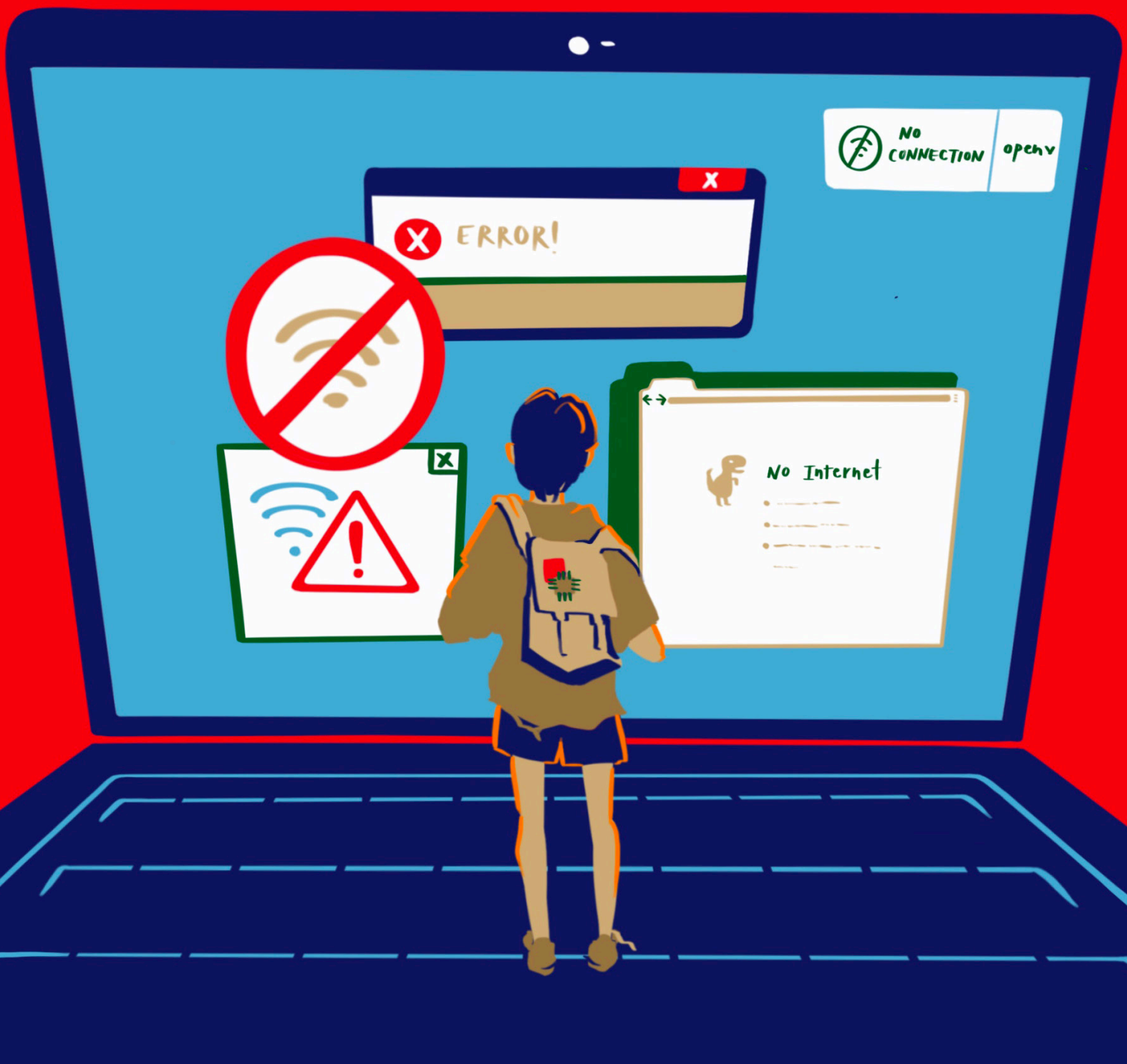
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Tackling Technological Inequalities: How Bridging the Digital Divide Can Enhance Progress in Developing Countries

Lucie Taïeb

Edited by Sebastien Villegas and Rory Daly

Authors Note

In a world in which technology has been a synonym of worsened mental health, data privacy concerns, and fake news, exploring the full impact of digital devices and how we can harness them is increasingly important. I would like to thank Professor Paola Perez-Aleman for giving me the opportunity and providing me with the tools to write about how business resources can be put to good use to create societal value by reaching untapped markets. To my parents, thank you for supporting me through all of my endeavors and for trying to feign interest in the papers I write, even if you don't understand a single thing I'm doing. To Elise, thank you for bearing with me while I was writing this, and to Alice, thank you for bearing with Elise that had to edit my paper and challenge all of my points of view. To Elisa, I am so happy I draw you into SSUNS and I am grateful for the chance we got to be on Dias together and work on technological inequalities.

Abstract

In a year in which many activities have moved online due to the pandemic, digital devices have proven more important than ever, once again emphasizing the crucial role of technology as a force of progress. However, there exists a technological divide that benefits high-income nations, leaving behind developing countries and reinforcing existing gaps in income and resources. As such, the digital divide represents one of the principal challenges to the development of lower-income countries. Corporations, as part of the international community, have the resources and capacities to develop profitable models that bridge the digital divide. Through boosting technological diffusion, access, and usage, firms can improve the educational, health, and economic outcomes of developing countries all while attaining financial gains.

Through focusing on technological diffusion, access, and usage, firms can improve the educational, health, and economic outcomes of developing countries while attaining financial gains. Firstly, firms need to focus their efforts on technological learning, which can provide substantive job creation for citizens of developing states. This acquired knowledge can then reach the global poor through mechanisms such as group investments, ensuring access to technology in developing nations. Examining this proposed process will demonstrate how corporations can use tools such as leapfrogging and innovation to reach these goals. Through bypassing intermediate stages of technology to accelerate development, and by designing products with the needs and circumstances of citizens in the developing world in mind, firms can create devices that are both profitable and easy to implement (UNCTAD 2018, 27; Basu, Banerjee and Sweeny 2013, 64).

How to Diffuse Technology?

Technology diffusion — or when new technologies spread across all users, uses, and geographic regions — is the first step in bridging the technological gap (Stokey 2020, 2). It can be achieved by encouraging technological learning, reversing brain drain, and by fostering a creative environment for businesses. In this paper, technological learning will refer to the process in which a firm acquires and builds knowledge on a new technological capability. In turn, technological capability refers to the use of knowledge to "assimilate, use, adapt, and change existing technologies" (Kim 1997, 86).

Technological learning has allowed companies to transfer research and development (R&D) knowledge to lower-income countries, which then innovate on their own. This process is often part of a company's R&D strategy: to efficiently invest in their human and financial capital, in order to generate long-term rewards. One example of technological diffusion through learning is the case of the South Korean company, Samsung. Through the creation of task forces in the United States and South Korea, Samsung passed foreign knowledge of semiconductors to their own research teams through long hours of demonstrations by Silicon Valley experts. As a result, the Korean engineers were able to imitate, reproduce, and implement the demonstrated practices, indicating successful internalization of the knowledge. Thus the creation of these two collaborative R&D groups resulted in diffusing semiconductor technologies to Korea (Kim 1997, 90-94). This effort also increased Samsung's productivity relative to its peers, allowing it to create a specific model of a semiconductor chip first, and invent the highest of patents relating to that chip design (Kim 95).

Clearly, setting up R&D teams is one of the ways firms can diffuse their know-how. By spreading their knowledge to developing countries, firms can bring considerable improvements to the economic and innovative climate. Similarly, as demonstrated by Samsung, technological learning enables productivity gains and broadens perspectives among innovators in less developed countries. With their newly acquired expertise, individuals are equipped to innovate in the domain of digital devices. Moreover, rather than being purely reliant on partners in developed countries, local firms can attain knowledge and quickly respond to the needs of their domestic population.

Reversing brain drain, the process of highly educated workers returning to work in their home country can also play an important role in bridging the digital divide. Attracting expatriate engineers through a competitive and creative work environment can be crucial to creating a high-skill economy and attaining technological gains. Taiwan is one notable example of this. Taking advantage of many Taiwanese nationals who had received an American education, Taiwanese companies developed their technological capabilities by attracting and retaining this foreign-educated workforce, enabling the country to build up an advanced manufacturing base (Saxenian 2006, 143). This is similar to what South Korea achieved through Samsung's R&D program, as Taiwanese workers were able to diffuse knowledge from their studies in developed nations to their jobs in Taiwan (143-144). Taiwan's universities were also able to teach at higher levels as foreign knowledge flowed in the country (136).

Similar to immigration, bringing expatriates' or foreign entrepreneurs' ideas and innovation to a developing country can stimulate a climate of innovation (Melo 2012, 20). Overseas engineers returning home can also facilitate new relationships, as their simultaneous maintenance of work ties in the developing country and with their former international coworkers creates linkages that would not otherwise exist (Saxenian 2006, 144). These new links between domestic and international networks could consequently increase technological learning in the developing world.

The spread of technological learning often accompanies and facilitates entrepreneurship (Saxenian 2006, 145). While there are more high-skilled jobs, there is an overall lack of positions to be filled, meaning that many citizens of these developing countries who have graduated with top degrees cannot get a job. For example, Information and Communication Technologies (ICT) graduates are forced to take on low skill jobs to make a living in many places, and as new jobs present higher wages, many will transfer into these new positions. This lack of adequate movement from top schools to jobs causes issues in countries such as South Korea, India, and even Cambodia, where ICT graduates have previously been forced to work as taxi drivers due to the lack of employment opportunities in their sector (UNESCAP 2018, 71). Ultimately, technological diffusion creates these two positive consequences: the inflow of knowledge and skills to developing states, and the creation of jobs as this inflow of knowledge stimulates innovation by entrepreneurs, both serving to boost technological development and bridge the tech gap.

Technology diffusion can prove a holistic solution to developmental inequalities between countries and within societies. In fact, in pursuit of maximizing their profits in the same manner as Samsung or corporations in Taiwan, firms can favor the spread of technologies as a means of development by either operating in developing countries or taking advantage of pre-existing skilled local workforces. However, the diffusion of technology between countries does not mean that the technological gap has been fully vanquished. For that to be the case, and for firms to have a profit incentive, technology must reach the global poor.

How to Access Technology?

Once knowledge is acquired, it needs to

reach local populations to ensure better access to technology. This next step can be achieved successfully by creating collective initiatives and bottom of the pyramid (BoP) ventures. These solutions can also potentially play a role in bridging gender gaps within developing countries.

The high cost of digital devices is a problem still encountered in lower-income countries. This restricts access to education and other information available through digital platforms. It contributes to the broad gap in access to technology which exists between developed and developing nations (Figure 1) (Lishan et al. 2018, 8).

One way to reduce the cost of buying a technological service or device is by pooling resources. This is a system that CEMEX, a multinational cement manufacturing company operating both in and outside of Mexico, has successfully adopted (Prahalad 2005, 147). In 1998, the company launched an experiment called Patrimonio Hoy to help very poor people pay for services to upgrade their homes (Prahalad 148). Customers of the program, which the company calls *socios*, form a group of up to three people and share payment responsibilities. While it is not clear whether this program is sustainable in the long-run, it shows that implementation of group purchase plans is possible (Prahalad 154).

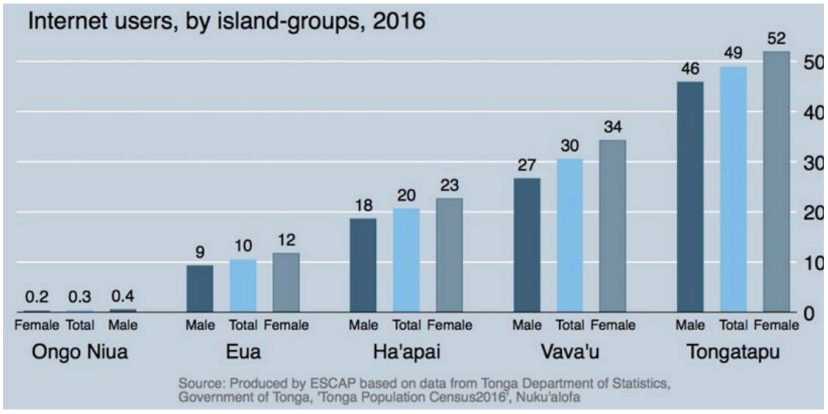

Figure 1: ICT penetration levels by level of development, 2017.

As CEMEX's *socios* system demonstrates, collective responsibility has proven effective in taking the first step towards the consumption of costly goods. Following the same model, individuals could first acquire a phone, tablet, or computer in groups. Not only would this reduce debt for each individual member, but interacting in a group purchase system would likely see group members understand and trust such a process in the future. Group sharing would also enable individuals to save money on their first device while still assessing its features and usefulness. In the long-term, programs such as socios would factor into more people having access to information and online services; greater trust and understanding in these devices and systems would encourage consumers to be less afraid to seek out these goods in the future.

Group initiatives are not restricted to devices; they also apply to their connected services such as repairs or charging. Installing kiosks in villages, for example, would make services accessible to a broader public. These processes would gain visibility while reducing consumers' costs, thereby assisting with high prices and promoting the goods and related services. This approach has proven successful in India. In 2013, Amul, the country's leading dairy firm, installed refrigeration systems in each village where they operate. This megaproject addressed the increasing demand for dairy products in the country by improving Amul's infrastructure, maintaining its cooperative model, and reducing operation costs and consumer prices in the long-run (Goldberg & Cornell 2013, 8). Similar innovation initiatives use public goods to advantage the population. For instance, the Nairobi-based asset financing platform M-Kopa took advantage of the abundant solar energy in the region and developed solar panels with integrated USB-ports for charging cell phones (Shapshak 2016). Using a 'pay-as-you-go' model, they effectively diffused cheap solar power throughout rural areas. Identifying opportunities that improve a country's infrastructure demonstrates the potential of

technology firms to close the digital divide. Pursuing group initiatives enables broader socio-economic sectors to access technology, thereby opening the market, and generating both development and profit in the long-run.

Undertaking BoP ventures has a similar impact: by focusing on an individual or community's economic development, firms facilitate access to basic products and services at reasonable prices in lower-income areas where most of the population cannot afford them. More importantly, new BoP-focused businesses create a dual value by benefiting both buyers and sellers. For instance, BoP ventures often focus on the pay-per-use basis to access internet connection, computers, and cell phones. This translates into the creation of new jobs, the expansion of markets, increased productivity, access to educational tools and knowledge, facilitation of interconnection and networking, etc. (London 2009). This represents a win-win situation for the seller and buyer: the consumer does not have to buy a device but can still benefit from its use while the seller gets increased returns from their investment (Prahalad & Hammond 2002). Therefore, by fostering economic upheaval, BoP ventures can create positive repercussions for all parties: local communities have better access to less-expensive technology and more job opportunities while the company sees its relationships improve and hopes for even more value creation in the future.

In addition to bringing access to the internet, education opportunities and knowledge, better access to technology can bridge a country's internal inequalities. The Polynesian state of Tonga, composed of over 170 islands scattered across the South Pacific ocean, exemplifies domestic disparities within a developing nation. For instance, internet access is highly unequal across the different islands, with the main and largest island, Tongatapu, having the highest percentage of Internet users (Figure 2). While other developed islands within Tonga enjoy relatively high rates of internet access, the lack of infrastructure along socioeconomic lines makes internet users more the exception than the norm ('Ofa 2018, 18). Only two-thirds of Tonga's Internet users access it from their home, and internet access in public places, including schools, is still limited ('Ofa 20). Moreover, Tonga has exhibited a marked gender divide in its internet users ('Ofa 7). The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) launched an initiative called the Asia-Pacific Information Superhighway (AP-IS) Master Plan to tackle these domestic divides. By partnering with regional organizations, as well as private sector technology firms, UNESCAP was able to close these gaps in the Asia-Pacific region. In the case of Togo, internet use increased outside Tongatapu and women became the main internet users across the board. By making women play a central role, collective initiatives and BoP ventures can have important effects in closing the gender gap (London 2009). Therefore, technology firms can play a role not only in bridging the global digital divide but also in internal particular divides based on socio-economic, geo-political and gender cleavages.

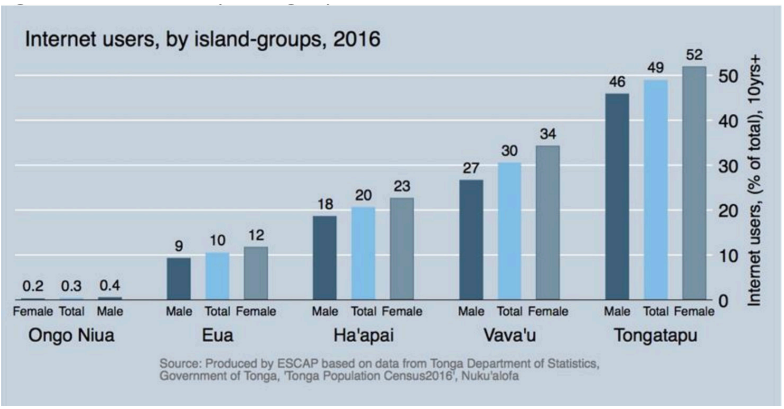

Figure 2: Internet users by island group in 2016 in Tonga

How to Use Technology?

Having access to technology is worthless without understanding how to use it. It is therefore necessary to integrate technological devices that are simple, easy to manipulate, and that target the consumer's needs, while being useful in multiple

situations. Daily integration, frugal innovation, and leapfrogging have proven to be viable methods that facilitate product usage.

The more complex a task is, the harder it is for consumers to use devices effectively. Keeping this barrier in mind, the Kenyan initiative M-PESA launched a mobile service for digital payments, targeted specifically to the unbanked population. Developed by Safaricom, Kenya's leading telecommunications provider and part of the Vodafone group, M-PESA has shown the need to simplify products and tasks to ensure maximum familiarity and use. By allowing users to access the service from its initial versions, a process of trials and errors allowed for integral development of the service after achieving several successful monetary transactions (Hughes & Lonie 2007). While normally such initiatives are carried out by recruiting small training groups through several sessions, this initiative had a relatively lower budget, highlighting the use of frugal innovation. Moreover, new services must take into account the problems and needs of the local population and potential consumers. Firms need to build a product with appropriate features that match the population's expectations and skills without losing quality. Additionally, a thorough assessment of technical issues and the integration of the target population to the creation process are likely to facilitate innovative ways to design new products. Re-designing a product during its initial phases can potentially be more profitable and efficient since it becomes easier to use and reinforces features that are integral to the consumer's experience (Govindarajan & Winter 2015). The easy manipulation of a new digital service can open doors for the use of more complex applications such as Zoom, multiplying the number of times individuals use their tablet or phone.

Building a business through technology is a means to reconcile digital gaps. As shown by the M-PESA banking service, digital devices are increasingly becoming the primary platform for activities. Technology thus appears as a way to solve problems, something also known as 'leapfrogging' (Philling 2018). Despite the limitations of harnessing technological innovation - such as the lack of industrial capacity, absence of a good government, or lack of solid infrastructures - leapfrogging has enabled countries to develop quicker and more efficiently. For instance, the mobile revolution (a phenomenon particularly acute in Africa, a continent with 350 million phone subscribers and counting) has not only benefited the urban population but also the countryside (Etzo & Collender 2010). This new wave of smartphone usage has opened up many doors for further innovation and development in different areas from buying goods online to having access to taxi services (Philling 2018). Another notable example is Zipline, a Rwandan high-tech startup engaged in drone manufacturing, logistics-service providing, and public health consulting. In October 2016, Zipline began using drones to deliver medical supplies to remote health clinics in Rwanda. This partnership with the Government of Rwanda dramatically aided the delivery of essential medical supplies in the country ('Utoikamanu n.d.). The access to a broader range of basic services through the integration of technology into daily activities has created opportunities for improvement in the areas of education, health, economy, employment, and the overall standard of living of target populations. Leapfrogging has therefore proved to bring benefits to developing nations through the integration of technology into business ventures.

Technological devices need to be designed considering the expectations and needs of the poorer communities. By engaging in frugal innovation, technology firms can create services designed and perfected by their own users, increasing their usability and facilitating the adoption of more complex digital applications. If new services and devices are successful, they can lead to leapfrogging and close the digital divide through technology. The objective is therefore to aim for cheap, accessible services and devices that are also viable and scalable.

Conclusion

This paper has demonstrated that the underlying gains of bridging the digital divide are unrivaled for local populations. Furthermore, by helping to achieve this goal, firms too can gain unmissable benefits. Bridging the digital divide can be reached by three consecutive steps. By gaining knowledge through technological learning and enhancing innovation, firms can collectively create job opportunities for expatriates returning to the country. Then, they can both establish collective initiatives and Bottom of Pyramid ventures to ensure wider access to technologies at the lowest cost possible. However, firms must have consumers' needs in mind when creating a device that is easy to use, which can be achieved through frugal innovation and leapfrogging.

By reconciling diffusion, access, and use of technologies, firms impact impoverished populations by ensuring access to basic goods and services in an increasingly digital world. By bridging the digital divide, firms have the potential to alleviate gaps in education, healthcare, and the labour market, creating a long-term positive loop of development. After having understood the considerable impact and profit untapped markets hold, technology firms can put their resources to good use. This is particularly important since few actors in the global arena have financial resources comparable to these firms. This study has highlighted the benefits and incentives of using technology to bridge the digital divide, and compels companies to consider a paradigm shift in assessment of the risks associated in undertaking such initiatives. A look into how firms and international organizations act in partnership could thus be useful in providing the right incentives for firms to act upon the digital divide.

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