Globalization and Technological Achievement: Implications for Macromarketing and the Digital Divide

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This article examines the impact of globalization and technological achievement on the lives of vulnerable groups in society as well as the larger environment so that the marketing community may better understand the macrolevel implications of the digital divide. Using data collected by a variety of international organizations and in cooperation with the United Nations Development Programme, this research explores the creation, diffusion, and use of technology within the context of economic inequities, gender discrimination, and carbon dioxide pollution across nations. The article opens with a brief introduction to the technology revolution and the digital divide along with a theoretical discussion of the research objectives. Data descriptions are presented in the next section, and the findings show comparisons across technology achievement categories. The article closes with suggestions for abridging the digital divide and research implications for macromarketing.

Keywords: *digital divide; technology; poverty; gender discrimination; ecology*

> Globalization can be reshaped, and when it is, when it is properly, fairly run, with all countries having a voice in policies affecting them, there is a possibility that it will help create a new global economy in which growth is not only more sustainable and less volatile but the fruits of this growth are more equitably shared
>
> —Joseph Stiglitz (2002, 22)

The sweeping technological changes of the late twentieth century have affected consumers worldwide. Spawned by the convergence of the computer and telecommunications industries, the development of the World Wide Web, and the globalization of markets and consumer culture, the network age has dramatically increased the diffusion of knowledge across national and geographic boundaries (Hill and Dhanda 2002; Hussein 1999; Rust and Oliver 1994). As a result, citizens of even the least developed nations have access to information that was unavailable to the richest individuals in the wealthiest countries as recently as a century ago (Stiglitz 2002). Thus, the purpose of this article is to examine the impact of technology creation, dissemination, and use on a number of social and economic variables including consumption inequities, gender discrimination, and carbon dioxide pollution.

The development and expansion of the World Wide Web, often referred to in common parlance as the Internet, was exponential during the 1990s because of these trends (United Nations Development Programme [UNDP] 2001). From approximately 20 million users in 1995 to more than 400 million users by late 2000, the United Nations now predicts that 1 billion people globally will be online by 2005. In addition, there were just 200 available Web sites on the Internet in 1993, but this figure grew dramatically to more than 20 million sites by late 2000. Global expenditures by governments and industry on information and communications technology associated with the Web were expected to progress from $2.2 trillion in 1999 to $3 trillion by the end of 2003.

Such explosive growth notwithstanding, much of this technology has yet to reach ordinary consumers in less developed nations (Bucy 2000; Metzl 1996). Haythornthwaite (2001, 365) revealed, “It is important to examine how the increasing presence and importance of the Internet in the everyday lives of those with access separates [*sic*] others from the ongoing social, economic, and commercial activity the Internet supports and creates.” For example, in a global community where fewer than half of all people have used a telephone, the ability to access the Web is a remote possibility for many (Hammond 2001). The UNDP reported that just 7 percent of the world’s population is online (Norris 2000). These consumers typically reside within developed Western nations, which contain

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97 percent of Internet hosts, 92 percent of computer hardware and software buyers, and 86 percent of all Internet connections (also see Godlee, Horton, and Smith 2000).

These differences are encapsulated in the term *digital divide*, a concept that captures the vast disparities in accessibility of information and communications technology within and among nation states. For example, high-income Organization for Economic Cooperation and Development (OECD) countries comprise only 14 percent of the world's population, yet they contain almost 80 percent of all Internet users (UNDP 2001). Among the remainder, nearly 900 million consumers are illiterate, close to 3 billion people live on less than $2 a day, and most women face multiple forms of discrimination (Hill, Peterson, and Dhanda 2001). Scholars believe that the digital divide that separates the "knowledge rich" from the "knowledge poor" continues to grow (Hussein 1999), condemning entire regions of the world to even greater poverty and inequity (Hanshaw 2000; Persaud 2001). In the end, globalization and technological advancement may be exacerbating the gap between the haves and the have-nots within and among countries (Hunter and Yates 2002).

RESEARCH DIRECTIONS

Given these dire circumstances, a call for more research investigating the impact of information and communications technology on human development is warranted (see Wade 2002). This complex relationship, however, has yet to be clarified in the broader social science and human rights literatures. The UNDP (2001) has described the relationship as reciprocal, with technology advancing quality of life in terms of health, education, and consumption opportunities, and improved quality of life increasing access to and innovation of technology goods and services.

Macromarketing scholars have a long history of work on quality of life (QOL), and they have contributed significantly to this debate (see Sirgy 2001 for an excellent comprehensive review). One particularly relevant study, conducted by Peterson and Malhotra (1997), used factor analysis to determine the underlying dimensions of the QOL construct. Their findings reveal a three-dimensional model, which the authors termed benefits, costs, and sustainability. In addition, they found that measures of infrastructure, including the level of information and communications technology, are excellent "proxies" for the consumption (benefits and costs) portion of QOL. Consistently, this investigation uses technological achievement as an indicator of QOL across nations.

What is clear, as described previously, is that vast differences in technological achievement exist worldwide, resulting in tremendous inequities. James (2002a, 71) reported that

> recent evidence indicates that globalization based on technical advances in information technology is creating a dualistic situation in the world economy, whereby the benefits tend to accrue to a narrow group of relatively affluent countries, while the majority lags behind.

His rationale is that technological innovations typically are designed with the needs of developed countries in mind, almost to the exclusion of less developed nations. Regardless of the origin, most scholars believe that "the move toward an increasingly digital society has had economic and social impacts that threaten to exacerbate existing inequalities" (Servon and Nelson 2001, 280). Improving macromarketers' understanding of the impact of globalization and technological achievement on such inequities is the basis of this study.

One issue that has received some attention within the macromarketing field is global poverty. For example, using information reported by the United Nations, Hill and Adrangi (1999) estimated that approximately one-half of the world's population lives under conditions of ill health, low literacy, and a lack of financial resources. Although potential causes are multifaceted, authors such as Cawkell (2001, 56) posited, "Material poverty and information poverty go hand-in-hand." Wade (2002) concurred and believed that the digital divide may be exacerbating economic differences both within and between countries. Others, referred to in the literature as *cyber-optimists*, have taken a more hopeful perspective, hypothesizing that information technology benefits citizens through improved educational opportunities that lead to greater economic development (see Barrett and Greene 2001; Garson 2001). Consistently, Norris (2001) put forward an Internet engagement model that suggests Internet technology is intimately tied to material success. Thus, *research proposition 1* is that technological advancement by a nation will reduce income disparities among its citizens.

A second area of concern involves consumption inequities that result from gender discrimination (Hill and Dhanda 1999). The UN acknowledged that, although significant improvement has occurred during the previous decades, inequalities still exist between men and women in every nation of the world (UNDP 1998). These disparities cross several domains of basic human progress, including life expectancy, educational attainment, and income (Hill, Peterson, and Dhanda 2001). Mazrui and Mazrui (2001) advanced a possible link between technological achievement and gender development, contending that information technology provides significant economic and political opportunities for women, including those living in traditionally Muslim nations. Access to adequate health care, which has been a vexing problem for women worldwide, also has been enhanced through Internet access (Sorensen 2001). Thus, *Research Proposition 2* is that technological achievement by a nation will improve human development opportunities for female citizens.

The third and final proposition is influenced by the findings of Peterson and Malhotra (1997), who demonstrated the multidimensional nature of the QOL construct. Their findings showed that the consumption aspects (benefits and costs) were separate from the sustainability factor, which includes the long-term integrity of the environment. In support of this result, Ger (1997, 112) opined, “Consumption and production patterns of affluent countries are responsible for most transboundary problems, such as ozone layer depletion, ocean pollution, and chemicalization of the habitat.” The latest *Human Development Report* from the United Nations (UNDP 2003) provides supporting evidence that the countries that are most technologically advanced, including in information and communications technologies, are the primary culprits of environmental degradation. Thus, consistent with the extrapolation in proposition two above, *Research Proposition 3* is that technological achievement by a nation will increase the amount of environmental damage from its citizens.

TECHNOLOGICAL ACHIEVEMENT AND QUALITY OF LIFE

Data Description and Analyses

The UN assesses QOL worldwide through the activities of the UNDP. Founded nearly forty years ago, this unit has offices around the globe that conduct and assimilate hundreds of individual data-collection projects (Hill and Adrangi 1999; Hill, Peterson, and Dhanda 2001). Major sources of standardized data include the International Monetary Fund, the World Bank, the World Health Organization, and a wide variety of UN-supported agencies such as the United Nations Educational, Scientific, and Cultural Organization (UNESCO).

These efforts culminate in its annual publication of the *Human Development Report*, which has updated the status of the international community of nations for the past thirteen years. The focal topic of a recent volume is “Making Technologies Work for Human Development,” and it is the source of all data in this research. For the first time, the UNDP (2001, 46) presented its technological achievement index (TAI), “which aims to capture how well a country is creating and diffusing technology and building a human skill base.” This index is a composite of several indicators involving the creation of technology, the diffusion of recent innovations, the diffusion of older innovations, and human skills. Although it has yet to meet all of the valid criticisms of QOL scholars such as Sirgy (2001), it is consistent with the infrastructure model described by Peterson and Malhotra (1997).

Creation of technology is determined by two indicators, patents granted per capita and receipts of royalty and license fees from abroad per capita, and the sources of these data are the World Intellectual Property Organization (WIPO 2001) and the World Bank (2001b) respectively. Diffusion of recent innovations is measured by Internet hosts per capita and high- and medium-technology exports as a share of all exports, using data from the International Telecommunication Union (ITU 2001a) to estimate Internet dispersion and data from Lall (2001) and the UN (2001a) to calculate export share. Diffusion of old innovations is composed of the logarithm of telephone lines per capita and the logarithm of electricity consumption per capita; the data source for the former is the ITU (2001b) and for the latter is the World Bank (2001b). Finally, human skills are measured by mean years of schooling within a nation along with gross enrollment at the tertiary level in science, mathematics, and engineering. These data were abstracted from Barro and Lee (2000) for the mean years of schooling and from UNESCO (1998, 1999, 2001a) for tertiary-level training. The range of the combined indicators is from 0 to 1, with higher numbers suggesting greater technological achievement.

The measurement of income insecurity and disparity has received considerable attention by the United Nations, consistent with their interest in eradicating poverty by the early twenty-first century (see UNDP 1997 for more details). Unfortunately, their Human Poverty Index (HPI), which was designed to expose the dimensions of impoverishment worldwide, varies between developed and developing countries, making comparisons difficult. Therefore, this investigation uses the Gini Index for Research Proposition 1, which measures the equitability in the distribution of consumption opportunities among citizens within a nation (UNDP 2001). Values close to 0 suggest nearly equitable consumption potentialities, and values close to 100 suggest vast disparities between higher and lower socioeconomic groups within a society. The original source of these data is the World Bank (2001b).

The UN measures human development through an index composed of longevity (life expectancy), knowledge dissemination (adult literacy and school enrollments), and standard of living (GDP per capita; see Hill and Dhanda 1999). The Gender-Related Development Index (GDI) adjusts this construct to reflect disparities between men and women across all three variables, providing an appropriate indicant for Research Proposition 2. GDI values close to 1 intimate near equality in development between genders, whereas numbers close to 0 imply significantly lower development possibilities for women. Data on longevity were provided by the UN (2001b), data on adult literacy and schooling by UNESCO (2001a, 2001b), and on per capita GDP by the World Bank (2001a).

Although there are several possible causes of environmental destruction, one of the leading culprits is carbon dioxide (CO_2), which is a byproduct of consumption for a wide variety of personal and industrial uses. The burning of fossil fuels has nearly quintupled since 1950, and emissions of carbon dioxide annually have quadrupled as a result (UNDP 1998). Dhanda (1999, 258) asserted, “Not surprisingly, the world’s dominant consumers are concentrated in the industrialized west, where high levels of consumption are matched with serious environmental damage." Thus, the measure used for research proposition 3 is CO_2 emissions per capita within a nation, and the source of these data is the Carbon Dioxide Information Analysis Center (CDIAC; 2000).

The research propositions were tested using ANOVA, which was used to examine differences in three dependent variables across the four technology achievement categories described below. The first step was to determine whether changes in these variables are in the predicted directions, with the expectation that the GDI and CO_2 emissions would increase and the Gini Index would decrease as TAI values rise from one category to the next. The second step used the F test to determine whether these differences are statistically significant. Results from the analyses are provided in the following subsection.

Findings

An examination of the TAI among nations shows great disparities in the ability of countries to participate in the network age. Values range from a high of .744 in Finland to a low of .066 in Mozambique, and the mean TAI across the seventy-two nations for which reliable data existed is .374. The average TAI is .556 among the relatively wealthy OECD countries for which information is available. In contrast, the developing countries of the world have a mean TAI of .272, and within the few least developed states among this group, the index drops to .075. (Table 1 provides a complete listing of countries by TAI values, along with data for the three other variables.)

Further examination of the developing world reveals differences across geographic boundaries. For example, East Asia and the Pacific have the greatest technological achievement with a mean TAI of .354. Latin America and the Caribbean are next with an average TAI of .292, and the Arab states follow as the TAI drops to .238. South Asia, one of the least developed regions of the globe, has a mean TAI of only .182. Finally, data reports from Sub-Saharan Africa provide an average TAI of .150, the lowest mean value among geographic regions.

For the purpose of comparison, the UNDP (2001) divided countries of the world into four technology creation, diffusion, and use categories: *leaders* (TAI values of .50 and above), *potential leaders* (TAI values of .35 to .49), *dynamic adopters* (TAI values from .20 to .34), and *marginalized nations* (TAI values below .20). Eighteen countries are categorized as *leaders* in technology achievement with an average TAI of .609; they are located primarily in North America, Western Europe, Scandinavia, and parts of Asia, and also include Australia. Nineteen countries are in the *potential leaders* category with a mean TAI of .418, and they are found principally in Eastern Europe with substantial representation in Latin America and the Caribbean. Twenty-six countries are considered *dynamic adopters* with an average TAI of .266, and this category is dominated by nations in Latin America and the Caribbean as well as some East Asia and Pacific and Arab countries. Finally, nine nations are deemed *marginalized* with a mean TAI of .119, and they are from Sub-Saharan Africa and South Asia.

The Gini Index values largely support research proposition 1, demonstrating critical differences in the appropriate direction across technology achievement categories. The correlation coefficient for the TAI/Gini combination is –.484, consistent with lower numbers revealing less disparity across socioeconomic groups. For example, technology leaders boast a mean Gini statistic of 30.707. In contrast, potential leaders have an average Gini of 34.094, and dynamic adopters have an average of 45.883. Surprisingly, marginalized nations show a slight improvement with a mean Gini of 41.425. This result may be due to the small sample size of the cell (as noted by a reviewer), or it may be an artifact of the "low" high range of economic opportunities in these least developed nations. Regardless, ANOVA results confirm these differences as statistically significant ($F = 10.91$, $p < .01$). Table 2 provides additional information.

The GDI values and the correlation coefficient for the TAI/GDI (.894) are consistent with research proposition 2. Technology leaders have the highest GDI of .916, followed by potential leaders at .834, dynamic adopters at .702, and marginalized nations at .463. These differences are statistically significant (ANOVA with $F = 150.30$, $p < .01$). In addition, the results for research proposition 3, using carbon dioxide pollution as a proxy for environmental damage, demonstrate that technological achievement is matched with increasing levels of ecological degradation. The correlation coefficient of the TAI and per capita emissions is .796, and CO_2 values move from a high of 11.347 for technology leaders to 5.879 for potential leaders, 2.758 for dynamic adopters, and a low of only .289 for marginalized nations. These ANOVA results also are statistically significant ($F = 29.39$, $p < .01$).

DISCUSSION AND IMPLICATIONS

Summary of Findings

Using data collected by the United Nations, its affiliates, and other international organizations, this article explores technology creation, diffusion, and use among nations through the Technology Achievement Index advanced by the UNDP. The findings reveal great differences between developed and developing countries, with the least developed nations facing acute deficits in technological advancement. These differences expose a north-south divide in capability, with Scandinavia, Western Europe, and North America as technology leaders, and South Asia and Sub-Saharan Africa as technology laggards. Most of the rest of the world—Latin America and the Caribbean, East Asia and the Pacific, and the

TABLE 1
LISING OF COUNTRIES BY TAI VALUES

Country	*TAI*	*TAI Category*	*GDI*	*GiniIndex*	*CO_2 Per Capita*
Finland	.744	Leaders	.923	25.6	10.9
United States	.733	Leaders	.932	40.8	20.1
Sweden	.703	Leaders	.931	25.0	5.4
Japan	.698	Leaders	.921	24.9	9.2
Republic of Korea	.666	Leaders	.868	31.6	9.4
Netherlands	.630	Leaders	.926	32.6	10.4
United Kingdom	.606	Leaders	.920	36.1	8.9
Canada	.589	Leaders	.934	31.5	16.2
Australia	.587	Leaders	.935	35.2	17.3
Singapore	.585	Leaders	.871	NA	23.4
Germany	.583	Leaders	.916	30.0	10.2
Norway	.579	Leaders	.937	25.8	NA
Ireland	.566	Leaders	.908	35.9	10.0
Belgium	.553	Leaders	.928	25.0	10.2
New Zealand	.548	Leaders	.910	NA	8.3
Austria	.544	Leaders	.915	23.1	7.5
France	.535	Leaders	.922	32.7	5.8
Israel	.514	Leaders	.888	35.5	9.7
Spain	.481	Potential leaders	.901	32.5	6.2
Italy	.471	Potential leaders	.903	27.3	7.1
Czech Republic	.465	Potential leaders	.842	25.4	11.9
Hungary	.464	Potential leaders	.826	24.4	5.7
Slovenia	.458	Potential leaders	.871	28.4	7.5
Hong Kong (SAR)	.455	Potential leaders	.877	NA	3.5
Slovakia	.447	Potential leaders	.829	19.5	6.9
Greece	.437	Potential leaders	.874	32.7	7.6
Portugal	.419	Potential leaders	.870	35.6	5.0
Bulgaria	.411	Potential leaders	.770	26.4	5.9
Poland	.407	Potential leaders	.826	31.6	9.0
Malaysia	.396	Potential leaders	.768	49.2	6.2
Croatia	.391	Potential leaders	.799	29.0	4.2
Mexico	.389	Potential leaders	.782	51.9	3.9
Cyprus	.386	Potential leaders	.872	NA	7.1
Argentina	.381	Potential leaders	.833	NA	3.9
Romania	.371	Potential leaders	.769	28.2	4.8
Costa Rica	.358	Potential leaders	.813	45.9	1.3
Chile	.357	Potential leaders	.817	57.5	4.0
Uruguay	.343	Dynamic Adopters	.825	42.3	1.6
South Africa	.340	Dynamic Adopters	.695	59.3	8.2
Thailand	.337	Dynamic Adopters	.755	41.4	3.5
Trinidad/Tobago	.328	Dynamic Adopters	.789	40.3	17.2
Panama	.321	Dynamic Adopters	.782	48.5	2.8
Brazil	.311	Dynamic Adopters	.743	59.1	1.8
Philippines	.300	Dynamic Adopters	.746	46.2	1.0
China	.299	Dynamic Adopters	.715	40.3	2.7
Bolivia	.277	Dynamic Adopters	.640	58.9	1.4
Columbia	.274	Dynamic Adopters	.760	57.1	1.7
Peru	.271	Dynamic Adopters	.724	46.2	1.2
Jamaica	.261	Dynamic Adopters	.736	36.4	4.3
Iran	.260	Dynamic Adopters	.696	NA	4.5
Tunisia	.255	Dynamic Adopters	.700	41.7	1.8
Paraguay	.254	Dynamic Adopters	.725	57.7	.7
Ecuador	.253	Dynamic Adopters	.711	43.7	1.7
El Salvador	.253	Dynamic Adopters	.694	50.8	.9
Dominican Republic	.244	Dynamic Adopters	.712	47.4	1.6
Syrian Republic	.240	Dynamic Adopters	.677	NA	3.2
Egypt	.236	Dynamic Adopters	.620	28.9	1.7
Algeria	.221	Dynamic Adopters	.673	35.3	3.2
Zimbabwe	.220	Dynamic Adopters	.548	56.8	1.6
Indonesia	.211	Dynamic Adopters	.671	31.7	1.2

(continued)

TABLE 1 (continued)

Country	TAI	TAI Category	GDI	GiniIndex	CO_2 Per Capita
Honduras	.208	Dynamic Adopters	.623	59.0	.7
Sri Lanka	.203	Dynamic Adopters	.732	34.4	.4
India	.201	Dynamic Adopters	.553	37.8	1.1
Nicaragua	.185	Marginalized	.628	60.3	.7
Pakistan	.167	Marginalized	.466	31.2	.7
Senegal	.158	Marginalized	.412	41.3	.4
Ghana	.139	Marginalized	.538	39.6	.2
Kenya	.129	Marginalized	.512	44.5	.2
Nepal	.081	Marginalized	.461	36.7	.1
Tanzania	.080	Marginalized	.432	38.2	.1
Sudan	.071	Marginalized	.413	NA	.1
Mozambique	.066	Marginalized	.309	39.6	.1

TABLE 2
ANOVA STATISTICS

	GDI		Gini		CO_2	
Leader	.916	(.021)	30.707	(5.275)	11.347	(4.961)
Potential leaders	.834	(0.044)	34.094	(11.035)	5.879	(2.34)
Dynamic adopters	0.702	(0.066)	45.883	(9.602)	2.758	(3.369)
Marginalized	0.463	(0.090)	41.425	(8.533)	0.289	(0.252)
F statistic	150.30*		10.91*		29.39*	

NOTE: Each number represents the mean and the numbers in parentheses are standard deviations.
*$p < .01$.

Arab states—reside somewhere in between. The exceptions to this rule are Japan, the Republic of Korea, and Australia.

In large part, the research propositions of this investigation are supported. For example, inequalities of consumption opportunities in a society are reduced with increased technological achievement, suggesting that the digital divide may exacerbate the plight of the impoverished in nations without the capacity to create or disseminate basic and/or advanced technology. In addition, equity in human development capabilities between men and women improves with technological achievement, which may be the result of educational and employment options that transcend traditional gender roles and boundaries. Finally, technological achievement within a society as a quality of life proxy is associated with greater environmental pollution and its concomitant ecological devastation. These findings reveal that globalization and technological achievement are a mixed bag that has positive economic and social benefits along with serious environmental consequences.

Abridging the Digital Divide

Our results suggest that the creation and diffusion of technology associated with the Internet contribute to the advancement of vulnerable consumers within developed countries. Such nations possess the necessary infrastructure in telephony and electricity that allows for the widespread dissemination of increasingly affordable Internet connections. Nevertheless, the least developed nations globally have few of these assets. Telephony and electricity in their countries typically are lacking, and the cost of service and the necessary computer hardware and software are beyond the reach of most consumers. For example, the UNDP (2001) reported that access charges are approximately 1 percent of the monthly income of U.S. citizens, but represent 614 percent of the monthly income in Madagascar, 278 percent in Nepal, and 191 percent in Bangladesh. As a consequence, the Internet only is widely available to the wealthiest consumers in much of the developing world.

Dholakia and Kshetri (2002) aptly noted that bridging the digital divide is dependent on identifying and meeting the needs of “digitally-excluded” consumers, and designing appropriate and affordable goods and services that are consonant with their requirements. Of course, one essential prerequisite is improvement in basic telephony service, especially in rural areas of developing countries (see James 2002a). One possible solution that has been advanced calls for the use of mobile phone networks to bypass the need for a traditional telecommunications infrastructure. Described as Mobile E-Development Models (MED), these flexible networks allow consumers and small business operators to access information and opportunities previously unavailable within their communities (Dholakia and Kshetri 2003).

In addition, the cost of the necessary computer technology is a fundamental roadblock to resolving this global dilemma. Wade (2002, 451-52) presented the situation in ominous terms:

> In several ways, developing country users are being tied more tightly into hardware and software escalation with ramifications difficult to anticipate. . . . The effect of this technological arms race is to keep widening the digital divide between the prosperous democracies and the rest of the world.

Once again, Dholakia and Kshetri (2002) posited that the solution lies in the creation of systems that are simple in design, adequate for the intended uses, affordable to the target market, and easily implemented and used.

A possible source of technology that may help meet these demands is the discarded personal computers from the developed world, which are of growing concern to environmentalists as scarce landfill space increasingly is filled with their remains. James (2002b) reported that at least 20 million PCs become obsolete annually in the United States alone, with only a small number currently recycled. The private firm New Deal, Inc., has stepped in to take advantage of this opportunity by renovating old 486 and early Pentium machines and selling them for approximately $100 each (James 2001a). They infuse these computers with "sustainable software" that includes word processing, spreadsheet, database, and Internet access applications (James 2001b).

Another possible source of technology is nongovernmental organizations such as the World Computer Exchange, which operates as a clearinghouse for donated secondhand personal computers from organizations in developed nations. Their explicit charter is to reduce the digital divide by shipping technological products to partner institutions in the developing world that install, maintain, and connect these machines to the Internet (James 2002b). Ten separate shipments of 3,800 PCs were transported to 500 schools that educate more than 200,000 students around the globe. The use of open-source software based on the Linux protocol may help keep the overall cost of these systems reasonable throughout their lifetimes.

Successes of such ventures notwithstanding, the ability of most consumers in developing counties to own telephones and computers and to have Internet services is severely constrained. As an alternative, James (2002a, 4) recommended, "In the poorer regions of the world reality demands a much more modest target, namely, to provide members of the community with reasonable *access* to (as opposed to individual ownership of) these technologies." One option may be the so-called Simputer, which is priced at less than $200 and contains a slot for smart cards that may be purchased for as little as $1. Impoverished consumers are able to rent these machines within their communities for about 20 cents an hour and have the ability to use its functions and storage capabilities. An additional benefit is that these PCs are designed for local conditions, and services can be delivered in a variety of languages as well as formats for nonliterate users (James 2001a).

Governments also have a role to play in closing the digital divide. For example, Dholakia and Kshetri (2002) suggested that policy makers accelerate technology diffusion and adoption through need identification of the underserved, development of appropriate network architectures to meet these needs, and tax incentives/reduced tariffs on information and communication technology goods and services. In addition, governmental entities may join together with multinational organizations such as the United Nations or World Bank to form what Yunus (2001, 25) called an "International Center for Information Technology to Eliminate Global Poverty." Such an agency's primary responsibility would be to collect, summarize, and distribute information on the varieties of low-cost technology currently available (see James 2002a for more details).

Macromarketing Research Implications

One troublesome finding, the environmental results of QOL defined in technology infrastructure terms, and issues of causality provide impetus for additional study. For instance, the implications of a decrease in the Gini Index by the lowest technology achievement countries are unclear. As noted earlier, this discrepancy may be due to the relatively "low-high" among the least developed nations, leading to smaller absolute differences across socioeconomic groups. One reviewer, however, suggested an alternative explanation based on the macrolevel of this analysis, contending that some countries with lower TAI values have pockets of significant achievement that are masked by these national aggregates. Thus, a possible future investigation might examine the impact of wide variations in the creation and dissemination of technology products within rather than among nation states on this set or a similar set of variables.

Inferences from the results on environmental degradation are particularly vexing, especially in light of the recent conflict over the Kyoto Protocol (UNDP 2001). Under this accord, developed nations tentatively decided to reduce their carbon dioxide emissions by more than 5 percent on or before 2012. Although no targets were established for developing or less developed nations, postindustrial countries could meet their goals by supporting emission-reduction programs in less affluent nations. For example, the United States could reach its target reduction of CO_2 more cheaply by helping producers in developing countries make factories less polluting than by making their facilities less polluting. Such trading would result in the transfer of advanced technologies that are estimated to exceed $100 billion. Of course, this exchange of wealth depends on the ratification of the Kyoto agreement by the most affluent countries—including the United States, which has failed to do so at this point in time.

Issues of causality and rival explanations for these findings present a third avenue for additional investigation by macromarketers. Although the research propositions are grounded in multidisciplinary studies that triangulate around the rationales provided, the cross-sectional and selective nature of the data make the findings less compelling. Consider the results involving gender development. Is it possible that advancing the educational status of women leads to greater diffusion of information and communication technologies throughout a society? In addition, is it possible that gender development and technological achievement covary and are influenced by overall advancement of a society as measured by more comprehensive QOL measures? Exploration of such issues will become possible as the number of countries reporting the TAI increases and longitudinal data become available.

Macromarketing scholars interested in QOL issues may contribute to this debate through additional study and the development of technology measures. The current UN index clearly captures the influence of important indicators that are associated with the ability of a nation to exploit the benefits of an information-based economy. Which aspect of the TAI, however, drives the environmental damage revealed in this investigation? Is this relationship potentially causal, or do intervening variables such as economic success and its impact on per capita purchasing power play a role? In addition, macromarketers may consider advancing alternative technology achievement constructs that tap into the creation and dissemination of environmentally friendly technologies, which enhance QOL while avoiding or reducing damage to the ecology. Policy makers interested in global legislation could use such measures to bolster their positions and persuade reluctant national representatives.

On a larger level, it may be an appropriate time for macromarketing scholars to reconsider the QOL construct that is so closely tied to the field. The seminal work of Joe Sirgy at Virginia Tech has advanced thinking in this area for several decades, with intermittent contributions from a number of other scholars (Sirgy 2001). The beginning of the twenty-first century, however, with its postmodern hue in the developed world and the intimate tie of technology to work, leisure, and entertainment, represents a significant shift in how we define ourselves. The prototypical consumer in the industrialized West is in contact with information and communications technology at virtually every waking moment through pagers, cell phones, laptops, desktops, cable television, and more. Imagine their lives if these devices disappeared even for twenty-four hours. Now imagine living without the hope of ever having them. It may be time to recognize that the quality of consumers' lives is significantly influenced by access to a host of technology goods and services, representing a fundamental change in how we conceptualize QOL.

REFERENCES

Barrett, K., and R. Greene. 2001. *Powering up: How public managers can take control of information technology.* Washington, DC: CQ Press.

Barro, R. J., and J. W. Lee. 2000. International data on educational attainment: Updates and implications. NBER working paper no. 7911. Cambridge, MA: National Bureau of Economic Research.

Bucy, E. 2000. Social access to the Internet. *Harvard International Journal of Press/Politics* 5 (Winter): 50-61.

Carbon Dioxide Information Analysis Center (CDIAC). 2000. *Trends: A compendium of data on global change*. December. http://cdiac.esd.ornl.gov/trends/trends.htm.

Cawkell, T. 2001. Sociotechnology: The digital divide. *Journal of Information Science* 27 (1): 55-60.

Dholakia, N., and N. Kshetri. 2002. Electronic architectures for bridging the global digital divide: A comparative assessment of e-business systems designed to reach the global poor. In *Architectural issues of Web-enabled electronic business*, edited by N. Shi and V. K. Murthy. Hershey, PA: Idea Group.

———. 2003. Mobil commerce as a solution to the global digital divide: Selected cases of e-development. In *The digital challenge: Information technology in the development context*, edited by S. Madon and S. Krishna. Aldershot, UK: Ashgate.

Garson, G. D. 2001. *Social dimensions of information technology: Issues for the new millennium.* Hershey, PA: Idea Group.

Ger, G. 1997. Human development and humane consumption: Well-being beyond the good life. *Journal of Public Policy and Marketing* 16 (1): 110-25.

Godlee, F., R. Horton, and R. Smith. 2000. Global information flow. *Lancet* 356 (9236): 1129-30.

Hammond, A. S. 2001. Digitally empowered development. *Foreign Affairs* 80 (March-April): 96-106.

Hanshaw, M. 2000. Venture philanthropist. *Harvard Business Review* 78 (July-August): 26.

Haythornthwaite, C. 2001. The Internet in everyday life. *American Behavioral Scientist* 45 (November): 363-82.

Hill, R. P., and B. Adrangi. 1999. Global poverty and the United Nations. *Journal of Public Policy and Marketing* 18 (Fall): 135-46.

Hill, R. P., and K. K. Dhanda. 1999. Gender inequity and quality of life: A macromarketing perspective. *Journal of Macromarketing* 19 (December): 140-52.

———. 2002. Advertising, technology, and the digital divide: A global perspective. *Advances in International Marketing: New Directions in International Advertising Research* 12: 175-93.

Hill, R. P., R. M. Peterson, and K. K. Dhanda. 2001. Global consumption and distributive justice: A Rawlsian perspective. *Human Rights Quarterly* 23 (February): 171-87.

Hunter, J. D., and J. Yates. 2002. In the vanguard of globalization: The world of American globalizers. In *Many globalizations: Cultural diversity on the contemporary world*, edited by P. L. Berger and S. P. Huntington, 323-57. New York: Oxford University Press.

Hussein, N. A. 1999. Keys to the global village. *New Perspectives Quarterly* 16 (Fall): 53-55.

International Telecommunication Union (ITU). 2001a. *World Internet reports: Telephony.* Geneva: International Telecommunication Union.

———. 2001b. *World Telecommunication indicators: Database.* Geneva: International Telecommunication Union.

James, J. 2001a. Bridging the digital divide with low-cost information technologies. *Journal of Information Technologies* 27 (4): 211-17.

———. 2001b. Low-cost computing and related ways of overcoming the global digital divide. *Journal of Information Science* 27 (6): 385-92.

———. 2002a. *Technology, globalization and poverty.* Cheltenham, UK: Edward Elgar.

———. 2002b. The human development report 2001 and information technology for developing countries: An evaluation. *International Journal of Technology Management* 23 (6): 643-52.
Lall, S. 2001. Harnessing technology for human development. Background paper, United Nations.
Mazrui, A., and A. Mazrui. 2001. The digital revolution and the new reformation: Doctrine and gender in Islam. *Harvard International Review* 23 (1): 52-55.
Metzl, J. F. 1996. Information technology and human rights. *Human Rights Quarterly* 18 (4): 705-46.
Norris, P. 2000. Information poverty and the wired world. *Harvard International Journal of Press/Politics* 5 (Summer): 1-6.
———. 2001. *Digital divide: Civic engagement, information poverty, and the Internet worldwide.* Cambridge, UK: Cambridge University Press.
Persaud, A. 2001. The knowledge gap. *Foreign Affairs* 80 (March-April): 107-17.
Peterson, M., and N. K. Malhotra. 1997. Comparative marketing measures of societal quality of life: Substantive dimensions in 186 countries. *Journal of Macromarketing* 17 (Spring): 25-38.
Rust, R. T., and R. W. Oliver. 1994. The death of advertising. *Journal of Advertising* 23 (December): 71-77.
Servon, L. J., and M. K. Nelson. 2001. Community technology centers: Narrowing the digital divide in low-income, urban communities. *Journal of Urban Affairs* 23 (3-4): 279-90.
Sirgy, M. J. 2001. *Handbook of quality-of-life research: An ethical marketing perspective*. Boston: Kluwer.
Sorensen, A. A. 2001. Promoting public health through electronic media: A challenge for schools of public health. *American Journal of Public Health* 91 (8): 1183-85.
Stiglitz, J. E. 2002. *Globalization and its discontents*. New York: W.W. Norton.
United Nations. 2001a. Correspondence on technology exports, statistics division. January. New York: United Nations.
———. 2001b. *World population prospects 1950-2050: The 2000 revision: Comprehensive tables*. New York: United Nations, Department of Economic and Social Affairs, Population Division.
United Nations Development Programme (UNDP). 1997. *Human development report 1997*. New York: Oxford University Press.
———. 1998. *Human development report 1998*. New York: Oxford University Press.
———. 2001. *Human development report 2001: Making new technologies work for human development*. New York: Oxford University Press.
———. 2003. *Human development report 2003: Millennium development goals—A compact among nations to end poverty.* New York: Oxford University Press.
United Nations Educational, Scientific, and Cultural Organization (UNESCO). 1998. *Statistical yearbook 1998.* Paris: UNESCO.
———. 1999. *Statistical yearbook 1999.* Paris: UNESCO.
———. 2001a. *Correspondence on gross enrollment ratios*. March. Paris: UNESCO.
———. 2001b. *Correspondence on net enrollment ratios*. March. Paris: UNESCO.
Wade, R. H. 2002. Bridging the digital divide: New route to development or new form of dependency? *Global governance* 8:443-66.
World Intellectual Property Organization (WIPO). 2001. Basic facts about the patent cooperation treaty. April. http://www.wipo.int/pct/en/basic_facts/basic_facts.htm.
World Bank. 2001a. *Correspondence on income poverty.* February. Washington, DC: World Bank.
———. 2001b. *World development indicators 2001*. CD-ROM. Washington, DC: World Bank.
Yunus, M. 2001. Microcredit and IT for the poor. *New Perspectives* 18 (Winter): 25-26.

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