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## Innovation as iconoclasm

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In 2004, the innovation platform published its report *Vitalisation of the Knowledge Economy*, with a proposal for how this vitalisation could be achieved contained in the subtitle: *Improved development and utilisation of the potential of people as the key to a dynamic knowledge economy*. A lot is expected of technical universities and the people involved in scientific research at these institutes. Will the UT have lived up to those expectations by 2020?

The issue addressed by the innovation platform is called the “knowledge paradox.” Excellent scientific research is being conducted, but this is seldom – if ever – converted into products and services that are valued by society. Can this paradox be resolved? What changes does that require?

In his contribution, Herman Wijffels presents an interesting image of the knowledge and innovation system. In his proposal, it should be looked at as an *ecosystem* – a system comprising different kinds of living organisms that need each other to survive. These organisms continuously adapt themselves, changing the system and keeping it vital.

This is a powerful and useful model. It shows that the players are not opponents, but need each other to survive. It also demonstrates that control is difficult. One single intervention can have all kinds of unexpected effects, and once the balance of the system is disturbed too much by external factors, it may sustain irreparable damage. We know that ecosystems are more robust the more diverse and complex they are. Monocultures are more vulnerable because it is difficult for them to respond to changing conditions.

Measures proposed by ecologists are not so much aimed at bringing the system under control as at creating more space by eliminating obstructive and aggravating environmental factors, allowing diversity and repairing infrastructures.

The innovation platform relies heavily on the ecological approach. According to the report, solutions will have to be found to break down barriers between compartmentalised organisations, to establish new networks within the system, to encourage interactions between players, etc.

From a social point of view, enhancing the contribution of university research to innovation can only be applauded. At the same time, among scientists the emphasis on application often results in opposition, scepticism and concern about the quality of research and education. Why that opposition? And, moreover, is it justified?

The opposition can be explained by employing yet another image: that of *practices* – practices of scientific research, practices of technological design, and practices of commerce. A characteristic of a practice is that it not only targets external objectives, but also – and more importantly – the internal quality of the practice. Excellent scientific research, for example, complies with the standards upheld *within* the scientific practice. Any good researcher seeks compliance – usually even without being explicitly aware of those standards.

What are the roots of these internal standards of scientific practice, and why are they so persistent? They are based on entrenched, often very old concepts of science. Over 2000

years ago, the philosopher Aristotle already distinguished between the nature of scientific knowledge (*epistèmè*) and the nature of technological knowledge (*technè*). *Epistèmè* concerns the constant, true reality, while *technè* has to do with objects that are man-made and, consequently, less true. We associate the former concept with truth, the latter with practicality and usefulness.

Aristotle's dichotomous view of knowledge no longer fits in with current scientific practices. After all, we practice science using man-made tools, while experiments constantly involve manipulation and change. The knowledge gained is not only used to understand the world – it is also used to intervene, to create, to change. It is rather surprising, therefore, that the classic Aristotelian view still has such a hold over scientists. The distinction between scientific and technological knowledge is still recognised and it is as part of that view that some researchers are thoroughly convinced that applied research can only yield superficial, low-quality science.

The innovation platform is rooted in an older tradition. Science policy has been grappling with word combinations like “technical science”, “interdisciplinary research” and “social relevance of science” for over forty years, based on two types of control models. The *behavioural model* assumes that reward and punishment can change the behaviour of researchers in order to achieve the desired external goal. The ecological model described above departs from this notion – it is a type of *system model*, which assumes that changes at system level will automatically change the practices.

The behaviouristic models can be dangerous, because they may corrupt the practice – that is to say, they may destroy the internal norms of the practice. “You ask, we answer, but don’t expect quality”. This increases momentum of destruction, as these models tend to promote monocultures. The ecological model is the best possible model for thinking about science policy. It visualises several key aspects of complex systems, including the importance of diversity for scientific practice. Yet I am not convinced that eliminating bureaucratic obstacles and encouraging interaction between business and science will automatically bring about innovation.

And this is exactly the core of the knowledge paradox. The sciences should make a larger contribution to innovation, on the one hand, while the implicit, internal norms embedded in scientific practices often oppose this on the other. That too, is how it should be, as it is the implicit, internal norms that guarantee the quality of the practices! After all, what good is substandard scientific research for society?

This understanding is not one that science policy can easily accept – because changes in internal norms can only take place *within* the practice. It requires a change in the self-image of researchers, which cannot be forced upon them from the outside.

Should this make us feel pessimistic? No, because researchers’ integrity and their stubbornness in adhering to high scientific standards make me feel optimistic.

My ideal is that the image researchers have of ‘good’ research will change, so that “applied” and “fundamental” will be reconciled, without them having to abandon their high requirements with respect to scientific quality. This self-iconoclasm calls for the intelligence, integrity and tenacity of the researchers at this institute. They are the foundations upon which, in 2020, the UT will have met its sanguine expectations.