CHAPTER 1.4

The Promise of Technology

CÉSAR ALIERTA, Telefónica

The pace of change and technological evolution has accelerated greatly over the last decades. It is remarkable not only how dramatically the technologies in everyday use have changed, but also how easily society as a whole has adopted these innovations. For example, until just a few years ago, only the earliest adopters had access to mobile phones; most people relied on landlines for telephone communication. Now digital mobile telephones are ubiquitous: nearly everyone has ready access to local, national, and global connections. And this seems to have happened in the blink of an eye.

The transformation above has been unequivocally positive—for societies, for companies, and for individuals. This optimistic view rests on the broad platform of the liberation and democratization of information and of technology.

Not too long ago, having information—data—in an organization conferred power. Particular individuals were thought of as the "owners" of critical bits of information, ensuring them the attention of, proximity to, and influence over top decision makers. Today, however, even medium-sized enterprises have well-organized information systems characterized by affordable and powerful applications capable of processing, analyzing, and interpreting data without quantitative limitations of time, space, or place. Data have been liberated from the control of the few and are now accessible to the many.

Essentially, it is this transformation—embodied in information and communication technologies (ICT)—that has provided the foundation for the huge leaps that we have witnessed in the last few decades.

The impact of ICT can be grouped into at least three distinct categories: economic, business, and social. The three are interrelated, in the sense that what happens in each of them is both cause and consequence of what happens in the others. Nonetheless, it is useful to discuss them separately.

This chapter will provide an overview of these recent technological advances, and will also point to some of the possibilities for future evolution.

The fifth revolution

Since the late 18th century, Western society has experienced five distinct eras or revolutions: the Industrial Revolution (beginning roughly in 1771), steam power (beginning in 1829), electricity (in 1875), oil (in 1908), and ICT (in progress).

Each of these eras has entailed a paradigm shift, more or less abrupt or disruptive, which has led to profound changes in the organization of the economy, starting with individual businesses and, eventually, transforming society as a whole. Each era has experienced three major phases: installation, re-accommodation, and deployment.

During the first phase, new learning spreads and past conventions are dislodged, with the clear result

that certain companies, sectors, and territories lose importance and new ones begin to emerge. The second phase is characterized by an abundance of examples of transition, although often there are doubts about the sustainability of change. In the third phase, the new paradigm becomes dominant and unleashes widespread opportunities for generating wealth. Of course all this results in significant changes in the relative position of businesses, industries, and whole countries.

This is exactly what we see now, with one crucial difference: today the velocity of change is spectacularly accelerating.

A rapid change

Each of the first four periods of capitalist restructuring took half a century, with one, two, or more decades for each phase. For example, the widespread use of steam and then of electricity in the processes of production and transportation in the early and late 19th century, respectively, entailed a conversion over several decades in each phase before the transformation was complete. The more recent contributions to domestic life, such as the telephone, radio, and television, are other examples.

However, this is changing in our current experience. A mere decade elapsed between the start of the commercial availability of both mobile phones and the Internet and their widespread adoption. Something similar is happening with the spread of broadband.

This increased velocity of adoption, while distinctive, does not alter the essence of the similarities with earlier transformations and, consequently, of the lessons that can be drawn from them. The main lesson is that any change of paradigm—or, if you prefer, the technological breakthrough that it creates—opens a wide range of opportunities, but also risks becoming a serious threat to all those who shun its adoption.

The point is simple, but critical. Globalization is here to stay, with the resultant increasing interdependence among economies, industries, and markets, characterized by intensified and ever-changing competition. Success in this world will increasingly be defined by the extent and pace at which an organization (or a society) innovates and becomes more productive. In turn, innovation and productivity are related to the adoption and appropriate adaptation of new technological applications.

Challenges for productivity and competitiveness

Assessing the impact of new technologies in general, and ICT in particular, in the evolution of economic productivity has been controversial, both in academic circles and among practitioners.

One source of the controversy is the so-called Solow paradox. Stripped of its scientific garb, this paradox asserts that there is a lag between investing in or deploying ICT and the generation of positive effects on productivity, whether these effects occur in the production system as a whole or in one or in another of its sectors. At least part of the controversy lies in disagreements over how best to measure productivity gains. But, even while these quantitative differences persist, they do not undermine the fundamental point: ICT contributes decisively to the evolution of productivity. This is as true at the micro level of an enterprise or business as it is for the entire economy that benefits from the competitiveness of individual companies.[1]

This contribution is reinforced by accelerating globalization, which has changed—and changed a lot—many of the paradigms that once determined competitiveness. Put another way, the ingredients or the profile of the comparative advantages that, centuries ago, conferred greater capacity for progress and welfare on some than on others are not the same today. The effect of technological advances on this change has not been studied sufficiently, but technological innovation is clearly one of the most important factors driving change.

No less important is the extent to which the impact of new technologies in the social sphere benefits the entire economy. For example, it is common sense that a better-educated population and healthier citizens with longer life expectancies contribute to the way an economy optimizes its global position. The contribution of ICT to both social fields—education and health—is not only obvious, but is also one of the areas where the implementation of technology has enormous potential, even if that technology is only partially applied.

Contributions to business management

Overall, ICT implementation in any organization makes possible the access to resources that contribute to improved efficiency. In the specific case of companies, this provides essential elements for improving their competitive position. One result is that sheer size has become less important to success. Conversely, any lag or gap in incorporating new technologies into the production process has become a serious impediment to strengthening one's market presence. Of course, choosing the right technologies is critical: anything else imposes costs and loss of opportunities.

In general, appropriate use of technology reflects two of the essential elements of improvement: efficiency and efficacy. With regard to efficiency, technology promotes improved dissemination and processing of information at all levels of an organization and, moreover, significantly reduces the risk of making a mistake. With regard to efficacy, technology allows for the application of company resources in a more appropriate manner, increasing the effectiveness of the tasks or processes being undertaken.

Students of management methods like to talk about the reciprocal role of business strategy versus the tactics of choosing specific management tools. However, the

two are inseparable and must be addressed in parallel because they depend on each other.

The traditional approach argued that ICT should be subordinated to the strategic business focus. That is, essential components—such as applications—should be designed to optimize already-established processes, while infrastructure would be built out to enable the best and most efficient use of the selected applications. However, the constant evolution of available technology has changed this conceptual sequence.

In fact, the tools and equipment available today allow for the introduction of processes that otherwise would be unaffordable, often because of simple economies of scale or other factors related to size or the availability of financial, human, and other resources. To put it another way, the availability of technology, in its broadest sense, is now an added element in setting the strategic positioning of any company.

Thus, two formerly subordinate and to some extent disconnected processes must be thought about as being interactive. Technology strategy has become a significant part of business strategy. This is so because, among other reasons, technology configuration has become a potential competitive advantage—or disadvantage—in the global market.

Moving from theory to practice: today there are many globally successful companies that have based their business models on technological tools that allow them to identify market trends and customer preferences and to manage their products in nearly real time. Companies such as the fashion distributor Inditex and the online shopping enterprise Amazon have changed the parameters of their businesses, creating new ways of selling and producing that, in turn, have created new ways for consumers to buy. And the key to these market successes has been innovation.

Inditex is a great example of how the strategic use of ICT can provide a competitive advantage in a sector that, to a certain extent, was very standardized, as was the case for fashion production and retail sales. Their key has been to incorporate the customer into the production and distribution process by obtaining, processing, and applying information on sales and market trends in real time. The daily knowledge of the evolution of sales, as well as the unmet demand of consumers, allows Inditex to organize not only the production, but even the design of new clothing and accessories. Moreover, Inditex can renew the product range in its stores with more frequency than the sector average: at least twice a week with a maximum of two or three weeks between the store request and the supply. This advantage would not have been possible without the integration of ICT as a key strategic element, using information in real time in an intelligent manner and incorporating it in all aspects of design, production, and distribution—the logistics—of the company. It is worth mentioning, notwithstanding, that Inditex is, within its industry, the only global company in the sector integrating design, production, distribution, and sales with its own retail network.

Amazon has been a pioneer at leveraging the huge possibilities of electronic commerce in the digital age. ICT plays a crucial role in Amazon's strategy, not only in its web catalog of products, but also in its purchasing process and delivery logistics. Also, and very importantly, ICT is key to creating an interactive relationship with its customers, with the resulting customer loyalty and cross-selling it obtains by taking advantage of the new generation of Web 2.0 technologies.

These are only two examples of companies, in traditional sectors, that understood very early the importance of putting intensive ICT use as the foundation of innovation. It should be pointed out that many other companies have chosen a similar path and become leaders in their sector: banking, tourism, distribution, and so on. In every case, they highlight the relevance of basing the innovation of their business models in the strategic use of ICT.

Technology and size

Although technology tends to minimize the crucial importance of business size, it is an empirical fact that large organizations continue to use technology more intensely than smaller ones.

This matters not only because small- and medium-sized enterprises (SMEs) comprise the majority of the productive activity in almost all countries, but also because their preponderance is often inversely proportional to their relative economic potential and performance. An exception has been the United States, with its historically dynamic growth, which has many SMEs but also a cast of big corporations. However, other countries with economies that are dominated by small-scale businesses but lack significant numbers of larger ones have experienced much slower growth and development. This situation is starting to change, in significant part because of the spread of technology.

This is true, for example, in Latin America. The region is evolving from a chronic developmental laggard to a strong grower, becoming one of the most dynamic areas for the implementation and use of new technologies. In Latin America, the expansion of mobile technology has been particularly relevant. It is important also to highlight how this technology reaches remote areas, underprivileged populations, and, in general, areas and social groups that otherwise would be excluded from new technologies. Therefore ICT has become instrumental in strengthening the links within communities and giving access to business and employment opportunities to large segments of the population. Mobile phone technology has contributed to narrowing the digital divide, reaching a penetration rate of more than 80 percent of the population.

Latin America's great leap forward is also characterized by the development of corporations with a global dimension that are beginning to assume leadership positions in different sectors. The extent to which this is the cause or the effect of the shift in economic performance is open to debate, but it clearly reflects the rapid adoption of new technologies in the region, with everything that entails. The fast development of telecommunications in the region during the past 20 years would not have been possible without the contribution of sound public policies that pushed for the opening of markets, created competition, and attracted the large capital investments required to create and renovate the necessary infrastructures. The current positive scenario is, to a great extent, a consequence of a private investment effort in telecommunications infrastructure. This effort has contributed to making Latin America the region with the highest rate of foreign direct investment in the world. Latin America's leap is something where, without diminishing the importance of other elements, a decisive factor is the contribution of telecommunications, essential for undertaking or participating in innovative processes. To put it simply, to be without access to global intercommunication today is not an option.

Necessary networks

Another point worth highlighting is that of the emerging risks from bottlenecks to innovation-based growth: the increasingly urgent need for advanced communication networks capable of providing sufficient speed, quality, and security. In industry jargon, these are called *next generation networks* (NGNs). Such networks make the difference between having access to a wide array of tools, applications, and services and being confined to the limitations of the immediate surroundings.

To put it bluntly, progress does not really exist for those who are unable to access a telecommunications network. However, not just any network will do: it must have sufficient—and probably growing—bandwidth to provide suitable quality and reliability. This will allow the full potential of the phenomenon of convergence (networks, equipment, applications, services, and so on), in turn permitting yet new options to be developed.

Some studies have analyzed the effects of broadband deployment. For example, last year the World Bank published research demonstrating that every 10 percent increase in broadband penetration produces a 1.4 and 1.2 percent rise in GDP growth in middle-income and developed countries, respectively.[2] Another study showed that increased broadband penetration significantly increases productivity growth in countries with high and medium ICT intensity—potentially by as much as 15 percent.[3]

This and other research make clear that places with broadband connections are better able to attract and retain investment than those without such infrastructure. As a result, areas with broadband tend to host more competitive companies, producing greater employment, creating more value-added, and generating greater wealth for the benefit of the whole community.

In light of these findings, it is surprising that there is not greater urgency in rolling out NGNs. The reasons for this undoubtedly depend on different factors in different places. Sometimes the obstacle is regulations; sometimes it is the considerable investment required without an adequate framework for its recovery by the operators. However, it is clear that markets or countries that fail to build advanced networks are likely to be left further and further behind.

Crisis as opportunity

The challenge is even more relevant now because many countries are rethinking their growth and development models after the global economic crisis of the past few years. This is an area in which technology—and particularly ICT—can play a crucial role, even if there are no solutions that guarantee success.

The irony is that the budgetary constraints that are pressing on almost all countries are often presented as an insurmountable obstacle to the provision of public policies that could foster increasing innovation and access to technology. This view is shortsighted and reflects the idea that innovation requires government incentive programs, grants, and direct participation. In fact, the more important role on which governments should focus is that of developing an overall framework, including appropriate regulation, that effectively promotes innovation.

In addition, governments could provide education in those areas where barriers to the implementation of new technologies still exist, especially since such barriers are often psychological. Oddly enough, access to technology does not override the mental block of seeing it as something elusive, whether because of its cost, the ability to use it, or even fears of loss of control of the production process of the company. Governments could help address this factor.

All corporate leaders, regardless of the sector in which they operate, the scale of the companies they lead, or the size of the markets they serve, must sooner or later make decisions in at least three broad areas: determining what applications are best suited or most appropriate for improving the performance of processes; what equipment, infrastructure, and tools are needed to optimize the contribution of ICT to the business; and what management model for the available technology is best suited for distinct characteristics of the organizations they lead.

Although these are seemingly simple issues, they are difficult to define and implement. In practice, finding the right answers often challenges not only leaders'

management capabilities, but also the internal dynamics of many organizations. The right answers, however, are critical to success.

"Knowledge" of the market

One of the most sensitive—and decisive—strategic responsibilities for any management team is the ability to accurately anticipate the future. Of course it is not easy, and in some turbulent periods it may not even be possible. But in any environment, access to sound information, in the right form and on a timely basis, is necessary for an executive team to have even the possibility of developing effective and actionable visions of future trends.

Understanding markets has always provided a competitive advantage. Today, however, accurate data about market behavior, trends, and preferences are critical for business success, especially as the availability of such information approaches "real time." To put it another way, business strategy is becoming increasingly dependent on the consumer, who is demanding to be treated more as an individual, even by the world's largest corporations. This is the unstoppable advance toward increasing segmentation that is driven by technological progress in the broadest sense: equipment, tools, applications, and so on, which provide an ever-greater capacity to capture, process, analyze, store, and transmit data. Again, telecommunications is a key factor in this process.

Managers have available an extensive catalog of applications, equipment, tools, and services, but optimizing their use inevitably requires the right kind of training and education within the organization. Even when ICT services are outsourced, selecting service providers requires sufficient technology management capacity to identify what kind of contributions are appropriate to meet the specific needs of a given company.

The networked society

We are not always fully aware of the changes in social dynamics that ICT, in particular in the telecommunications arena, have encouraged. This is true not only at the level of the individual and the household, but also at the level of societal welfare. For example, technology is making important contributions to reducing long-existing gaps in education and connectivity, to society's overall betterment.

The recent explosion in social networking and the related evolution of new forms of business, operational, scientific, and other relationships point in even more promising directions. Contrary to many predictions—including those made by some of the more inventive science fiction writers—technological change has not led to a progressive isolation of the individual. Instead, technology is facilitating the emergence of new forms of interaction—among individuals, groups, and companies—creating a new kind of cooperative that overcomes limitations of space, time, and place. The implications extend to many fields, but for society as a whole, three areas are particularly important: education, health, and relationships between government and governed.

Lifelong learning

No one doubts the determining role that education holds for the welfare and prosperity of any country. Going back to the Middle Ages, knowledge and information were reserved for the small circle of the upper classes and the monastic orders: the former because of their dominant power, and the latter because of their tasks of copying, translating, and preserving learning. For centuries, manuscripts, papers, and documents were mainly located in palaces and monasteries, putting them out of reach of the majority of the population.

Gutenberg's invention of the printing press and its slow and costly universalization brought about a transcendental break in terms of the availability, dissemination, and access to knowledge. At first this collided with the obstacle of a barely literate population, leaving a fairly narrow band of readers and narrators to control access to knowledge through their subjective interpretations. Eventually, however, the flow of printed material overwhelmed even those constraints and produced one of the most significant qualitative leaps in the history of social organization.

Some observers ascribe the same potential transformative power to the Internet. The similarity is that the network has overcome a series of persistent barriers—access, geography, time, and space—to the diffusion of knowledge. The significant difference is the speed with which Internet use has become widespread, thanks mainly to ICT advances in areas such as connectivity (which produces widespread access) and usability (which allows for a user-friendly environment). The result is that the Internet today is accessible to virtually all strata of society.

While the ultimate potential of the Internet has yet to be defined, the transformative contributions to education are already quite substantial. These include free and instant access to sources of knowledge as well as opportunities to improve teaching methods, both in the classroom and at a distance. Taken together, these developments offer the possibility of true lifelong learning, allowing individuals to maintain and renew the knowledge needed to cope with a rapidly changing context.

No less important has been the way new technologies have enabled the overcoming of socioeconomic gaps and even centuries-old isolation, opening up underdeveloped regions to modernity. For example, in Latin America, mobile telephony, in its various forms, has enabled vast territories and communities to join an

interconnected world, effectively bypassing the massive investments that fixed line networks would have required.

Living longer . . . and better

Decades of sustained economic growth and technological and scientific progress are transforming the demography of the planet. People are living longer and healthier lives, and most countries are witnessing steady—in some cases spectacular—increases in the level and standards of living. Ironically, the healthier people get, the more concerned they become about everything related to health. In fact, recent surveys identify healthcare as the issue that arouses the greatest concern among citizens in many countries.

Constant advances in the treatment of diseases, surgical procedures, and pharmaceuticals have much to do with the improvements. But new information technologies play an important role as well. These include the introduction into the healthcare system of tools such as the generation of medical records in real time from any location, remote diagnostics and telemedicine applications, and processes that generate electronic prescriptions that increase the efficiency of prescribing and help reduce pharmaceutical expenditures.

The aging of societies, in the West as well as the East, is forcing a new focus on continuous improvement of efficiency in spending and the quality of patient services. Although this is primarily a budget imperative, it also meets the needs of citizens for the most advanced care possible for their health and personal welfare.

ICT holds great potential for continued progress in both the cost and quality of healthcare. Networks encourage the proliferation of new techniques; immediate access to the results of clinical trials and innovative therapies; and the interchange of experiences, both in diagnosis and in treatment. This constitutes one more field where technology enables the availability and access to sources of knowledge, in contrast to the old situation where knowledge—and in this case, superior healthcare—was exclusively available to a few or, at best, a particular country.

In other words, in healthcare, as in other issues, technology and communications networks allow a global system to replace a regional or local one—with profound benefits for society.

The hour for e-government

A third area where information technology has transformative implications is in relations between the government and the governed. Here the field is very broad, with many different scenarios and possibilities. But overall, there are enormous opportunities for improving the quality and lowering the costs of services provided by government.

The majority of countries are on track to banish to the archives of history the need for face-to-face administrative proceedings, with enormous consequent savings of time, effort, and cost. There are many examples of implementation of e-government programs that have quickly led to greater efficiency and effectiveness.

Moreover, just as in education and health, technological innovation is constantly generating new options and opportunities for the provision of governmental services. Even forms are changing: in many cases technology allows for a new kind of public-private collaboration, or even the full privatization of certain kinds of services.

But, although all this is important, the progressive adoption of e-government acts as an incentive for the adoption of ICT in society as a whole. This provides clear benefits for a country's competitive position and, consequently, for its welfare and prosperity.

Conclusion: The road to travel

Most people are not fully aware of how a wide range of technological equipment, tools, services, and applications has been incorporated into and changed their daily lives. Indeed, it is hard to remember how we coped before these technologies became part of our reality.

For example, only a few decades ago, our ability to communicate depended on where we were. When we moved away from home or office, we were—literally—out of touch in ways that are almost unimaginable today. While some might feel nostalgic about the benefits of not being located, the reality is that technology has provided the option, not the obligation, to be always connected. What we do with our connections is up to us, which is why technology needs to be understood as fundamentally a liberating force, not a determining one.

This cursory review of the technological advances of the past several decades leads to an inescapable conclusion: we almost certainly have much yet to discover. In light of the transformation we have already experienced, it is improbable that the next decades will not see further significant discoveries or, for that matter, that the innovation dynamic in ICT will substantially diminish. Indeed, the known pipeline is already full and promising, and constantly being refilled.

The idea, however, is not to seek innovation for innovation's sake. Technology has profoundly and positively reshaped the world in which we live—for individuals and for whole societies. To put it colloquially: technology has been changing our lives . . . and it has been for the better.

Notes

1 See, for example, Katz 2009—a paper that largely focused on the situation and prospects of major Latin American countries.

2 World Bank 2009.

3 Nokia 2008.

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