communication	53
Data Processing and Image Processing	48
Industrial Economics	48

NP = Number of Publication

Sasaki, Hirofumi, James, Jeffrey, Yahara, Mitsutoshi, and Fujimoto, Kuniaki are authors from top in the list of the DD publications.

5) Distribution by Subject Category

Table 7 shows that "Computer Applications," Telecommunication; Radar, Radio and Television," "Computer Software, Data Handling and Applications," "Information Science," "Impact of Technology on Society," and "Education" are the most frequently used classification code appearing in the DD publications.

2. Research Trends and Forecasts

Papers produced from the key word "digital divide" search in EV2 database were reviewed and analyzed based on their main topics, approaches, and suggested solutions for the DD. Categorizing these papers identified a number of research themes/trends:(a) regional evidence (Geography), (b) specific topics of the DD, (c) frameworks/perspectives of the DD, and (d) suggested solutions for the DD (See table 8).

Among 340 papers produced from the key word "digital divide" search in EV2 database, the researcher categorized papers based on four main trends. the quite numbers of papers are excluded in this categorized process because some papers belonged in multiple trends and the paper belonged in only one unique trends.

As seen in Table 8, the total numbers of papers showed regional evidences both in domestic settings and global settings was 43. In the domestic setting, the relative number of studies (12) have been conducted in Asia compared with other areas. And, the number of studies for comparing the DD in cross-countries (global settings) was only nine because the DD in global settings might be difficulty to collect data and to define scope of study. In addition, the number of studies has focused on comparison between urban

and rural regardless of within or outside countries, which led the researcher sub-categorized urban/rural in this study.

As seen in Table 8, the trends of papers showed specific topics of the DD were education (20), e-government (12), medical industry (6), others including politics (4), entertainment (2), and Information security (3). The number of DD studies in the education context was higher than other areas because education has been highly paid attention to by numerous researchers. However, e-government and medical industry also have been popular topics of the DD to many researchers. In terms of the perspectives, some papers shared common perspectives and adopted the similar frameworks for the DD studies as indicated in Table 6. The socio-economic perspective has been adopted by numerous researchers (11) to study DD. The behavioral perspective was the second popular approach to multiple researchers (7). Other popular frameworks or theories for the DD studies were individual technology diffusion/acceptance model (7), ethnography approach (3), and organizational

〈Table 8〉 Research Trends

Regional Evidences	Domestic Settings	Asia	12
		North/South America	7
		Africa	7
		Europe	8
	Global Settings	9	
	Urban/Rural	13	
Digital Divide in Specific Topics	Education	20	
	E-government	12	
	Medical Industry	6	
	Others	Politics	4
		Entertainment	2
		Information Security	3
Perspectives	Socio-economic	11	
	Behavioral	7	
	Frameworks	Individual technology Diffusion/acceptance Model	7
		Ethnography Approach	3
		Organizational Adoption	3
Solutions	Wireless/Mobile	13	
	Public Policies	7	
	Sharing/borrowing	6	
	Others	Cooperation	5
		Human Computer Interaction (HCI)	4
		Robotics	2

adoption (3). This indicated that individual technology diffusion/acceptance model has been frequently used in studying the DD.

The DD solutions suggested by the studies were wireless and mobile (13), public policies (7), sharing/borrowing (6), and others including cooperation (5), HCI (4), and robotics (2). Wireless and mobile including satellite technology was suggested by numerous studies as the most powerful solutions for the DD issues. In addition, some studies emphasized the cooperation to solve the DD problems. For instance, information and financial cooperation between content owners, users, and advertisers was important (Kabulov, et al., 2010), emphasizing the cooperation of ICT standardization (Canazza, 2009), and cooperation of the telecommunications sector to reduce the DD (Azam, 2008).

Through above discussion of research trends, in the context of regional evidences (geographical evidences), more studies in the global settings will be needed for the balance of domestic settings. In the case of specific topics of the DD, further studies need to a little more focus on medical industry, politics, entertainment, and information security areas. In terms of perspectives and frameworks, it is desired that behavioral perspectives, and ethnography and organization approaches will be more adopted for the DD studies in the future. In the case of suggested solutions for the DD issues, many studies have suggested wireless and mobile solutions. However, more attentions should be paid to the areas of public policies, sharing/borrowing, and other areas, such as HCI, cooperation, and robotics.

In the next section, the seminal studies and their key findings are discussed based on the above categorized trends.

1) Regional Evidence in the DD

Despite the efforts devoted to the analysis of the DD over the last years, the regional evidence on this issue is still scarce (Vicente & López, 2011). As a result, this study attempts to show the taxonomy of the regional evidence of the DD found in the EV2 database from 2000 to 2011.

(1) Regional Evidence in Asia

Many scholars in numerous Asian countries have actively used populations within their countries to explain the DD issues. Physical impairment has been considered as a factor in the DD studies. Yeh and colleagues (2008), who developed the alternative input device and an adapted web platform, conducted testing of people in Taiwan who both did and did not have physical impairments. Chung and colleagues (2010) conducted another DD study in the Taiwan region in order to describe the current status of the DD in Taiwan for government policy makers (Chung, et al., 2010). Their study found that the cause of the DD in Taiwan was mainly a lack of willingness and ability to learn among those with lower educational backgrounds and/or elderly individuals, which was significantly different from the causes of the DD that had been previously mentioned, such as

the expense of computer equipment and Internet access fees, poor connectivity and bandwidth, or a lack of availability of computer access in public places. The other study also investigated the impact of DD factors on perceived motivation to utilize technology to learn English in Taiwan (Chuang, et al., 2009). In this study four DD-related factors were determined: (a) perceived computer and Internet skills, (b) school-related Internet use, (c) computer and Internet resources outside the home, and (d) gaming/leisure use of the Internet.

A DD study in the Thailand region addressed and reviewed the strategies of the DD mainly by focusing on ICT accessibility for the poor, the disabled, and the elderly (Punyabukkana, et al., 2008). Fahmi (2002) conducted a study regarding the challenges and struggles of the Indonesian Digital Library Network as a result of the DD. Razak and colleagues (2010) presented findings from a study they conducted on the effectiveness of the training programs offered at the telecenter, which included training for policymakers and telecenter managers in Malaysia. Still, another study (Aziz, 2009) discussed the researcher's ongoing experience in building a community portal for underserved children in Malaysia.

Lalmas and colleagues (2007) investigated a DD issue in an Indian village regarding the current availability of information technology access. Likewise, Mohanty (2008) critically examined the existing problems and possibilities of digital development in India in order to show the immense impact that availability of information and communication technologies could have on rural economies and societies there. Further, Rao's (2005) study highlighted India in the context of the DD by looking at India's infrastructural bottleneck that includes electricity, IT penetration, teledensity, and Internet industry, and its enabling policies to transform India into a knowledge society. The article also discussed various technology options for connectivity, terrestrial wireless, satellite, and wireline, by presenting snap shots of selected and successful projects that made an impact in helping to bridge DD in India. Jing's (2007) study compared an overview of the DD on a global basis with the specific aspects of the DD in construction of Guizhou Province, China.

(2) Regional Evidence in North and South America

White and Lester (2001) proposed to use a medium that is culturally relevant to inner-city youth—i.e., hip-hop music—to increase information technology awareness and acceptance, fostering the use of resources that offer wealth-creation in an Internet-based economy in the USA. Another study (Beníez, 2006) explored some dimensions of the DD among Salvadoran immigrants in the Washington DC metropolitan area. This study concluded that the limited accessibility to the Internet and ICTs among Salvadoran immigrants, particularly in terms of generation, need to be considered to design and implement

communication and technology policies. Qureshi and Trumbly-Lamsam (2008) investigated how information and communication technology was communicated in Native American communities, using a framing analysis of tribal newspapers to develop key concepts and relationships that explain how the DD takes place.

Ménard and Proulx (2007) discussed an engineering exercise that a providing wireless high-speed Internet access to as few as 25 subscribers located in rural areas in Canada in order to lead commercial success in other rural areas throughout the world. Mariscal's work (2005) focused on DD issues in Mexico. Her study collected from the various recommendations for telecommunications policies and developed frameworks to examine the case of Mexico in considering the social capital concept. A study by Báez and Kocaoglu (2007) applied the Analytic Hierarchy Process (AHP) as a methodology to provide appropriate information about which technology will have the greatest impact on bridging the gap of the DD based on a case study of Costa Ricans.

Bogle and Irving's (2008) study outlined the forms of distance education and other emerging challenges faced by certain regions in the Caribbean as the formal education system is transformed, as well as opportunities of capitalizing with offshore marketing and blended learning to address issues in the DD of these Caribbean regions.

(3) Regional Evidence in Africa

The African region has been another favorite spot to test DD issues. Agbeja and Salawu (2007) studied the digital gap between Sub-Saharan Africa and the rest of the world. Kim (2010) suggested a model based on Internet penetration percent (IPP) and capital GDP in the context of Africa. Another study regarding the DD in Africa (Chéneau-Loquay, 2007) presented multiple approaches in focusing on the opportunities of new technologies for Africa, based on case studies. Cunningham's work (2004) discussed two DD issues: (a) technology divide between Africa and the rest of the world and how to bridge it, and (b) the characteristics of integrated strategies for the new world economy. Fuchs and Horak (2008: 99-116) took a look at the global DD concerning Africa and analyzed the situation using specific examples (Ghana, South Africa). Mutula's (2005) study provided a proposal on how e-governance could be used to narrow the DD within libraries in Africa. Roycroft and Anantho (2003) identified the factors affecting Internet subscription in African nations, such as English as the official language, the monopoly of the ISP market structure, the overall economic development, and the amount of international bandwidth.

(4) Regional Evidence in Europe

Cooke and Greenwood (2008) reported the findings of research into the extent and the impact of restricted access by specific groups to ICT-based communications in UK and higher education institutions.Various aspects of digitization programs to reduce the DD in

relation to the UK's army were discussed by Pengelley (2005).

Bayrakci's (2009) study aimed to determine and identify possible policy actions, structures, and applications to achieve a fully inclusive information society in Turkey. Vandenbroeck and colleagues (2007) conducted a study to assess to what degree technology may be integrated into family day care (FDC) providers' experience, cultures, and beliefs based on a case study of family day care providers in Flanders, Belgium. Another study (Feijóo, et al., 2006) examined the role of wireless technologies in the development of broadband in Europe and presented a progress model for broadband and a case study of the wireless communications market of Latvia, which entered the European Union (EU) in May 2004.

Vodoz and colleagues' (2007) study was conducted in the context of farmers and workers in Switzerland, and the findings of this study suggested that the priority for reducing inequalities of access to ICT resources is no longer the provision of high-performance ICT infrastructures for peripheral regions, but rather the implementation of continuing education and social action policies within the urban centers.

An analysis was made in a community of Madrid by Gómez-Barroso and Pérez-Martínez (2007) to test the adequate broadband infrastructure based on the size of a municipality, which was measured by number of inhabitants, households, telephone lines, or economic activity units. The analysis of this Madrid community found that the size of the residence district impacted on the condition of asymmetric digital subscriber line (ADSL) expansion. Minguez's (2006) study presented a comparative analysis of the effect that new technologies have had on the social structure and on unequal access by gender in Southern European countries, particularly in Spain. Its findings suggested that inequalities were more significant in the group of women with low educational levels than those who were not integrated into the labor market because of the family-based culture that characterizes Southern European countries, where women have historically been confined to the private environment of the family, thus limiting their opportunity for integration into the labor market and exposure to new technologies.

(5) Regional Evidence in Global Settings

Beyond studying the local settings within countries, inter-countries or a group of countries have been used to better understand DD issues in a global setting. Many scholars use global or international lenses to look at DD issues.

For example, Cullen's work (2003) examined a number of these issues at the national level in the USA, UK, Canada, and New Zealand, looking for the evidence of the DD, assessing factors that contribute to it, and evaluating strategies that can help reduce it based on socio-economic factors, geographical factors, educational, attitudinal, and generational factors. Cullen also explored whether the presence of physical disabilities was a factor

of the DD.

Kosuge's work (2006) described Japan's Asia Broadband Program to reduce the DD problems in the Asia Pacific region, especially Japan, Singapore, and China, by building the space infrastructure for the development of an ICT society. Wong's (2002) study examined possible determinants, such as whether Asian countries have been slow to adopt ICT in comparison to non-Asian countries. This was done by providing an empirical evidence on the basis of their current level of development (GDP/per capita) and competitiveness (world competitiveness index).

James (2011) focused on the use of mobile phones based on settings during the period from 2000 to 2006. His findings ranked some countries based on their performance of the use of mobile phones based on their income levels. Pick and Azari (2007) analyzed the influence of education and the workforce, as well as economic and policy factors, on ICT usage, expenditure, and infrastructure in 67 countries. Their findings indicate the importance of R&D capacity, foreign direct investment, government prioritization of ICT, and math/science education on the DD.

James (2005) also emphasized the importance of new measures of the Internet in poor countries where individual ownership of Internet access was very limited among the population. As James noted in the abstract to his article, "We suggest that foreign aid donors and national governments pay less attention to providing individual access facilities … and focus instead on ways to foster indigenous rural innovation systems devoted to finding relevant and cost-effective applications of the Internet."

Chircu and Mahajan (2009) showed that the DD appeared different from what was previously thought for the fastest-growing developing countries—Brazil, Russia, India, and China (BRIC)—based on 2006 data, while mobile technology depth that was number of subscriptions as percentage of population was lower in BRIC.

Boje and Dragulanescu (2003) provided a comparative study of different kinds of the DD between emerging democracies (or new market-oriented economies) from Eastern Europe, as well as differences between them and developed countries (e.g., Western Europe, USA), due to the scarce attention paid to how to solve the Eastern European digital disparity. Their study measured the DD across the regions of 27 European member states, and within each country, and explained the observed regional disparities. Vicente and López's (2011) study used a multivariate framework to analyze the DD in 15 European countries to identify factors related to the DD (Vicente & López, 2006).

(6) Regional Evidence in Urban/Rural

Examining and collecting data of the DD studies in rural areas within countries seem to be a common strategy by numerous scholars because of the obvious difference of technology infrastructure between metropolitan and rural areas impacting the DD. Kim and others (2011) studied the Korean government's rural broadband policies to overcome the limited

use of interesting and useful services based on high-speed Internet in rural areas. Yang and others (2010) produced a study that focused on discovering the factors (age, income, education, region, and gender) affecting digital inequality, and they tested their findings in the remote rural areas of South Korea. Hossain (2010) targeted persons with disabilities in rural Bangladesh areas and discussed the importance of information and communication technology (ICT) development and accessibility for persons with disabilities.

Various factors related to the DD that alienate people from enjoying the benefits of ICT in developing countries, especially in Bangladesh, were identified by Rahman and colleagues (2006). Another study was conducted by Sun and others (2010) in five urban and rural areas of China regarding the internet DD. They proposed a policy that would serve to encourage the supply and demand based on increasing government information supplies and information demands of rural areas. Chen and colleagues (2009) also studied rural China's DD issues from a social structure perspective, especially in terms of the DD existing in different types of village structures, such as traditional villages versus industrialized villages. Xia and Lu (2008) carried out a review of possible deficiencies in the rural areas of China and explored a sustainable institutional arrangement for universal service obligations (USOs) based on the identification of unique institutional constraints after a Village Access Project (VAP) had been executed over a period of four years.

One study examined the current status of information literacy among students in primary schools in rural and urban areas in Taiwan using influential factors, such as the local environment, information settings, and individual backgrounds, as variables for the adjustment of government policies in Taiwan (Chang & Tsou, 2006). Another study by Patel and others (2006) described "iShakti," which was a real-world, Intelligent, Interactive and Adaptive Web application, was deployed across 1000 rural kiosks in India to reduce the DD problems in daily lives.

Wijers (2010) identified and illustrated key determinants of the DD in the context of information technology development as a case study of Cambodia. Cullen's (2003) study reviewed recent research concerning the DD in urban Maori and Pacific Island communities in New Zealand and noted factors that alienate people from enjoying the benefits of information technology and participation in the knowledge economy. Ferro and others (2005) presented a comparative study on the DD between a rural and main metropolitan area, and showed how barriers to technology access and usage may vary in terms of both nature and intensity of areas. Schleife (2010) conducted an interesting study by focusing on regional versus individual determinants of the DD. The results indicated that it was the different composition of individual characteristics

between rural and urban populations that accounts for the regional DD. At an individual level, the findings underlined the importance of network effects.

2) Main Topics in the DD

(1) Education

A study that took place in Malaysia (Razak, et al., 2010) conducted research on the effectiveness of the training programs offered at a telecenter, which included training for policymakers and telecenter managers. Keats and Beebe (2004) addressed digital divide issues in a partially online masters program in Africa.

Payton (2003) addressed the need to increase efforts to eliminate the DD—including increasing minority participation in academically gifted programs and improving minority performance—based on the stated perspectives on DD of 41 African-American teenagers attending high schools and middle schools in the USA.

Bo and Changxian (2010) highlighted that educational informatization was the key to bridge the DD and achieve knowledge-sharing among universities in China. Haler and Jackson's (2010) study presented an overview of DD issues associated with the global disparity in availability and cost of bandwidth, and they provided examples and discussions of its relevance to global use of open educational resources.

Eamer (2010) suggested the use of videoconferencing technology in classrooms to facilitate virtual languages for reducing the DD problems. Another study by Salajan and others (2010) examined students' and faculties' perceptions regarding the development of digital learning technologies in the curriculum between the native and immigrant of the digital at the University of Toronto. Rye (2008) investigated how the uneven distribution of Internet connection influences students' participation in higher education.

Tien and Fu (2008) looked at two dimensions of the DD—computer use and computer knowledge—and identified the correlations between the DD and their impact on college student learning. The application of technology in enhancing multicultural and multilingual aspects of education at South East European University for reducing the DD problems was described by Abazi et al. (2008).

A study by Hohlfeld and colleagues (2008) provided evidences of the existence of the DD among Florida's K-12 schools by looking at whether low socio-economic status (SES) schools provide students with equitable supports for achieving information communication technology (ICT) literacy. Another study (González, et al., 2006) suggested an economic approach to the DD issues by focusing on improving cost-effectiveness in physics teaching laboratory resources to enable students to use expensive laboratory equipment that is not usually accessible to students.

Hoole and Hoole (2002) addressed the

challenge for educators, particularly engineering educators in Third-World countries, many of which were highly selective, male-dominated, comparatively expensive, and unconcerned with environmental standards to overcome and address these problems. They determined that a solution would necessitate the introduction of cheaper ways of delivering education and attracting disfranchised groups to academic programs.

Wolk's (2004) study examined and measured the effect of English language dominance on the DD by focusing on the relationships between the English language and Internet usage patterns based on two groups (developed and developing countries) and further subdivided into two groups (English speaking and non-English speaking). Chuang et al. (2009) discussed factors that may be critical in the development of e-learning for young Taiwan English learners. Huang and Russell (2006) explored the relationship between technology accessibility and academic achievement, and addressed the fact that the DD exists in technology accessibility and cuts through various socioeconomic factors in public schools.

Fourie and Bothma (2006) argued that the DD concerns more than just ICT access and information skills. They highlighted that individual commitment, group work, and intellectual and academic support from the institution might contribute to bringing people to higher levels of knowledge generation and communication. Doyle (2006) discussed the fact that MIT's OpenCourse project allowed college teachers all over the world to adapt MIT courses to their local needs. Doyle found that local learning uses the digital classroom to generate new contents that will empower students with their own blogs and class wikis, which will ultimately help in crossing the DD.

Comparisons of engineering education in India and some Latin American countries were made to enhance and improve engineering education—specifically, to consider their discipline within the context of regional economic growth (Parmentier, et al., 2006). The utilization of new information technologies based on self-directed learning communities (SDLC) to bridge the DD was discussed by Clark (2003). Another study (Johnson, et al., 2006) reported on the successful prototyping and evaluation of a low bandwidth, an easy-to-use tool for distance learning, in order to address the DD in education.

(2) E-government

A case study regarding mainland China and Macao investigated relationships between the use of e-government services and theDD and suggested that a reason for not using the services was the lack of computer/Internet skills (Li, 2008).

A study by Sipior et al. (2011) applied the technology acceptance model to explore the DD and transformational government (t-government) in the United States. Bélanger and Carter's (2006) study explored the potential effects of the DD on e-government and indicated that income, education, age,

and frequency of Internet use significantly impact the use of e-government services. Fass (2006) investigated information integration and security concerns of national and local e-services, e-voting, and a local e-Gov system. Semantic web-based improvements were proposed as a solution.

The effects of demographic variables identified in the DD literatures on the usage of e-government services have been discussed by Bélanger and Carter (2009). Four types of services were suggested by Becker and others (2008) for developing the E-Inclusion-Gap Model, which addresses gaps between service-specific uses. They were: (a) Internet usage, (b) E-Commerce usage, (c) E-Government for Information, and (d) E-Government for Transaction. Pimenidis et al. (2009) reviewed successful implementations of secure and trusted e-government services available on mobile networks for providing services to people living in rural and remote areas. Huang and Fang (2010) also analyzed e-government efforts to reduce the DD in construction areas of Taiwan.

(3) Medical Industry

Specific contexts, like medical settings, have been useful to scholars who study the DD issues. For instance, Kim and Kim (2010) revealed that the use of the web-based Personal Health Record (PHR) by the low-income elderly was limited due to their poor technical skills and low physical/cognitive abilities. On the other hand, the younger and more affluent populations used the web-based PHR much more easily and efficiently, compared to the elderly and low-income group. Another study by Rully and others (2005) was conducted regarding the use of broadband wireless LAN for the implementation of telemedicine applications in rural hospitals, based on experiments on video transmission, X-ray image transmission, and exchange of electronic medical documents. With regards to the "haves" and "have-nots" of PHR, Kim et al. (2005) developed and customized a web-based patient-centered electronic PHR called the Personal Health Information Management System (PHIMS), and then evaluated the system. Related to the telemedicine system, Masucci et al. (2006) found that underserved populations who lack computer experience or skills and are at increased risk for cardiovascular disease (CVD) can be educated to use an Internet telemedicine system to communicate their health status to their health care providers. A study by Houston and others (2006) assessed the feasibility of "bridging the DD" by training community health advisors (CHAs) from low-income communities to use high-quality Internet-based health information in the context of health outreach activities to low-income, low-literacy African-American populations in the deep south of the United States. For designing strategies to overcome the DD among deaf signer users, Fajardo and colleagues (2008) suggested that knowledge about how interaction between cognitive and systems factors can be used to increase Web information knowledge among people who are

deaf signers.

(4) Others

Some scholars have conducted studies in political settings. For example, a study by Shirazi and others (2009) investigated the relationship between the global expansion of ICT and the level of democracy within nations by analyzing archival data on 133 countries from 1995 to 2003. Two important findings from their study were as follows: (a) there is a growing DD in democratic freedoms among countries; and (b) in spite of rapid ICT expansion in some countries, Internet filtering is having a significant impact on democratic freedoms. Another study (Blanger & Carter, 2010) explored the impact of the DD on Internet voting (I-voting) and proposed a model of I-voting, which determined that age, income, education, and frequency of Internet use had an impact on I-voting utilization.

Scholars have also paid attention to the DD in the entertainment setting. Seshagiri and Blom (2010) described media use practices that were observed among consumers in India and highlighted affordable digital media design opportunities based on their key findings that the notion of digital media acts as a contributor to bridging the DD.

A few publications over the last eleven years have studied the DD from an information security perspective. Albrechtsen and Hovden (2009) studied surveys and in-depth interviews with information security managers and noted that users indicate that a DD exists between these groups in terms of their views on and experience with information security practices. Fass (2006) investigated information integration and security concerns of national and local e-services, e-voting, and a local e-government system, and proposed semantic web-based improvements as a solution.

3) Frameworks and Perspectives in the DD

Because the Internet and ICT have been highly adopted in the industrialized part of the world, the focus has shifted away from the classical DD, which explained the divide between those who do and do not have access to the Internet, to a more explorative focus on social divides (Peter & Valkenburg, 2006). Thus, a variety of frameworks and perspectives regarding the DD are found in publications registered in the current EV database.

(1) Socio-economic Perspectives

Bristow (2009) found that the influence on the DD was significantly more socio-economic and demographic, as well as rather more behavioral and habitual, in terms of technology usage, profiles, and characteristics.

The social cognitive model of the DD found in the social cognitive theory and computer self-efficacy literature was conceptualized and tested with more than 4,000 students in Singapore by Wei and colleagues (2011). They developed a model having three levels: (1) the digital access divide (the inequality of access to information technology in homes and schools), (2) the digital capability divide (the inequality of the capability to exploit IT), and (3) the digital outcome divide (the

inequality of outcomes—e.g., learning and productivity—of exploiting IT). The self-efficacy of the Internet was also considered by Lam and Lee (2005) as an important factor in their study examining the influences of the two mediating factors—Internet self-efficacy and outcome expectations—on elderly persons' intentions to adopt new technology (i.e., the Internet).

A study by Bristow (2009) classified users as digital natives (always on) and digital immigrants (on demand); according to terms first identified by Prensky (2001a, 2001b), "natives" are young people born after 1982 that have grown up with technology to such an extent that it has become integrated into their lives; "immigrants," on the other hand, were not born into the technological age but have embraced it even under duress.

Azari and Pick (2002) also analyzed the socioeconomic influences on technological levels in 164 counties in the United States regarding the DD, and found that factors that were important in correlating among several technology sectors were the professional, scientific, and technical services workforce, other services workforce, household income, federal grant funds, college education, and ethnicity. A study by Genus and Nor (2005) considered a social shaping approach to analyze innovation in ICTs in order to assess the prospects for improvements in the DD between developed and developing countries and for stimulating economic development through the promotion of e-business.

A gender-based approach was also often used for the DD study. Minguez (2006) used one of the social factors of the DD, which was the gender perspective in Southern European countries, particularly in Spain. Another study by Cyprian (2010) investigated for the comparison of the ICT literacy levels of boy and girl students in Nigeria, and made recommendations to narrow the DD. Prieger and Hu (2008) examined the gap in broadband access to the Internet between minority groups and white households with geographically fine data from broadband subscriptions. They also examined quality of service and competition as components of the DD, in addition to income and demographics. A study by Kvasny and others (2007) examined gendered perspectives on the DD, motivations for engaging in information technology (IT) education, and expectations regarding IT workforce participation in Kenya. Their findings imply that IT education and workforce entry require a complex mix of digital technologies, organizational capacity building, gender equity, and IT policy remedies because women were particularly concerned about gender discrimination in the workplace.

Yuguchi (2008) presented an economic analysis of Japan's attempt to address the geographical DD problem for broadband and mobile telephone services. To justify return of investment (ROI) of universal broadband in rural or poor areas, Marine and Albrand (2006) identified a key factor, the availability of technologies that can provide access at

affordable cost, and they highlighted an economic approach based on trials that focus on providing applications and international cooperation. Another study by Adams (2010), based on human capital theory and labor market theory, used an economic approach to investigate the discrepancy between salaries offered among adjunct lecturers utilizing traditional methods of instructional delivery versus those employing online instructional delivery methods.

(2) Behavioral Perspectives

Andrews (2010) adopted a grounded ethnographic and linguistic analysis to understand blog comment threads where blogging "natives"—bloggers and their readers—identify "strangers' " comments as errors. His findings suggested that strangers lack natives' understanding of the Internet's structure, and their references to online literacy elements also differ. Andrews concluded that DD studies should transition to a focus on usage patterns and quality, not access quantity.

Huang et al. (2003) examined how differences in willingness to trust influence Internet adoption rates across countries. Their findings revealed that trust had a statistically significant influence on levels of the Internet penetration and success in increasing Internet adoption rates through policies to promote trust levels, so that differences in trust may produce the DD among nations. Luyt (2006) showed how e-readiness indicators participated in defining the problems of DD policy and how ready the nations of the world were to exploit the potential of new information and communication technologies.

Wilbon's (2003) work also used a behavioral approach to highlight the importance of the role of technology environment to narrow the DD by suggesting that personality composition—particularly motivation, self-esteem, learning styles, and cognitive thinking—influences a person's academic performance and the decision to pursue IT education and careers.

(3) Frameworks

A study by Han et al. (2006) suggested an technology diffusion model based on Keith Griffin's model in the context of the agricultural green technology revolution and analyzed users' different choices in communication technologies in different stages of informatization and the ratio between different users' capital and labor. In another study that used data from the Piedmont region in Italy, two competing views were tested: (a) fundamental social differences and opportunities (multi-dimensional divide), and (b) determinant of Internet use (access divide) (Gil-Garcia, et al., 2006). To answer the claim that technology diffusion emerges from the existing social order, Wattal et al. (2011) used data on adoption of multiple technologies by individuals in the US over different time periods, and suggested that technology diffusion largely took place along existing social class lines, and that the arrival of newer technologies ensured that

the DD was perpetuated. Razak and others (2010) studied the technology acceptance and development to reduce the DD problems by focusing on the impact of the application of the device by measuring users' acceptance toward the device in order to eliminate technophobia and the complexity of the technology.

Based on a media ethnography approach, the analysis by Benítez (2006), which combined structuration theory with diasporic media studies, was conducted in areas that included Internet communications, diasporic websites, the use of mobile phones and teleconferencing, and the transnational dimensions of the DD. McIver and Prokosch (2002) conducted studies of DD issues within the Wiggin Village and the International Institute of Rhode Island in the USA. They suggested an approach that was not captured by access-oriented models. Their study revealed language and social networks are often more important in information-seeking behavior than having access to a telephone, the Internet, or other types of communication such as newspapers. To introduce the European perspective on the DD, a study by Brandtzg and colleagues (2010) was conducted to better understand the DD by identifying the variety of ways in which people in Europe use the Internet based on five user types: Non-Users, Sporadic Users, Instrumental Users, Entertainment Users, and Advanced Users. Mohammad and Lan (2010) proposed a framework that included the development, training, and maintenance of the ICT and information systems for local communities, and reviewed the DD that existed between the indigenous and nonindigenous sections of the population.

Ishii (2005) mentioned that only a few studies on the DD were undertaken in organizational settings, and considered the human side of the DD in an organizational setting and investigated whether the DD exists in the workplace by examining multiple dimensions of communication satisfaction. A study by Forman (2005) explored determinants of Internet adoption affecting the DD in organizational settings by examining Internet adoption decisions in a very large sample of organizations in the finance and services sector.

A multi-channel model of separating equilibrium was proposed by Riggins (2004) to show how the DD, where high type consumers dominate the online channel and low type consumers dominate the offline channel, segments the marketplace to reduce the cannibalization problem. Qureshi and Davis (2007) suggested a framework that described the relationship between the tools and benefits of e-commerce and its effect on development to overcome the DD.

4) Suggested Solutions for the DD

Numerous studies have introduced and suggested solutions regarding various problems resulting from the DD. In this study, sharing or borrowing, local or national government policies, wireless and

mobile, and various other solutions are proposed.

(1) Sharing/Borrowing

A study by Selwood and others (2005) that was conducted in rural primary schools in Australia identified a number of benefits associated with borrowing a notebook program for use at home. In this program, the participants' ability to have easy access to ITC in their homes resulted in improved skills and increased confidence. James (2011) suggested sharing mobile phones in developing countries to cease or reduce the DD, and using free software such as the GNU/LINUX operating system for the advantages that it afforded to developing countries to bridge the global DD (2003). Caudill (2010) also highlighted the use of free software and services to bridge the DD. A study by Qureshi and others (2007) investigated how knowledge networking/sharing can enable the DD to overcome. Tibben (2007) also provided a knowledge-based approach as an effective means to understand and develop responses to various forms of disadvantages related to access and use of ICTs.

(2) Public Policies

Numerous studies have tried to solve the problems of the DD by suggesting and measuring effective national public policies. Yates and others (2010) examined the DD by analyzing the impact of national policies in the form of strategic planning, regulation, and investment in approximately 150 countries. They revealed that when controlling for measures of economic, political, social, or educational development, there was a greater digital opportunity and greater overall technology adoption and use in countries that have competition for the provision of basic telecommunication services and make a higher financial investment in ICT development.

Another study regarding national policies related to the DD was about developing a policy tool for a national strategic framework on bridging the DD in Malaysia (Ramachandran, 2008). Holmes (2003) discussed factors affecting national public policies for the DD such as economic and social inequity. The links between digital technology and global capitalism were examined in a world summit on the Information Society that was held by the United Nations, 2003.

A study by Feijóo, et al., (2006) described the challenges for policymakers who must design the appropriate policies to achieve an end to the DD, and they highlighted the role of wireless technologies as one of the main pillars of broadband connectivity extensions. Yu, et al., (2005) measured the performance of various government agencies to demonstrate the flexibility and usefulness of the adapted balanced scorecard approach. Horikoshi (2005) also introduced Japan's policies and measured the universal design of various Japanese ministries for the e-Japan Strategy formulated by the Japanese government to end the DD in Japan.

A study by Chang and others (2011) investigated whether a gap in digitalization

exists among different government agencies, causing the DD. They generated five dimensions (including ICT infrastructure, human resources, external environment, internals of organization, and information).

(3) Wireless and Mobile

Mobile and wireless devices have been discussed and suggested as one of solutions for the DD. Oliver et al. (2010) suggested wireless commons to narrow the DD. They identified key factors for the exponential growth and success of the WiFi network, which had put some rural areas in Catalonia in Spain well above the European average for broadband penetration. Maddison and Lorincz (2003) suggested three key enablers for these applications of mobile phones to successfully eliminate the DD: (a) networks that provide data services readily and cheaply; (b) devices that are easy to use and economically priced; (c) applications of practical value and need.

Boyera (2007) suggested providing mobile e-services in developing countries and defining the size and capability of a lightweight Web browser as a possible solution to the DD. Bogliolo (2007) discussed the Urbino Wireless Campus (UWiC) project that was implemented by the University of Urbino, in Italy, illustrated its technical, organizational, and economic aspects, and presented early results of this project. A portable wireless based architecture for solving the DD problems was proposed by Fenu and Piras (2008). Bucciol et al. (2007) discussed the wireless network project, "Broadband for All," that was financed by the European Commission for rural and remote areas and showed their efforts to improve the technical aspects of this project, especially, routing and quality of services (QoS). A study by Yarali and others (2007) identified mobile Worldwide Interoperability for Microwave Access (WiMAX) as a cost-effective solution to answering the challenges posed by the DD, compared to third-generation (3G) technologies. A study by Rully and others (2005) reported on a project carried out by Waseda University, KDDI Corporation, and the Hatinh community. The aim of this project was to study the use of broadband wireless LAN for implementation of telemedicine applications in rural hospitals. Zhang and Wolff (2004) also introduced the cost benefits of using several emerging technologies and architectures, including high gain antennas, dynamically steerable beam-forming antennas, and multi-hop routing, for smaller remote communities and widely scattered users in order to bridge the DD.

A new world space digital sound broadcasting (DSB) service via satellite was introduced for long distance and nationwide service provisions in order to bridge the DD (Butler & Davey, 2001). Boccolini et al. (2008) introduced a novel two-way broadband satellite architecture that was sponsored within the EU research programs that was able to bring multimedia services to digital-divide end users. De Sousa (2005) suggested wireless technologies as a

solution for the DD due to their greater flexibility and ability to be deployed rapidly. In addition, De Sousa suggested that satellites appeared to be good technology candidates if satellites can complement the well-established terrestrial systems to deliver universal broadband access. However, reducing the DD is a new challenge for international cooperation. Neumann (2006) examined the extent to which public international law supports the reduction of the DD with regard to the use of satellite telecommunications based on international telecommunications law, on space law, and on international economic law.

Internet kiosks have also been suggested as one of the solutions for rural populations. Bowonder and Boddu (2005) proposed a new wireless option, an ICT platform that was extended to cover a large number of villages, as an example of a successful public-private partnership. Another study (Pee, et al., 2010) examined the factors influencing individuals' intentions and behaviors to use public Internet kiosks in Mauritius, and this study also suggested using public Internet kiosks.

Panchanathan's (2002) study illustrated the power of ubiquitous media and its ability to respond to the needs of a population or a consumer that did not have an access to visual media. Eamer (2010) explored relationships between language teaching, social justice, and online networking, and suggested that virtual classrooms and video conferencing could overcome challenges of time and distance for language speakers and learners in disparate locations. An alternative input device and an adapted web platform have been developed for physically impaired persons as one solution to the DD (Yeh, et al., 2008). Dietz and Noerr (2004) introduced one-stop search engines as a means to bridge the DD.

Razak (2009) suggested the E-Rakan University Portal as a way to help bridge the knowledge gap and the DD between the communities on campus. Nesbitt and Thomas (2010) focused on the use of Twitter to send updates and messages to older adults and their younger relatives based on the results from preliminary focus groups. They recommended the proper design of systems for facilitating family communication.

(4) Others

Blythe and Monk (2005) suggested the application and adaptation of human computer interaction (HCI) techniques to narrow the DD. Using robotics allows teachers and students to achieve the best cognitive practices based on the approach of the ideal pedagogic model, such as the language must be translated to a simple vocabulary to allow students to achieve their learning goals (Gomes, et al., 2010).

A new scheme of information and financial cooperation between content owners, users, and advertisers was offered by Kabulov et al. (2010) to reduce the DD. Canazza (2009) described global efforts to bridge the DD by emphasizing the role of ICT standardization. The role of the telecommunications sector has also been emphasized as a means to

bridge the DD (Azam, 2008).

Ⅳ. Results and Discussions

1. Results

Based on an historical analysis of the digital divide (DD) in this study, some interesting findings were identified. From the distribution by year of publication of available findings on the subject, it can be inferred that interest in and popularity of DD studies have steadily increased since 2000. It was also interesting to note that the majority of document types in DD are journal articles. Since English is considered to be the global language, it was not surprising to find that publications of scientific research and nearly all international publications from business transactions, meetings, and conferences were written in English. Surprisingly, we found nine publications written in Chinese, and two publications written in Japanese. The U.S. and Italy rank as the top two countries delivering studies by individual scholars in DD disciplines.

Information technology, Internet, and economic and social effects are the three most frequently used key words or phrases appearing in DD publications reviewed in this study. The historical analysis also revealed that an increasing number of various kinds of regional evidence have been suggested and tested to improve the understanding of the complicated DD issues. Scholars, institutions, and local/national governments employing DD projects include education, engineering-government, medical industry, and others in various geographical and organizational settings.

Various frameworks and perspectives of the DD have been suggested. Socio-economic views of the DD included self-efficacy, race, age, nationality, gender, cost, and other behavioral characteristics focused on development of the DD policies and strategies to end or reduce the DD issues. Researchers in the DD disciplines have seriously considered not only the improvement of the DD policies by government efforts but also an increase in sharing or borrowing programs through non-government efforts. An extensive number of the DD publications regarding wireless and mobile technologies have been listed herein, and they seem to be very important to solutions of the DD due to their widespread characteristics. To increase effectiveness in solving the DD, many improvements, such as WiFi networks (Oliver, et al., 2010: Yarali, et al., 2007), new broadband satellite architecture (Boccolini, et al., 2008), and international law supports for satellite telecommunications (Neumann, 2006) have been proposed.

2. Discussions

Traditional views of the DD have focused on the dichotomous gap between groups, i.e., whether they had access to computing facilities, including the Internet. However, more recent studies have focused on

exploring social divides resulting from the DD that involve socio-economic and behavioral differences (Peter & Valkenburg, 2006). This notion is supported by Vicente and López (2011), who argue that various regional evidence of the DD focusing on the social divide is still scarce. Moreover, there seems to have been very little research that provides comprehensive explanations for the overall DD (Yates, et al., 2010). Most of the recent the DD studies tended to be either largely descriptive, qualitative case studies, or quantitative analyses that have revealed a narrow concept of ICTs. While a few studies have attempted to provide comprehensive explanations for the global DD, all have been hindered by a shortage of recent data for a large number of cases.

Thus, this study contributes to the literature on overviews of the DD that was motivated by the current lack of comprehensive views of the DD research disciplines, by proposing various kinds of regional evidence, topics, and solutions from articles on the DD published over the last ten years. This study finds that strong regional evidence has been presented around the world, especially in Taiwan, India, Africa, USA, and some European regions. In addition, numerous comparison studies focusing on urban versus rural areas have been conducted to increase understanding of the phenomenon of the DD. Another finding of this study reveals that by carefully looking at the DD issues in education, e-government, and specific settings like medical, political, and entertainment, we are able to learn that a solution for those areas will require a complex mix of digital technologies, organizational capacity-building, and strategy remedies. When controlling for economic, social, behavioral, and other perspectives, there is greater digital opportunity and ICT development in various geographical regions or specific societies where there is competition to provide a variety of solutions, such as basic telecommunications services including wireless and mobile, and higher financial investment in technology development. From the specific policy efforts examined in this study, it is clear that promoting investment and competition in the telecommunications sector and improving ICT standardization, including support from international law, will have the highest impact on bridging the DD.

It is hoped that the comprehensive review of the DD research trends introduced in this study will generate new directions for future research and provide some guidelines for additional attempts to produce a greater number of publications and expand research in new areas of interest and concern related to the digital divide. In addition, many suggestions have been made for closing the global DD, and it has been demonstrated that such solutions will require more fundamental changes in society that cannot be achieved by technology alone.

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