Go4 Baltic

BONUS
SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

POLICY BRIEF NO. 1

HOW CAN AGRICULTURAL NUTRIENT POLICIES FOSTER TECHNOLOGY INNOVATION AND ADOPTION?

Technological innovations may have the potential to lower the costs of reducing nutrient loads to the Baltic Sea and/or increase the potential for nutrient reductions. In this context three important questions arise: (1) Do current policies and markets provide sufficient incentives for innovation? (2) If not, how can the incentives be improved? and (3) Will the novel technologies be adopted by the intended users?. The research project BONUS Go4Baltic has studied these questions and now provides recommendations on policy design, based on the results from the investigations

ECO-INNOVATION AS A TOOL TO MEET ENVIRONMENTAL TARGETS

Baltic Sea nutrient policies applied hitherto have been successful in achieving abatement at point sources, whereas agricultural load reductions have been modest. Agriculture therefore remains the main source of nutrient inputs into the sea. One possible reason for the limited policy success in the agricultural sector is the low speed of innovation. A low speed of innovation can hamper the development of cheap and environmentally effective technologies.

Eco-innovation plays an important role in reducing the environmental impact of human activities. Environmental regulation can positively affect eco-innovation by providing firms that have creative ideas with incentives to invest in R&D. By investing in R&D, they can develop technologies which can be sold to polluting firms that wish to reduce their costs for compliance. The innovative firms can, but need not, be polluters themselves.

In GO4BALTIC we examined the effects of environmental regulations on innovations in nitrogen and phosphorus management technology in the wastewater treatment sector and the agricultural sector. Figure 1 illustrates the approach: general conditions for innovation affect the overall level of innovations, which together with environmental regulations determines innovations in the studied sectors. We utilised Swedish patent data over a 50-year period, see Figure 2, as a measure of innovation, and took into account also more general determinants of innovation, such as income, R&D expenditure, intellectual property rights, and openness to trade. Results suggest that increased regulation induced innovation in the wastewater treatment sector, both in the short and long run. The short-run effect was estimated to 40-70% increase in the years immediately following the introduction of new environmental regulations. A corresponding effect could not be identified in the agricultural sector. The difference between the sectors is likely explained by differences in policy design, where performance standards, setting limits on emissions, are applied in the wastewater sector, while design standards, requiring specific technologies to be applied, and technology-specific subsidies dominate in the agricultural sector.

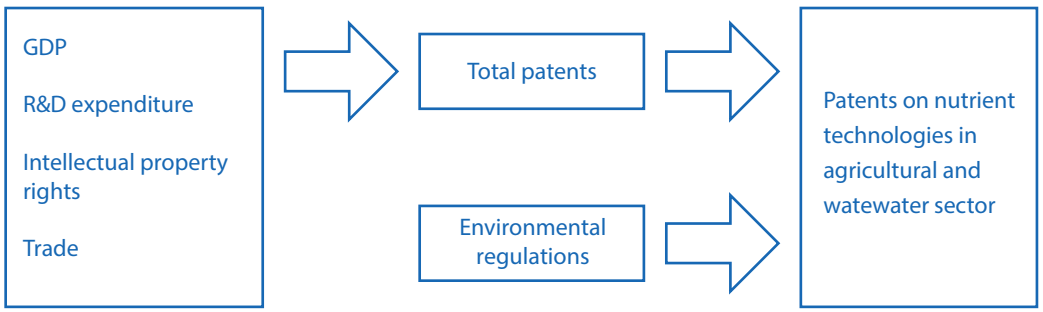

Figure 1. The process of innovation in nutrient technologies in the agricultural and wastewater sector.

POLICY BRIEF NO. 1

ADOPTION OF ENVIRONMENT-FRIENDLY AGRICULTURAL TECHNOLOGY

For novel technologies to have an impact on the environment, it is necessary that they are adopted by farmers. Direct regulation of technology uptake is effective in achieving adoption if farmers comply, but may be socio-economically inefficient because it ignores potential differences in the technology specific costs of reducing emissions. The propensity of farmers to voluntarily adopt environment-friendly technologies differs depending on the availability of subsidies, and on farm and farmer characteristics.

In BONUS Go4Baltic we carried out a survey of 2,439 farmers in five countries around the Baltic Sea. From this survey we identified the drivers of actual technology adoption for three technologies that reduce nutrient losses; manure spreading equipment, slurry tanks, and precision technology for fertilizer application. The study was focused on farm and farmer characteristics. Results reveal that larger farms have a higher propensity to adopt the three technologies, illustrating that the scale of operations is of crucial importance for the profitability of investments in nutrient efficient technology. Farmers' general concerns for the environment were not found to influence decisions. However, concerns for on-farm soil quality, which represents an environmental characteristic that has an important impact on farm profit, was found to affect decisions on investment in spreading equipment and sophisticated fertilizer technology. Finally, we identified farmers' perceived innovation readiness by asking the farmers to place themselves somewhere on the scale between the two extremes 'I prefer to wait for using new technologies until they have proven effective' and 'I prefer to use new technologies as soon as they are available'. Results showed that farmers that placed themselves closer to the latter statement were more likely to invest in slurry tanks and fertilizer precision technology.

Figure 3. Technological innovations for manure spreading on agricultural land: a) broadspreading (older technology), b) trailing hoses (newer technology) and c) injection (modern technology).

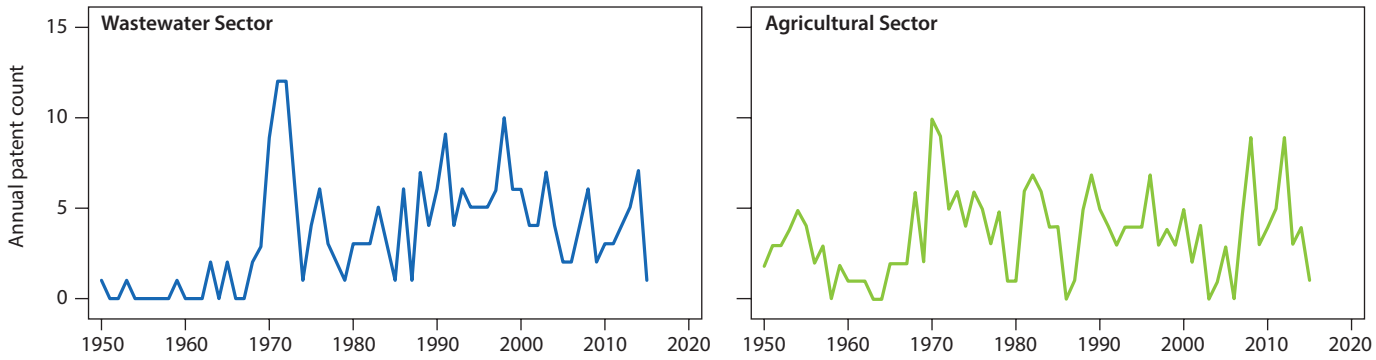

Figure 2. Wastewater and agricultural annual patent activity in Sweden 1950-2015.

RECOMMENDATIONS

Set emission performance standards for larger farms in order to encourage innovative activity

For large farms we suggest to replace the current EU and national regulations for agri-environmental measures, based on compensation of farmers' costs for using specific technologies, by performance standards that allows farmers to apply novel technologies.

Provide the public and private sector with direct, competitive rewards for technological development

Reward public and private sector eco-innovations that are promising in delivering economically and environmentally effective nutrient abatement.

Provide farmers with differentiated incentives for technology adoption

Mandatory abatement technologies should be targeted to regions not only based on environmental sensitivity but also focusing on low-cost regions and low-cost farm types. Information campaigns on subsidies to voluntary technology adoption should be targeted to farm types with lower costs of adoption.

Manuscripts on which the policy brief is based:

Häggmark Svensson, T. & Elofsson, K. The Impact of Water Quality Policies on Innovation in Nitrogen and Phosphorus Technology in Sweden. Contact person: Tobias Häggmark Svensson, e-mail: tobias.haggmark@slu.se.

Konrad, M.T., Nielsen, H.Ö., Pedersen, A.B. & Elofsson, K. Adoption of three nutrient abatement technologies in five Baltic Sea countries. Contact person: Maria Theresia Hedegaard Konrad, email: mthk@envs.au.dk.

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This policy brief disseminate results from the **BONUS Go4Baltic** project (2015-2018). The aim of the project is to

- provide policy relevant advice and recommendations for reductions of the eutrophication in the Baltic Sea in coherence with climate and agricultural policies
- examine national and international environmental and agricultural policies across the Baltic countries, to analyze and propose cost-effective solutions
- point at coherence and conflicts between the policies.

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