

Have we reached the twilight of the fundamental science era?

History reveals a succession of many dawns and twilights, in different facets of human activity. Looking at the past, we can date and understand the reasons for the birth of science, specifically fundamental science. However, we do not know precisely when its twilight will take place. Nevertheless, clues of the advent of such twilight are already in the air; after a very hot summer the season of falling leaves always comes. This article presents the underlying rationale suggesting that we are now past the golden age of pure science, and how we need to accommodate our research to this new era.

Symptoms of decline

Today, science and some of its priests enjoy a high status in our society. By science this article refers to pure sciences, as distinct from applied sciences. We have witnessed gargantuan amounts of money invested to support such sciences. The quantity of publications, the quantity of big instruments and the technology created, the number of jobs created in research, the accurate control of our science in comparison with past times, could all be considered as arguments used to show that science is presently living in a golden age.

But there are some symptoms which indicate a decline of our scientific culture. First, our society is drowned in huge amounts of knowledge. Most of it is about research of little importance to progress our world view or produces no advances in the basic fundamentals of pure science. Instead, we invent countless technical applications or investigate secondary details.

Second, in the few fields where some important aspects of unsolved questions have arisen, powerful groups of administrators of science control the flow of information. They have inherent biases resulting in a preference for consensus truths, rather than having objective discussions within a scientific methodology. This process gives few guarantees that we are obtaining solid new truths about nature.

Finally, should the current scientific process continue the way it is, individual creativity is condemned to disappear. Indeed, truly creative scientists are substituted by large corporations of administrators and politicians of science specialised in searching ways of getting money from States in megaprojects with increasing costs and diminishing returns.

A hive without a soul

In essence, our science has become an animal without a soul. Or rather a colony of animals, a group of organisms, which devour human efforts and do not offer anything but growth for the sake of growth. Scientific organisations behave like a colony of bacteria which reproduce as far as the available food and money allow. The more you feed them, the more they grow: more PhD students, postdocs, staff researchers, papers, supercomputers, telescopes, particle accelerators etc. And, if the money tap is closed, the number of people who dedicate their time to science and its by-products is reduced proportionally.

Almost everything in science is reduced to find a small fiefdom of nature to analyse—regardless of the existence any fundamental question to solve there. The whole process boils down to publishing papers on such fiefdoms, getting citations from colleagues with the aim of getting jobs and extra money for expenses, getting money to employ more PhD students, postdocs, etc. And when these students and postdocs grow up, they become new senior researchers who ask for more money, and so on... The

sense of all this industry is one of primitive life: just a struggle for survival and spreading intellectual genes.

The business of science in crisis

It is not only a crisis of senses and spirit. But it will also be a crisis in the business of science, at least for pure sciences—not necessarily for technological applications. Scientific institutions follow the structure of capitalism, so they must continuously grow. Experimental science becomes more and more expensive with time, and science has opted for this way of no return, going always for an increase in funds. When the investment in science reaches the limit where it can no longer grow, a crisis will become unavoidable.

Nowadays, the richest countries aim to invest around 3% of GDP in research and development, from which 20% is dedicated to pure sciences. This ratio is much higher than in the past—both in absolute and relative terms—and it has grown continuously in the last few decades, with some small fluctuations. Such investment is, possibly, already close to the asymptotic limit in terms of the relative ratio of money that a society can afford. So an economic crisis in science may be not very far away. It could well be that many research centres will continue for some decades with a constant or decreasing budget. But eventually they will recognise that no advances can be made without increasing budgets. Then, these centres will begin to close, one after another.

This will not happen very fast. But it will be a process possibly lasting several generations. And this decline will not only affect science but the sinking of science will run parallel to the sinking of many other aspects of our civilisation. The end of science will mean the end of modern European culture, the twilight of an era initiated in Europe around the fifteenth century and which is extended nowadays throughout the world: the scientific age.

The end of the golden age of science

Are we not wise enough to stop this decline? No, we are not. We have plenty of cumulative knowledge. But memory is neither intelligence nor wisdom. Humans are individually intelligent, but when they associate in big groups this intelligence is diluted. For instance, global warming cannot be halted, due to this collective stupidity. In my opinion, the fate of our civilisation cannot be changed. “It is not the individual but the spirit of a culture who gets fed up,” said early XX century philosopher of history [Oswald Spengler](#) in his book ‘The Decline of the West.’ Whatever has to happen, will happen. Societies develop their cultures, and they grow, reproduce and die.

The golden age of science will never come again. But we could, at least, try to preserve something of the spirit of science, in which the best intelligences can produce smart solutions to various problems.

Thinking about new ideas with low-budget experiments or intellectual developments produced by few individuals has more merit than the mega-expensive macro-projects of big science. Many scientists might, possibly, complain about this statement and say: “With a low budget, we cannot create innovative science.” And the answer should be equally firm: “If you cannot produce new ideas or new analyses of available data in science, and your only idea of advance is to ask for more money for a device more expensive than the previous one, then the only option left is to leave research.”

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The ideas presented in this article are developed further in an [article](#) and in a [book](#) called 'The Twilight of the scientific age.'