

CHAPTER 1

The Next decade, a Challenge for technological and societal Innovations

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“It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change.” Charles Darwin

PREAMBLE

About 25 years ago, the world entered a period that we can call — although it is not brutal or quasi-instantaneous, but progressive — a revolution, which is rooted in political and economic, as well as scientific and technological forces. This revolution has brought increasing prosperity to the developed world and allowed many other countries not only to take off, but also to become economic partners on an equal footing. Today, the same world is fighting one of its worst financial and economic crises. The political, social and economic impacts of both events are deep and will, we believe, contribute to changing dramatically the face of the world over the decades to come. But this crisis offers a great opportunity to leaders in governments and business, as well as to researchers and other intellectuals, to make the world better than it would have been if recent trends had continued.

Since the Renaissance, the main aspiration of populations has clearly been to find a better life than their ancestors, that is a better standard of living, greater security and less uncertainty, better health standards, more enriching professional activity and, for many, to live in a society that is more just and is based on ethical values. In other words, people desire economic development, that is economic growth plus something which, together with growth, con-

tributes to prosperity and well-being. This burst of prosperity is very positive for humanity. However, and the crisis has reminded us of this in a dramatic fashion, it has become increasingly important to make sure that the development is globally sustainable, that is politically, socially, environmentally and economically sustainable; neither should we forget the many other very troubling situations, such as conflicts, poverty and disease, around the world (Weber, 2008).

The roots of the current revolution and of the crisis are to be found in various powerful and interdependent forces that will be briefly identified and described. But one force of particular interest to us in this chapter is innovation. Innovation can be roughly defined as a new way of doing something: a new product or service, a new process to produce and/or deliver it, or a new organization. Innovation implies change, in order to take full advantage of existing knowledge. In their own jargon, economists are using the concept of the technology frontier, which, in order to encompass societal innovations, should be broadened to technological and **organizational** frontiers, organizational being used here to focus both on structures (static) and processes (dynamic). In a static environment, innovation depends on the implementation of existing knowledge that defines the technological and organizational frontier. In a dynamic world, it is possible to push this frontier out thanks to research and to the development of human capital through education. However promising they are, many discoveries and inventions made possible by research may remain unexploited. Innovation is the art of turning them into a reality.

This first contribution on the topic of the colloquium “*Innovation and the Research University*” is meant to convey three messages, which will be exposed and developed in two sections and a first conclusion:

- Knowledge and innovation are key to a sustainable prosperity for mankind.
- The frontier to human prosperity depends in fact on hard and life sciences, as well as on innovative technologies, but also increasingly on what we shall call societal sciences, that is on social sciences and humanities, and on social innovations that can be derived from them.
- And, by way of conclusion, the responsibility of science policy and universities to create the right environment to encourage social sciences and humanities to play fully the role expected of them in today’s world.

THE REVOLUTION OF THE LAST 25 YEARS AND ITS CAUSES

Since World War II, and in particular during the last quarter-century, the world has experienced profound changes, which will certainly be considered

as a real revolution by economic historians a few decades from now. The origin of this revolution whose impact is as important as the French political revolution at the end of the 18th and the industrial revolution in the late 18th and early 19th centuries, is to be found in the growing economic, military and scientific supremacy of the United States after World War II and accelerating scientific and technological progress, notably in information and communications technologies, as well as in life sciences. Another key factor was the progressive liberalization of world trade and the creation, in 1957, of the European Common Market, which became the European Union in 1993. The full potential of these various events was unleashed with the fall of the Berlin wall 20 years ago, and the following implosion of USSR that marked the end of the Cold War. Without any immediate impact, the slow opening of China in the early 1970s — the so-called “ping pong” diplomacy of April 1971 — that followed the catastrophic Cultural Revolution, now has immense consequences for the world. And, when examining these events, we should also keep in mind that the world’s population has been growing at an increasingly faster rate since the beginning of the 19th century, increasing relatively recently by 1 billion people every 12 years to reach 6.8 billion today, whereas the first billion was reached only 200 years ago.

Today’s world is not only globalized, but is the witness of the emergence of gigantic, new economic powers, mainly in Asia, but also in Latin America, which have become part of the global supply chain for services and manufacturing. One of the most important impacts of these developments is that the standard of living has increased considerably, not only in the “Old World” of Northern America, Europe, Oceania and Japan, but also in many countries in Asia, Latin America and the Arabian Peninsula. Furthermore, we are witnessing the emergence of new economic superpowers, in particular, but not only, China and India. Economic activity is moving globally and quickly, which requires the majority of world citizens to run faster in order to stay in place (Friedman, 2005). In other words, the world has become increasingly competitive: there is competition to maintain market positions and to gain new markets, to attract economic activities (industrial and services) and for cheap production locations, for cheap natural resources and energy, and for financial capital, as well as for well educated and experienced human resources (brains).

There are basically two opposite responses to competition. One is to try avoiding it by embracing a protectionist attitude at country or business levels. But there is a price to pay: the gains of trade are not fully exploited and the allocation of resources is not optimal; moreover, considering the forces of competition, such an attitude cannot last forever and the “wake-up call” might be painful. The alternative and positive attitude is on the contrary, to increase competitiveness! For firms and public organizations, this implies minimizing the cost of bringing goods and services to the potential consumers/

beneficiaries, while responding to their changing needs and taste and reacting to the supply of competitors or acting as if the competition was high. For governments and nonprofit voluntary organizations, it means creating a good environment for citizens and firms.

Knowledge creation and dissemination, as well as innovation, are keys to promoting competitiveness. Economists working on growth theory and/or human capital development have shown two important, strongly related phenomena. First, knowledge, which is embedded in human capital and created by research, has become a means of production as important as labour and capital (see for ex. Atkinson, 1983, or Psacharopoulos & Woodhall, 1985). Innovation, which is drawn more or less successfully from knowledge and the changes it implies, is the engine of growth. Second, innovation is all the more indispensable for a country the closer the country is to the “technology and organizational frontier” (Aghion & Cohen, 2004). Indeed, countries that are still far from the technology and organizational frontier can use the technologies developed in more advanced countries, whereas countries that are near the frontier are bound not only to innovate, but to push the frontier out thanks to research and better education. In other words, scientific progress and education are the best sources of new solutions to contribute to prosperity; however, it is a necessary, but not a sufficient condition for further progress, because potential advances have to be correctly implemented by business leaders and governments.

It is necessary to put scientific progress and its applications, technological or other, into perspective. They have indeed contributed to many good changes, but also to negative ones, and also to changes that appear difficult to categorize as either good and bad, notably as this might depend on the utilization made or even the point of view of the observer. Among the positive aspects, we note the rapid increase of the global standard of living and development of many traditionally underdeveloped countries. Moreover, knowledge societies mean better education, more interesting jobs, longer lifespans, less vulnerability to illness and poverty and a more enriching societal environment.

However, economic development, combined with a fast-growing population, has in particular provoked an over-utilization of non-renewable resources and has serious environmental consequences. It has also increased the income disparity between rich and poor countries and between individuals within countries. One cannot avoid also reflecting on the absurd contrast between the consumption pattern of the well-off in rich countries and those of the poor, in poor as well as in rich countries. No doubt these huge inequalities are giving birth to political instability and to terrorism. Finally, globalization is pushing firms to become global and gigantic and to be more concerned by value for shareholders than by citizens-consumers’ real interest. Yet, huge

firms are notably less innovative than smaller ones and are exaggeratedly driven by markets shares and profits, largely in response to the short-term requirements of financial markets.

In addition to that, even if it not necessarily a direct cause of economic development and of globalization, the world is suffering from many problems for which there are no apparent solutions or which are even deteriorating further. There are still many dictatorial and corrupt or unstable political regimes (mainly, but not only, in Africa), some of them posing a threat (e.g. North Korea), local tensions and wars (e.g. in the Middle East). Intercultural-ethnic-religious tensions are also growing, which are the source of great misunderstanding and of open or hidden conflicts, and this can also give additional roots to terrorism. Hunger is far from being eliminated and could even spread further. Pure water, as well as agricultural land, is becoming scarce, or is even used to cultivate cereals for producing alternative fuels to oil. Many chronic diseases like malaria are far from being eradicated and viruses are dangerously mutating, increasing the fear of a devastating pandemic. On the education front, even today many youngsters do not have access to basic schooling, let alone professional or tertiary education.

Last, but not least, the emergence of new economic powers is contributing very strongly to a displacement of the production of goods and services from developed countries to low salary countries with a high reservoir of workers (East Europe, China and India, Brazil and others). But, most importantly, many of these countries do not restrict themselves to producing low tech — low-quality products with a technology borrowed from developed countries — but invest heavily in human capital in order to be able to innovate, contrary to what was considered the right policy not very long ago. Considering the size of their populations, their eagerness to increase their standard of living and their capacity for change, it is understandable that the old world is worried about its own competitiveness, all the more so as its populations is ageing and about to diminish and given that their well developed social security systems are not only costly, but also reducing the willingness to work and to invest — on the whole impeding economic dynamism. Following Paul Kennedy (1989), one can even wonder if the old world is not going to lose its knowledge and economic supremacies in the quarter-century to come.

THE FINANCIAL AND ECONOMIC CRISIS

The above developments were focused at the trend over many decades. But today, most if not all the attention is focused on the financial and economic crisis that is deeply affecting the whole world. The banking (and insurance) system has suffered a destruction of capital estimated by the *Economist* (2009) at three trillion dollars, due to wrong economic policies, insufficient regula-

tion and exaggerated usage of new financial products and the cupidity of a few thousand bankers, financiers and traders who had lost their sense of reality and ethical values. Inevitably, the destruction of wealth and reduction of income in the financial sector have directly affected the real economy. Industrial production and international trade diminished dramatically in the last quarter of 2008 and first quarter of 2009, contributing to the generalization of the crisis. This extraordinary situation condemned central banks and governments to take strong and extraordinary measures to save what could still be saved in the financial sector, to provide huge amounts of liquidity to respond to some of the absolute basic borrowing requirements of the economy, to support other sectors of the economy on the edge of collapsing, in particular the U.S. car industry, and to compensate for the insufficient private demand to avoid a terrible surge of unemployment and enterprise failures.

Policy-makers in central banks and governments benefited greatly from macroeconomic theories developed since the 1930s and implemented Keynesian and monetary instruments with a scope and intensity that were unimaginable a year before. Thanks to these measures, the heavyweight countries that have a real impact on the world economy, in particular the United States, the United Kingdom and China, prevented the collapse of the world economy. Today, the free fall of the economy has been stopped and there are signs of a timid recovery. But what the situation will be in six months, two, five or ten years is very hard to predict. In the short term, that is one to two years — the prediction capacity of econometric models has been reduced because they are based on a econometric representation of the economy over the past 20 years or more, which obviously does not include such a deep crisis. Moreover, the crisis was so serious and the measures so dramatic that we can expect that it will take a couple of years before the world economy finds itself again in a situation that can be considered normal. Probably the biggest challenge ahead will be to reduce the exploding budget deficit (expected to reach 12-13% of GNP in the United States and United Kingdom in 2009) and to control the upsurge of public debt. In the worst case, a few traditionally fragile countries could default unless supported by the IMF or other organizations. And a country like the United States, which is far too big to be supported, will have to pay very attractive interest rates to convince its traditional creditor countries, China and Japan, to continue buying state bonds. Moreover, almost all other countries will have to decrease expenditures and increase taxes. This will contribute to slowing down the recovery, not to speak of the negative consequences of reduced public expenditures. Many observers also believe that the dollar will fall as creditor countries will increasingly diversify their holdings in favour of other currencies and because, for the United States, it is an attractive policy to increase competitiveness and decrease the real value of the debt. And, if by any chance, the recovery is stronger than expected, there

is also a risk that demand exceeds potential output, which would induce inflationary pressures. The policies implemented by the central banks are raising similar threats: higher inflation is unavoidable if they do not withdraw a large part of the additional liquidities they put into the system or if they continue to conduct a policy of cheap money.

OLD VS. NEW WORLDS

Last but not least, it is time to differentiate the long-term developments between different regions of the world, more precisely to look at the specific situation of the old world facing the emergence of new gigantic economic powers. Indeed, the old world is increasingly challenged, not to say threatened, by the emerging countries that not only have a competitive hedge to produce low technology products thanks to their immense reservoir of cheap labour, but are increasingly capable of innovating and producing high-tech products thanks to a huge effort in education and research. More and more countries are realizing that the “Chinese” model, characterized by a voluntary effort to develop a knowledge society thanks to huge investments in education and research on top of an abundant and relatively cheap labour force, is paying dividends. This strategy of forcing the development of the knowledge society, although the country could satisfy itself in taking advantage of great masses of still cheap labour, is now being imitated by many other countries in Asia, as well as in Latin America and in some Arabic countries. In other words, these countries are imitating the occidental model of good education and research that contributed so much to the prosperity of North America and Europe. This is also the same old world that promoted free trade for industrial products and which is now faced with the fact that most of the mass industrial production has deserted their lands. Economists have always agreed that these changes of structure are part of the growth process, but originally, these changes would take place within the country (jobs lost in one industry were replaced by jobs created in another industry in the same country). But, today, the new jobs are created in neighbouring countries and most often in another part of the world. The old world is condemned to produce very sophisticated or exclusive (luxuries) industrial products and to develop the service industries like banking, insurance, trading, consultancy, where it has still a competitive hedge.

THE IMPORTANCE AND SCOPE OF INNOVATION

As observed above, knowledge creation and dissemination, as well as innovation, are playing a key role in the wide-ranging revolution that is deeply transforming the world. In particular, it explains why the development of countries

like China and India is so rapid and why the old world, with its decreasing, ageing and well paid population, must more than ever count on knowledge and innovation to secure its high standard of living. We believe that the sudden and deep financial and economic crises will not modify the situation. On the contrary, the fight to keep the economy moving and very soon to absorb the long-term negative consequences of all the strong measures that have been taken will even reinforce the pressures to develop new knowledge and innovation. More than that, some aspect of the roots of the crisis will — or at least should — be the object of deep reforms; the post-crisis era should give a much greater importance to government regulation and to the respect of professional and ethical values; moreover, stakeholder value should be an objective for firms as important as shareholders' value. This is in particular the aim of the United Nations Global Compact about Corporate Citizenship in the World Economy. The ultimate aim should be to promote **global sustainability**, that is a development that can last economically, politically, socially and environmentally (Weber, 2008) and in which the citizen-consumer is the ultimate aim of economic activity, the producer being only a means to this end.

The number of objects that deserve great attention if one is really concerned with improving the state of the world is impressive. The World Economic Forum has recently worked on it by setting up approximately 70 councils of experts to address the most important challenges facing the world in a collaborative and integrated way (WEF, 2009). These councils debated two questions: what is the state of the world on a specific issue? and what needs to be done to improve the state of the world on a specific issue? The non-exhaustive list of objects is: alternative energies, challenges of gerontology, chronic diseases and malnutrition, climate change, corporate governance, corruption, demographic shifts, economic imbalances, ecosystems and biodiversity loss, energy security, faith, food security, fragile states, future of transportation, gender gap, global governance, global trade regime, healthcare systems, HIV/AIDS, human equality and respect, illicit trade, international legal system, migration, negotiations and conflict resolution, pandemics, role of sport in society, skills gap, social entrepreneurship, systemic financial risk, terrorism, proliferation and weapons of mass destruction, urban management, water security...

This list speaks for itself: as argued before, improving the state of the world requires as much policies inspired by the social sciences and humanities — that we suggest calling societal sciences — as policies drawn from hard and life sciences¹. As noted before, most of the economic development of the past quarter-century came through innovation in industry and a couple of services.

1 We observe that some purist English-speaking scientists like to reserve the word “science” for hard and life sciences.

Considering that many societal problems were neglected before the crisis, our conviction is that it would be essential today to broaden the search for new knowledge and innovation in order to contribute to solving these societal questions. In short, knowledge creation and dissemination, as well as innovation, should be all-inclusive to promote the long-term prosperity of nations, developed and developing. All the traditional scientific disciplines are concerned, but the place that has to be occupied by social sciences and humanities like economics, law, sociology, political sciences, history, philosophy, religious sciences, linguistics and their derived disciplines like anthropology, comparative literature, business should play a much bigger role.

As for scientific progress, innovation requires a capacity for change. This implies that government, public administration, board and management of firms, the leadership and stakeholders of other organizations, national or international, as well as individual citizens, are willing to change and/or have the capacity to convince or impose a decision on their organization. As for innovation in science and technology, innovation in societal sciences seems to be less painful in the United States than in Europe and Asia. Even if we cannot draw a generalization from a specific case, the way the federal government and Federal Reserve Board decided to implement totally new instruments to fight the crisis is certainly worth noting.

This increased expected role of societal sciences raises the serious question of the development and reputation of soft sciences vis-a-vis hard sciences. Universities with a high reputation are exclusively or in majority active in life sciences, medicine, applied and fundamental sciences. The size of their budget is determined by that specialization, and rankings of world universities are clearly biased in favour of those institutions. All this would be acceptable if it did not draw the other disciplines down. There is even a widespread fear that some of these soft disciplines are too critical of the establishment.

Societal sciences are not “cheap” (scientific) disciplines. The matter they are studying is quite different from the world of nature, but also immensely complex, among others because the human factor plays a key role. Indeed, human beings are making decisions on the basis of incomplete information and do not always act rationally; therefore, human behaviour is often difficult to predict. Knowledge is also strongly based on scholarship (erudition) and in general less formalized into universal theories; it is also often regional. Moreover, social sciences are sensitive to philosophical ideas and political positions. This explains why there is much more room for diverging positions and burgeoning ideas. However, the diversity of opinion in social sciences and humanities is real wealth. The brutal realization last year that markets do not always self-regulate is a strong example. In other words, any *pensée unique* is bound to perish some day, as it impoverishes itself in refusing to take into account critics and alternative proposals.

BY WAY OF CONCLUSION: CONSEQUENCES FOR SCIENCE POLICY AND UNIVERSITIES

Inspired by economics and social sciences, this contribution can be summarized with two strong statements. First, globalization and the climate of increasing competition over the last quarter-century, as well as the severe financial and economic crisis, demand more innovation for rich countries to keep a high standard of living or for emerging countries to continue developing. The incapacity of approximately half the countries of the world to succeed in taking off should be a concern for all developed and developing countries. Second, scientific and technological innovation are indeed a key pillar to economic prosperity in the old world and emerging countries; but it is far from sufficient; at least three sets of problems or difficulties require a much greater investment in societal innovation: the rapid expansion of recent decades is not sustainable for ever due to the overexploitation of natural resources and of the environment; too many countries are left out of prosperity, cannot satisfy all their basic needs and are particularly suffering from instability and conflicts; finally, many manmade political, economic and social systems are not sustainable. The financial and economic crisis is just one example of what eventually happens if one does not pay enough attention to the sustainability of a system and/or of its development, not to speak about the rise of Nazism in Germany in the 1930s rooted in the preceding very severe economic crisis. Obviously, if science and technology can contribute to responding to many of these challenges, societal sciences, that is social sciences and humanities, also have a very important role to play.

This role to be played by societal sciences should be of direct concern to universities and those responsible for science policy. Indeed, it is already partly the case, but more could and should be done. In other words, we make a plea that the development of social sciences and humanities should be a priority of science policy and university institutions. As other contributions in this book are more directly focused on the role of universities, we shall remain very brief.

As is the case for science and technology, social sciences and humanities have a great record of seminal works in all sorts of subjects and their best figures are probably as well known as the best scientists. They have also contributed to developing instruments capable of solving problems. The best example today is certainly the successful intensive use made by governments and central banks of theories developed by Keynes and Friedman respectively more than 70 and 50 years ago.

The main weakness of social sciences and humanities is that their specialists are mainly working in separate disciplinary silos and according to their own curiosity and motivation. They have little incentive to spontaneously

join forces with colleagues from other disciplines and too often to work on societal issues. However, we have strongly argued before that society expects today that societal sciences are more involved, when necessary with sciences and technologies, in contributing to solving societal problems. This will be possible only if one is able to better balance curiosity-driven and individual work and teamwork. We believe that soft sciences would gain in maturity if researchers increasingly work together within the limits of their discipline and, better, with other disciplines. The problems to solve are indeed multidisciplinary. Therefore, transdisciplinary and, even better, interdisciplinary work have to be strongly promoted.

Bringing social sciences and humanities to a greater maturity should be a priority for science policy and universities, comprehensive ones or specialized in social sciences. This important objective should be pursued essentially with measures of a financial and organizational nature. Regarding finance, social sciences and humanities should be better funded in money terms and the funding programs should entail the right incentives to encourage the specialists to work together both on curiosity-driven projects and societal questions.

The organizational question is more at the level of institutions. They should in particular launch long-term research projects or create temporary ad hoc research centres to give researchers the opportunity to spend some of their time with researchers from other disciplines in order to slowly develop the pleasure of working on broader topics and the right "savoir-faire". Universities should also envisage adapting their organizational structure to lower the existing barriers between faculties or departments; the ultimate aim is to create a flatter organization with less compartments. This requires clearly strong steering by the leadership of the institution, with the support of adequate committees. To facilitate restructuring, financial incentives to change appears often as more efficient than moral suasion.

To conclude with this brief description of the measures that should be taken to increase the contribution of societal sciences to sustainable development and to solve societal problems, we would like to mention two additional points. First, regarding technological innovation, progress towards a better societal organization requires a broad partnership between universities, governments, business and other organizations concerned. Even if this seems obvious, there is even a much bigger effort to make in this respect than for technological innovation.

Second, but not least, Europe, Asia and Latin America should grant more autonomy to their universities. The world rankings of universities show unambiguously that the immense majority of the best performing institutions are also those that enjoy the greatest autonomy. In other words, there is strong correlation between the degree of autonomy and performance (Aghion *et al*, 2009). And, contrary to what might be thought at first view, autonomous uni-

versities are those that are the most responsible and responsive towards society as the system of rewards and sanctions ensure that they have to be accountable to their sponsors, the State, their students, donors and partners. With little or no autonomy, institutions are placed in a vicious circle that condemns them to wait for instructions and to take as few initiatives as possible.

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