# Technologies: expectations and impacts

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Climate change has become one of the global political priorities. They are usually represented by the temperature trend, which has increased exponentially in recent decades (through the so-called hockey stick chart). This temperature's increase is a consequence of the presence of greenhouse gases in the atmosphere that are generated by human activities, be they in the energy or agricultural field.

Temperature is just one of the indicators of this phenomenon, which foresees the increase of extreme events (hurricanes, rainfall, floods, landslides), ice melt, sea level rise and its acidification, drought and desertification, migration of organisms, etc. These impacts have different intensities at the geographical and, indirectly, political levels. The concerns for damage to the environment and populations has therefore pushed to policy-decisions related to boost renewable energies, monitoring and environmental alert systems, search of new solutions for adaptation and mitigation.

Could it have been foreseen?

We are talking about complex systems, at environmental, economic, social and political levels. They involve different industrial sectors, cultures, traditions and legislation. In complex systems, the prediction of their evolution is extremely difficult, if not for short periods or if not able to control the essential variables. Evolution models of such systems are indeed often not very accurate.

Could, at least, it be guessed?

Let's go back over a hundred years. At that time, the steam engine and the various introduced technologies gave the human kind such recognized advantages, helping in strenuous, repetitive, risky jobs. The use of fossil fuels was not indicated as a possible risk to the environmental sustainability of the entire planet. It was the beginning of the industrial revolution. Other lesser known technologies have made the difference in history, especially in the military field: just reflect on the introduction of the threaded barrel in gunshots and which has allowed greater precision and range of fire.

Is therefore possible to understand or imagine the negative consequences of a technology?

It has been done, and it concerns everything that deals with nuclear energy. The idea of a possible nuclear disaster linked to peaceful or military use has led to international treaties, monitor and limitations aimed at reducing the risks of its improper use. The superpowers decided, and the technology is the domain of a few.

Recently the debates on the impacts of artificial intelligence at the global level are triggering concerns and debates, similar from a psychological point of view to those on nuclear power but different in perception and analysis. Access to this technology is more widely distributed, certainly easier and the resulting market is widespread and promising.

But why can't we understand how a technology can change the global socio-economic system from the beginning?

Because, in addition to addressing a complex system itself and therefore difficult to predict, there are no valid models for the impact of technologies, that is, they are models that adopt different assumptions,

different formulations and processes. Therefore, they are difficult to compare or to extract useful empirical laws. In practice, they only work under certain conditions and with very simplistic restrictions.
These models can be distinguished in different groups: from those of an evolutionary type (when a technology is described analogously to a species that must compete or collaborate with others and dominate over the territory), or linked to quantum physics (with determined and discrete states) or classical physics (through interference between different variables). Other models could be used, such as those for small world networks, but certainly we are facing with a classic problem of socio-economic science, which at the moment has great difficulty in producing reliable results.
It is a question of shaping the future.
There are innumerable methods of dealing with predictions, on a scientific and non-magical level: they are called foresight or forward-looking activities. Many of these show obvious aspects of conflict of interest or cognitive biases. An interesting approach, and completely out of the chorus, is based on historical and anthropological reflections. The article to which I refer to reflect about, is "The future imagined: Exploring fiction as a means of reflecting on today" s Grand Societal Challenges and tomorrow's options ".