Doctrinal and Comparative Assessment of GMO Liability Laws in the UAE

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ABSTRACT

Genetically modified organisms (GMOs) have become an integral part of modern biotechnology. However, their increasing use has sparked complex debates. The controversy pertains to balancing the benefits of biotechnological improvements against potential risks to biodiversity and public health. The current study aims to critically evaluate the legal texts related to accountability and civil liability for damages caused by GMOs. It seeks to assess the adequacy of UAE legislation in establishing effective mechanisms for liability and compensation for environmental and health impacts, thus answering the central question to what extent does the current UAE law enhance accountability compared to international standards. It employs a descriptive-analytical and comparative legal approach based on the analysis and critique of relevant international and UAE legal documents. The findings reveal that the UAE has established an advanced regulatory system aligned with international standards; however, significant legal gaps remain in definitional clarity, sanctions framework, liability rules, and enforcement provisions. The study concludes with a synthesis table and figure mapping points of convergence and difference between national and international instruments. The study recommends further development of the rules related to compensation and penalties to ensure appropriate legal deterrence for GMO-related harm and calls for legislative amendments that enhance the clarity of texts and their integration with international frameworks.

Introduction

Genetically modified organisms are plants, animals, or microorganisms whose genetic material has been altered through modern biotechnology or genetic engineering techniques in ways that do not occur naturally "by mating and/or natural recombination and encompasses those produced artificially in whole or in part".[1] GMOs are defined as "organisms that are genetically engineered/modified, especially for commercial gains." To ensure the safety of GMOs prior to

[1] Sunil Kumar Verma and others, 'Genetically Modified Organisms and Environment', in *Climate Change and Sustainable Developments* (Boca Raton: CRC Press, 2025), pp. 206–27 https://doi.org/10.1201/9781003654438-12 H. Mammadov and A. Gulamova, 'Impact of Genetically Modified Organisms on Human Health', *Bulletin of Science and Practice*, 11.2 (2025), 145–50 https://doi.org/10.33619/2414-2948/111/18

commercialization, each country has established regulatory frameworks for promoting risk assessment and biosafety, namely; stages and processes for approval and monitoring, mechanisms for risk assessment, and labeling protocols of genetically modified products.[2]

Recently, GMOs have seen expanding application across various fields, namely; agriculture, medicine, and industry, raising significant legal and regulatory concerns at both the national and international levels.[3] These organisms provide notable benefits, including improved agricultural productivity, enhanced pest resistance, and greater resilience to major environmental challenges such as climate change and pollution.[4] They can also reduce greenhouse gas emissions, lower fuel consumption, and decrease the use of pesticides and chemical fertilizers.[5] However, the use of GMOs may lead to the emergence of pesticides resistance, potential toxic effects on plants, difficulty in controlling pathogens, risks of gene transfer to wild species, increased rates of allergies, in addition to their impact on biodiversity.[6] Ultimately, the true test of any legal regime occurs not during its formulation, but in its implementation and actual impact.[7]

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[2] Siddhesh B. Ghag, 'Genetically Modified Organisms and Their Regulatory Frameworks', in *Global Regulatory Outlook for CRISPRized Plants* (Elsevier, 2024), pp. 147–66 https://doi.org/10.1016/B978-0-443-18444-4.00023-5

[3] Anca Amalia Udriste and Liliana Badulescu, 'Genetically Modified Organisms', *Research Journal of Agricultural Science*, 49.4 (2017), 308–13; Richard J. Roberts and Viviane Naimy, 'Overcoming Agricultural Challenges with GMOs as a Catalyst for Poverty Reduction and Sustainability in Lebanon', *Sustainability*, 15.23 (2023), 16187 https://doi.org/10.3390/su152316187 V. D. Naumenko and others, 'Development of Biosensor Technologies for the Determination of Genetically Modified Organisms', *Visnik Ukrains'kogo Tovaristva Genetikiv i Selekcioneriv*, 22.1–2 (2025), 56–66 https://doi.org/10.7124/visnyk.utgis.22.1-2.1689

[4] Jianyu Deng, 'Enhancing Environmental Conservation through the Implementation of GMOs', *MedScien*, 1.9 (2024) https://doi.org/10.61173/z026t125

[5] Graham Brookes, 'Genetically Modified (GM) Crop Use 1996–2020: Impacts on Carbon Emissions', *GM Crops & Food*, 13.1 (2022), 242–61 https://doi.org/10.1080/21645698.2022.2118495 Zakia Batool, Qurat ul Ain, and Abdul Rehman, 'Exploring the Effects of Farm Mechanization, Financial Development, and Renewable Energy on China's Food Production', *Environment, Development and Sustainability*, 26.7 (2023), 18883–902 https://doi.org/10.1007/s10668-023-03419-2

[6] Kelvin Ngongolo and Gideon S. Mmbando, 'Necessities, Environmental Impact, and Ecological Sustainability of Genetically Modified (GM) Crops', *Discover Agriculture*, 3.1 (2025), 29 https://doi.org/10.1007/s44279-025-00180-0

[7] Maya Khater and Yassine Chami, 'Effectiveness of the Legal Framework for Humanitarian Assistance during Armed Conflicts: The Aggression against Lebanon as a Case Study', *Research Journal in Advanced Humanities*, 6.1 (2025) https://doi.org/10.58256/caqpva90 Maya Khater and others, 'Assessing the Impact of Green Tourism on Sustainable Development: A Case Study of the United Arab Emirates', *Research Journal in Advanced Humanities*, 6.2 (2025) https://doi.org/10.58256/0m0wvr07 Maximilian Haag, Steffen Hurka, and Constantin Kaplaner, 'Policy Complexity and Implementation Performance in the European Union', *Regulation & Governance*, 19.3 (2025), 656–74 https://doi.org/10.1111/rego.12580

GMOs are currently used across many sectors, including livestock and health care, but their most prominent applications are in the agricultural field.[8] According to the 2024 report on the global areas planted with genetically modified crops, the total area reached about 209.8 million hectares, which represents an increase of 1.9% over the previous year. Five countries account for more than 90% of this area: the United States of America (38%), Brazil (28%), Argentina (13%), Canada (7%), and India (6%). The most modified crops are soybeans (105.1 million hectares), corn (68.4 million hectares), cotton (24.8 million hectares), and canola (10.4 million hectares), which together represent more than 99% of the total areas planted with genetically modified crops.[9] In the United Arab Emirates, however, there are no official reports of commercial cultivation of GM crops. This may be due to the fact that the UAE's agricultural strategy focus on importing genetically modified agricultural products rather than growing them. Imports are regulated under Federal Law No.9 of 2020, which requires prior licensing and registration of GM products in a national registry designated for this purpose. The law also mandates clear labeling of products containing more than 0.9% genetically modified ingredients, and imposes penalties on non-compliant parties. In parallel, the UAE is witnessing an increasing trend towards using advanced agricultural techniques, such as vertical and indoor farming, as part of its strategy to enhance food security and achieve agricultural sustainability.[10]

Several studies emphasize the need to operationalize legal accountability and environmental control mechanisms for GMOs. These contributions call for further legislative reforms to balance environmental objectives with socio-economic development imperatives, improved coordination with regional and international bodies, and harmonization of national legislation with international standards,[11]

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[8] Ayten Erol, 'Genetically Modified Foods from Islamic Law Perspective', *Journal of Agricultural and Environmental Ethics*, 34.1 (2021), 3 <https://doi.org/10.1007/s10806-021-09845-4>.

[9] AgBioInvestor, *Global GM Crop Area Report*, 2024 < >

[10] Khaled Elzoughbi, *Agricultural Biotechnology Annual* (Dubai, 2024) https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural+Biotechnology+Annual_Dubai_United+Arab+Emirates_TC2024-0011.pdf Elena Cebadera Miranda, Mª Victoria Castillo Ruiz-Cabello, and Montaña Cámara Hurtado, 'Food Biopharmaceuticals as Part of a Sustainable Bioeconomy: Edible Vaccines Case Study', *New Biotechnology*, 59 (2020), 74–79 https://doi.org/10.1016/j.nbt.2020.06.005 F.T. Nezhmetdinova, M.E. Guryleva, and L.D. Kardanova, 'Risks and Safety Standards for the Use of Genetically Modified Organisms in the Context of Food Security', ed. by F. Nezhmetdinova and others, *BIO Web of Conferences*, 161 (2025), 00030 https://doi.org/10.1051/bioconf/202516100030

[11] Fatma Ulfatun Najicha and others, 'The Shaping of Future Sustainable Energy Policy in Management Areas of Indonesia's Energy Transition', *Journal of Human Rights, Culture and Legal System*, 3.2 (2023), 362–82 https://doi.org/10.53955/jhcls.v3i2.110 Bongani Z. Nkhabindze and others, 'Regulatory Framework for Genetically Modified Organisms in the Kingdom of Eswatini', *GM Crops & Food*, 15.1 (2024), 212–21 https://doi.org/10.1080/21645698.2024.2375664 Michael F. Eckerstorfer and others, 'Environmental Applications of GM Microorganisms: Tiny Critters Posing Huge Challenges for Risk Assessment and Governance', *International Journal of Molecular Sciences*, 26.7 (2025), 3174 https://doi.org/10.3390/ijms26073174 Angelina Ivanova, 'LEGAL REGULATION OF GENETICALLY MODIFIED CROPS IN THE EUROPEAN UNION AND OTHER STATES

particularly in light of the emergence of new generations of genetically modified Crops.[12]

Consequently, GMO's have significant opportunities to meet global food, health, and environmental needs. However, genetic modification technologies raise serious concerns. And to effectively address these concerns, it is imperative to design and implement biosafety policies and laws at both national and international levels to ensure their efficacy and sustainability. Furthermore, increased public awareness and broader societal engagement are also required.[13] Genetically modified organisms support the sustainability of agricultural systems, enhance food security, and improve farmers' incomes by increasing productivity and reducing the costs of disease and pest control. They also help reduce the use of chemical pesticides thereby decreasing environmental pollution and carbon emissions[14]. Despite their positive environmental impacts and their contribution to environmental conservation, their use is fraught with potential risks, including decreased genetic diversity and ecological imbalance.[15]

On the health front, GMOs hold significant potential to improve public health by enabling prevention and treatment and by enhancing the effectiveness of medical

(USA, CANADA, JAPAN, CHINA): BASIC APPROACHES AND RULES', *Pravovedenie IAZH*, 4, 2022, 96–108 https://doi.org/10.31249/rgpravo/2022.04.08 Ramilya G. Novikova, 'Legal Regulation in the Field of Genetically Modified Organisms (GMO) Turnover in Russia and Foreign Countries', *RUDN Journal of Law*, 25.1 (2021), 32–66 https://doi.org/10.22363/2313-2337-2021-25-1-32-66

[12] Crystal Turnbull, Morten Lillemo, and Trine A. K. Hvoslef-Eide, 'Global Regulation of Genetically Modified Crops Amid the Gene Edited Crop Boom – A Review', *Frontiers in Plant Science*, 12 (2021) https://doi.org/10.3389/fpls.2021.630396 Joginder Singh Duhan, 'Genetically Modified Crops', in *Bioresources and Ecological Sustainability*, 1st edn (Kota: Vital Biotech Publication, 2024); Sherly Montaguth, 'Genetic Literacy Project', *Seed, Battle over 15-Year GMO Ban Extension Rages in Peru as Farmers Breed and Cultivate Illegal Biotech*, 2020 https://geneticliteracyproject.org/2020/12/01/battle-over-15-year-gmo-ban-rages-in-peru-as-farmers-breed-and-cultivate-illegal-biotech-seed/

[13] Richard Ampadu-Ameyaw, George Owusu Essegbey, and Eric Okoree Amaning, 'Public Awareness, Participation and Attitude toward the National Biosafety Framework and Genetically Modified Organisms in Ghana', *Journal of Biosafety and Biosecurity*, 3.2 (2021), 147–53 https://doi.org/10.1016/j.jobb.2021.10.003 Azadeh Shooshtari and others, 'Awareness of GMOs in Terms of the Iran Biosafety Act: A Case Study of Tehran City', *Heliyon*, 10.3 (2024), e25487 https://doi.org/10.1016/j.heliyon.2024.e25487 Yang Xue, Lijun Shang, and Weiwen Zhang, 'Building and Implementing a Multi-Level System of Ethical Code for Biologists under the Biological and Toxin Weapons Convention (BTWC) of the United Nations', *Journal of Biosafety and Biosecurity*, 3.2 (2021), 108–19 https://doi.org/10.1016/j.jobb.2021.09.001 W T. Godbey, 'Transgenics and Genetically Modified Organisms in Agriculture', in *Biotechnology and Its Applications* (Elsevier, 2022), pp. 411–28 https://doi.org/10.1016/B978-0-12-817726-6.00018-6

[14] Stuart J. Smyth, 'Regulation of Genome Editing in Plant Biotechnology: The First Decade and Beyond', *Frontiers in Plant Science*, 11 (2020), 219. https://www.springerprofessional.de/en/regulation-of-genome-editing-in-plant-biotechnology/17076650

[15] Deng.

responses.[16] However, ongoing concerns remain about the direct threat they may pose to human health[17]. These uncertainties regarding the use of GMOs and biotechnologies continue to hinder their acceptance in some societies.[18] Economically speaking, GMOs represent a promising avenue for developing improved future crops, especially given their growing use in recent years. Although GMOs have been used in agriculture for a while, their commercial use is expanding rapidly.[19]

Previous studies focus on the legal framework governing the use of GMOs and the challenges related to it. Saltykova et al. argue that the increasing number and diversity of GMOs on the market along with the associated risks, necessitate the establishment of national and international regulatory frameworks aimed at managing risks, determining liability, and ensuring transparency.[20] Drawing on the Oslo perspective, genetic modification technologies actively shape the global agricultural economy and international trade by influencing production systems, market access, and cross-border commodity flows; as a consequence, these technologies generate heightened regulatory attention and legal scrutiny at both national and international levels.[21] Vezzani on the other hand advocates for a more rigorous legal framework around liability and reimbursement for the damages inflicted by GMOs, arguing that implementation should proceed cautiously

[16] M. Buiatti, P. Christou, and G. Pastore, 'The Application of GMOs in Agriculture and in Food Production for a Better Nutrition: Two Different Scientific Points of View', *Genes & Nutrition*, 8.3 (2013), 255–70 https://doi.org/10.1007/s12263-012-0316-4

[17] Mohammad Abou Adel and others 'Unsettling the Norm: A Posthumanist Reading of Sameness and Differences in Kathryn Erskine's *Mockingbird*', *Theory and Practice in Language Studies*, 15.11 (2025) https://doi.org/10.17507/tpls.1511.03

[18] Rakhad Abdulrazak Alrawi and Rafal Abdulrazak Al-rawi, 'Facts and Horizons of Genetically Modified Organisms/Foods and Health Issues', *World Journal of Advanced Research and Reviews*, 13.2 (2022), 071–075 https://doi.org/10.30574/wjarr.2022.13.2.0040 John Komen and David K. Wafula, 'Authorizing GM Crop Varieties: Policy Implications for Seed Systems in Sub-Saharan Africa', *Agronomy*, 11.9 (2021), 1855 https://doi.org/10.3390/agronomy11091855 V. Kalidasan and Kumitaa Theva Das, 'Is Malaysia Ready for Human Gene Editing: A Regulatory, Biosafety and Biosecurity Perspective', *Frontiers in Bioengineering and Biotechnology*, 9 (2021) https://doi.org/10.3389/fbioe.2021.649203 Alessandro Nicolia and others, 'An Overview of the Last 10 Years of Genetically Engineered Crop Safety Research', *Critical Reviews in Biotechnology*, 34.1 (2014), 77–88 https://doi.org/10.3109/07388551.2013.823595

[19] Gerald C.Nelson, *Genetically Modified Organisms in Agriculture: Economics and Politics* (Amsterdam: Elsevier, 2001). https://shop.elsevier.com/books/subjects/life-sciences/agricultural-and-biological-sciences?page=344

[20] Assia Saltykova and others, 'Detection and Identification of Authorized and Unauthorized GMOs Using High-Throughput Sequencing with the Support of a Sequence-Based GMO Database', *Food Chemistry: Molecular Sciences*, 4 (2022), 100096 https://doi.org/10.1016/j.fochms.2022.100096

[21] Tugce Uslu, 'Advantages, Risks and Legal Perspectives of GMOs in 2020s', *Plant Biotechnology Reports*, 15.6 (2021), 741–51 https://doi.org/10.1007/s11816-021-00714-0

without specific formulas for accountability.[22] A study by Dennis Eriksson et al. discuss options for reforming the regulatory framework for GMOs, focusing on risk assessment and management procedures in EU countries, to make risk assessment and decision-making more consistent, and to pave the way towards international harmonization.[23] In the same context, Usman Babar and Ruqiang Xu advocate for the drafting of legislation, regulations, administrative measures, and laws relating to genetically modified agricultural organisms.[24] To the authors' knowledge, this study may be the first of its kind to highlight the extent of alignment between the UAE legislative framework and international standards on GMO's. The research concludes with a detailed table and figure that accurately illustrate the points of convergence and divergence between the UAE framework and international standards in terms of definitions, governing principles, institutional mechanisms, and aspects related to civil and criminal liability.

The research is also unique in that it highlights the legal challenges and gaps in the compensation mechanisms for the damage inflicted by these organisms, liability provisions, and related penalties. Hence, the novelty of the research and its contribution to filling the gap in the literature and providing practical recommendations for developing clear regulatory controls for the production, marketing, and consumption of these organisms, as well as enhancing accountability, transparency, and enforcement practices aimed at aligning the national system with international best practices to ensure the highest levels of protection for public health and the environment. In view of the foregoing discussion, this study examines the extent to which the United Arab Emirates' legislative framework on genetically modified organisms, particularly Federal Law No. 9 of 2020 and the associated civil liability provisions, effectively promotes the principles of accountability and compensation, and evaluates its alignment with international benchmarks, including those reflected in the Cartagena Protocol on Biosafety.

This study addresses a complex and sensitive contemporary legal issue: GMOs. It aims to provide a comprehensive and an in-depth legal analysis of the legislative framework regulating this type of biotechnology, by examining the relationship between legal regulation at the international and national levels and exploring ways to bridge the existing gaps between them. The importance of this approach

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[22] Simone VEZZANI, 'The International Regulatory Framework for the Use of GMOs and Products Thereof as Food Aid', *European Journal of Risk Regulation*, 9.1 (2018), 120–36 https://doi.org/https://www.jstor.org/stable/26408244

[23] Dennis Eriksson and others, 'Options to Reform the European Union Legislation on GMOs: Risk Governance', *Trends in Biotechnology*, 38.4 (2020), 349–51 https://doi.org/10.1016/j.tibtech.2019.12.016

[24] Usman Babar and Ruqiang Xu, 'Agricultural Genetically Modified Organisms (GMOs) Regulation in China', in *GMOs and Political Stance* (Elsevier, 2023), pp. 53–74 https://doi.org/10.1016/B978-0-12-823903-2.00009-3 Aristidis M. Tsatsakis and others, 'Impact on Environment, Ecosystem, Diversity and Health from Culturing and Using GMOs as Feed and Food', *Food and Chemical Toxicology*, 107 (2017), 108–21 https://doi.org/10.1016/j.fct.2017.06.033 Moisés Burachik, PhD, 'GMOs in Argentina', in *Genetically Modified and Irradiated Food* (Elsevier, 2020), pp. 151–71 https://doi.org/10.1016/B978-0-12-817240-7.00009-7

lies in the multidimensional nature of GMOs, which are not merely a scientific or technical products but rather a complex phenomenon whose effects overlap with fundamental issues such as food security, public health, environmental protection, and economic stability. This requires adopting proactive and integrated legal systems capable of accommodating these dimensions while keeping pace with the rapid developments in this vital field, particularly in light of the continued global commercialization of genetically modified crops, with a significant increase in cultivated areas and trade volume.[25]

The study critically evaluates the effectiveness of the UAE's regulatory system in addressing key issues such as accountability, liability, and compensation for any damage caused by GMOs. It addresses the key gaps in this system, most notably the lack of clear definitions of key regulatory terms, the lack of precise mechanisms for liability and compensation, and the potential for overlap between other relevant federal laws. This emphasizes how urgently legislative reforms are required to ensure the implementation of internationally recognized biosafety standards. Accordingly, the main problem of the research revolves around the growing production and use of GMO's and the associated risks to biodiversity and public health. An analysis of national legal texts reveals gaps related to penalties, liability rules, and compensation mechanisms, which may limit the effectiveness of deterrence and enforcement at the national level when compared to the international framework.

Research Method

This research is a descriptive-analytical and critical doctrinal legal study. It assesses the legal framework regulating GMOs and analyzes information pertaining to GMOs by evaluating the legal provisions included in international agreements and conventions, as well as national laws in the United Arab Emirates. The research also employes a comparison technique to analyze the amount of harmony between UAE legislation and key international norms. Additionally, it employs a comparative methodology to elucidate the similarities and disparities between worldwide GMO legislation and UAE laws, with the objective of assessing the efficacy of these regulations in terms of safety, liability, and legal monitoring.

At the national level, the study focuses on UAE Federal Law No.9 of 2020 on Biosafety of GMOs, and its executive regulations issued by Cabinet Resolution No.84 of 2022, in addition to the general principles stipulated in the UAE Civil Transactions Law No.5 of 1985. Internationally, the study examines the most important conventions and legal documents on biosafety, the environment and human health, namely; the Cartagena Protocol on Biosafety, the joint Codex Alimentarius Guidelines by FAO and WHO, and the International Code of Conduct for Biotechnology by the same two organizations. The study also relies on

[25] Xingru Cheng and others, 'Trends in the Global Commercialization of Genetically Modified Crops in 2023', *Journal of Integrative Agriculture*, 23.12 (2024), 3943–52 https://doi.org/10.1016/j.jia.2024.09.012

a systematic literature review of recently published scientific and legal research, collected from prestigious academic databases such as ResearchGate and Google Scholar. The review focuses on studies published in English between 2017 and 2025, with a particular emphasis on peer-reviewed articles and systematic reviews addressing the legal, environmental and health aspects of GMOs, as an approach to strengthen the analytical framework of this study.

In light of the diversity of types and methods of interpreting legal texts, this study seeks to clarify the extent of compatibility and consistency between current UAE laws and international standards related to GMOs. The study adopts an appropriate inductive logical approach to address legal issues related to accountability and liability for damages related to GMOs. It also focuses on a comparative evaluation of the international and UAE legislative frameworks, so as to identify areas of convergence and gaps. The study utilizes a table and chart focusing on specific criteria, including definition, governing principle, institutional mechanisms, licensing and trade, labeling threshold, transit notification, penalties, civil liability, human rights aspect, challenges and gaps. Conformity was measured using a 0 to 5 scale with the following definitions respectively: 5 = best practice, 4 = strong practice with only minor gaps, 3 = existence of rules and procedures with limited enforcement, 2 = existence of some rules and procedures but with unclear definitions, 1 = limited rules or lack of mechanisms to enforce, and 0 = absence of formulaic provisions or clear provisions.

Results and Discussion

National Regulatory Frameworks Governing GMO Use and Their Criminal Law Implications

According to Federal Law on GMOs, these organisms are defined as: "biological entity capable of transferring or replicating genetic material, including organisms, viruses, viral components, animals, plants, and microorganisms". The law further defines Genetic Modification as: "modifying genetic material by using modern biotechnology".[26] These legal definitions highlight that GMOs fundamentally differ from their natural counterparts due to alterations in their genetic structure. Consequently, these organisms can no longer be considered as biologically natural, but rather as the result of human intervention through modern biotechnology. According to the Federal law, Article 1 defines GMOs as "A living organism that possesses a novel combination of genetic material, differing from its original genetic composition, obtained through the use of modern biotechnology".

This transformation may potentially lead to physical or psychological harm, as well as potential environmental damage, which could entail civil or even criminal liability and open the way for compensation claims under the law. In this respect, this paper will examine the scope and mechanisms of the United Arab Emirates' national legal framework governing the use of GMOs, with a particular focus on the relevant criminal and civil liability provisions, as a prelude to later comparing

[26] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs* (UAE, 2020).

this framework with the standards enshrined in international law in this area. The primary purpose of criminal liability for crimes related to GMOs is to hold offenders accountable, whether an individual or a legal person, whereas civil liability primary centers on compensating the victim and restoring the status quo.

According to the UAE Federal Law No. 9 of 2020 on the Biosafety of GMOs, several acts are criminalized, including the "import, export, re-export, transit, trading, development, manufacture, production, release and transfer of GMOs or their products as well as other products containing (0.9%) or more of them ", without prior consent from the Ministry and/or authorization from the relevant authority.[27] The Law further states that the Cabinet may issue a decision to amend the 0.9% threshold.[28] It also provides specific exclusions from the application of these provisions, namely: "Products containing a Genetically Modified Component at a rate less than 0.9%." and "GMOs or their manufactured products considered pharmaceuticals for humans and Genetic Modification of humans and human cells".[29] It can be concluded that the import of genetically modified animals or their products or offal with a genetically modified component percentage of 0.9% or more is strictly prohibited in the UAE. In contrast, the import of other GMOs is permitted under certain conditions and restrictions. Notably, the UAE's adoption of 0.9% level aligns with global regulatory best practices, as is the case in the European Union, where this level constitutes the accepted reference for identifying products containing genetically modified ingredients and determining advertising and labeling requirements.[30]

The UAE legislator has outlined a range of penalties for violations of Federal Law on GMOs provisions. These penalties include imprisonment for a period ranging from three months to three years and/or a fine between five hundred thousand to four million UAE dirhams, depending on the nature and gravity of the crime, as specified in Articles 19 to 24 of the said law.[31] The imposition of these sanctions aims not only to punish the offender but also to deter future abuses and enhance the sustainability of biosafety measures in the context of GMOs. These general penalties are further specified according to the nature of the violation. For instance, "the unauthorized export or re-export of GMOs without the compulsory prior approval and license is punishable by at least six months' imprisonment and a fine ranging from AED 2,000,000 to AED 3,000,000, or by either of these sanctions."

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[27] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.
[28] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.
[29] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.
[30] John PAULL, 'THE FAILURES OF GENETICALLY MODIFIED ORGANISMS (GMOS): RESISTANCE, REGULATION, AND REJECTION', *AGROFOR*, 4.3 (2019) https://doi.org/10.7251/AGRENG1903139P Tomasz Twardowski and Aleksandra Małyska, 'Uninformed and Disinformed Society and the GMO Market', *Trends in Biotechnology*, 33.1 (2015), 1–3 https://doi.org/10.1016/j.tibtech.2014.11.006
[31] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.

The same applies for the "importation of GMOs or in the case of their first importation, without approval by the Ministry of Climate Change and Environment." Moreover, "the manufacture, production, development, or trading of GMOs in the UAE without the required authorization, as prescribed by law, incurs at least six months' imprisonment and a fine ranging from AED 1,000,000 to AED 2,000,000." However, the contained use or release of GMOs for research, education, or business without approval is also subject to the same penalty. Notably, the law does not distinguish between genetically modified animals and other GMOs for such purposes. Finally, the "transportation of GMOs or GMO-derived products within the UAE without authorization is punishable by a minimum of three months' imprisonment and a fine of no less than AED 500,000."[32]

These legal provisions reflect the UAE's clear commitment to implementing internationally recognized principles such as notification, prior informed consent, notification, and precaution. Collectively, these provisions enhance the credibility and re-liability of the UAE's national regulatory system in managing the transboundary movement and the internal circulation of GMOs. It is also noticed that the Federal law, had set clear accountability provisions across the entire supply chain, as the legislator had imposed liability not only on the procedures, but also on the importers, exporters, circulators, developers, manufacturers, and transporters.[33] And despite the advanced regulatory framework established under the UAE law, some aspects still require further development. Notably, the GMOs Federal Law lacks precise definitions and detailed regulations for key activities such as the "import, export, re-export, development, manufacture, production, and transfer of GMOs and their products." This is in contrast to the Federal Law by Decree No. (30) of 2021 on Combating Narcotics and Psycho-tropic Substances, which clearly defines these terms.[34] The absence of precise definitions may cause ambiguity and hinders the effective enforcement, potentially resulting in environmental risks, threat to health and safety, trade disruptions, and reduced investment in GMO-related industries.

Furthermore, these legal gaps have rendered the provisions on GMOs ineffective in addressing the border legal and ethical considerations surrounding these organisms, particularly in the context of evolving international standards.[35] This shortcoming has put the UAE's compliance with global norms into question. Additionally, while the GMOs Federal Law stipulates the requirement to notify the Ministry when GMOs or their products are transiting through the State, it is noteworthy that the Emirati legislator has not prescribed any punitive measures for

[32] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.
[33] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.
[34] UAE, *Federal Law by Decree No. 30 of 2021 on Combating Narcotics and Psychotropic Substances*, 2021 https://uaelegislation.gov.ae/en/legislations/1540/download
[35] Gazala Yasmin Ashraf, 'GMO : ETHICAL ISSUES IN BIOTECHNOLOGY', *Vidyabharati International Interdisciplinary Research Journal*, 2023, 119–23 https://www.researchgate.net/publication/384762294_GMO_ETHICAL_ISSUES_IN_BIOTECHNOLOGY

violations of this specific provision.[36] This regulatory omission may weaken the deterrent effect of the law and undermine its enforceability.

Another concern relates to the unequal treatment of genetically modified animals under the current legal framework. While the law imposes harsher penalties for the unauthorized import of these organisms, it applies the same level of penalties to other serious unauthorized activities, such as development, release, or domestic production, regardless of the category of genetically modified organism in question. This inconsistency in imposing penalties highlights the need for a more well-founded penalty structure that reflects the nature and seriousness of each prohibited act. In addition to the above, despite the fact that the Federal Law has set a range of penalties, the authors believe that there might be an overlap with other Federal Laws, such as the Food Safety Law,[37] which already regulates matters related to food imports, labeling and safety including risks associated with genetically modified foods. It might also overlap with the Federal law on consumer protection which prohibits misleading or unsafe products reaching consumers.[38] Furthermore, it may interact with the federal law on commercial fraud law which criminalizes the sale of unsafe, adulterated, or mislabeled goods.[39]

Civil Liability and Compensation for GMOs Usage

Using genetically modified foods entails numerous negative effects on health and environment. It is therefore natural that individuals who suffer harm should seek compensation, making this concern a central priority within the legal framework. However, claimants often face the challenge of proving the "causal relationship" between the consumption of these foods and the diseases or damages incurred. This is due to the nature of these damages, which are often hidden and not immediately apparent, and only manifest after a long period of time. Their long-term manifestation requires highly specialized medical and technical expertise to detect.[40] Under the UAE Civil Transactions Law, "the obligor shall, after being given notice, be compelled to discharge his obligation by way of specific performance, if that is possible. Provided that if specific performance would be oppressive for the obligor, the judge may, upon the application of the obligor, restrict the right of the obligee to a monetary substitute unless that would cause him serious loss".[41] This reflects the fundamental principle of civil liability, which

[36] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.
[37] UAE, *Federal Law No. 10 of 2015 Concerning the Food Safety (Abu Dhabi: Official Gazette, 2015)* https://uaelegislation.gov.ae/en/legislations/1161/download.
[38] UAE, *Federal Law No. 24 of 2006 on Consumer Protection (Abu Dhabi: Official Gazette, 2006)* https://uaelegislation.gov.ae/en/legislations/1455
[39] UAE, *Federal Law No. 19 of 2016 on Combating Commercial Fraud (Abu Dhabi: Official Gazette, 2016)* https://uaelegislation.gov.ae/en/legislations/1036/download
[40] Felix Beck, 'Titelei/Inhaltsverzeichnis', in *Self-Spreading Biotechnology and International Law* (Nomos Verlagsgesellschaft mbH & Co. KG, 2022), pp. 1–44 https://doi.org/10.5771/9783748913528-1 Chunyi Liu, 'Legal Reconstitution of Remedies for Damage Caused by Genetic Pollution', *Open Journal of Social Sciences*, 09.02 (2021), 451–67 https://doi.org/10.4236/jss.2021.92029
[41] UAE, *Civil Transactions Law (Federal Law No. 5 of 1985) (Abu Dhabi: Ministry of Justice, 1985), Art. 380* https://www.moj.gov.ae/

establishes the obligation to redress damages resulting from an individual's harmful acts or negligence.

Complementing this general principle, the Federal Law on GMOs states: "The importer, exporter, trader, developer, manufacturer, producer and carrier of Genetically Modified Organisms or their products shall be liable for any damage resulting from the import, export, re-export, transit, Trading, development, manufacture or production of Genetically Modified Organisms or their products".[42] This Article affirms that the UAE legislator has expressly established the responsibility of all parties involved in genetically modified organisms and their products. This includes their importers, exporters, traders, developers, manufacturers, producers, and transporters. This as the following paraphs shall reveal, shows that the Federal law adheres to the international "polluter pays" principles, consistent with the Cartagena Protocol on Biosafety in which anyone introducing risks through GMOs must bear the cost of prevention, mitigation, and compensation.

The right for compensation for material damage is well-established. If an individual suffers harm or illness as a result of consuming genetically modified foods, they have the right to judicially claim compensation. This right passes to heirs in case of the injured person's death. With regards to moral or psychological damage, there remains an ongoing debate among supporters and opponents on its compensability.[43] Nevertheless, the UAE Civil Transactions Law does not disregard moral or psychological harm, acknowledging that "every harm to others obliges its doer, even if not distinguished, to pay compensation".[44] This indicates that compensation includes the losses incurred by the injured party and the gains missed. The legislator has also determined that moral damage includes anything that affects dignity, feelings, or honor, including psychological distress. It should be noted that compensation for damages varies depending on the type of damage. The amount of compensation for material damages is transferred to the injured party's heirs immediately upon death, is included in the estate, and is distributed among them as an inheritance. Compensation for moral damages, however, is due to the heirs only if the injured party and the person responsible agree on the amount of compensation, or a final court ruling is issued before the injured party's death.

Civil liability is established upon the occurrence of its elements, which are: a "harmful act or fault," a "material or moral damage," and a "causal relationship

[42] UAE, *Federal Law No. 9 of 2020 on the Biosafety of GMOs*.
[43] William E. Foote, Jane Goodman-Delahunty, and Gerald Young, 'Civil Forensic Evaluation in Psychological Injury and Law: Legal, Professional, and Ethical Considerations', *Psychological Injury and Law*, 13.4 (2020), 327–53 https://doi.org/10.1007/s12207-020-09398-3
[44] UAE, *Civil Transactions Law (Federal Law No. 5 of 1985) (Abu Dhabi: Ministry of Justice, 1985), Art. 380*.

between the act and the damage."[45] Accordingly, any act that causes harm to others, whether through a positive act or by negligence, obliges the doer to compensate for the resulting damages. The injured party is entitled, by law, to compensation for the harm incurred, irrespective of the type of action. The crucial pillar for establishing liability and compensation is the occurrence of harm. Once harm is proven, compensation becomes necessary, with the aim of restoring the injured party to their state before the injury. It is essential that a causal relationship between the harmful act and the damage is established. The burden of proving harm and its connection to the harmful act rests on the injured party claiming damages.[46]

With respect to identifying the party responsible for compensation, it may be observed that, although the UAE legislator has specified individuals responsible for GMOs, the multiplicity of these actors and the possibility of avoiding liability necessitates a clearer identification of the party liable for compensation. The producer is primarily responsible for the presence of such organisms that pose harm to humans and the environment. This person, as the producer, is responsible for the damage or defect resulting from the use or consumption of any of these products, irrespective of the existence of a contractual relationship with the injured party. The damages resulting from genetically modified foods go beyond the scope of ordinary damages for which traditional civil liability rules, based on the established elements of harmful acts, damage, and causal relationship.[47] The study concludes that these traditional liability rules prove inadequate in this context as these damages are exceptional in nature and are characterized as "catastrophic." Therefore, addressing this type of damage requires laws that ensure compensation once the harm is established, without insisting on proving its source or the specific responsible party. In such cases, as long as the harm is realized, compensation is warranted.

The study reveals the shortcomings of the UAE's civil system, which continues to rely on traditional tort liability rules to compensate those harmed by GMOs due to their release, misuse, or failure to strictly follow instructions and guidelines.[48] Given the multiple actors involved- the producer, carrier, and importer-, it is very challenging for this model to establish liability for the damage and prove the

[45] Ciprian UNGUREANU, 'General Considerations on the Elements of Civil Liability in the Environmental Law', *European Journal of Law and Public Administration*, 6.2 (2019), 268–77 https://doi.org/10.18662/eljpa/104

[46] AbdUl-Rahman Salem, 'Civil Liability for Damage Resulting from Genetically Modified Organisms (GMOs): A Comparative Study', *UAEU Law Journal*, 83 (2020) https://scholarworks.uaeu.ac.ae/sharia_and_law/vol2020/iss83/8 Miljuš-Đukić and B. Banović Đeri, 'Civil Liability and Compensation for Damage Caused by Genetically Modified Organisms', *Zbornik Radova Pravnog Fakulteta u Novom Sadu*, 55.3 (2021), 783–800 https://doi.org/https://doi.org/10.5937/zrpfns55-33977

[47] Chunyi Liu, 'Liability for Transboundary Damage of Genetically Modified Organisms: Existing Patterns and Application', *Beijing Law Review*, 12 (2021), 16–26. https://www.scirp.org/journal/paperinformation?paperid=107036

[48] AbdUl-Rahman Salem.

existence of a causal relationship between the act and the result. Therefore, the study recommends an objective liability system for GMO producers and importers without having to prove fault. Instead, once the GMO-related damage occurs, with a reasonable connection to the activity, the producer or importer bears responsibility, as the law automatically presumes the existence or commission of a fault. This recommendation is based on similar analogies in strict liability for hazardous substances in civil law, where liability for damage is assumed by the person who controls the risk, without the need to prove fault. Thus, producers or importers of GMOs are presumed liable without the need to prove fault. Furthermore, the burden of proof does not always fall on the injured party (this situation is known as a reversal of the burden of proof).[49] In such cases, the injured party is relieved of the burden of proof, and it is presumed that the other party made a mistake and failed to perform its duties to protect the injured party and facilitate their access to compensation.

International Legal Frameworks of GMOs Usage

The international law regulates the transboundary movement of GMOs and their products, with the aim of preventing and mitigating the risks that could arise from their circulation across national borders. This law seeks to protect the environment as well as human, animal and plant health. The law further ensures that no country receives genetically modified or modified organisms or their products, without its prior knowledge, and without adherence to the necessary procedures for their safe transfer. The Cartagena Protocol on Biosafety of the Convention on Biological Diversity represents one of the most prominent international instruments on biosafety. The Protocol seeks to "ensure an adequate level of protection regarding the safe transfer, handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity".[50]

Article 7 of the Protocol requires countries exporting GMOs to provide "prior written notification to the competent national authority of the Party of Import regarding any transboundary movement of such organisms." This allows importing countries to assess risks associated with GMOs before deciding whether to permit or refuse the import. Moreover, the Protocol enacts the precautionary principle outlined in Principle 15 of the Rio Declaration on Environment and Development. This permits nations to prohibit the importation of GMOs if they suspect potential damage to health or the environment, even without definitive

[49] Caroline E. Foster, 'Reversing the Burden of Proof to Give Effect to the Precautionary Principle', in *Science and the Precautionary Principle in International Courts and Tribunals: Expert Evidence, Burden of Proof and Finality* (Cambridge: Cambridge University Press, 2011), pp. 240–78. https://www.cambridge.org/core/books/abs/science-and-the-precautionary-principle-in-international-courts-and-tribunals/reversing-the-burden-of-proof-to-give-effect-to-the-precautionary-principle/1A03BC71CE3A0D1284967980ACFDA78A

[50] Secretariat of the Convention on Biological Diversity, *Cartagena Protocol on Biosafety, Arts. 1-2*; Jonathan H. Adler, 'The Cartagena Protocol and Biological Diversity: Biosafe or Bio-Sorry?', *SSRN Electronic Journal*, 2000 https://doi.org/10.2139/ssrn.227644

scientific proof.[51] This means giving countries broad discretion to restrict the entry of GMOs into their territories based on their national risk assessment. In addition, Article 18 of the same Protocol requires that measures be taken "to ensure the safe transport and packaging of GMOs ," and that accurate documentation regarding their nature and use be provided.

Article 26 also allows countries to incorporate "socio-economic considerations arising from the impact of living modified organisms on the conservation and sustainable use of biological diversity," into their import decisions, in accordance with their international obligations. This illustrates the acknowledgment of non-scientific factors in GMO decision-making, hence improving the consideration of environmental and social justice within the context of international law. This guarantees an equitable allocation of the advantages and hazards of these organisms among cultures.[52] Thus, the Cartagena Protocol constitutes an international framework that combines considerations of scientific integrity, national sovereignty, and social and environmental considerations, enabling risk assessment and safe management of GMOs.[53]

Alongside the Cartagena Protocol, a significant international document is the International Code of Conduct on the Distribution and Use of Pesticides. The Code seeks to provide a voluntary code of behavior for public and commercial entities involved in pesticide management, intending to promote safe practices that increase food security and safeguard the environment. The Code outlines the shared duty of all sectors of society to guarantee the proper and acceptable use of pesticides, without detrimental effects on people and the environment. It also applies the concept of "life cycle to address all key aspects related to the use, regulation, production, management, packaging, labeling, distribution, handling, use, and control of all types of pesticides, including post-registration activities and disposal".[54] The Code urges countries to develop and implement effective legislative frameworks to monitor and evaluate the use of pesticides, and to follow rational and acceptable commercial practices. It also helps them establish controls to monitor the quality of pesticides and address potential environmental and health risks associated with their use.[55] Therefore, this Code provides a framework

[51] Secretariat of the Convention on Biological Diversity.

[52] Hudali Mukti and Bobur Baxtishodovich Sobirov, 'Environmental Justice at the Environmental Regulation in Indonesia and Uzbekistan', *Journal of Human Rights, Culture and Legal System*, 3.3 (2023), 476–512 https://doi.org/10.53955/jhcls.v3i3.171 Burcu Bostanci Ozgul and Ozgul Yilmaz-Tuzun, 'National Association for Research in Science Teaching (NARST)', in *Relationships Between Middle School Students' Epistemological Beliefs and Argumentation Quality in Genetically Modified Organisms* (United States of America).

[53] Fatemehsadat Mirmohammadmakki and Mahmoud Abbasi, 'Proceedings of the V. Uluslararası Bilim ve İnovasyon Kongresi', in *Cartagena Protocols and Its Importance in Food Safety: A Review* (Turkey: Bildiri Kitabı, 2024).

[54] Food and Agriculture Organization of the United Nations, *International Code of Conduct on Pesticide Management* (Rome, 2014) https://openknowledge.fao.org/items/3eef65f0-478d-48c1-ac75-43b5f5a2a174

[55] FAO, *International Code of Conduct on Pesticide Management, Art. 1.*

to guide government and private regulatory agencies, civil society and other stakeholders on best practices in pesticide management throughout their life cycle.[56]

Concurrently, a framework for conducting risk analyses of the nutritional value and safety of foods created from contemporary biotechnology, including DNA methods, is offered by the Principles for Risk Analysis of Foods created from Modern Biotechnology. The principles allow for the assessment of the product's effect on consumer health and lay out standards for the analysis and evaluation of the dangers connected to these foods.[57]

Despite the importance of the international legal frameworks regulating the use of GMOs, numerous studies highlight the persistent challenges facing the international GMO legal regime. These challenges include the lack of scientific consensus on the safety of these organisms, varying levels of compliance, and weak international enforcement mechanisms.[58] Recent scientific advances also illustrate how biotechnology tools can contribute to regulatory compliance via prompt, sensitive, and reliable monitoring approaches.[59] This hinders the ability of these frameworks to achieve the desired balance between scientific development and the protection of public health and the environment.

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[56] Mutia Hariati Hussin and Esti Kukuh Perbawati, 'The Effect of The International Code of Conduct on Pesticide Management on the Use of Pesticide in Kerala, India (2003-2017)', in *Proceedings of the 4th International Conference on Sustainable Innovation 2020–Social, Humanity, and Education (ICoSIHESS 2020)* (Paris, France: Atlantis Press, 2021) https://doi.org/10.2991/assehr.k.210120.123 Fatemeh Ashrafi Tafreshi and others, 'Ultrasensitive Fluorescent Detection of Pesticides in Real Sample by Using Green Carbon Dots', ed. by Sabato D'Auria, *PLOS ONE*, 15.3 (2020), e0230646 https://doi.org/10.1371/journal.pone.0230646 Arun Kumar and Jay Shankar Singh, 'Cyanoremediation: A Green-Clean Tool for Decontamination of Synthetic Pesticides from Agro- and Aquatic Ecosystems', in *Agro-Environmental Sustainability* (Cham: Springer International Publishing, 2017), pp. 59–83 https://doi.org/10.1007/978-3-319-49727-3_4

[57] FAO, 'CAC/GL 44-2003: Principles for the Risk Analysis of Foods Derived from Modern Biotechnology', *Codex Alimentarius: Foods Derived from Modern Biotechnology*, 2009, 1–5 http://www.fao.org/3/a-a1554e.pdf

[58] Jennifer Clapp, 'Unplanned Exposure to Genetically Modified Organisms', *The Journal of Environment & Development*, 15.1 (2006), 3–21 https://doi.org/10.1177/1070496505285443 Angelika Hilbeck and others, 'No Scientific Consensus on GMO Safety', *Environmental Sciences Europe*, 27.1 (2015), 4 https://doi.org/10.1186/s12302-014-0034-1 Peter Newell, 'Globalization and the Governance of Biotechnology', *Global Environmental Politics*, 3.2 (2003), 56–71 https://doi.org/10.1162/152638003322068218

[59] Xia Zhu and others, 'CRISPR/Cas12a-Mediated Entropy-Driven Electrochemical Biosensor for Detection of Genetically Modified Maize Mon810', *Analytica Chimica Acta*, 1296 (2024), 342290 https://doi.org/10.1016/j.aca.2024.342290 Meng Xu, Ronghui Wang, and Yanbin Li, 'Electrochemical Biosensors for Rapid Detection of Escherichia Coli O157:H7', *Talanta*, 162 (2017), 511–22 https://doi.org/10.1016/j.talanta.2016.10.050 S-Z Mousavian and others, 'Advancement in Electrochemical DNA Biosensors for GMO Detection: A Review Study', *J. Nutr. Fasting Health*, 6.4 (2018), 168–73 https://doi.org/10.22038/JNFH.2018.34319.1138

International agreements and standards provide important guidance, they leave significant room for interpretation and flexibility for countries implementing them."[60] The implementation of biosafety at the national level "has proven to be a major challenge, particularly in developing countries, and consequently, the actual functioning of the international regulatory framework for biotechnology is still in a state of flux." This legal reality highlights the ongoing need to review and strengthen international biosafety frameworks to ensure their adaptability, integrity, and scientific modernization.[61]

Compatibility of the UAE Legal Framework for GMOs with International Standards

A biosafety regulatory system that is remarkably in line with international legislation for the use of genetically modified organisms has been established in the United Arab Emirates. The United Arab Emirates' Federal Law No. 9 of 2020 incorporates fundamental ideas from international agreements including the Codex Alimentarius Commission standards and the Cartagena Protocol on Biosafety. These include mandatory authorization for the import and distribution of genetically modified organisms, prior informed consent, and the precautionary principle. A key aspect of the UAE's approach is the adoption of a 0.9% threshold of measuring the lowest permissible level of genetically modified materials (GMOs) in food or agricultural products, without the need for special labeling by producers. This threshold reflects the country's commitment to the precautionary principle, allowing it to re-strict the circulation of GMOs even in the absence of full scientific certainty, in line with Article 15 of the Rio Declaration.

The UAE law also stipulates many controls consistent with the international framework regarding the biosafety of GMOs, the most prominent of which is the requirement to obtain prior approval from the competent authorities before importing, introducing or trading these organisms, in line with the principle of prior notification adopted in the Cartagena Protocol. In addition, the requirement to notify the competent authorities regarding any transit or circulation of GMOs enhances transparency and supports international co-operation in biosafety governance. The law also clearly defines the government agencies responsible for regulating and monitoring the handling of modified organisms, which enhances the clarity of institutional roles as recommended by international standards.

In addition, UAE law prescribes penalties for violations, including unauthorized trading or non-compliance with environmental or regulatory requirements, thereby reflecting the Cartagena Protocol's call for stronger enforcement mechanisms. This approach demonstrates that environmental protection is not only a regulatory requirement but also a fundamental human right embedded in sustainable

[60] Komen and Wafula.

[61] Ngongolo and Mmbando; Paul Chege and others, 'Best Practices for Acceptability of GM Crops Field Trials Conclusions: Lessons for Africa', *GM Crops & Food*, 15.1 (2024), 222–32 https://doi.org/10.1080/21645698.2024.2376415

development policies.[62] Despite this strong compatibility between UAE legislation and the international legal framework governing GMOs, several gaps continue to hamper their effectiveness. A key shortcoming lies in the absence of precise definitions for essential regularity terms such as import, re-export and transfer, which may create ambiguity and weakens implementation.

The current structure of sanctions also reveals shortcomings in certain violations, one of the most prominent examples is Paragraph (3) of Article (4) of the law, which obliges concerned authorities to notify the Ministry if GMOs or their products transit through the country. However, it does not specify an explicit penalty for the violation. Moreover, this legal framework does not differentiate between GMOs in general and GMOs of animal origin, even though the latter may pose complex risks.

Table (1): Comparison between UAE Legislative Framework Vs International Instruments on GMOs (Prepared by the authors)

	UAE Legal Framework (Federal Law No. 9 of 2020 on Biosafety, the Civil Transactions Law No. 5/ 1985, Federal Decree-Law No. 30 of 2021)	**International Framework (Cartagena Protocol on Biosafety, Rio Declaration and the Codex Alimentarius Commission guidelines)**
Definition	GMOs are defined as "any biological entity that has been altered at the molecular level by modern biotechnology."	The definition focuses on two areas: "living modified organisms" that may negatively affect biodiversity.
Governing Principle	Precautionary principle, consent prior to advancement, and compulsory licensing.	Precautionary principle (Rio Declaration), advance notification, risk assessment for biotechnology products.
Institutional Mechanisms	National competent authorities (i.e., Ministry of Climate Change and Environment).	Conference of the Parties, Biosafety Clearing-House.
Licensing and Trade	Pre-import license, national registry and mandatory labeling when content exceeds 0.9%.	Mandates Pre-notification (with approvals), as well as labeling and safe transport requirements, prior to cross-border transport.
Labeling Threshold	The threshold is set as 0.9%, and products below this threshold are exempted from labelling, in line with the precautionary principle set out in Article 15 of the Rio Declaration.	There is no uniform quantitative limit for labeling; and it is up to countries to decide to use quantitative limits and how to implement them.

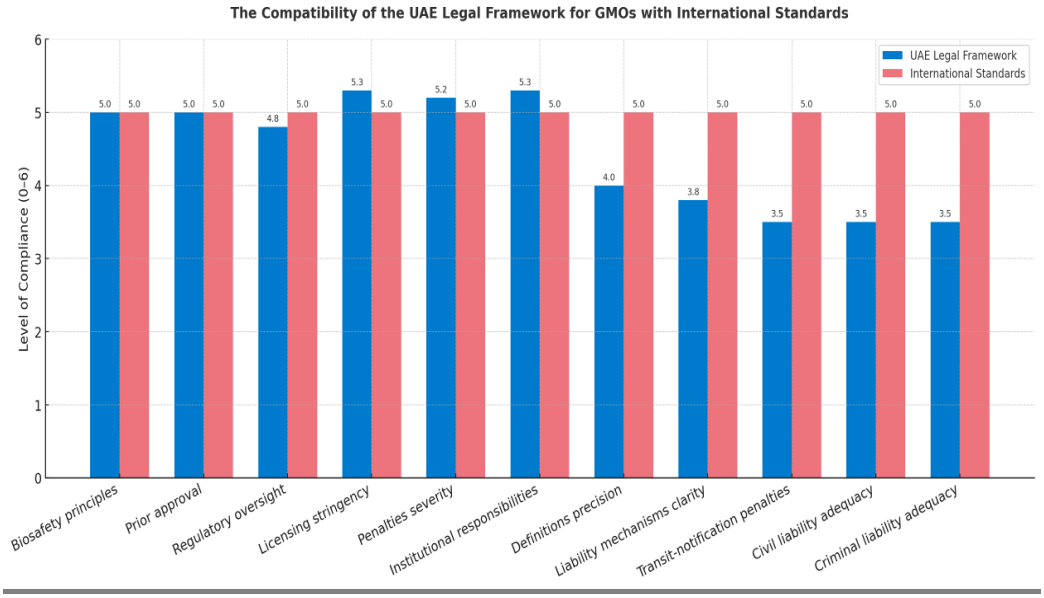
[62] F. Francioni, 'International Human Rights in an Environmental Horizon', *European Journal of International Law*, 21.1 (2010), 41–55 https://doi.org/10.1093/ejil/chq019 Maya Khater, Yassine Chami, and Mohamad Albakjaji, *Legal Environmental Protection and Sustainable Development in the United Arab Emirates*, *Journal of Human Rights, Culture and Legal System*, 2025, V https://doi.org/10.53955/jhcls.v5i2.469 Marija Vuković Domanovac and others, 'Sustainable and Advanced Strategies for Bioremediation of Highly Contaminated Wastewater', *Processes*, 13.7 (2025), 2250 https://doi.org/10.3390/pr13072250 Iza Rumesten RS and others, 'Protection of Human Rights Against the Environment in the Indonesian Legal System', *Journal of Law and Sustainable Development*, 11.10 (2023), e570 https://doi.org/10.55908/sdgs.v11i10.570

Transit Notification	Governments must notify the Ministry when GMOs/products are being transited through the country, promoting transparency and biosafety governance.	Cartagena Protocol encourages advanced notice for transboundary movement, but there are no specific obligations for transit.
Penalties	Imprisonment for 3 months to 3 years and fines between 500,000 and 4 million dirhams.	No direct penalties, implementation left to member states.
Civil Liability	Importers, exporters, producers, and carriers are held responsible for any environmental or health damage.	There is no enforcement mechanism for compensation; it is left to countries to develop the required civil liability systems.
Human Rights Aspect	Identifies environmental protections as a basic human right. This is clearly related to 'sustainable development' and the right to development.	Though the Rio declaration and other International Standards emphasize sustainable development , they do not define it in terms of a human right.
Challenges and Gaps	Lacking some clarity in definitions (import, re-export, transfer); there is no explicit penalties for certain breaches (e.g., Art. 4/3); there is no distinction between GMOs in the general sense, and GMOs of animal origin.	There are gaps in particular regarding liability and compensation.

The table above illustrates the convergence between UAE legislation and international standards on GMOs. It indicates that the UAE has established more stringent mechanisms (such as mandatory licensing, significant financial penalties, and clear institutional responsibilities) compared to some international agreements. A comparison of the two systems reveals specific omissions and implementation gaps, including the absence of precise definitions, the ambiguity of some binding liability mechanisms, and the lack of explicit penalties for certain violations, such as those related to transit notifications. This calls for more precise definitions, a more precise gradation of penalties, and a clarification of all liability rules.

The figure below illustrates the degree of alignment between the United Arab Emirates' legal framework on genetically modified organisms and applicable international standards, as assessed through a structured conformity scale ranging from 0 to 5. This scale systematically evaluates regulatory quality and implementation, where a score of 5 denotes best practices; 4 indicates strong regulatory practice with only minor normative or procedural gaps; 3 reflects the existence of formal rules and procedures accompanied by limited enforcement; 2 signifies the presence of certain rules or procedures that lack clear definitions; 1 represents minimal regulatory provisions or the absence of effective implementation mechanisms; and 0 denotes the complete absence of structured or explicit legal provisions.

Figure (1): Compatibility of the UAE's legal framework on GMOs with international standards (Prepared by the authors)



The figure above reveals a significant degree of compatibility between the UAE's legal framework and relevant international standards, particularly in the areas of biosafety principles, prior approval procedures, and regulatory oversight. However, the study highlights shortcomings in traditional rules of civil liability, which may not be sufficient to ensure effective compensation for victims, especially in light of the difficulty of proving causation and the specificity of damages associated with the use of GMOs. Moreover, the current criminal liability rules remain insufficient to adequately deal with risks and crimes related to the use or circulation of modified organisms, which may limit its effectiveness. Accordingly, the results of this study reveal that UAE legislation is largely consistent with international instruments related to GMOs, and that the general structure of UAE legislation is considered advanced in terms of foundational principles and institutional framework. However, there are some structural and conceptual gaps, particularly in the areas of civil and criminal liability. In addition to the need for more precise definitions and harsher penalties. This framework still requires further expansion and legislative development, to ensure full compatibility with international obligations and achieve the highest levels of protection for public health and environmental protection.

Conclusion

This study establishes that genetically modified organisms constitute a central product of contemporary biological engineering, as they actively contribute to agricultural productivity and food security while simultaneously generating substantiated risks to human health and environmental sustainability, thereby necessitating the development of clear, coherent, and enforceable regulatory mechanisms governing their production, circulation, and consumption. The analysis demonstrates that the United Arab Emirates has adopted an integrated legal framework for GMO governance that reflects a substantive commitment to

internationally recognized biosafety principles and aligns, in key respects, with prevailing global standards, positioning the UAE among jurisdictions that pursue nationally grounded yet internationally responsive approaches to biotechnology regulation. Nevertheless, the findings confirm that formal regulatory alignment alone does not ensure optimal protection, as persistent normative and institutional gaps continue to constrain the effectiveness of the existing framework, particularly in relation to accountability, enforcement capacity, and access to effective remedies. At the international level, the study underscores the need to establish permanent oversight and coordination mechanisms capable of strengthening cooperation among states, enhancing compliance with international standards, and addressing regulatory challenges arising from the transboundary movement of GMOs, thereby promoting regulatory coherence and more effective collective risk management. Within the UAE legal system, the research advocates targeted reform of the criminal liability regime applicable to GMOs through the introduction of explicit definitions of prohibited conduct, the clear delineation of authorized activities, and the formulation of proportionate criminal sanctions calibrated to the nature and severity of GMO-related risks, as such clarity enhances legal certainty and reinforces deterrence. In parallel, the study emphasizes the necessity of developing a comprehensive civil liability framework specifically tailored to GMO-related damage, which should move beyond traditional fault-based models and account for the potentially exceptional, diffuse, and widespread consequences of such harm, while ensuring that victims receive prompt and effective compensation upon proof of damage without the burden of establishing causation or identifying a specific source, thereby advancing fairness, equitable risk allocation, and the overall effectiveness of biosafety governance.

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