**Massimo Florio**

*Professor of Public Economics at the University of Milan*

# AN AGENDA FOR THE STATE AS KNOWLEDGE ENTREPRENEUR

*In the field of knowledge production, States can do something that companies cannot do: investing in the very long-term by choosing to make knowledge freely accessible, without geographical boundaries nor legal barriers, inventing new cutting edge technologies, managing a complex organization with an international management selected exclusively on merit criteria with incentives based on intrinsic motivations and not on financial rewards.*
*The best investment, for a State driven by far-sighted policy, today, is to equip itself with new public enterprises to produce knowledge and make it freely accessible in order to resolutely intervene in at least five areas: energy transition, sustainable mobility, digital communication, health and great natural risks.*

Knowledge has been defined by Joseph Stiglitz[1] as a global public good: A good the usage of which does not subtract anything from other people's use, the usage of which it is impossible, or too expensive, to exclude anyone from, and the production of which, in a given place, produces potential benefit everywhere. Not all knowledge, however, belongs to this type. A private enterprise invests in the production of certain forms of knowledge to the extent that it may be appropriate for an economic return, creating a legal barrier to its dissemination, like a virtual custom duty. The fundamental point of the dynamics of capitalism lies in the ability to privatize knowledge and profit from it. But the most important knowledge, namely in the long term, is privatizable.

An example, upon which I have worked in recent years with a group of researchers from Milan[2], is the experimental confirmation of the existence of the *Higgs boson* at CERN in 2012. Nothing could seem further away from the possibility of generating an economic return. It took fifty years to transform the intuition of a theoretical physicist into an experiment involving thousands of physicists. It was necessary to build the largest ever-designed machine (the Large Hadron Collider - LHC) with a budget of several billion euros, fully supported by taxpayers from the CERN Member States. No one knows today any practical use of this discovery. Perhaps, we will know it in another fifty or one hundred years, as happened for electromagnetism, relativity, or quantum mechanics. Yet, it can already be anticipated (considering the construction and operation period of the LHC, 1998-2025) that socio-economic benefits will be greater than costs. The creation of a global public good, in this case, has measurable economic effects involving more than 1400 technology providers, thousands of professional healthcare and industrial users of the freely accessible CERN software, tens of thousands of doctoral and post-doc students, millions of users of scientific divulgation, as well as about ten thousand scientists and researchers.

The CERN case shows how States can do something that companies cannot do: investing in the very long term in knowledge, choosing to make it accessible without geographical boundaries nor legal barriers, inventing new cutting edge technologies, managing a complex

[1] J. Stiglitz, *Knowledge as a Global Public Good*, in I. Kaul, I. Grunberg, M. Stern (ed.), *Global Public Goods: International Cooperation in the 21st Century*, Oxford University Press, Oxford 1999.
[2] M. Florio, S. Forte, E. Sirtori, *Forecasting the Socio-Economic Impact of the Large Hadron Collider: a Cost-Benefit Analysis to 2025 and Beyond*, in "Technological Forecasting and Social Change", 112/2016.

organization with a management internationally chosen merely on merit criteria and motivated by intrinsic reasons, not by financial rewards.
This miracle, incomprehensible to those who think that efficient organizations are only profit-oriented, may perhaps be seen as a new public policy paradigm. CERN could be a frontier example, but belonging to a potentially large class of new type of public enterprises, organisations whose main mission is to produce knowledge and make it freely accessible.
I will argue here that no investment, today, could be better for a State than those ones guided by such a far-sighted policy.
I use the term "public enterprise" in this context to emphasize a point that has gone missing in thirty years of privatization policies. The State cannot be just a regulator; it must also be a businessman that is producing in a creative manner.

THE STATE CANNOT ONLY BE A REGULATOR, IT MUST ALSO BE ENTREPRENEURIAL, THAT IS TO PRODUCE CREATIVELY

The only way for an organization to learn is to do something that seeks for problem-solving. A State limiting itself to regulate what others do, does not learn and, therefore, does not create well-being. If it draws and redistributes resources created elsewhere, it loses legitimacy, as we are witnessing in our era of discrediting the public sphere.
Whoever perceives itself as a net contributor has an interest in pulling out and supporting anti-political politicians. To earn citizens' respect, a State must produce something useful and do it with its own organizations having a precise mission. A public-sector bank without a public mission is not really worthwhile. A public development bank such as the European Investment Bank (EIB) – which at a critical moment, among other things, offered a loan to CERN to support the LHC's investment – has an identifiable and useful mission.
I mentioned CERN and the EIB, two supranational organizations. The frontier of global public goods production needs the abolition of frontiers through new types of businesses, where not only there are no private owners, but also there are no national hegemonic States. The paradigm of the LHC and the new world of knowledge production is cosmopolitan, not unlike global information managers such as Alphabet, Amazon or Facebook, but more radically.
The agenda for building a new portfolio of public enterprises could be of paramount interest for Europe, if the EU could ever get out of the self-destruction process triggered by the prevailing interests and ideologies of neoliberalism and nationalism. I will imagine for a moment that robust, public mission knowledge-based, industrial projects can thought of at European-level.
The fields in which these organizations (which already have embryos in Europe and elsewhere) may be useful are least five: energy transition, sustainable mobility, digital communication, health and great natural risks.
Let us imagine five European agencies similar to CERN, where the best research in the world is centred and where the technology transfer is actively promoted to private and public companies in the Member States and to third parties, where the mission, which is clear and recognizable, is to move and disseminate, in a long-term perspective, what we know in some crucial fields. I can only briefly elaborate on these five missions.
We know that we are experiencing an enormous energy transition, which consists in trying to solve *forever* one of the central problems of human development that is how to use nature without destroying it while applying work on objects . We cannot invent a machine that creates perpetual motion, but we know that burning hydrocarbons and nuclear fuels is not the right choice for the next few centuries. Despite important efforts by some European governments (such as Denmark) to promote renewable energies, such as solar and wind, these are still unsolved technological and scientific issues, with the renewable Kwh still not costing

much less (or costing more) than the fossil one. Can we go any further? The EU finances an expensive research project on nuclear fusion[3], and different other smalelr scale projects, but perhaps, today, we would need something more ambitious. A new Euratom, with an ambitious research agenda on the whole spectrum of R&D options in the field of generation, distribution and energy efficiency (including saving it) . What we are starting to catch a glimpse of what a world where the marginal cost of producing energy could be zero or extremely small. Large private or semi-public companies cannot invest more than that what they already do in the discovery of technological and scientific principles, otherwise they would destroy their profitability, and that is why they have stopped doing so. Through national subsidy bills, national governments have devised expensive cost transfer schemes for electricity companies to invest in renewables and reserve capacity. But the main avenue is not the support to technologies that are still immature. Instead we need a knowledge leap that would bring these technologies to ultimately suppress hydrocarbons and nuclear. A new Euratom (the current one is focused solely on nuclear power) should be a CERN of energy research for the transition to a sustainable model forever.

For example, Einstein's article on the photoelectric effect, at the base of the current solar technology, dates back to1905. Today, we know that a further scientific jump is needed in the solar panel physics. A differen example: The first ideas on nuclear fusion date back to the 1920's, well before the Manhattan project (the first example of Big Science for military purposes). The ITER and DEMO projects, one hundred years later, are the right way? But it is not just a matter of electricity generation. Today, superconductivity and computerization can revolutionize networks. In order to fully derive the consequences of the scientific principles of the energy transition, we need a supranational public entity that would not be paralyzed by the awareness that, in case of success, the electricity price could be pulverized, and profits of utilities with them. The new organisation's mission would not be related to a single project, but to a wider mission: to definitively close with scientific progress the fossil era, the nuclear fission, copper networks and energy waste.

TO DERIVE ULTIMATELY THE CONSEQUENCES OF THE SCIENTIFIC PRINCIPLES OF THE ENERGY TRANSITION, WE NEED A SUPRANATIONAL PUBLIC ENTITY THAT WOULD NOT BE PARALYZED BY THE AWARENESS THAT, IF THE ELECTRICITY TRANSITION IS SUCCESSFUL, PRICES AND PROFITS COULD BE PULVERIZED.

A similar case concerns mobility. We know a few things: that the paradigm of the engine burning hydrocarbons is the analogue of inefficient conventional electrical generation; that the idea of a per capita car is not compatible with our cities; that reducing air transport costs is creating a congestion scenario; that sea and freight transport creates enormous environmental problems. We still do not know what substitute could replace the transport world as we know it today. And it does not seem that the solutions we are looking for will come from the R&D of those who ultimately want to sell more cars, more aircrafts, or more ships. If we really go for the private car without driver, this would be an example of the privatization twist of scientific progress. A much more significant progress would be one that drives us to live without a car. But how? It is not just a question of political choices – as if it were enough to order people to ride bicycles – but above all, it is a matter of radical technological innovation. Here too, it would be a matter – which is not motivated by the economic profit, but by the social well-being it can derive – of providing all the knowledge necessary to get out of the current mobility model.

[3] Please see: ec.europa.eu/research/energy/euratom/index_en.cfm?pg=fusion&section=iter-future.

Even more evident is the maturity of a new public enterprise that would break the barriers to knowledge that would force us to pay for digital communication and data processing, whereas innovations that would make zero the marginal cost of processing and transmitting electronic information in all its forms (voice, data, and contents) are at our fingertips. Internet, as we know, is the result of a combination of two public projects, one originally funded by the US Federal Government (then Arpanet in the 1960s) and the World Wide Web conceived at CERN in 1989. Telecommunication Satellite Technology derives from research conducted by the US Navy and the Soviet Sputnik (there are about 2,000 satellites and millions of scoria in orbit today). Optical fibre was born from independent university research in the UK and elsewhere. The potential that might arise from the development of fields such as quantum computers and new material physics is enormous, but it cannot be claimed that these technologies are only developed, or primarily developed, by ICT companies that live by making users paying a price for each processed bit, while with new technologies the cost would tend to zero. The ongoing demographic transition, which today is pessimistically defined as the ageing of the population, and which could, of course, be optimistically called lengthening life expectancy and responsible procreation, raises medical research challenges that the current model of care is unheard of. This model is based on private pharmaceutical companies and, in the United States and elsewhere, on insurance companies and other organizations based on seeking a financial return. One and the other are more obstacles than elements leading to the knowledge quality leap needed to discover, for example, antitumor drugs that would not cost directly to the patient or indirectly to the taxpayer hundreds of thousands of euros per year of life gained.

PRIVATE PHARMACEUTICAL COMPANIES, INSURANCE AND OTHER ORGANIZATIONS BASED ON SEEKING A FINANCIAL OUTLAY, IN THE HEALTH SECTOR, ARE MORE OBSTACLES THAN ELEMENTS LEADING TO THE LEAP OF QUALITY OF KNOWLEDGE NEEDED TO DISCOVER, FOR EXAMPLE, CHEAPER ANTITUMOR DRUGS

One could imagine a CERN of medicine, also thoroughly studying the case of the National Institutes of Health, the American public organization located in Maryland, which has 27 research institutes housed in 75 of buildings and laboratories, universally regarded as world-class excellence in the field.[4] But we should reinvent the relationship between a great scientific enterprise of this type and the European public health model, which has nothing to learn from the United States.

Finally, research on major risks, above all, but not just those that derive from climate change, could be mature for a quality leap based on a "Manhattan project" for the planet's salvation. There has been immense progress in predicting meteorological phenomena and, today, we have a new ability to monitor the marine environment or geological risk, but we are still far from having developed scientific, technological and economic solutions to ensure pacific coexistence between the nature of the planet and its 7.5 billion inhabitants or perhaps 10 billion planned in 2050[5]. In less than fifteen years, mankind grew by a billion individuals, that is like all the world's population just before the industrial revolution at the beginning of the nineteenth century. The truth is we do not know how to manage the combination of environmental and demographic risks that await us. It is not just a question of policies that would be right and that we are not able to enact because of interest and myopia. That is just half the problem. The other half is that we do not have the knowledge necessary to avoid, for example, an imminent African catastrophe, of which we only see little warnings on the boats of the desperate in the Mediterranean see. The Green Revolution in India, in the Sixties, is an

[4] For a description of the project National Institute of Health, plese see: www.nih.gov/about-nih/who-we-are/organization.

[5] United Nations, World Population Prospects. The 2015 Revision, available on: un.org/unpd/wpp/Publications/Files/Key_Findings_WPP_2015.pdf.

example of how genetics can help address the famine problem, but it also illustrates what problems today poses the lack of a global public enterprise that offers alternatives to developing countries to the unsustainable conditions offered by multinationals in the biotechnology sector. Monsanto does not have the same reasons for research that might have a supranational public agency. And we cannot expect an anti-seismic revolution in construction without a quality leap in geological research and building material research.
The examples I gave are just illustrative of what a farsighted public policy could do. The creation of European public organizations of this type, not just research funding agencies, but real public enterprises of a new type, with an autonomous capacity to do and learn, could perhaps give a new meaning to the European Union. A sense not based on the imitation of the US model (which in fact often presupposes research ultimately based on the financing by the military-industrial complex)[6] but on a more advanced and original European way.

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[6] M. Florio, *Il progetto europeo come motore di crescita e il confronto con gli Stati Uniti: la politica industriale dopo il "Rapporto Sapir"*, in "L'industria", 4/2005, pp. 707-30.