Will the Digital Revolution Revolutionize Development? Drawing Together the Debate

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This concluding article returns to the broad question that motivates this special issue of *Studies in Comparative International Development*: Will the Digital Revolution constitute a revolution in development? In addressing this issue, we explore a number of common themes emphasized by the different contributions: the future of the North-South divide, the role of the state in promoting digital development, the transferability and adaptability of specific information and communication technologies, the challenges and potential benefits of controlling digital information, and the developmental effects of digitally enabled communities. We argue that the Digital Revolution's ultimate impact on development will depend on several key variables, including the extent to which these technologies foster within-country linkages among different sectors and socioeconomic classes; the degree to which new technological applications may be customized or transformed to advance local development; and the outcome of political contests between organized interests that are promoting different ways of organizing and governing the global digital economy. While it is difficult to fully assess a transformation while living in the midst of it, research on the social, political, and economic implications of the Digital Revolution will constitute an important agenda for development scholars in the years to come.

The contributions to this special issue of *Studies in Comparative International Development* concur in one crucial respect: the Digital Revolution is having and will have important effects on the development prospects of the global South. As the articles have shown, the spread of digital information and communication technologies (even in its incipient stages) has the potential to bring about massive changes in such areas as labor mobility, social networking, property rights, and the organization of production, all with major consequences for developing countries. Of course, it is impossible at present to assess fully the scope of the social, economic, and political transformations brought about by digitization and to evaluate their comparability to the Agricultural or Industrial Revolutions. Nonetheless, even as we focus our research efforts on more specific and tractable issues, it is impor-

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tant to keep in mind a larger question: Will the Digital Revolution revolutionize development, writ large? Motivated by this question, this concluding article seeks to synthesize a number of common themes emphasized by the different contributions: the future of the North-South divide, the role of the state in digital development, the transferability and adaptability of information and communication technologies (ICTs), the challenges and potential benefits of controlling digital information, and the importance for development of digitally enabled social connectedness. These areas of common concern suggest important implications not just for economic development but also for those ICT initiatives that are concerned primarily with social development objectives, such as improvements in rural health and literacy.

The Future of the North-South Divide: Core-Periphery Relations, Transnational Elites, or Regional Enclaves?

Of all the issues addressed by contributors to this volume, the single, overriding question is what the Digital Revolution means for the future of the North-South divide. An important theoretical reference point for discussions of this sort is the core-periphery model of the world economy advanced by dependency and world systems theory. These schools of thought built upon a thesis, originally advanced by Prebisch (ECLA, 1950) and Singer (1950), about unequal terms of trade between peripheral countries that exported raw materials and core countries that exported manufactured goods. In moderate versions of dependency theory, this basic economic imbalance meant that economic advancement in wealthy countries contributed to "distorted" forms of development in the periphery (Cardoso and Faletto, 1979; Evans, 1979). In their strongest versions, dependency and world systems theory postulated that development in the North came *at the expense* of the South—that it was necessary for peripheral countries to remain stagnated as poor suppliers of low-cost raw materials so that rich countries could continue their economic growth (Frank, 1967; Wallerstein, 1974). In either version, the product cycle also conspired against developing countries: technological innovation was confined to the core, and only routine technology was transferred to the periphery, depriving these countries of opportunities for innovation and windfall profits (Evans, 1979; Kurth, 1979). Moreover, firms in peripheral economies were linked only to firms in the core countries, such that multiplier effects did not accrue within the South.

How well does the global economy as described by dependency and world systems theory correspond to today's digital divide between North and South? As Weber and Bussell note in their contribution to this special issue, in some ways the basic core-periphery ideas still apply. The South still primarily exports raw materials; the income gap between rich and poor countries remains large and may be increasing;[1] and the geography of telecommunications linkages is reminiscent of colonial railroads leading only to export ports—or, of a model of the global economy in which elites in different parts of the periphery are linked to each other only via connections to elites in the core countries. But with respect to the key sustaining feature of orthodox versions of this model—the need for Northern countries to limit the development of the South in order to further their own advancement—Weber and Bussell suggest that the unique characteristics of the digital economy

will reduce if not eliminate zero-sum competition over development. Industrialization depended (and still depends) on access to scarce resources such as coal and oil, which made struggles for control of such resources an important aspect of the global political economy. But in a global economy in which the major productive assets—information goods—are non-depletable and non-rival, they argue, "the possible exclusion of four billion people from the next era of wealth creation makes no sense" (67).

Indeed, most present-day research on development has abandoned the notion that progress in the North must come at the expense of the South. In the language of Hirschman (1981), it takes place within the context of the "mutual benefits claim" about economic interaction between rich and poor countries. The major axis of today's debate instead concerns what Hirschman termed the "monoeconomics claim"—that a single developmental model is the best prescription for both North and South.[2] As Weber and Bussell note, those who emphasize the developmental prospects of reduced transactions costs in a digital economy tend to accept the monoeconomics notion: the G-8 Digital Opportunity Task Force advocated a familiar formula for ICT-driven development, including telecommunications liberalization and fewer government restrictions on information flow. However, Weber and Bussell's focus on new forms of property rights as the more significant feature of the digital economy challenges this monoeconomics claim. Under a scenario in which open-source software forms the basis for a shared (rather than proprietary) global digital infrastructure, countries in the South would have access to productive assets that could be used to pursue development on their own terms and in a different fashion than those in the North. If Weber and Bussell's vision is correct—if many of the future "killer apps" come from the South, having been created there and having added significant value to Southern economies—we will have come a long way from the strongest versions of dependency and world systems theory.

However, even if one accepts the scenario of a "shared global digital infrastructure" and its implications for the North-South gap, much of the evidence presented in this special issue suggests that the benefits of digitization may accrue disproportionately to a domestic elite that is comparatively "transnationalized." Classic core-periphery models posited stratification not only in the international system but also within countries, and when one focuses on the wealthy few versus the poor majority in developing countries, it is much less clear that any gap is being closed. Cartier and colleagues' contribution to this volume, for instance, posits a certain opposition between the interests of the technological elite in China—those who would certainly be driving the development of any killer apps in this massive portion of the global South—and the working class "information have-less," who eschew the latest and greatest technology for cast-off or lower-tech alternatives. A different reading of the popularity of Little Smart or SMS among internal migrants in China might label it a case of "The Fortune at the Bottom of the Pyramid" (Prahalad, 2004)—entrepreneurs successfully meeting market demand among poorer consumers, with benefits for everyone involved. Nonetheless, even a sanguine interpretation of technology use among the have-less is consistent with the notion that the benefits of digitization are unequally distributed among the Chinese population.

Saxenian's article in this issue similarly suggests that the Digital Revolution may be helping to reduce stratification between North and South more than it reduces

stratification within countries. Saxenian underscores the benefits of "brain circulation" for the development of independent technological capacities in certain regions of the global South, an argument that might seem to augur well for the development prospects of some Southern countries. However, even if one agrees that brain circulation is an important engine of economic development for India and China, the transnational embeddedness of the Indian and Chinese elites who brought venture capital to their home countries is somewhat reminiscent of the role of domestic elites in the "triple alliance" sustaining dependent development in Brazil (Evans, 1979)—a pattern that served the interests of the state and of national and transnational capital, but not necessarily the broader population. Saxenian's argument *does* challenge the strongest version of dependency theory, that the South cannot develop when it engages with the global economy, but it does not necessarily contradict the more moderate claims of Cardoso and Faletto (1979) and Evans (1979), that dependency implies a distorted form of peripheral development where economic advancement is confined to particular industries and closed circles of elites. Ultimately, the question is one of backward and forward linkages with the rest of the economy (Hirschman, 1958). Is the dynamism of the venture capital industry and the firms that it funds being multiplied throughout the Indian and Chinese economies, or does it primarily benefit a few elites in these countries along with the foreign firms who put up some of the funding?

Perhaps the most likely answer to this question about India and China is that the benefits of the information economy may spread beyond transnationally embedded elites, but only within particular geographic areas. As both Saxenian and Cartier et al. argue, dynamic growth in the high-technology and venture capital industries is concentrated in certain sub-national areas: primarily Southeast, coastal China, and certain parts of India, such as Bangalore. In China, dramatic growth in the coastal regions over the past twenty-five years has largely accounted for the high economic growth rate of the country as a whole. In some of the most dynamic cities and counties of the Pearl River delta, for instance, annual GDP growth has been as high as 40 percent.[3] But while national-level averages are boosted because of the dynamism of particular sub-national regions, the development prospects of the hinterland are not necessarily improved by massive growth in other geographic areas. As Saxenian notes, Bangalore and Silicon Valley are in many ways better connected than Bangalore and India's poorer rural regions.

Given the regional patterns of high-tech growth in India and China, there is a strong possibility that we are witnessing enclave development, albeit concentrated in particular geographical regions more than in certain specific industries. There may therefore be increasing-returns-driven linkages and spillovers among firms in the particular regions in which they are clustered (Arthur, 1994: Ch. 4; Krugman, 1980). Within these dynamic regions, while there may still be an information "haveless," they undoubtedly do obtain some benefits of connectedness, even if not to the "latest and greatest" technologies. It remains to be seen, however, whether the Digital Revolution that has brought so many benefits to Bangalore and Shanghai can enrich Bihar and Xinjiang as well.

Ultimately, the question of whether the Digital Revolution exacerbates or reduces sub-national stratification will probably depend much more on the economy in question than the specific technologies being deployed. India and China are mas-

sive countries with well-established patterns of inequality between different regions; other large developing countries such as South Africa and Brazil are even more extreme in this regard. But in smaller and wealthier countries like Taiwan, or those that have better economic linkages between different geographic areas and sectors of the economy, dramatic ICT growth could potentially contribute to a more evenly distributed pattern of national development.

On the question of the North-South divide, then, the Digital Revolution may well shape and transform the character of development in well-defined hubs within the global South, leading to Hirschman's "multidimensional conspiracies in favor of development." Depending on the case in question, these hubs may correspond to specific sub-national regions, to the entire national territory, or possibly to regions that span more than a single country. In other cases, of course, the Digital Revolution may fail to play any role in furthering development, even on a limited scale. Therefore, an important area for future research concerns the formulation and testing of hypotheses about where and why we are likely to see the emergence of the felicitous scenarios that Saxenian describes.

The Role of the State in a Digital Era: Leader of Development or Lagging Behind?

In our introductory discussion of the Digital Revolution and its implications for the North-South divide, we focused most of our attention on private actors—domestic entrepreneurs, technology users, and foreign firms. Such a framing, however, runs contrary to recent trends in the study of development, which have emphasized the independent role of the state rather than treating it simply as a tool of organized interests. Evans's (1995) conception of the developmental state, for instance, involves such efforts as creating conditions in which local entrepreneurs can thrive and facilitating joint ventures with transnational corporations in such a way that the domestic private sector is not a subordinate partner. To what extent do the cases examined here exhibit similar patterns?

In the Indian and Chinese cases, the image that emerges is one of a state rather out of touch with real business opportunities, and of entrepreneurs leading the way in the face of bureaucratic intransigence. In India, the burgeoning software and venture capital industries developed through private initiative, with few connections to government and university research centers. In China, the government has not put in place a legal framework conducive to venture capital, and one observer states that it is still trying to "grow the new economy using the tools of the planned economy" (Saxenian, 2005: 47). Moreover, the development of many of the technologies of China's information have-less—in particular, Little Smart mobile telephones—lies outside of the state's official vision for "informatization." Although Little Smart has become an important tool of working-class communication, the most the state has done to promote its growth is to refrain from cracking down on it. Aside from creating the background conditions for competitiveness in the digital economy, such as higher education in technology, we do not see any patterns of state-facilitated digital development in these case studies of China and India.

Taiwan, the shadow case in Saxenian's analysis, provides a notable contrast with respect to the role of the state in supporting the early development of the venture

capital industry. While pioneering entrepreneurs confronted an entrenched business culture of family firms, enlightened policymakers played a crucial role in creating a welcome environment in which venture capital could thrive. Taiwan, of course, is a classic example of successful state-led development (e.g., Amsden, 1979), and the fact that this pattern is replicated in the venture capital industry may not be surprising. But it remains to be seen if India and China can match Taiwan's success in ICT-related venture capital initiatives without the same active involvement of the state.

In many ways, of course, India and China are unique cases. Their size—and particularly, the presence of a large low-cost labor force and massive consumer markets—lends a particular dynamic to their engagement with the international economy that may not occur elsewhere in the global South. Countries like India and China may well be able to succeed in luring ICT investment and creating dynamic ICT industries simply by "brute force"—by being large and therefore attractive, without necessarily having a nimble and capable state that encourages partnerships between domestic and foreign firms or creates favorable conditions for the ICT industry to thrive.

Even in areas where we might envision the state taking on a more active role—for instance, funding local programmers to develop open-source software that can serve as an alternative to Microsoft's proprietary offerings—a certain scale may be essential. It may be economically feasible for China to develop its own Red Flag Linux, and Brazil may be moving in this direction by requiring government-funded software developers to license their products as open source, but what about the prospects for smaller economies? As Weber and Bussell note, other leaders in this area have advocated the adoption of off-the-shelf open-source packages rather than truly customizing and developing software locally.

In light of these observations, an important area for future research concerns the question of when and why some states will be positioned to capture the benefits of digitization for development. Our initial expectation is that not only will size matter for this outcome, but also the presence of an administrative apparatus that is both embedded in private sector networks and autonomous from any one organized interest. China and India are, at best, only intermediate cases in this regard, whereas Taiwan is much closer to the pattern of "embedded autonomy" (Evans, 1995).

Technology and Business Models: Transfer, Adaptation, or Ground-Up Innovation?

An important implication of digitization for development concerns the potential shift from a pattern of wholesale technology or institutional transfer to one in which technological applications and business models are substantially adapted to suit different conditions in the South, or even designed and built locally from the ground up. The notion of catch-up with imported technology is an old one in the study of development, and it inspired major episodes in foreign assistance, such as the Green Revolution (which also involved a fair amount of local innovation). Often, of course, transferred technology does not suit new conditions particularly well (see, e.g., Wade, 2002). Even when technology imported from abroad "works" locally, price may mean that it only works for a few—e.g., the state-of-the-art mobile phones that

Cartier et al. contrast with communication tools for the have-less masses. At a minimum, it seems that development tools imported from abroad need to be adapted to be most effective in countries of the South. At best, they may be designed from the ground up to suit local conditions. In examining this question of customized tools for development, therefore, we can both distinguish between a production process and its products, and also assess whether either of these is more likely to be transferred wholesale, imported in adapted form, or designed locally through a process of ground-up innovation.

By facilitating the diffusion of detailed knowledge of the diversity of local conditions prevailing in the global South, digitization allows for the adaptation of business models and production processes that first debuted in Northern countries. The success of venture capital in India and China is a good example. In both cases, the venture capital models promoted by transnationalized entrepreneurs contrasted markedly with established business practices in these countries; clearly they were imported rather than homegrown. But rather than trying to implement the same models they were familiar with from Silicon Valley, Indian and Chinese entrepreneurs adapted these models so that they were better suited to a new environment. Because these entrepreneurs were intimately familiar with local business conditions, and because digital communication tools allowed them to remain connected to their home countries during their years abroad, they were better prepared than foreign entrepreneurs to import and customize the venture capital model.

Open-source production methods constitute a somewhat different example of how a business model pioneered in the North might operate differently when implemented in the South. The open-source model was first developed to support the production of computer operating system software by a distributed network of (mostly Northern) engineers who exchanged source code updates via the Internet (Weber, 2004). When applied to software production in the South, this business model does not necessarily need customization; one could just substitute computer programmers from the South as the primary actors involved in conceptualizing and creating new products. But other applications of the open-source model might involve extending this process to other realms, such as computer hardware. One example is the Simputer, a $250 portable computer designed and built in India for use among the rural poor, whose hardware specifications have not been copyrighted but rather are freely available to engineers working on similar products.[4] Weber and Bussell also envision applications of the open-source model to areas entirely distinct from the computer industry, such as pharmaceuticals.

If venture capital and open-source software both show how imported production processes can be adapted for better use in the South, the technological applications produced through these methods illustrate the potential for ground-up innovation. There are virtually infinite possibilities for creating from the ground up technologies that are attuned to the specific conditions of countries in the South, such as Web browsers that seamlessly integrate on-the-fly translation into local languages, or computers with advanced voice-interaction capabilities that can be widely utilized among semi-literate populations. The venture capital model, which has proven so essential for supporting innovative technological applications in Silicon Valley, could potentially fund such ground-up innovation for the domestic market in India, China, and other countries of the South. Yet this possibility is arguably a best-case

scenario. At present, it remains an open question as to whether venture capital in India and China will support true ground-up innovation, versus being used to fund the establishment of call centers or other products and services quite similar to those already available in the North.

Venture capital might or might not be used to fund technological applications involving ground-up innovation, but open source is fundamentally a method for creating innovative products, and its adoption the South holds great potential for building new technologies from the ground up. It seems somewhat more likely that the sorts of language-translation and voice-recognition applications mentioned above would be created by networks of open-source programmers in countries of the South, rather than by for-profit firms supported by venture capital, simply because there may be less potential for windfall profits in the market for these products. As mentioned above, however, a certain scale may be necessary to support the creation of customized open-source products. Thus, for instance, it seems more likely that open-source language-translation tools would be developed for major languages of the South such as Mandarin Chinese and Hindi than for the more obscure local languages where they would potentially be even more useful.

Regardless of what sorts of technological applications they ultimately support, the potential adaptability of foreign business models such as venture capital and open source is a theoretically significant development. Much of the recent research on systems of production and innovation has argued to the contrary, maintaining that particular methods such as "just in time" production are deeply embedded in national institutional structures and cannot easily be altered to thrive in different contexts (e.g., Hall and Soskice, 2001; Johnson, Tyson, and Zysman, 1989). An important research question thus concerns whether venture capital and open-source software constitute a different type of production process that can be adapted to local conditions with greater success, or whether the applicability of these models is ultimately more limited than we have suggested here.

The Control of Digital Information: A Struggle over Property Rights

As several of the contributions to this issue make clear, the broader developmental consequences of digitization depend on the ability of firms and other actors in the North and South to appropriate the returns from digital innovation. This ability is a product of both technology and politics, but it is rooted in several fundamental characteristics of digital goods. Such products are generally non-rival, in that another's consumption does not diminish one's own, and often non-excludable, in that it can be difficult to prevent others from copying or consuming them (examples include digital images and music). Perhaps most crucially, many digital goods are subject to increasing returns—they become more valuable to consumers or less costly to producers as more units are produced and used. On the consumer side, for example, Microsoft Office is more valuable to current users as more of their friends and colleagues use the program, and also as they become more accustomed to using it themselves (that is, its adoption is subject to network externalities and learning effects). On the producer side, once the software code for Office is written, the marginal cost of producing additional units is near zero.

Control over the use of digital goods is thus both extremely *difficult*—because

non-excludability implies that they are easy and cheap to copy, while non-rivalry means that a copy is just as attractive to consumers as the original—and extremely *valuable*—because increasing returns to scale imply that whoever gains an initial advantage in a particular product line or platform may hope to reap monopoly rents for years to come. This tension between the difficulty and the potential payoff of controlling the returns from the use of digital goods constitutes a defining feature of the information age, and one that may be all the more exaggerated in the context of North-South economic relations. On the one hand, it seems extremely unlikely that applications from the global South will displace a similar product from the North, particularly if the Northern product enjoys initial advantages and early acceptance among a community of users. On the other hand, *different* products that Southern innovators develop and establish among users in the South—perhaps programs customized for local languages or local cultural or institutional contexts—may enjoy unique advantages in these markets. Indeed, the potential to capitalize on increasing returns within their own markets may underlie the possibility that killer apps of the future come from the South.

As Evans argues in this issue, the extent to which countries of the South can hope to develop productivity-enhancing software tools for their own markets, versus being forced to purchase these tools from Northern software firms, will largely depend on the outcome of a political struggle at both the domestic and international levels. The positions of the most relevant state actors in the North and South have been fairly predictable—the United States has favored the global extension of an intellectual property regime built around the "right to exclude" rather than the "right to distribute," while major developing economies such as China have contested this position. What is perhaps most interesting, however, is that opinion on intellectual property is not necessarily homogenous among major corporate actors in the North. Many of the principal players in the software (not to mention pharmaceutical and entertainment) industry have lined up in favor of U.S.-style intellectual property rights, for obvious reasons: Microsoft's ability to protect and appropriate returns from the South's use of its software products depends not only on protecting its proprietary software code but also on the enforcement of existing intellectual property law to its advantage. Yet certain firms may also have an interest in the emergence of a shared global digital infrastructure, as suggested by the recent release of patents by IBM,[5] or the efforts of Merck to finance the coding and public release of human genome sequences in the face of patenting efforts by other research scientists (Castells, 1996). How powerful this latter tendency is, when weighed against the interests favoring status-quo property rights, will largely determine which of Weber and Bussell's two scenarios ultimately comes closer to prevailing.

The effective *enforcement* of intellectual property rights, of course, is as much a technological problem as a political one. In an international environment lacking an effective and coercive central legal authority, enforcement of intellectual property law becomes that much more difficult, if not impossible. Though the technological character of digital goods may give the United States and other Northern countries ample incentives to use international institutions for bullying recalcitrant states into passing Western intellectual property laws, the same characteristics raise immense monitoring problems in the context of the international system of states: domestic authorities in the South can, at least for the time being, claim to be sty-

mied by the technological difficulties of actually implementing effective digital property protection. It therefore seems certain that the tension between the value and the difficulty of controlling and monitoring the use of digital information will help shape the future governance of digital property rights, with important consequences for development in the South.

Social Connectedness and Communities: Networking for Production, Mobility, and Political Change

One of the ways in which ICTs play a positive role in development is by creating some kind of community at either the international, domestic, or local level. Indeed, information and communication technologies are always first and foremost tools for connecting people, whether for economic exchange, political organization, or social networking. When digitally enabled communities succeed in generating positive economic outcomes, they often do so because they have established trust and social capital, often at great distances. In advanced countries, the rise of open-source software is largely a story of a community of engineers working together on a common project, with a set of shared norms that regulate and channel their activities (Weber, 2004). Digital communication tools have been essential for the development of the open-source model not only because it is most convenient to exchange source code modifications online, but also because technology facilitates a sense of community among this far-flung network. If there is to be any South-South collaboration in the creation of open-source products, a similar ICT-facilitated community across different countries will be essential.

Digitally enabled communities that build trust and facilitate cooperation among disparate individuals are an important component of the pattern of "brain circulation" among Indian and Chinese elites. In previous generations, migration implied more of an identity commitment to a new home—the expense of returning to one's country of origin, and the frequently adverse political and economic conditions left behind, encouraged migrants to treat their move as a one-way trip, cutting old ties and establishing new ones. Now, the ability to conceive of oneself as living abroad but still part of a home-country community has been key to the decision of Indians, Chinese, and other emigrants to move back home and bring with them the skills they acquired abroad. This new sense of transnational community is greatly facilitated by the ease and minimal expense involved in international electronic communication.

Information and communication technologies are similarly essential for building social networks of rural-to-urban migrants within China. Because they operate in a legal gray zone, internal migrants to urban areas are very much in need of communities that can help them find employment in both the formal and informal sectors and allow them access to services. Digital technologies facilitate the formation of support networks in migrants' new homes and also assist in the maintenance of ties with their home regions. The availability of ICTs is certainly not essential to internal migration, but it undoubtedly facilitates the practice.

The case of internal migration in China reminds us that digitally enabled communities are not only forms of organization that can engage in self-help solutions to everyday problems; they may also constitute organized interests that can make de-

mands on the state. The potential political implications of digitally enabled communities may be part of what is behind the Chinese government's ambivalence toward their technologies of choice. In this instance, it is instructive to compare the experience of the information have-less in China to that of Falun Gong, another community whose social networking was greatly facilitated by the use of ICTs (Bell and Boas, 2003). Arguably, Chinese authorities' greatest concern over Falun Gong was the fact that this group constituted an independent source of organization. Government crackdowns on the group thus targeted not only the public display of allegiance to Falun Gong, but also members' ability to maintain a network, in part through the use of digital technologies. Compared to the experience of Falun Gong, the absence of a draconian response against digitally enabled networks of internal migrants suggests a certain deliberate tolerance by the Chinese state, or at the least the presence of some equilibrium in which elites weigh the economic benefits against the potential political costs of the diffusion of digital tools among the information have-less.

Digital Technologies for Social Development: A More Widely Accessible Goal?

Social networking is not the only way in which the developmental implications of digital technologies extend beyond the strictly economic sphere; these technologies can also be useful in the efforts to promote social development in the global South. Economic development is typically understood as an increase in economic resources, measured with an indicator such as income per capita, and often considered in terms of the relative wealth of the North versus the South (Mann, 2003: 67). Social development, on the other hand, includes changes such as reductions in absolute poverty, improvements in egalitarianism, and increasing access to education, health care, and a clean and safe environment. It is typically measured with the Human Development Index or an alternative combination of social welfare indicators (UN, 2000). As Sen argues, social freedoms such as these can be considered "among the *constituent components* of development. Their relevance for development does not have to be freshly established through their indirect contribution to the growth of GNP or the promotion of industrialization" (Sen, 1999: 5, emphasis in original).

Although it has generally occurred under the radar of social scientists, the use of ICTs to promote social development is an important trend in the global South. Examples from three areas of social development give an idea of the potential of these initiatives. In the health sector, the combination of wireless connectivity and digital video technologies can improve access to medical services. For instance, a telehealth project in Eastern Cape, South Africa, links health workers and doctors through a local wireless network, enabling patient consultations via digital video.[6] A similar initiative at Narayana Hrudayalaya Heart Hospital outside Bangalore, India, uses real-time video to provide consultations to heart patients in remote areas lacking in cardiovascular specialists.[7]

In the area of education, ICT initiatives typically emphasize the provision of technology resources to both teachers and students. A core component of the international World Links program, operating in 42 countries including India, is to train teachers to better utilize ICTs in their pedagogical activities.[8] Programs oriented

toward students typically emphasize placing computers in schools, such as the Khanya and Gauteng Online programs in South Africa, as well as the development of specialized content in local languages, as seen in the efforts of the Azim Premji Foundation in India.[9]

Finally, community connectivity initiatives, commonly known as "telecenters," are an increasingly common form of ICT-for-development that often integrates social and economic development goals. The Akshaya project in Kerala, India, for instance, gives entrepreneurs the opportunity to own a center that provides technology training and access to the community.[10] Similar projects exist across India and other developing countries (Bussell, 2004).

The use of ICTs for these types of initiatives in health, education, and other social areas can potentially make a major contribution to development in the global South, even in countries that do not have much hope of becoming significant competitors in the international market for information technology. While the ICT industry has become an important engine of economic growth in countries such as China and India, thanks in part to their large, well-educated labor force and the size of their domestic economies, smaller countries with less investment in education will probably continue to be consumers rather than producers of digital technology. Although economic growth in many of these countries could certainly be driven by the integration of ICTs into other domestic industries, the use of ICTs for social development may be more likely to provide tangible benefits for a much larger percentage of the population.

A number of the issues discussed above regarding applications of ICTs for economic development are also relevant for ICT-driven social development. Within countries, are the benefits of these initiatives likely to cluster regionally in a manner similar to that of economic development? Cities and regions with strong economic growth, particularly related to ICT industries, may be more likely to experience social development "spillovers" to surrounding areas. One example is the TelNek women's empowerment initiative on the outskirts of Bangalore, which provides technology education to young women. On the other hand, efforts to promote ICT-driven social development in the poorest and most rural communities could play an important role in alleviating patterns of regional divergence in health, education, and other social indicators.

The question of technology transfer versus adoption and adaptation versus ground-up innovation is also quite relevant when ICTs are applied primarily to the social realm. As with applications of ICT for economic development, boilerplate initiatives to build rural telecenters or put computers in schools may not succeed if these plans are not at least modified to take account of particular local contexts. In many cases, however, those involved in the design and implementation of ICT initiatives for social development have extensive knowledge of on-the-ground conditions in particular communities, which bodes well for their likelihood of success. Indeed, some of the most innovative uses of ICTs in the global South may occur in the area of social development, such as the development of educational software programs based on local content and local languages, or new wireless technologies used to achieve connectivity in remote rural environments.

A final question relevant to social as well as economic development concerns the role of the state versus non-governmental and private actors. State agencies

have traditionally been the actors most concerned with the health, education, and general welfare of their nation's population, though non-governmental and multilateral organizations have played a particularly important role in promoting the use of ICT for social development, perhaps because of their greater familiarity with new digital technologies. Recently, for-profit corporations have also begun to get involved in particular ICT-driven social development ventures. One prominent example is Hewlett-Packard's e-Inclusion initiative, which builds and runs telecenters in ten countries to support local digitally enabled social and economic development ventures. The implications of these and similar initiatives for the character of development remain to be seen.

Will The Digital Revolution Revolutionize Development? Living in the Midst of a Transformation

Does the Digital Revolution imply a revolution in international development? If the process of digitization does indeed constitute a revolutionary transformation, it is certain that we are living in the midst of it, perhaps only in the initial stages. Observing events from this vantage point makes social science all that much harder. Our most authoritative accounts of such transformations as industrialization, democratization, and the commodification of land, labor, and capital were not those written in the midst of events, but decades, if not centuries, later. The comparative-historical method of Polanyi (1944), Gershenkron (1962), and Moore (1966) relies on plentiful evidence, the tracing of historical legacies, and interpreting the significance of events in a much broader context. If the Digital Revolution is anything like previous revolutions, the most important questions we can ask may not be the ones that we can definitively answer at present. Weber and Bussell's contribution to this volume confronts this issue head-on: while offering provocative scenarios, they acknowledge that the definitive history of the Digital Revolution's implications for the North-South divide will be written by a future generation of scholars.

Despite the inherent difficulties in assessing the overall significance of the Digital Revolution for development, the contributors to this special issue present new evidence and propose intriguing insights into the relationship between these two variables. As discussed in the introduction, their arguments testify not only to the effect of technological change on the potential for economic and social advancement in the South, but also to the fact that the character of this change is dependent on existing power relations, economic conditions, and the nature of the societies in which it occurs. Given the inherent endogeneity of digitization, therefore, the most sensible answer to the question posed in our title is a qualified one. Ultimately, whether the Digital Revolution implies a revolution in development will depend on a number of factors discussed here, including the extent of within-country linkages among different sectors and socioeconomic classes, the degree to which new technological applications can be customized to thrive in local conditions, and, above all, the relative strength of organized interests favoring different ways of organizing and governing the global political economy.

Emphasizing the endogenous nature of technological change, of course, does not imply that digitization itself has no independent impact on development. Even if digital ICTs are produced within a particular constellation of institutions and a

set of economic and political relationships, the inherent characteristics of these technologies (such as network externalities and non-rivalry) lead to tensions that will confront actors in both North and South. The contributors to this special issue have clearly outlined the force of these tensions and the impact that their resolution may carry for developmental outcomes across the global South.

Acknowledging the difficulty of drawing definitive conclusions about the Digital Revolution and international development should not cause us to be timid with our questions. The potential developmental consequences of digitization are sweeping, and transformations currently underway may have massive welfare consequences for the average citizen of the global South. On the one hand, technological innovation in the global North, bolstered by an effectively-enforced system of intellectual property rights, may continue to channel profits to elites and firms in core countries of the global economy. On the other hand, the emergence of a shared global digital infrastructure, with open-source software as the paradigmatic case, may afford the South significant new opportunities for innovation and even for income convergence with the global North. Between these stark alternatives lies a range of possibilities, including the emergence of dynamic, digitally enabled sub-national hubs which may or may not have significant economic linkages to other parts of the country, and the possibility that the majority of ICT users even in these dynamic regions will be members of the information have-less who make do with only mid-range technology. The consequences of digitization for development therefore constitute a crucial and pressing agenda for future research—an agenda which the contributions to this issue have helped to further, and which students of development should pay close attention to in the years to come.

Notes

1. Recent trends in global inequality are widely debated. Sala-i-Martin (2002) and Firebaugh and Goesling (2004) have recently asserted that global inequality has declined over the last twenty years, but Milanovic (1997, 2002) and Wade (2004) are among the many skeptics. See also the exchange between Arrighi et al., Amsden, and Firebaugh, published in *Studies in Comparative International Development* 38:1, 39:1, and 40:1.
2. For further discussion of this notion of single versus multiple models of development, see Dunning and Pop-Eleches (2004) and other contributions to a special issue of *Studies in Comparative International Development* (Vol. 38, No. 4).
3. Thanks to Carolyn Cartier for providing us with data on growth rates in Guangdong province and China as a whole over the reform period.
4. See <http://www.simputer.org>.
5. Steve Lohr, "I.B.M. to Give Free Access To 500 Patents," *New York Times* Jan. 11, 2005: C1.
6. See <http://www.cda.co.za>.
7. See <http://www.hrudayalaya.com/>.
8. See <http://www.world-links.org>.
9. See <http://www.khanya.co.za>, <http://www.gautengonline.com>, and <http://www.azimpremjifoundation.org>.
10. See <http://www.akshaya.net>.

References

Amsden, Alice H. 1979. "Taiwan's Economic History: A Case of *Etatisme* and a Challenge to Dependency Theory." *Modern China* 5, No. 3: 341–380.

Arthur, W. Brian. 1994. *Increasing Returns and Path Dependence in the Economy*. Ann Arbor, MI: University of Michigan Press.
Bell, Mark R., and Taylor C. Boas. 2003. "Falun Gong and the Internet: Evangelism, Community, and Struggle for Survival." *Nova Religio* 6, No. 2: 277–293.
Bussell, Jennifer. 2004. "Evaluating a Development Panacea: The Politics of Information and Communication Technology in Developing Countries." Presented at the Annual Meeting of the American Political Science Association, Chicago, IL, September 2–5.
Cardoso, Fernando Henrique, and Enzo Faletto. 1979. *Dependency and Development in Latin America*. Berkeley: University of California Press.
Cartier, Carolyn, Manuel Castells, and Jack Linchuan Qiu. 2005. "The Information Have-Less: Inequality, Mobility, and Translocal Networks in Chinese Cities." *Studies in Comparative International Development* 40, No. 2: 9–34.
Castells, Manuel. 1996. *The Rise of the Network Society.* Malden, MA: Blackwell.
Dunning, Thad, and Grigore Pop-Eleches. 2004. "From Transplants to Hybrids: Exploring Institutional Pathways to Growth." *Studies in Comparative International Development* 38, No. 4: 3–29.
ECLA (United Nations Economic Commission for Latin America). 1950. *The Economic Development of Latin America and its Principal Problems*. Lake Success, NY: United Nations.
Evans, Peter. 1979. *Dependent Development: The Alliance of Multinational, State, and Local Capital in Brazil*. Princeton, NJ: Princeton University Press.
Evans, Peter. 1995. *Embedded Autonomy: States and Industrial Transformation*. Princeton, NJ: Princeton University Press.
Evans, Peter. 2005. "The New Commons vs. The Second Enclosure Movement: Comments on an Emerging Agenda for Development Research." *Studies in Comparative International Development* 40, No. 2: 85–94.
Firebaugh, Glenn and Brian Goesling. 2004. "Accounting for the Recent Decline in Global Income Inequality." *American Journal of Sociology* 110, No. 2: 283–312.
Frank, Andre Gunder. 1967. *Capitalism and Underdevelopment in Latin America: Historical Studies of Chile and Brazil*. New York: Monthly Review Press.
Gerschenkron, Alexander. 1962. *Economic Backwardness in Historical Perspective*. Cambridge, MA: Harvard University Press.
Hall, Peter A., and David Soskice, eds. 2001. *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. New York: Oxford University Press.
Hirschman, Albert O. 1958. *The Strategy of Economic Development*. New Haven: Yale University Press.
Hirschman, Albert O. 1981. "The Rise and Decline of Development Economics." In Hirschman, *Essays in Trespassing: Economics to Politics and Beyond*. New York: Cambridge University Press.
Johnson, Chalmers, Laura D'Andrea Tyson, and John Zysman, eds. 1989. *Politics and Productivity*. Cambridge, MA: Ballinger.
Kurth, James R. 1979. "The Political Consequences of the Product Cycle: Industrial History and Political Outcomes." *International Organization* 33, No. 1: 1–34.
Krugman, Paul. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade." *American Economic Review* 70: 950–959.
Mann, Catherine. 2003. "Information Technologies and International Development: Conceptual Clarity in the Search for Commonality and Diversity." *Information Technologies and International Development* 1, No. 2: 67–79.
Moore, Barrington, Jr. 1966. *Social Origins of Dictatorship and Democracy: Lord and Peasant in the Making of the Modern World*. Boston: Beacon Press.
Milanovic, Branko. 1997. *Income, Inequality and Poverty During the Transition from Planned to Market Economy*. Washington, D.C.: World Bank Publications.
Milanovic, Branko. 2002. "True world income distribution, 1988 and 1993: First calculation based on household surveys alone." *Economic Journal* 112: 476.
Polanyi, Karl. 1944. *The Great Transformation*. New York: Farrar & Rinehart, Inc.
Prahalad, C. K. 2004. *The Fortune at the Bottom of the Pyramid*. Upper Saddle River, NJ: Wharton School Publishing.
Sala-i-Martin, X. 2002. "The Disturbing 'Rise' of Global Income Inequality." National Bureau of Economic Research Working Paper No. 8904.

Saxenian, AnnaLee. 2005. "From Brain Drain to Brain Circulation: Transnational Communities and Regional Upgrading in India and China." *Studies in Comparative International Development* 40, No. 2: 35–61.

Sen, Amartya. 1999. *Development as Freedom*. Oxford, U.K.: Oxford University Press.

Singer, H. W. 1950. "The Distribution of Gains Between Investing and Borrowing Countries." *American Economic Review: Papers and Proceedings* 40, No. 2: 473–485.

United Nations. 2000. *UN Millennium Development Goals*. <http://www.un.org/millenniumgoals/>. Access date?

Wade, Robert Hunter. 2002. "Bridging the Digital Divide: New Route to Development or New Form of Dependency?" *Global Governance* 8, No. 4: 443–467.

Wade, Robert Hunter. 2004. "Is Globalization Reducing Poverty and Inequality?" *World Development* 32, No. 4: 567–589.

Wallerstein, Immanuel. 1974. "The Rise and Future Demise of the World Capitalist System: Concepts for Comparative Analysis." *Comparative Studies in Society and History* 16, No. 4: 387–415.

Weber, Steven. 2004. *The Success of Open Source*. Cambridge, MA: Harvard University Press.

Weber, Steven, and Jennifer Bussell. 2005. "Will Information Technology Reshape the North-South Asymmetry of Power in the Global Political Economy?" *Studies in Comparative International Development* 40, No. 2: 62–84.