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Pozície relevantných stakeholderov SR a vplyv na rozhodovanie o NGT na národnej aj európskej úrovni

Positions of relevant stakeholders in Slovakia and their influence on decision-making on NGT at both the national and European levels

Publikácia odoslaná do procesu posudzovania alebo vydaná

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Nové genomické technológie v poľnohospodárstve: spoločenská akceptovateľnosť, ekonomické dopady a rozhodovacie procesy

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Deliverable description

Deliverable 6 comprises two scientific papers.

The first paper, **"Positions of Relevant Stakeholders in Slovakia and their Influence on Decision-Making on NGT at Both National and European Levels,"** was presented at the **International Scientific Days (ISD) 2026** conference. It analyses the positions of key Slovak stakeholders regarding New Genomic Techniques (NGT) and examines how these positions influence decision-making processes at both the national and European Union levels.

The second paper, **"Political Economy of Decision-Making on New Genomic Techniques,"** is currently **under review by the journal Agricultural Economics**. The paper develops a political economy framework for analysing the EU legislative process on NGT, focusing on the interaction between institutional rules, stakeholder preferences, and regulatory outcomes. It identifies the key determinants shaping NGT policy and decision-making within the European Union.

Both papers are attached to this document.

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Positions of Relevant Stakeholders in Slovakia and their Influence on Decision-Making on NGT at Both National and European Levels

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Abstract

New Genomic Techniques (NGTs) may support more resilient and sustainable agriculture, but their adoption depends on farmers' acceptance, perceived risks, institutional trust and expected economic benefits. We evaluate Slovak farmers' and agricultural stakeholders' knowledge, attitudes and preferences regarding NGT-derived crops. The study combines a representative online survey of 202 Slovak farms, a focus group discussion and a discrete choice experiment focused on wheat varieties.

The results show that awareness of NGTs is lower than awareness of GMOs, although most respondents reported clear or partial understanding after receiving basic information. Farmers recognised potential agronomic benefits, particularly higher yields, improved stress tolerance and resistance to pests and diseases, but attitudes toward NGTs were more cautious than toward conventional breeding. Perceived risks were highest for future generations, biodiversity and long-term ecological sustainability. Focus group participants emphasised the need for transparent regulation, labelling, traceability and safeguards against market concentration. The discrete choice experiment showed that farmers valued yield and stress-tolerance traits, while the NGT attribute reduced choice probability. Adoption of NGTs in Slovakia will therefore depend on regulatory clarity, consumer acceptance, market incentives and credible communication.

Key words: New Genomic Techniques (NGT), stakeholders, Slovakia, farmer attitudes
JEL classification: Q18, D72, Q58

Introduction

NGT-derived foods have the potential to generate substantial benefits for consumers, producers, processors, retailers, the environment and the public sector (Parisi and Rodríguez-Cerezo, 2021). However, their successful introduction and market expansion depend on an appropriate regulatory framework and acceptance among consumers and agri-food supply chain actors (Beghin and Gustafson, 2021). The experience with genetically modified organisms (GMOs) in the 1990s shows that insufficient public acceptance was one of the main barriers to their adoption in the EU and elsewhere (Qaim, 2020).

According to the European Commission, New Genomic Techniques (NGTs) are techniques developed after 2001 that can alter the genetic material of an organism (EC, 2021). Unlike GMOs, which typically involve the insertion of foreign DNA from unrelated species, NGTs enable targeted and precise modifications within an organism's own genome, without necessarily transferring genes between species that cannot naturally reproduce with each other (Eckerstorfer et al., 2019). They can

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therefore generate new plant varieties more rapidly and accurately, including varieties that could also arise through conventional breeding or natural mutation.

A substantial body of literature has examined social acceptance of GMOs, while research on public and consumer acceptance of NGTs has expanded in recent years (Rousselière and Rousselière, 2017; Beghin and Gustafson, 2021; Strobbe et al., 2023). By contrast, research on farmers' attitudes towards NGTs remains more limited (Chatzopoulou and Chatzopoulos, 2024; Agnoli et al., 2025). Only a few studies have examined farmers' views on NGT-derived crops in Europe, and, to our knowledge, none have focused on Central and Eastern European countries. This gap is important because the adoption of new agricultural technologies differs substantially across EU Member States.

Farmers play a central role in the adoption and diffusion of NGTs. Their willingness to use these technologies directly affects their implementation in agricultural practice. Understanding farmers' knowledge, risk perceptions, trust and adoption conditions is therefore essential for effective agricultural and innovation policy (Greiner and Gregg, 2011). In the EU, adoption remains uncertain due to regulatory ambiguity and lower social acceptance compared with conventional crops (Pokrivcak et al., 2024). Against this background, this paper examines how Slovak farmers perceive NGTs and identifies the factors determining their readiness to adopt them.

The study applies a mixed-methods approach combining a representative quantitative survey with focus group discussions. The survey provides systematic evidence on farmers' awareness, attitudes and adoption intentions, while the focus group offers qualitative insights into the reasoning behind farmers' views.

Material and Methods

We conducted a representative online survey among Slovak farmers between January and March 2025. The survey was administered by an external company conducting annual farmer surveys for the Ministry of Agriculture and Rural Development of the Slovak Republic. The sample included 202 respondents and was representative by farm type, farm size, gender, age, education of the farm decision-maker and geographical location. A pilot survey with 10 respondents was conducted in 2024. All respondents were involved in strategic farm decision-making. The sample covered all Slovak regions and reflected the heterogeneous structure of Slovak agriculture, dominated by cooperatives and limited liability companies.

The survey was complemented by a focus group with experts and representatives of major Slovak agricultural organisations. The discussion explored perceived benefits, risks and barriers to NGT adoption, including agronomic performance, consumer acceptance, labelling, traceability, competitiveness, trade and possible market concentration in the seed sector.

Several non-parametric tests were applied. The Friedman test examined differences in perceived risk across seven domains. Kruskal–Wallis tests assessed differences by age group. The chi-square test examined the relationship between education and trust in public institutions and scientists, while the Mann–Whitney U test assessed whether opinions on conventional breeding and NGTs differed by education level.

A Discrete Choice Experiment analysed farmers' preferences for wheat varieties differing in selling price, yield, tolerance to drought, diseases and pests, and whether the seed was developed using NGTs. Respondents completed nine choice tasks using a D-efficient design generated in STATA. The data were analysed using a

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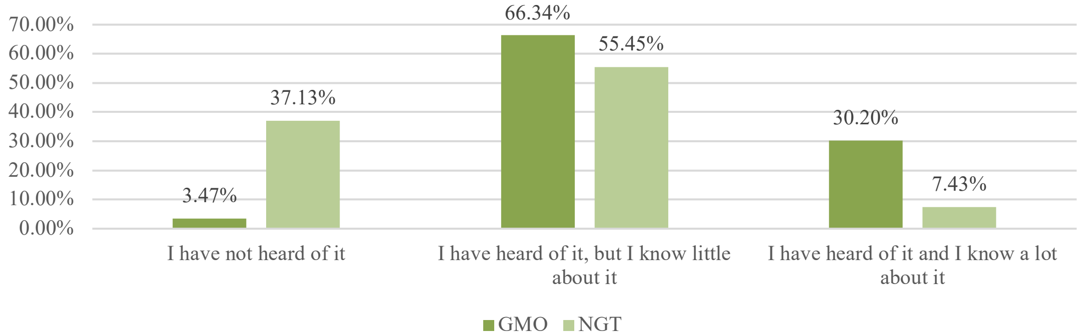
Mixed Logit Model, and willingness to produce NGT-derived crops was calculated using willingness-to-sell estimates.

Results

Awareness and understanding of NGTs

The results show that Slovak farmers are considerably more familiar with genetically modified organisms (GMOs) than with new genomic techniques (NGTs). Only 3.47% of respondents reported that they had never heard of GMOs, while 37.13% had never heard of NGTs. At the same time, most respondents had only limited knowledge of both technologies: 66.34% had heard of GMOs but knew little about them, compared with 55.45% for NGTs. A high level of knowledge was reported by 30.20% of respondents for GMOs, but only by 7.43% for NGTs. These results indicate a substantial awareness gap concerning NGTs and point to the need for targeted communication and educational activities.

Figure 1: Awareness about GMO and NGT



Source: own processing, 2025

After respondents were provided with a short explanatory text about NGTs, their understanding improved. Overall, 38.61% stated that they understood the benefits of NGTs compared with traditional breeding, while 51.98% reported partial understanding. Only 9.41% indicated that they did not understand the potential improvements at all. Respondents also demonstrated strong factual understanding of basic genetic concepts and potential NGT applications. Almost all respondents correctly recognised that organisms possess genes carrying genetic information, and most correctly rejected the false statement that potatoes do not have genes. A large majority also understood that NGTs can improve plant resistance to drought, heatwaves and pests, generate results similar to conventional breeding more rapidly and precisely, and help reduce harmful chemical inputs. Awareness of regulatory safeguards was slightly lower, although still high. Overall, the findings suggest that farmers can understand the basic principles and potential applications of NGTs when information is provided in an accessible form.

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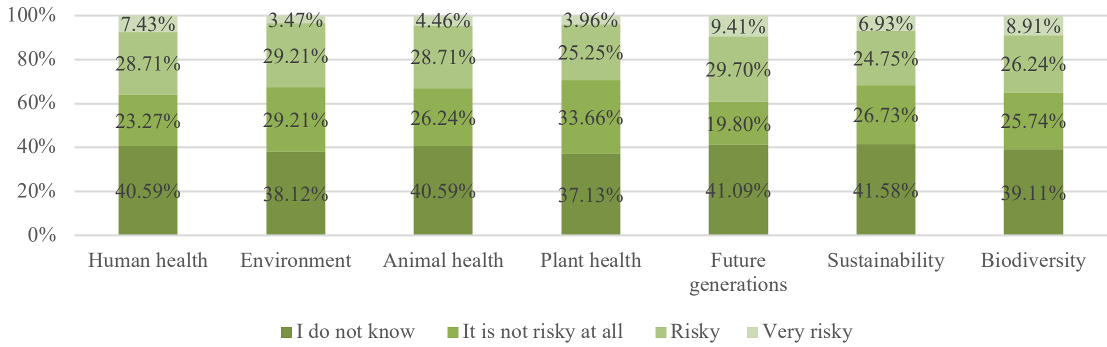
Attitudes towards NGTs and perceived risks

Farmers expressed more favourable attitudes towards conventional breeding than towards NGTs. Only 0.99% of respondents held a negative attitude towards conventional breeding, compared with 9.41% for NGTs. Positive attitudes were reported by 69.31% of respondents for conventional breeding and by 31.19% for NGTs. This indicates that NGTs are not broadly rejected, but farmers remain more cautious and less clearly positive than in the case of conventional breeding.

Risk perceptions were assessed across seven domains: human health, the environment, animal health, plant health, future generations, long-term ecological sustainability and biodiversity. A substantial share of respondents selected “I don’t know” across all domains, ranging from approximately 37% to 42%. This high level of uncertainty suggests that many farmers do not feel sufficiently informed to assess the risks of NGT-derived products. The greatest concerns were associated with future generations and biodiversity, followed by human health.

Figure 2: Risk of NGTs



Source: own processing, 2025

In contrast, perceived risks to plant health and animal health were lower. Between 23% and 34% of respondents considered NGT products to be “not risky at all” across the evaluated domains, indicating that a segment of farmers perceives NGTs as relatively safe.

The Friedman test confirmed statistically significant differences in perceived risk across the seven domains, $\chi^2(6) = 45.76$, $p < 0.001$. The highest mean risk rank was assigned to future generations, followed by human health and biodiversity. Plant health received the lowest mean rank, indicating that respondents considered this domain least risky. Post-hoc Wilcoxon signed-rank tests showed that risks to future generations were perceived as significantly higher than risks in all other domains. By contrast, plant-related risks were perceived as significantly lower than risks to human health, animals and future generations. These results reveal a clear pattern: farmers are less concerned about immediate agronomic impacts and more concerned about long-term, intergenerational and ecological consequences.

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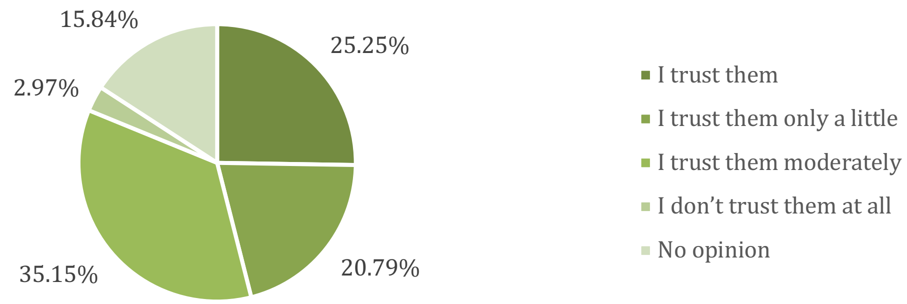
Trust, education and socio-demographic differences

Trust in public institutions and scientists as sources of information on NGTs was generally moderate to high. In total, 35.2% of respondents stated that they trusted these sources moderately, while 25.3% expressed full trust. Thus, approximately 60.5% of respondents had at least a moderate level of trust in institutional and scientific actors. However, 20.8% trusted them only slightly, 3% did not trust them at all, and 15.8% had no opinion.

Figure 3: Level of trust in institutions



Source: own processing, 2025

These findings suggest that scientific and public institutions are viewed as relatively credible, but that communication strategies must also address farmers with low trust or no clear opinion.

The chi-square test of independence showed a statistically significant relationship between education level and trust in public institutions and scientists, $\chi^2(4, N = 202) = 27.92$, $p < 0.001$. Respondents with university education were more likely to express full trust, while respondents with secondary education were more likely to report no opinion. The association was moderate in strength, as indicated by Cramér's $V = 0.372$. This suggests that education is an important factor shaping trust in institutional and scientific information on NGTs.

Kruskal–Wallis tests were used to examine whether perceived risk differed across age groups. The results showed no statistically significant age-based differences in any of the seven domains. The domain of plant health approached significance, $\chi^2(3) = 6.497$, $p = 0.090$, but did not reach the conventional threshold. Although not statistically conclusive, mean rank patterns suggested that younger respondents tended to assign somewhat higher risk ratings across several domains, particularly plant health, sustainability and human health. This trend may merit further examination in future research.

The Mann–Whitney U test showed that education level significantly influenced opinions on conventional breeding. Respondents with university education had a higher mean rank than those with secondary education, indicating a more favourable view of conventional breeding; the difference was statistically significant, $p = 0.003$. In

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contrast, opinions on NGTs did not differ significantly by education level, $p = 0.179$. This suggests that while education affects perceptions of conventional breeding, attitudes towards NGTs remain more uniform and possibly shaped by uncertainty rather than formal education alone.

Focus group findings

The focus group discussion provided qualitative insight into the survey findings. Participants included representatives of major Slovak agricultural organisations and experts from the agricultural sector. The discussion began with a presentation explaining the differences between NGTs and GMOs and outlining the proposed EU regulatory framework for NGT plants.

Participants identified several potential benefits of NGTs, including higher yields, improved resistance to pests and diseases, greater tolerance to extreme weather conditions and reduced chemical input use. These benefits were considered relevant for food security, competitiveness and the environmental objectives of the EU Green Deal. At the same time, participants expressed concerns about consumer acceptance, noting that previous experience with GMOs had created persistent public scepticism. They agreed that consumer trust would require transparent communication, education and public awareness campaigns.

Economic and trade implications were also emphasised. Participants argued that countries outside the EU with more flexible NGT regulations could gain a competitive advantage in agricultural exports. If Slovakia and the EU lag behind in NGT adoption, domestic producers may face stronger competition from cheaper imported NGT products, weakening the market position of Slovak farmers.

Opinions were not uniform. Supporters viewed NGTs as a tool for improving efficiency and sustainability, while others stressed the need for consumer trust, regulatory transparency, labelling and traceability. Opponents, including organic farming representatives, raised concerns about long-term risks, biodiversity loss, corporate control over seeds and farmer dependence on a limited number of suppliers.

Discrete choice experiment and willingness to sell

The mixed logit model was used to analyse the discrete choice experiment and estimate farmers' willingness to sell wheat varieties with different attributes. The model accounted for preference heterogeneity and repeated choices by respondents. The results show that farmers strongly value agronomic improvements. Higher yield levels were associated with negative willingness-to-sell estimates, meaning that farmers were willing to accept a lower selling price per tonne in exchange for higher total output per hectare. Compared with the reference yield of 4.50 t/ha, farmers were willing to accept EUR 39.16 less per tonne for a yield of 5.03 t/ha, EUR 86.34 less for 5.57 t/ha and EUR 143.76 less for 6.10 t/ha. All yield effects were statistically significant.

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Table 1: Willingness to sell – Main effects model

Attribute	Coefficient	Std. Error	z-value	p-value	95% Confidence Interval
Yield: 5.03 t/ha	-39.162	10.450	-3.750	0.000	[-59.644, -18.680]
Yield: 5.57 t/ha	-86.338	16.316	-5.290	0.000	[-118.317, -54.359]
Yield: 6.10 t/ha	-143.762	25.267	-5.690	0.000	[-193.28, -94.240]
Stress tolerance	-78.423	13.034	-6.020	0.000	[-103.96, -52.876]
NGT	65.741	12.857	5.110	0.000	[40.541, 90.941]

Note: Reference group for yield: 4.50 t/ha; stress tolerance = high stress tolerance relative to low; NGT = production process employing NGTs (relative to conventional production process without NGTs).
Source: own processing, 2025

Enhanced stress tolerance was also highly valued. Farmers were willing to accept EUR 78.42 less per tonne for varieties with higher tolerance to drought, diseases and pests. This confirms the importance of production resilience under changing climatic and agronomic conditions. In contrast, the NGT attribute had a positive willingness-to-sell estimate of EUR 65.74 per tonne. This means that farmers would require a higher selling price to choose an NGT-derived wheat variety over a conventional one. The positive compensation requirement indicates scepticism or perceived uncertainty associated with NGT adoption, potentially related to market acceptance, regulation, consumer response or reputational risk.

Conclusion

Based on a representative survey, focus group discussion and discrete choice experiment, the results show that awareness of NGTs remains lower than awareness of GMOs, although most respondents understood their main principles after receiving basic information.

Farmers recognised the potential agronomic benefits of NGTs, particularly higher yields, improved stress tolerance and resistance to pests and diseases. However, attitudes toward NGTs were more cautious than toward conventional breeding. The strongest perceived risks concerned future generations, biodiversity and long-term ecological sustainability. Trust in scientists and public institutions was higher among university-educated respondents, but attitudes toward NGTs did not differ significantly by education level.

The focus group confirmed that NGTs are seen as a potentially useful tool for improving competitiveness and sustainability, especially under climate change. At the same time, stakeholders stressed the need for transparent regulation, traceability, clear communication, consumer education and safeguards against market concentration.

The discrete choice experiment showed that farmers value higher yields and improved stress tolerance, while the NGT attribute reduced choice probability. Overall,

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NGT adoption in Slovakia will depend on regulatory clarity, consumer acceptance, credible communication, market incentives and protection against potential market distortions.

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Further information, including the conference programme, is available on the official conference website: https://isd2026.fem.uniag.sk/.

The peer-reviewed Book of Abstracts is available online at: https://shorturl.at/J234h

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POLITICAL ECONOMY OF DECISION-MAKING ON NEW GENOMIC TECHNIQUES

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Abstract

This paper analyses the political-economic determinants of the recent shift in European Union legislation on New Genomic Techniques (NGTs). For decades, restrictive regulation on genetically modified (GM) crops limited the development of agricultural biotechnology despite scientific evidence of their safety and potential contribution to sustainability goals. The study examines how changes in public attitudes, technological developments, and institutional features of EU decision-making contributed to the adoption of NGT-enabling legislation in 2025.
The paper employs a theoretical spatial political economy model of EU policymaking under the ordinary legislative procedure. Policy outcomes are analysed based on the preferences of key actors—the European Commission, the European Parliament, and the Council—together with the institutional status quo bias. The model captures how shifts in the distribution of preferences among member states and political actors affect the feasibility of regulatory reform.
The results show that the adoption of NGT regulation required substantial shifts in the preferences of pivotal member states in the Council and the median member of the European Parliament. Persistent legislative gridlock in the GMO regime is explained by insufficient preference changes and the inability to form a qualified majority. The eventual reform reflects increasing acceptance of NGTs as less controversial and more aligned with environmental and food security objectives. The paper contributes by providing a theoretical framework linking technological change, public preferences, and institutional constraints in EU policymaking, and by explaining the conditions under which regulatory reform becomes feasible.

Key words: New Genomic Techniques (NGT), EU agricultural policy, legislative gridlock, political economy

JEL classification: Q18; Q58; D72

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INTRODUCTION

The global development and adoption of genetically modified (GM) crops has progressed unevenly, with the European Union (EU) representing a notable outlier. While GM technologies have been widely adopted in other regions since the 1980s - primarily for feed crops such as maize and soy, and for industrial uses such as cotton - the EU has effectively halted their diffusion through stringent regulatory barriers. This stands in contrast to the rapid dissemination of improved seed varieties during the Green Revolution, which significantly contributed to reducing global hunger and poverty (Pingali, 2012; Herring and Paarlberg, 2016).

The EU's restrictive regulatory framework has had implications beyond its borders, affecting international trade and contributing to lower global acceptance of GM crops (Herring and Paarlberg, 2016). Importantly, this regulatory stance is not grounded in scientific consensus. Authorities such as the European Food Safety Authority (EFSA), along with numerous scientific academies, have consistently found no evidence that GM crops pose greater risks than conventionally bred varieties (DeFrancesco, 2013; Paarlberg, 2008).

More recently, advances in New Genomic Techniques (NGTs) have enabled targeted genetic modifications that can mimic changes achievable through conventional breeding or in nature. Unlike traditional GM organisms based on transgenesis, NGTs rely on more precise interventions within sexually compatible species, potentially improving both efficiency and public acceptance. Despite this technological progress, NGT development in the EU has also been constrained by regulatory uncertainty, as these techniques were historically subject to the same strict rules as GM crops (Purnhagen and Wesseler, 2021).

The persistence of restrictive regulation is commonly attributed to low public acceptance of biotechnology, which has shaped policy through political economy mechanisms (Scholderer, 2005). Institutional features of EU decision-making - such as qualified majority voting and multi-level governance - have further contributed to regulatory inertia and status quo bias (Pokrivčák et al., 2006). Although new legislation

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adopted in 2025 aims to enable the development and use of NGTs, the political and institutional drivers of this policy shift remain insufficiently understood.

This paper analyzes the political economy of biotechnology regulation in the EU, with a particular focus on the transition from GM technologies to NGTs. We develop a spatial model of EU decision-making to examine how changes in technology and public preferences affect policy outcomes. The model captures the interaction between member states' preferences, societal attitudes toward biotechnology, and institutional constraints in the legislative process.

The paper contributes in three main ways. First, it provides a theoretical framework linking technological change in agricultural biotechnology to policy outcomes within a multi-level governance system. Second, it explicitly models the role of public preferences and their evolution in shaping regulatory equilibria. Third, it offers insights into the conditions under which policy reform—such as the recent shift toward NGT-enabling legislation—can emerge despite strong status quo bias.

The remainder of the paper is structured as follows. The next section reviews the relevant literature. This is followed by a description of NGTs and the EU decision-making framework. We then present the political economy model and discuss its implications. The final section concludes.

LITERATURE REVIEW

The literature identifies several explanations for the relatively low adoption and acceptance of genetically modified (GM) crops compared to innovations of the Green Revolution. A key factor is the difference in funding structures: while the Green Revolution was largely supported by public and non-profit investment, GM technologies have been predominantly financed by the private sector, shaping public perceptions and political responses (Herring and Paarlberg, 2016). The emergence of GM crops in the 1990s coincided with increasing public skepticism toward large corporations, which further contributed to resistance against the technology.

At the same time, growing societal emphasis on environmental sustainability and "naturalness" in food production reduced acceptance of GM crops (Schurman and

Kelso, 2003; Schurman and Munro, 2006). Improvements in global food security also weakened the perceived necessity of GM technologies, while risk perceptions—often unsupported by scientific consensus—became more salient in shaping consumer attitudes (Herring and Paarlberg, 2016).

Regulatory divergence between the European Union and the United States reflects these differences in public attitudes and institutional contexts. The EU has implemented significantly stricter regulations on GM crops, including more demanding requirements for risk assessment, labeling, and coexistence measures (Vigani et al., 2010). Lower social acceptance of GM foods in the EU (Curtis et al., 2004; Vogel, 2003), combined with the legacy of food safety crises (Graff and Zilberman, 2007) and lower trust in regulatory institutions (Gaskell et al., 2004), has contributed to this regulatory stance. Political economy factors, including lobbying by interest groups and differences in producer benefits, have further reinforced transatlantic divergence (Anderson et al., 2004; Graff and Zilberman, 2007).

Institutionally, EU decision-making is characterized by a status quo bias that favors existing policies over potentially contentious reforms (Swinnen and Vandemoortele, 2011; Pokrivčák et al., 2006). In spatial models of EU policymaking, policy outcomes depend on the interaction between institutional rules, the preferences of political actors, and the location of the status quo (Tsebelis, 1994; Crombez, 1996, 2000). Applications of such models to agricultural policy show how institutional structures influence the likelihood of reform (Pokrivčák et al., 2001; Henning and Latacz-Lohmann, 2004).

The emergence of New Genomic Techniques (NGTs) introduces an important shift in the political economy of biotechnology regulation. Acceptance of NGT-derived products varies across countries and demographic groups within the European Union (Rousselière and Rousselière, 2017; Beghin and Gustafsson, 2021). While consumers generally prefer conventionally bred products, NGTs are viewed more favorably than genetically modified organisms (GMOs) (Beghin and Gustafsson, 2021; Pokrivčák et al., 2026). A similar pattern holds among stakeholders, including producers, processors, and retailers.

This relative acceptance reflects several factors. First, NGTs are perceived as less controversial, as they typically do not involve transgenesis, i.e., the transfer of genetic material across non-crossable species. Second, the absence of realized risks associated with earlier biotechnologies has reduced perceived uncertainty compared to the 1990s. Third, NGTs are increasingly associated with policy objectives such as food security and climate change mitigation (Lemarié and Marette, 2022; Sundström et al., 2024).

From a political economy perspective, these shifts in perceptions translate into changes in the preferences of voters and stakeholders, which in turn affect the positions of policymakers. In the context of spatial models, this implies a systematic shift in the distribution of ideal points toward less restrictive regulation relative to the GMO regime. This mechanism provides the micro-foundation for the preference shifts that are central to the empirical and theoretical analysis developed in this paper.

BACKGROUND

Global Adoption of GM and NGT Technologies

The global adoption of genetically modified (GM) crops is highly concentrated. The United States accounts for approximately 36% of global GM crop area, followed by Brazil (32%), Argentina (11%), Canada (6%), and India (5%). Globally, GM crops are cultivated on about 210 million hectares, dominated by soybean, maize, cotton, and canola. In contrast, GM cultivation in the European Union remains negligible, with approximately 66,000 hectares, almost entirely located in Spain and Portugal (AGbioinvestor, 2025).

The development of New Genomic Techniques (NGTs) is more geographically dispersed. China and the United States lead in the number of developed applications, followed by several European and Asian countries, indicating growing global interest in next-generation plant breeding technologies (EU-SAGE, 2025).

Regulation of GM Crops in the EU

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The EU has established a comprehensive regulatory framework for GM organisms. Directive 2001/18/EC governs the approval of GM crops for cultivation and market placement, defining GM organisms as those whose genetic material has been altered in ways not occurring naturally through reproduction or recombination. Approvals for GM food and feed are regulated under Regulation (EC) No 1829/2003, while labeling and traceability requirements are specified in Regulation (EC) No 1830/2003.

The approval process follows a two-stage system: scientific risk assessment conducted by the European Food Safety Authority and risk management by the European Commission and member states. Although procedures are harmonized at the EU level, member states retain discretion to restrict or prohibit GM cultivation under safeguard clauses and, since 2015, on non-scientific grounds.

NGT Regulation

In 2023, the European Commission proposed a revised regulatory framework distinguishing certain NGTs from traditional GM techniques. The reform introduces a differentiated approach based on the nature of genetic modifications. NGT plants are defined as those developed through targeted mutagenesis or cisgenesis, without introducing genetic material from outside the breeders' gene pool.

The legislation classifies NGT plants into two categories. Category 1 includes plants that could occur naturally or through conventional breeding and are therefore exempt from existing GMO regulations, including labeling requirements. Category 2 includes all other NGT plants, which remain subject to GMO legislation, albeit with somewhat simplified procedures.

The proposal was adopted by the European Parliament in 2024 and approved by the Council in 2025 following trilogue negotiations with the Commission. The reform aims to establish a more science-based and innovation-friendly regulatory environment while maintaining safeguards for higher-risk applications.

Ordinary Legislative Procedure

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NGT regulation is adopted under the EU's ordinary legislative procedure. The European Commission initiates legislation, which is then subject to approval by both the European Parliament and the Council.

The Parliament decides by simple majority in the first reading and by absolute majority in the second reading. The Council adopts positions by qualified majority. In cases of disagreement, a conciliation process is initiated, involving negotiations between the Parliament and the Council, with the Commission acting as mediator. Agreement is reached through a joint text, which must be approved by both institutions.

This multi-stage, multi-actor procedure introduces additional constraints into policymaking and plays a central role in shaping regulatory outcomes, as highlighted in the political economy model developed in this paper.

METHODOLOGY

To analyze the adoption of regulation on New Genomic Techniques in the European Union, we employ a spatial model of policymaking under the ordinary legislative procedure. In such models, policy outcomes depend on institutional rules, the preferences of political actors, and the location of the status quo (Tsebelis and Garrett, 1996; Crombez, 1996, 2000).

Policy Space and Preferences

Policy is defined on a one-dimensional space $P \subset \mathbb{R}$, representing the stringency of biotechnology regulation. At one extreme, P_L corresponds to minimal regulation (NGTs treated as conventional crops), while P_R represents a complete ban. The status quo reflects existing GMO regulation.

Each actor j has single-peaked, Euclidean preferences over policy:

$$U_j(P) = -(P_j - P_{EU})^2 \quad (1)$$

where $P_j \in P$ denotes actor j's ideal point. Preferences are shaped by factors such as agricultural competitiveness, environmental orientation, public acceptance of biotechnology, and trust in institutions.

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We assume that governments maximize their political support which is maximized at its ideal point. Each member state of the EU has an optimal level of biotechnology regulation represented by a point on the line. The further the country is from its ideal point, either to the left or to the right, the less political support domestic government of the member state obtains.

Inside the EU, ideal points of member states might change relative to the situation when the member state is outside the EU. The change of ideal level of biotechnology regulation inside the EU vs outside the EU might be because of effects of EU membership on domestic agriculture and food economy, effects of EU regulation on domestic competitiveness of farmers, or different level of trust (higher or lower) in EU institutions relative to domestic institutions.

Political Actors

The key players are the European Commission, the European Parliament, and the Council. The Commission and Parliament are represented by their median actors, P_C and P_{EP}, respectively, reflecting simple majority voting. In contrast, the Council operates under qualified majority voting, implying two pivotal member states, P_a and P_b, which determine the set of feasible policy changes. Under majority rule the ideal point of the median player cannot be defeated by other policies in voting using simple majority.

The Council uses qualified majority rather than simple majority. The Council therefore cannot be represented by ideal point of the median Council member. There are two member states that are pivotal under the qualified majority rule. Member state *a (b)* (Figure 1) is pivotal for a move of the policy to the right. Member state *a (b)* together with all member states with ideal points to the right (left) of member state *a (b)* have together qualified majority while all member states with ideal points to the right (left) of member state *a (b)* do not have qualified majority without member state *a (b).*

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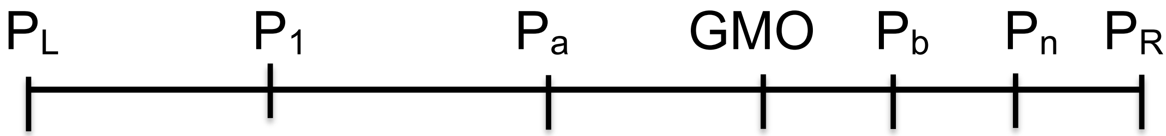
Figure 1. Positions of players on the GM regulation in the past.



Source: Own elaboration

Institutional Setting and Reform Potential

We assume that the status quo (GMO regulation) lies to the right of the pivotal member state P_b. In this case, the set of policies that can obtain a qualified majority in the Council (the qualified majority set, QMS) consists of all policies preferred by P_b to the status quo.

The European Parliament accepts any policy closer to its ideal point than to the status quo. Thus, feasible reforms must lie in the intersection of:

(i) the qualified majority set in the Council, and
(ii) (ii) the set of policies preferred by the Parliament to the status quo.

Technological Shift and Preference Change

We model the introduction of NGTs as a leftward shift in the distribution of member states' ideal points relative to their positions under GMO regulation. This reflects lower perceived risks, greater precision of NGTs, and their alignment with environmental and food security objectives. Consequently, reform becomes feasible if this shift is sufficient to generate a qualified majority in favor of moving away from the status quo.

Equilibrium

The policy outcome is determined through sequential bargaining under the ordinary legislative procedure. Assuming complete information and rational behavior, the equilibrium corresponds to a subgame perfect Nash equilibrium.

The equilibrium policy must:

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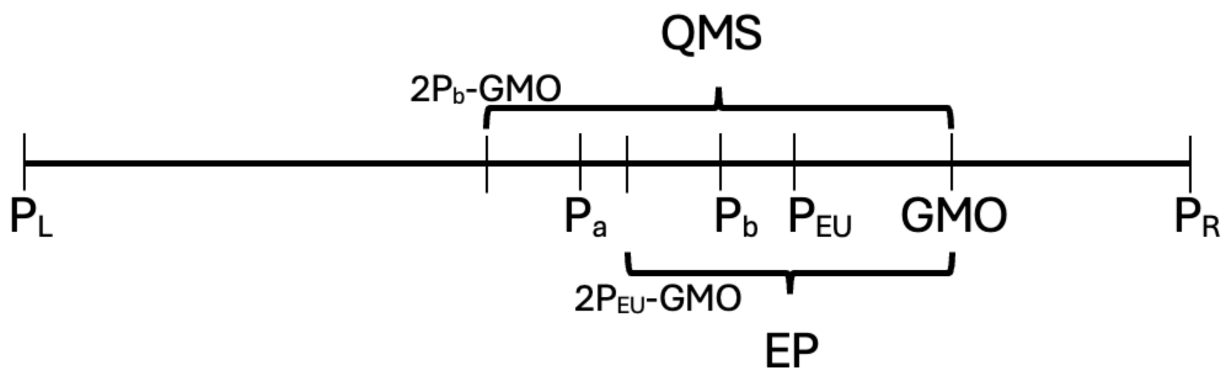
be preferred to the status quo by both the European Parliament and a qualified majority in the Council and lie between the ideal points of the European Parliament P_{EP} and the pivotal Council member state P_a.

Thus, the equilibrium set is given by:

$$P^* \in [P_a, P_{EP}] \qquad (2)$$

with the exact outcome determined by relative bargaining power in the conciliation stage on the relative bargaining powers in the Conciliation Committee.

Figure 2. Positions of players on the NGT regulation.



Source: Own elaboration

Results and discussion

The adoption of less restrictive regulation on New Genomic Techniques (NGTs), relative to the existing GMO regime, requires a shift in the preferences of both EU member states and the median member of the European Parliament. The magnitude of reform depends on the extent to which the ideal points of the pivotal Council member states and the Parliament move relative to their positions under the GMO status quo.

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The scope for reform is bounded. The maximum feasible shift toward less restrictive regulation is constrained by the position of the pivotal member state in the Council (P_a) and the median position in the European Parliament (P_{EP}). As a result, even when reform is possible, its extent is limited by institutional and preference heterogeneity across actors.

Status quo persistence arises when the existing GMO regulation lies within the interval defined by the pivotal Council members (P_a, P_b), implying that no qualified majority supports change. Reform may also fail if the Council and the Parliament do not agree on the direction of policy adjustment. These conditions generate a structural status quo bias in EU policymaking.

The multi-level governance structure of the European Union further constrains reform. Unlike in single-level systems, policy change requires agreement across multiple institutions with distinct preference distributions. Joint decision-making therefore narrows the set of feasible reforms relative to settings where only a single legislative body determines outcomes.

The findings of this study highlight the central role of preference shifts in enabling regulatory change in biotechnology within the European Union. While institutional features of EU decision-making—particularly qualified majority voting in the Council and bicameral approval—generate a strong status quo bias, these constraints alone do not fully explain the persistence or eventual reform of restrictive GMO regulation. Instead, changes in underlying preferences among voters, stakeholders, and policymakers are critical for overcoming institutional inertia.

Recent literature indicates that attitudes toward New Genomic Techniques (NGTs) are more favorable than toward genetically modified organisms (GMOs), both among consumers and along the agri-food value chain (Pokrivčák et al., 2026). This relative acceptance reflects several factors. NGTs are perceived as less controversial, as they typically do not involve transgenesis across non-crossable species. In addition, the absence of realized risks associated with earlier biotechnologies has reduced perceived uncertainty compared to the 1990s. Furthermore, NGTs are increasingly viewed as contributing to key policy objectives, including food security and climate change mitigation.

These developments provide a micro-foundation for the preference shifts identified in the spatial political economy model. As public perceptions evolve, they translate into changes in the positions of member states and the European Parliament, thereby altering the feasibility of policy reform. In particular, a leftward shift in the distribution of ideal points—toward less restrictive regulation—enables the formation of a qualified majority in the Council and alignment with the Parliament, which are necessary conditions for legislative change under the ordinary legislative procedure.

At the same time, the results suggest that institutional constraints continue to shape both the timing and the scope of reform. Even with more favorable attitudes toward NGTs, the extent of policy change remains bounded by the preferences of pivotal actors in the Council and the median position in the European Parliament. This explains why regulatory change has been gradual rather than abrupt, and why elements of the previous GMO regulatory framework persist.

Overall, the analysis underscores that biotechnology regulation in the EU is determined by the interaction between evolving societal preferences and institutional structures. While institutions impose constraints and generate status quo bias, shifts in public and stakeholder attitudes are ultimately decisive in enabling policy change.

Conclusion

For decades, restrictive EU regulation limited the development and adoption of GM technologies, despite a lack of scientific evidence indicating higher risks relative to conventional breeding. The adoption of enabling NGT legislation in 2025 represents a significant policy shift, creating conditions for the development of modern biotechnology in the EU.

Our spatial political economy model explains both the persistence of restrictive GMO regulation and the conditions under which reform became feasible. The analysis shows that policy change required sufficiently large shifts in the preferences of pivotal actors in the Council and the median member of the European Parliament. Absent such shifts, the combination of qualified majority voting and bicameral decision-making generated persistent legislative gridlock.

The results highlight two sources of status quo bias: (i) insufficient preference change among pivotal member states in the Council, preventing the formation of a qualified majority, and (ii) limited movement in the European Parliament's median position. Together, these institutional and preference constraints explain the long-standing stability of restrictive GMO regulation.

The eventual transition toward NGT-enabling legislation reflects changes in public attitudes and perceived benefits of biotechnology. Compared to GM technologies, NGTs are viewed as less controversial, more precise, and more aligned with environmental and food security objectives. As public perceptions evolved—partly due to the absence of realized risks from earlier technologies and the growing emphasis on sustainable agriculture—political preferences shifted accordingly, enabling reform.

Overall, the findings suggest that while EU decision-making institutions reinforce status quo bias, policy outcomes are ultimately driven by underlying preference changes among voters and political actors. Institutional constraints shape the timing and extent of reform, but do not fully determine its direction.

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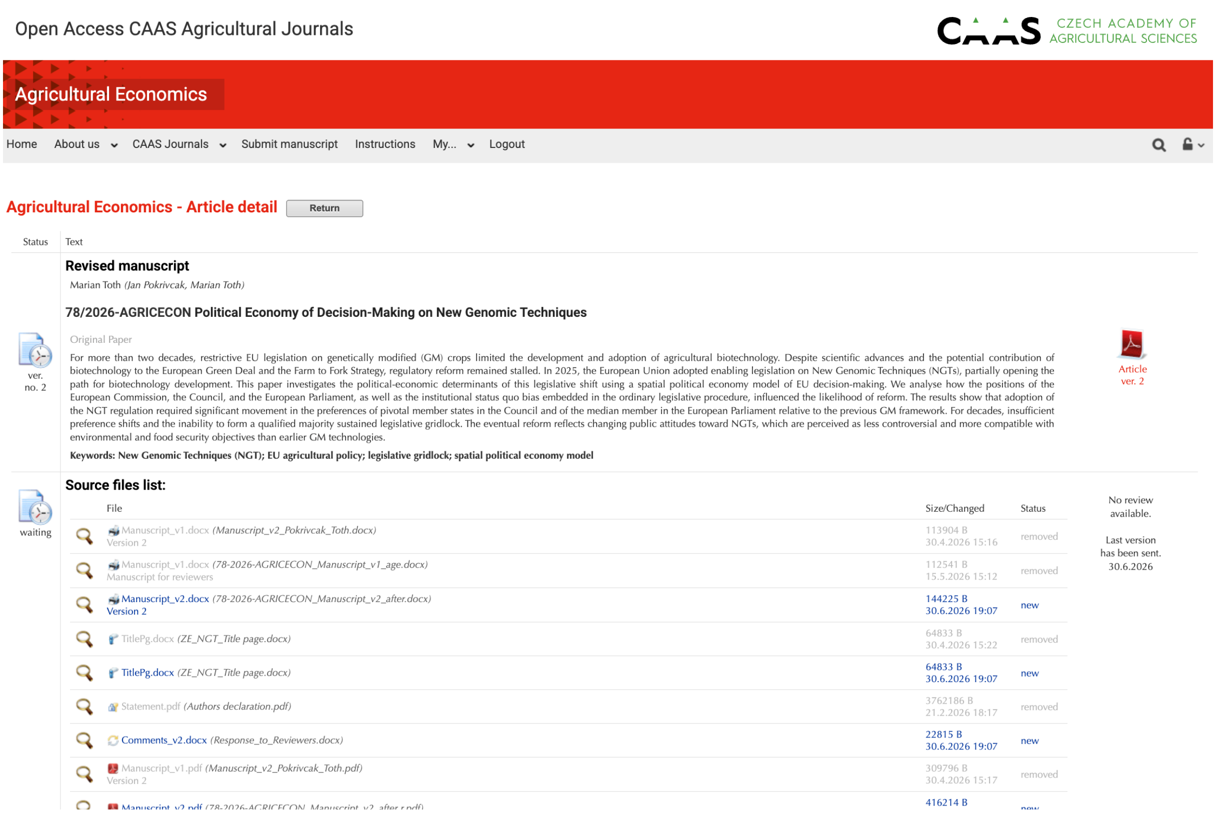

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Marian Toth *(Jan Pokrivcak, Marian Toth)*

78/2026-AGRICECON Political Economy of Decision-Making on New Genomic Techniques

ver. no. 2

Original Paper

For more than two decades, restrictive EU legislation on genetically modified (GM) crops limited the development and adoption of agricultural biotechnology. Despite scientific advances and the potential contribution of biotechnology to the European Green Deal and the Farm to Fork Strategy, regulatory reform remained stalled. In 2025, the European Union adopted enabling legislation on New Genomic Techniques (NGTs), partially opening the path for biotechnology development. This paper investigates the political-economic determinants of this legislative shift using a spatial political economy model of EU decision-making. We analyse how the positions of the European Commission, the Council, and the European Parliament, as well as the institutional status quo bias embedded in the ordinary legislative procedure, influenced the likelihood of reform. The results show that adoption of the NGT regulation required significant movement in the preferences of pivotal member states in the Council and of the median member in the European Parliament relative to the previous GM framework. For decades, insufficient preference shifts and the inability to form a qualified majority sustained legislative gridlock. The eventual reform reflects changing public attitudes toward NGTs, which are perceived as less controversial and more compatible with environmental and food security objectives than earlier GM technologies.

Keywords: New Genomic Techniques (NGT); EU agricultural policy; legislative gridlock; spatial political economy model

Article ver. 2

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Manuscript_v2.docx *(78-2026-AGRICECON_Manuscript_v2_after.docx)* Version 2	144225 B 30.6.2026 19:07	new
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