

Salvatore Rossi: Knowledge, innovation and relaunching the economy

Speech (lectio magistralis) by Mr Salvatore Rossi, Senior Deputy Governor of the Bank of Italy, at the Almo Collegio Borromeo, Pavia, 17 March 2015.

* * *

I wish to thank the Almo Collegio Borromeo, its Rector and the President of the European Pole of Excellence Professor Dario Velo for doing me the honour of inviting me to give a *lectio magistralis* within these walls, imbued with history and science, and before such an accomplished audience. I also thank the President of the Collegio's Board of Directors, Vitaliano Borromeo, for the very kind words with which he outlined my intellectual interests and professional career.

The title we chose for the lesson brings together three topics – knowledge, innovation, and relaunching the economy – which constitute as many decisive challenges for our country: decisive for our future and for our role in the world. I have dedicated much thought to these topics over the years, expressing my reflections time and again in writings and public addresses. Today, I would like to draw some of the threads together, retracing and connecting up those reflections, and advancing some policy proposals.¹

I will discuss the three topics of the title in reverse order. I begin, inductively, with the need to relaunch the Italian economy and set it on a stable path of efficiency, competitiveness, and progress. This, I will explain, depends on the productive system's ability to innovate continuously both what and how it produces. I will then work back to the basis of this ability – knowledge and competence – and how and where it can be “produced”.

Relaunching the economy

The Seven Years' War – Today, the Italian economy finds itself in the aftermath of a war, as it were. Not, fortunately for us, an old-style war with bloodshed and destruction, but one of those modern, virtual wars, in which factories, offices and jobs are obliterated with the click of a mouse.

We now produce almost a tenth less than we did seven years ago: in manufacturing, 17 per cent less; in construction, more than 30 per cent. It is estimated that manufacturing lost one sixth of its productive capacity in this period.² Net job destruction reached almost one million. Last year, Italian firms invested overall a third less than seven years earlier. As a whole, households spent 8 per cent less in real terms. Exports have struggled to stay on an even keel.

¹ I base this process on some of my recent speeches, from which I quote extensively: *Artigiani o scienziati? Capitale umano e crescita economica*, address to the International Symposium of University Professors “Giovani, formazione, università”, Rome, 21 June 2012; *Alle radici dello sviluppo: demografia, istituzioni, politica*, 5th Onorato Castellino Lecture, Moncalieri, 29 November 2013; *L'innovazione nelle imprese italiane*, address at the Conference “I giovani e il difficile futuro della ricerca scientifica in Italia: Riflessioni a 50 anni dalla nascita della Fondazione Luigi Einaudi onlus”, Turin, 15 October 2014; *Building the Future of the Italian Economy*, address at the ceremony for the opening of the academic year 2014–2015, University of Udine, 19 January 2015.

All the texts are available at www.bancaditalia.it/pubblicazioni/interventi-direttorio.

² L. Monteforte and G. Zevi (2014), “An inquiry on manufacturing capacity in Italy after the double-dip recession”, *Gli effetti della crisi sul potenziale produttivo e sulla spesa delle famiglie in Italia*, Seminari e convegni, No. 18, Banca d'Italia (<http://www.bancaditalia.it/pubblicazioni/collana-seminari-convegni/2014-0018/Effetti-crisi-n-18.pdf>).

The global financial crisis of 2007–08, followed by the European sovereign debt crisis of 2010–11, inflicted far greater damage on Italy's economy than on those of the other main advanced countries. "Why?" we must ask ourselves.

The first point to make is that the aggregate data hide significant disparities. The differences between firms and between households have increased. Italy's productive system, taken to include both industry and non-financial market services, is distributed in lopsided fashion along a line determined by size.³ The 25,000 firms located above the 50-employee line produce almost half the total value added of the sectors considered and use almost half the payroll employees: more than 5 million workers out of a total of 11 million. Some 4.3 million small firms employ, in addition to around 6 million permanent staff, 4 million self-employed workers, the very owners of the businesses. Thus, per capita value added – that is to say, productivity – is low among small firms. Labour costs are also lower, but with a much narrower gap, so that small firms are generally less competitive than medium-to-large ones. As is to be expected, almost all manufactures exports are by medium-to-large firms.

The size aspect is also key in shaping investment decisions. Large or very large firms continued to increase their stock of capital during the recession years. Many small firms, on the other hand, stopped investing, except in replacement assets for "survival". Then, in the last two years, numerous medium-size exporting firms that are both profitable and liquid have also put their investment plans on hold until the global and domestic economic outlook becomes clearer.

Viewed as a whole, the contraction in consumption in these seven years was atypical with respect to past negative phases of the economic cycle. Normally, one would expect consumers to try to maintain existing standards of living during a recession despite the drop in disposable income, assuming it to be temporary. This time the opposite happened: people tightened their belts more than the drop in income warranted. Thus, they assumed that drop to be permanent, and indeed that it would continue to worsen, and so they judged it wise to increase precautionary savings.⁴

Did all Italian households take this line? No, there was a split between them, and this time the dividing line was generational. Living standards, in terms of quantities consumed and decisions what to consume, fell sharply among the youngest households, and not only those whose head was unemployed: young payroll workers suffered from the widespread precariousness of jobs, while the self-employed, especially those at the head of small and micro businesses, had to use their own income to solve the firm's problems. Instead, the higher income brackets, which include few young households, increased their spending on luxury goods.⁵

Getting started again and moving forwards – Is the damage done by the Seven Years' War permanent? Well, we have certainly slipped some way down as far as economic conditions are concerned and we cannot get back what we have lost. But we can make a new start, albeit beginning from a lower position than the one we occupied seven years ago. We might even progress at a faster pace than we did before we were overtaken by the double-dip recession.

³ In what follows I quote data taken from Istat (2014), *Struttura e competitività del sistema delle imprese industriali e dei servizi, anno 2012*, Report of 27 November 2014.

⁴ M.L. Rodano and C. Rondinelli (2014), "The Italian household consumption: a comparison among recessions", *Gli effetti della crisi sul potenziale produttivo e sulla spesa delle famiglie in Italia*, Seminari e convegni, No. 18, Banca d'Italia (<http://bancaditalia.it/pubblicazioni/collana-seminari-convegni/2014-0018/Effetti-crisis-n-18.pdf>).

⁵ C. Rondinelli, A. Bassanetti and F. Scoccianti (2014), "On the structure of Italian households' consumption patterns during the recent crises", *Gli effetti della crisi sul potenziale produttivo e sulla spesa delle famiglie in Italia*, Seminari e convegni, No. 18, Banca d'Italia (<http://bancaditalia.it/pubblicazioni/collana-seminari-convegni/2014-0018/Effetti-crisis-n-18.pdf>).

All the premises are there. Prices for energy, on which we depend so heavily, are low again. The highly accommodative stance of monetary policy in the euro area has provided our firms with a favourable exchange rate, on both foreign and domestic markets, and unprecedentedly low interest rates. There is an increasingly strong drive to reform the country's economic and social fabric, which has elicited international approval even though it has met with internal division and resistance. In the latest scenarios prepared by several forecasters, including the Bank of Italy, output will grow modestly this year, and more the next.

It is a cautious and uncertain new start, however, and it needs encouragement. Many firms that could revive their investment plans hesitate to do so. If they decide in favour, it will lead to an increase in employment, and the renewed confidence will spread to households as well.

Trusting that the recovery will gain strength, we must ask ourselves again why these years of crisis have been so much harder for us than for the countries against which we measure ourselves. Our analysis will take us to the root of the structural problem that has beset the Italian economy for several decades.

Between the last two recessions – that of 1992–93 and that of 2008–14 – something fundamental has taken place around our economy: the dominant world technology has changed, speeding up the pace of market globalization; the euro has been created.

Most of Italy's productive system was slow to take up the new information and communication technologies as an opportunity to improve efficiency, as other national systems instead did.⁶ It failed to grasp immediately that its addiction to devaluations of the lira, with their short-term competitive gains but lasting inflationary consequences, had to become a thing of the past and that competitiveness needed to be structurally reinforced.

In reality, the productive system could do neither because the form and structure it had inherited were unsuited, being dominated by small firms, adverse to growth even when faced with a concrete opportunity to expand in size. That situation was the legacy of a family-centric culture and even more so of a political and institutional milieu hostile to a free market and entrepreneurship. Italy has the largest productivity gap between small and medium-to-large firms of all the main European countries. Firms everywhere are born small, but then they either die or grow up quickly. In Italy, if they don't die, they remain forever in the limbo of stunted growth.

Steps must be taken to change this situation because it conflicts with the need for innovative capacity, which I will now briefly discuss.

Innovation

The distinctive trait of modern times is constant innovation. A century ago, someone could easily spend an entire lifetime producing or trading the same goods or services with immutable characteristics, for which customers' demand rose and fell only with their changing financial situation. Today, no goods or services stay the same except for a very short time, after which they must be renewed, in substance or at least in presentation, if they are not to disappear from the market. Consumers want to be continually surprised by something they didn't know existed. Producer goods too must change in order to accommodate or power innovation in final consumer goods.

⁶ Banca d'Italia (2009), "Rapporto sulle tendenze del sistema produttivo italiano" (ed. M. Brandolini and M. Bugamelli), *Questioni di Economia e Finanza (Occasional Papers)*, No. 45; S. Rossi, ed. (2003), *La Nuova Economia. I fatti dietro il mito*, Il Mulino, Bologna.

The very distinction between manufacturing and services is becoming blurred. More and more commonly a manufacture is just a container for services, without which it would be valueless. It is the services that determine development in the quality of the good. Smartphones are the most obvious example.

Today's manufactures/services are produced in ways that are themselves new. The digital revolution has broken down vertically integrated production systems into single tasks – logistics, accounting, component production, maintenance, marketing and so on – that can be outsourced anywhere in the world. Long supply chains have been formed, or global value chains, under the direction of a lead firm but involving dozens of subcontractors, often located in emerging countries where low labour costs more than offset the costs of coordination and transportation.⁷ World trade has been revolutionized, both in geographical extent and in its very nature.⁸

Finally, robotics is advancing by leaps and bounds. Existing technologies still leave enormous untapped potential for innovation in production methods;⁹ we are on the eve of an era of practically total robotization of manufacturing, with far-reaching repercussions for the labour market in both the emerging and the advanced countries.¹⁰ Save for some niches of super high-end craftsmanship, making something “by hand”, which is the origin of the word *manu*-facturing, will come to mean not operating a lathe but handling a mouse or a joystick to activate servomechanisms and 3-D printers. And given this trend towards the automation of material production, global value chains themselves could shorten and relocate as the cost advantage of emerging countries is eroded.

Yet counterforces are also at play. Manufactures – or “robofactures” – will continue to be central to our life as containers of services. The conception and, at least in part, the production of these services will of course have to be done by flesh-and-blood workers. These workers will have to be specially educated and trained – a point to which I will return further on.

Coming back to the present, Italian firms as a group have much less innovative capacity than those of other advanced economies. The split that characterizes the corporate system is also apparent in terms of capacity for innovation.¹¹ This term “innovation” must be understood in the broad sense. It involves product characteristics and the production process, of course, but also marketing practices, corporate organization, and participation in global supply and value chains.

Confining our attention to product and process innovation alone, a survey conducted at the very onset of the global crisis found that only 40 per cent of Italian firms were engaged in such innovation, far below the 64 per cent reported for German firms.¹² And we also know that where explicit R&D activity is lacking, the results of innovation are not as good: firms are

⁷ R. Baldwin and J. Lopez-Gonzales (2013), “Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses,” NBER Working Papers, No. 18957; A. Accetturo, A. Giunta and S. Rossi (2011), “Italian firms between crisis and the new globalization,” *Questioni di Economia e Finanza* (Occasional Papers), No. 86, Banca d'Italia.

⁸ B. Hoekman (2014), *Supply Chains, Mega-Regionalism and Multilateralism. A Road Map for the WTO*, CEPR Press.

⁹ E. Brynjolfsson and A. McAfee (2014), *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W.W. Norton & Co.

¹⁰ I. Visco (2014), “Perché i tempi stanno cambiando ...”, *Lettura del Mulino*, Bologna, 18 October.

¹¹ M. Bugamelli, L. Cannari, F. Lotti and S. Magri (2012), “The innovation gap of Italy's productive system: roots and possible solutions”, *Questioni di Economia e Finanza* (Occasional Papers), No. 121, Banca d'Italia; B.H. Hall, F. Lotti and J. Mairesse (2013), “Evidence on the impact of R&D and ICT investment on innovation and productivity in Italian firms”, *Economics of Innovation and New Technology*, 22(3).

¹² Eurostat (2010), *Community Innovation Survey 2008*.

less capable of patenting inventions and industrial designs, registering brands and protecting intellectual property rights. The portion of sales accounted for by innovative products is smaller, and the chances of producing goods that are new on the market, not just new for the firm itself, are lower.

The prevalent model in Italy still seems to be incremental innovation, which requires less financial and organizational resources than formal R&D activity. Total formal R&D spending came to just 1.2 per cent of GDP in Italy in 2013, compared with 2.1 per cent in the EU as a whole and 2.9 per cent in Germany. These figures are very familiar and have been widely discussed; equally well known is the fact that the gap depends not so much on public spending as on business spending, which is undercut by Italian firms' systematically smaller size than their competitors in the other advanced countries.

This feature of the Italian economy means that R&D investment is highly concentrated. In 2013 the three biggest spenders accounted for 56 per cent of total private R&D expenditure, compared with 39 per cent in Germany. And although the per capita number of Italian patents deposited with the European patent office has been rising steadily since the mid-1990s, it is still relatively low. Here again, firm size is crucial. The return on formal R&D activity is about the same in Italy as in the other advanced economies.¹³ Nor does sectoral specialization, despite the economy's bias towards traditional, relatively low-tech manufactures, appear to count much; even if we could "impose" Germany's sectoral composition on the Italian economy, the innovation gap would be narrowed only marginally.¹⁴

Smallness is coupled with an ownership structure and management practices that are often loath to take on the risks of innovation. Meanwhile, the market in venture capital – which specializes in financing the rapid growth of innovative start-ups – is still poorly developed in Italy.

Above all, what is decisive is the quality of the work force.

Knowledge and the “knowledge factory”

Self-evidently, better educated working people have a greater capability for innovation and adapt better to organizational changes. The correlation between the share of university-trained staff in a firm and its capacity for innovation is high. When the share is above a certain threshold, the probability of the firm's investing in R&D is greater.

If there is little doubt about the benefits of a more highly skilled work force, it is not so straightforward to determine precisely which skills are required. The computerization of production processes achieved to date has put a premium on managerial and intellectual functions and made it possible to turn many repetitive functions, including intermediate functions, over to computers. The Internet and cloud computing make it unnecessary for people working together on a project to be in the same place. Many knowledge-related activities can now be performed via distance interaction. By unbundling productive functions some of them, such as planning and design, can be relocated to the other side of the world.¹⁵ In many countries these trends have led to the rapid growth of the more highly skilled professions at the expense of the intermediate. Many of the workers engaged in the latter have been forced to accept lower-skilled, lower-paid jobs, causing earnings to become polarized.

¹³ B.H. Hall, F. Lotti and J. Mairesse (2009), "Innovation and productivity in SMEs: empirical evidence for Italy", *Small Business Economics*, Vol. 33, No. 1, pp. 13–33.

¹⁴ M. Bugamelli, L. Cannari, F. Lotti and S. Magri (2012), *op. cit.*

¹⁵ H.R. Varian (2010), "Computer Mediated Transactions," *American Economic Review*, Vol. 100, No. 2, Papers and Proceedings, pp. 1–10; R. Baldwin (2006), "Globalisation: the Great Unbundling(s)", *Globalisation challenges for Europe*, Secretariat of the Economic Council, Finnish Prime Minister's Office, Helsinki.

The pervasive impact on all work-related activities of mobile connection to the Internet, which is at once an enormous pool of knowledge and a concentrate of the entire world's calculating capacity, requires new skills, such as the ability to gather, select and rapidly analyse data drawn from the web. Since this pool is also seriously polluted, the ability to instantly distinguish correct information from erroneous information presented as if it were correct is essential. Calculation capacity must be used sparingly and appropriately. This requires a powerful endowment of skills that need constantly updating to keep pace with often unpredictable changes.

To develop a country's human capital it is no longer enough to furnish a large number of students with a baggage of notions to be applied in routine fashion over the course of their working life. What educators call "competence" is indispensable, namely the ability to mobilize personal resources – knowledge, know-how, aptitudes – and outside informational resources to respond effectively to new situations.¹⁶

The importance of competence is not new. The economic historian Joel Mokyr holds that a key factor in the British industrial revolution of the eighteenth century was precisely the abundance of high-quality professional and craft skills:

Effective use of knowledge, however, required not only access and incentives to create and access new technology, but also the *competence* to make use of it and to carry out the "instructions" contained in the blueprint of the technique. Much of the knowledge employed by artisans and engineers was "tacit", that is, not formally written down in the "recipe" used for production, but little tricks and know-how based on experience or imitation.¹⁷

On this terrain Italy is not necessarily at a disadvantage. If you talk about the problems and prospects of our economy with entrepreneurs and managers, they regularly bring up one distinctive characteristic of Italy's successful companies, large and small alike: the ability to adapt their products to the diverse needs of customers, moving away from standard models. That is, Italian "flexibility" is often seen as the proper response to German "reliability".

The bedrock of artisanal skills and professional competence upon which the fortune of a good part of Italian industry was built naturally favours a mind-set emphasizing competences over one tending to the mechanical application of preconceived ideas. Here Italy does not seem to suffer from any handicap. So why haven't we managed to make greater use of this innate predisposition of Italian entrepreneurs and workers?

The fact is that an abundance of skills is not enough. As Mokyr observes with respect to Britain, the right combination of artisanal skills and scientific knowledge is more highly structured:

A purely artisanal-knowledge society will eventually revert to a technological equilibrium, in contrast to a society where the world of artisans is constantly shocked by infusions of new knowledge from outsiders.¹⁸

High-level scientific knowledge is essential to be at the frontier of basic and applied research; but a constructive interchange between artisans and scientists must also be developed.

That is the story of the telescope. It has been told by Ludovico Geymonat as follows:

We know that lens-shaped glasses had long been familiar to optical craftsmen and used by them to correct sight defects, but until Galileo all the representatives

¹⁶ I. Visco (2014), *Investire in conoscenza*, Il Mulino, Bologna.

¹⁷ J. Mokyr (2009), *The Enlightened Economy. An Economic History of Britain, 1700–1850*, New Haven, Yale University Press, p. 107.

¹⁸ *Ibid.*, p. 116.

of high science had always looked down on them with contempt. Galileo had the courage and the intelligence to make use of these lenses for his astronomical research, artfully combining them to achieve a power of magnification that was truly exceptional for the time.¹⁹

The place where scientific knowledge and the set of competences of the most highly skilled workers are “produced” is the university²⁰ Italy differs from the most advanced countries by the much smaller amount of resources allocated to universities by families and by the public sector:²¹ annual spending per student is less than 20 per cent of per capita GDP, compared with a European average of nearly 30 per cent.²² Despite the institution of the three-year university degree course, we still lack a clear distinction between “light” higher education – suitable for the blue and white collar tasks that are at the base of the production apparatus – and education designed to supply the economy with a steady flow of specialists and professionals who, in today’s globalized world, can keep up with their peers from INSEAD, MIT or London Business School.

A vicious circle of supply and demand has set in. The Italian universities do not supply adequate human capital for a modern, advanced economy, while the firms that should demand it are often not equipped to recognize different degrees of quality and put the right price on them, often because they are too small. Salary levels, even in individual contracts, almost never distinguish between graduates from a low-ranking Italian university and a Harvard Ph.D. Judging by the standards of American, British and German graduate schools or the French *grandes écoles*, it is almost as if Italy had given up the idea of training its professional elite at home and delegated the task to universities abroad.

The average American university student invests nearly \$15,000 a year (at 2011 prices) in post-secondary education. The public sector adds another \$8,000, bringing the total to \$23,000. In Italy, converting euros into dollars at purchasing power parity, the average student gets an investment of \$6,500, \$2,200 from his or her family and \$4,300 from the government. These numbers reflect a radical difference in fundamental social choices. In the US, investment in good education is central to the long-term spending decisions of families and also of the public sector. Anyone with even a slight familiarity with American lifestyles knows the sacrifices and the saving that so many families dedicate to this investment, going so far as to plan their children’s college admission from birth. So it should come as no surprise that that society generates such a large part of the world’s innovations in every field of knowledge and workaday practice.

The other substantial difference between these two systems lies in the use that is made of public resources. In the United States the share allocated directly to families in the form of scholarships and student loans is much larger than in Italy; indeed, student loans, which provide especially strong incentives, are practically unknown here. This form of public spending leaves it to the student to determine the end beneficiary of the funds through the choice of university; it has the advantage of spurring the competition for students among universities. In countries where diplomas do not have a mandated legal value, the same regardless of individual or institution, as they do in Italy, universities will not compete by offering easy courses and high grades but by gaining the reputation for enabling their graduates to succeed in the job market, where a degree from a better institution is more valuable.

¹⁹ L. Geymonat (1973), *Storia del pensiero filosofico e scientifico. Volume II: Il cinquecento Il seicento*, 2nd edition, Milan, Garzanti, p. 192.

²⁰ I. Visco, op. cit.

²¹ S. Rossi (2006), *La regina e il cavallo: quattro mosse contro il declino*, Rome-Bari, Laterza.

²² OECD (2014), *Education at a Glance 2014: OECD Indicators*, Paris, OECD Publishing.

Still tougher challenges lie ahead. As Brynjolfsson and McAfee observe, “Computers [have] started diagnosing diseases, listening and speaking to us, and writing high-quality prose, while robots [have] started scurrying around warehouses and driving cars with minimal or no guidance”.²³ Technical progress has always left entire occupations behind, soon to be replaced by others. This time around, the process may be extremely intensive, and governing it may prove complicated. In the United States, as in the main European countries, including Italy, one out of every two of today’s jobs risks being automated out of existence within a decade or two.²⁴

For workers with special skills or simply with the right education there has never been a better time than the present because they are in a position to use technology to generate value. By the same token, for workers with merely ordinary skills there has never been a worse time than now, because the replicants to replace them are advancing rapidly and there will be no “blade runners” to stop them.

But what is the right education, what do you need to keep from being swept away by the digital revolution? Acemoglu and Autor contend that work can be classified by a simple two-by-two table: cognitive/manual, routine/non-routine.²⁵ Labour demand for all routine jobs, including cognitive ones, appears to be on a secular downswing. And in our service-based, white-collar societies, cognitive but routine jobs are extremely numerous; they embrace a large part of the middle class, which is accordingly the most seriously threatened.

Conclusions

Economists have always sought to determine which variables are decisive for long-term growth. Tangible capital accumulation was long considered the principal lever of development. The focus shifted next to technical progress²⁶ and then, finally, to its determinants: namely, the capacity of firms, economies and societies to continue to “learn”,²⁷ dynamism and home-grown creativity, the thrill of an intellectual and entrepreneurial challenge.²⁸

How can a country acquire these talents? If aided by history, it will find them embedded in its culture and traditions. Otherwise, purposeful political action is required to stimulate the creativity of inventors and entrepreneurs.

To foster new entrepreneurs, to convince the existing ones to expand their businesses by separating them from their family fortunes, to reward daring and inventiveness, to discourage positional rents – this must be today’s economic policy priority in Italy. It is a complicated task, touching on all aspects of community life, first and foremost the education system, but also the legal order, competitive conditions, and the efficiency of government. In short, the entire regulatory and institutional environment within which businesses live.

²³ E. Brynjolfsson and A. McAfee (2014), op. cit.

²⁴ Ibid.

²⁵ Acemoglu and Autor (2011), *Handbook of Labor Economics*, Vol. 4, Orley Ashenfelter and David E. Card (eds), Amsterdam, Elsevier.

²⁶ Schumpeter (1934) *Theory of Economic Development*, Transaction Publishers; Solow (1956), “A Contribution to the Theory of Economic Growth”, *Quarterly Journal of Economics*, 70 (1); Solow (1957), “Technical Change and the Aggregate Production Function”, *Review of Economics and Statistics*, 39(3); Romer (1990), “Endogenous Technological Change”, *Journal of Political Economy*, 98(5); Grossman and Helpman (1991), *Innovation and Growth in the Global Economy*, MIT Press; Aghion and Howitt (1992), “A Model of Growth Through Creative Destruction”, *Econometrica*, 60(2).

²⁷ Stiglitz and Greenwald (2014), *Creating a Learning Society: A New Approach to Growth, Development, and Social Progress*, Columbia University Press.

²⁸ Phelps (2013), *Mass Flourishing*, Princeton University Press.

Indeed, it is within firms that the knowledge and skills acquired in laboratories and lecture halls are harnessed and transformed into a constant flow of innovation, and that the economy is revitalized through the creation of jobs and the generation of demand, income, and wellbeing.

It is up to politicians to perform the complex and onerous task of unblocking the virtuous circle of knowledge-innovation-economic recovery by removing futile obstacles, providing the right incentives and disincentives to safeguard matters of real public interest, and finally by ensuring social equity – whilst never forgetting that without growth all equity is vain.