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## Refining the debate on GM crops using technological foresight—the Danish experience

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### Abstract

Rapid developments in and the controversial nature of biotechnology call for communication, networks, partnerships, and collaboration in research, not just among researchers, but also between researchers and research “users” in industry, government, and elsewhere. Technological foresight appears to offer a coordinating method for developing and strengthening those linkages. To test this, a technological foresight study was performed on genetically modified (GM) crop technology in the Danish context. The background of the study was the conflict and intense debate in Denmark over applications of gene technology, especially over the deliberate release of genetically modified (GM) crops. However, the current debate characteristically involves sharply opposed fronts, lacking willingness and courage to engage in a free-flowing and open-minded debate on both rational and normative components of biosafety. In it, stakeholders and experts on both side of the conflict advocate widely differing opinions. Without a proper generally intelligible dialogue, the broader public audience finds it hard to comprehend this type of debate. The study pursues the notion that public dialogue can act as a driver of future applications in the technological domain, specifically GM crops. The study concluded with a stakeholder workshop that revealed three key issues that might provide helpful starting points for a more free-flowing and open-minded debate about the future of GM crops. The issues were those arising from the following statements: a broad perspective on risk is crucial; international regulation must make allowance for developing countries; a better configuration of the risk debate is needed. These issues are discussed in more details in the article.

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## 1. Introduction

Since the second half of the 1980s, when the first GMOs were introduced for industrial production of medicinal products, and legislation on gene technology was passed in the Danish parliament, debate about applications of gene technology has been intensified in Denmark. Discussion has been especially vigorous where the deliberate release of genetically modified (GM) crops for agricultural use is concerned. So far, however, the debate has failed to clarify an agreed direction of policy. It has instead run into deadlock. Sharply opposed parties of stakeholders and experts characteristically advocate conflicting opinions. Meanwhile, the public is left on the sidelines, while scientists, stakeholders, and other experts are in dispute.

When experts disagree, and when uncertainty and benefits simultaneously are thought out and affirmed on each side of the conflict, policy makers are put in a difficult position, and the public react with distrust [1]. When a concept like risk with its various problematic facets is being discussed, it is necessary for the experts to communicate across disciplines. Experts often find this difficult, probably owing to their different traditions or different epistemic cultures [2]. However, differences of professional language and culture are no excuse for the experts' failure to engage in a proper dialogue. Michel Gibbons [3] has pointed to the European debate on GMO as an example of breakdown in social authority that arises because dialogue is inadequately established: "Since expertise now has to bring together knowledge that is itself distributed, contextualized and heterogeneous, it cannot arise at one specific site, or out of the views of one scientific discipline or group of highly respected researchers. Rather it must emerge from bringing together the many different 'knowledge dimensions' involved. Its authority depends on the way in which such a collective group is linked, often in a self-organized way."

In an earlier study, we asked (at the microlevel, i.e., specific technology) which drivers of change likely would need to be considered for the commercialization of a specific technology, namely, biological encapsulation of ryegrass using GM technology [4]. We suggested that dialogue and public participation in regulatory procedures would have a serious impact on future attempts to commercialize GM crops. This suggestion contrasts vividly with the attitude of natural scientists who insist that the public should either be more educated in science or defer to the relevant scientific authorities—an insistence in turn suggesting that a one-way information strategy from experts and authorities to the public is needed [5].

The present study pursues (at the mesolevel, i.e., technological domain) the notion that stakeholder dialogue can act as a driver of future applications in the technological domain, specifically GM crops. It asks Danish stakeholders, experts, and scientists both to identify issues which, in their view, would play a major role in future public dialogue on the utilization of GM crops and to explain how these issues should be approached. The aim of the study has been to use a foresight framework to gain insight into and reflect upon primary issues that are likely to play a major role in public debate about GM crop technology in Denmark. A more balanced understanding of what kinds of development worry the public and what kinds of development are seen as a promising could promote sustainable and judicious use of GM crop technology in Denmark and other EU member states.

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