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Trade and sustainability: analysing Specific Trade Concerns (STCs) through the Theory of Change

This study explores the link between trade and sustainability, focusing on Sanitary and Phytosanitary (SPS) measures within the WTO framework. It highlights the importance of Specific Trade Concerns (STCs) as a dispute management tool and their implications for sustainability. Analysing three case studies – EU-China (African Swine Fever), EU-India (Methyl Bromide fumigation), and Senegal-EU (mango exports) – the paper identifies divergent, negotiable trade-offs, and cooperative behaviours among trading partners. The study applies the Theory of Change (ToC) framework to the three STCs to assess the effectiveness of linking trade with sustainability goals. Findings reveal that sustainability considerations are critical for resolving STCs and achieving policy coherence and integration. The EU-Senegal case demonstrates ToC alignment, showcasing the success of a cooperative approach in addressing sustainability. In contrast, unsolved issues in the EU-China and EU-India cases highlight faults in sustainability integration. The study underlines STCs' potential for modernising the WTO by fostering the linkages between trade and sustainability through institutional change.

Keywords: Specific trade concern (STC), Theory of Change (ToC), WTO, sustainability, European Union, China, Senegal, India
JEL classifications: F13, F18, Q17.

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Introduction

The role of trade in reducing poverty and integrating developing countries in the global world is widely recognised (World Bank Group and World Trade Organization, 2015 and 2018). International trade and investment have been shown to be essential to fighting poverty and achieving the Sustainable Development Goals (SDGs) of the United Nations (UN) Agenda 2030. Despite recognising the benefits of liberalisation through reducing tariff barriers, trade has faced growing protectionism in recent years (Gunnella and Quaglietti, 2019; Mariotti, 2023; Zahoor *et al*., 2023). The World Trade Organization (WTO), the main engine of this liberalisation, is under fire due to growing geopolitical tensions and the recognition that global competition has resulted in an unfair distribution of the economic gains and losses from trade experienced by sectors, regions and workers around the world (Stanford, 2020; Dullien, 2018). The WTO is experiencing a crisis of legitimacy and needs to be prepared effectively to address the challenges of rapid economic, political, social, technological and environmental change (Oonagh, 2020).

Discourses on the modernisation of the WTO refer to its three pillars: trade negotiations, trade policy monitoring and reform of the dispute settlement system (Mildner *et al.*, 2022; Van der Loo, 2022). Increasing attention is also paid to promoting environmental and social sustainability through trade. Agenda 2030 recognises international trade as a means to achieve socio-economic development; however, understanding the linkages between trade policy and sustainable development remains challenging for policymakers (UNCTAD, 2015 and 2016).

In recent years, the growing liberalisation of agricultural trade brought about by tariff reductions has been accompanied by an increasing use of non-tariff measures (NTMs) (Olper, 2017; Beguin, 2022; Grant and Arita, 2017; Matthews *et al*., 2017; Disdier and Fugazza, 2019; Beverelli *et al.*, 2014). These are defined as measures other than the imposition of tariffs that have the potential to affect trade in terms of the quantity of goods traded, prices or both (DITC, UNCTAD, 2010). NTMs range from measures used as trade policy instruments with a mainly protectionist scope (the so-called non-technical measures) to technical measures with non-trade policy objectives aiming to protect health or the environment (UNCTAD, 2016). UNCTAD developed a comprehensive classification of NTMs in 2012, and it has been progressively updated to reflect the evolution of international trade (UNCTAD, 2019).

Most NTMs are represented by Sanitary and Phyto-Sanitary (SPS) measures and Technical Barriers to Trade (TBT) regulations. Although the latter predominates in total trade in terms of the number of products covered and as a share of trade value covered, the former dominates in agri-food trade (Disdier and Fugazza, 2019; WTO ITC UNCTAD, 2021). Approximately 80% of world agricultural trade is estimated to be affected by SPS measures, representing 10% of total world trade (UNCTAD, 2016).

Within the WTO, the SPS Agreement covers regulations on food safety and animal and plant health standards. SPS measures are primarily used to protect human health, animal or plant life and the environment, and thus directly address issues related to sustainable development. This increases friction between countries over SPS measures because of their potential to distort international trade (Roberts and Unnevehr, 2003). In turn, by affecting trade, they also indirectly impact sustainability through trade (UNCTAD, 2015 and 2016). Therefore, we can observe a reciprocal relationship between trade and sustainability, where one influences the other.

Under the SPS Committee, a peer review system exists to allow countries to learn more about each other's national

implementation of SPS measures when they are considered adversely affecting trade in light of international obligations (Posada *et al*., 2022; Hoekman *et al.*, 2023). This system, called Specific Trade Concerns (STC), is considered a transparent monitoring tool to avoid trade disputes. STCs are raised orally in the SPS Committee, and progress made through bilateral discussions between trading partners is summarised in notes by the Secretariat. They are not formal disputes but are often a signal that a national measure taken by another WTO member is considered inconsistent with international rules (Horn *et al*., 2013). According to the literature, STCs have defused potential trade conflicts by resolving trade concerns non-litigiously (Horn *et al*., 2013; Posada *et al*., 2022; Holzer, 2019; Wolfe, 2020), leading some scholars to suggest using STCs to resolve trade frictions regarding national security issues in an expanded sense (Hoekman *et al.*, 2023). The literature also highlights the need to strengthen STCs to enable full participation of all WTO members, especially the less developed ones with more limited administrative capacity, information or financial resources for proactive and constructive engagement (Wolfe, 2020).

As STCs are raised because SPS measures are perceived to be overly trade-restrictive, thus affecting the achievement of sustainability goals, we analyse three STCs with the EU as a trading partner to identify potential problems that standards and their implementation pose for trade with a view on sustainability issues: a) EU-China on African Swine Fever (ASF), b) EU-India on Phytosanitary import restrictions, and c) Senegal-EU on the Rapid Alert System for mango imports.

An extensive literature has analysed STCs as a good proxy for non-tariff measures that constitute trade barriers (Laget and Deuss, 2023; Orefice, 2016; Fontagné *et al*., 2015), but to the best of our knowledge, no study has explored the sustainability issues behind STCs and the different perception of such matters of trading partners.

This study is developed within the TRADE4SD horizon project, and it aims to fill this gap through the three case studies, which are representative of the various behavioural dynamics of the EU and its partners in terms of reciprocity and asymmetries between countries regarding sustainability goals.

Moreover, we try to add new evidence to Wolfe's (2020) work on using STCs to manage conflicts within the WTO. In this context, we consider the Theory of Change (ToC) as a valuable tool to improve this system and contribute to resolving international frictions (Vogel, 2012), keeping in mind the goal of fostering positive linkages between trade and sustainable development. Institutions can contribute to building a bridge between trade and SDGs, ensuring that each component of the global value chain is actively involved in this integration process. Institutional building can be pursued mainly through two paths: policy coherence and policy integration (Cejudo and Michel, 2017).

The ToC represents an effective instrument for assessing policy coherence among different institutional levels, contributing to constructing links between trade and sustainability, and cooperating rather than competing in pursuing common goals. At the same time, given the established goals, the ToC contributes to assessing policy integration among measures and interventions in different fields (agriculture, trade, labour, safety standards, ecoservices, etc.). Institutional building is necessary to solve international controversies, and it is an incremental endogenous process requiring the involvement of all the actors interested in it (Pain, 2022).

Given the general framework of the ToC, we assess the extent to which this has been followed in the context of the three cases we chose to examine as well as whether there is a link between the stage the three cases are in and the proper setting of the ToC. It must be kept in mind, in fact, that the ToC is not a structured methodology but rather a process that needs to be built taking into consideration some relevant steps and interaction with the specific environment.

Our main objective is to analyse our case studies by applying the main steps of the ToC with the ultimate aim of verifying whether the ToC makes STCs more efficient and can be used as a conflict smoothing tool in the WTO. Our analysis demonstrates the validity of the ToC in bringing out sustainability issues underlying STCs, avoiding deadlock and contributing to the resolution of frictions more easily and quickly. In this sense the results of the analysis are generalisable, and the process can be applied to other cases, confirming the validity of the ToC applied to STCs.

This different reading of STCs through the lens of the ToC represents an example of WTO modernisation and a contribution to institutional change (Pain, 2022). In synthesis, the aim of this study is twofold:

1. To investigate how SPS measures may enhance the achievement of sustainability issues, as perceived by trading partners;
2. To outline a way to modernise the WTO in relation to sustainability through STC, with a view to increasing the participation of less developed countries following the principles of the ToC.

In the following pages, we first highlight the growing importance of STCs and their role in defusing potential disputes. In section 3, three case studies highlight the different sustainability issues underlying the STCs, as perceived by the trading partners. Section 4 focuses on a possible pathway for modernising the WTO, suggesting that STCs may be used to manage conflicts in alignment with a general ToC framework. Section 5 discusses the extent to which the results of our case studies are consistent with the different steps of a ToC, with a particular focus on sustainable issues. The final section concludes. Appendix A attempts to apply the ToC to our case studies dealing with trade and sustainable issues.

The relevance of STCs in WTO

The economic effects of standards NTMs have been thoroughly discussed (Josling *et al.,* 2004; Bureau *et al.,* 1998; Tian, 2003; Disdier and van Tongeren, 2010). TBTs, SPS and other "technical" NTM policies impacting the quality of products, or the way in which commodities are manufactured and sold to end users are examples of NTMs that resemble

standards. Unlike tariffs, their effect on trade is more nuanced. The rationale is that, in comparison to tariffs, NTMs are more varied and complex. NTMs fall into sixteen categories, ranging from trade-related non-technical measures (like subsidies, quotas, anti-dumping, pre-shipment inspections, etc.) to product-related technical measures (like technical requirements and conformity evaluations). In 1995, both NTMs were implemented following the Uruguay Round agreements. The SPS and TBT agreements aim to safeguard consumers and the environment, thwart protectionism, aid in industry standardisation, and establish technical limits for particular items. TBTs and SPSs are frequently applicable to a product in one or more industries simultaneously. As such, it occasionally affects an entire industry. It can help trade by bringing better information and fostering greater trust between partners, or it can harm trade by adding to the administrative load and raising compliance costs for both exporters and domestic businesses through new rules about the environment and industrial processes. For other WTO members to provide feedback in either scenario, an SPS or TBT must be informed at the WTO as soon as possible. Changes may be made following the comment period. After that, the NTM is approved and released, taking effect at least half a year later. The new TBT or SPS is only in effect during this enforcement period, despite the possibility of some consequences resulting from anticipations.

Researchers have demonstrated a strong interest in product-related SPSs and TBTs since they address the majority of NTMs. WTO committees and councils are key fora where members raise trade concerns concerning measures that may affect trade. Since 1995, the use and discussion of trade issues increased and sometimes facilitated the resolution of trade issues between members. The database detailing trade problems makes it possible to classify them into different categories: a) Council for Trade in Goods (CTG), b) Market Access Committee (CMA), c) Committee for Import Licences (IL), d) SPS and TBT Committees. The graph below shows the current data from which TBT and SPS emerge as the main concerns raised.

As Figure 1 displays, there are currently roughly less than 90,000 notifications between TBT and SPS. 35,246 are the SPS notified compared to about 54,700 TBT measures for the period 1995-august 2024 (see WTO website for detailed information).

The impacts of SPSs and TBTs on trade are challenging to determine. In a study on the TBT and SPS regulations in the agri-food sector, Santeramo and Lamonaca (2019) provide insights into why there are diverse results in the literature. Different industries have distinct objectives for implementing TBTs and SPSs, leading to varying effects. To avoid diluting the significance of TBTs that are not restrictive, some research in the NTM literature has focused on STCs.

Trade concerns related to specific issues, such as SPS measures or TBT, can be raised at the WTO at any time from the notification until after the measures are in effect. These complaints are known as SPS STCs and TBT STCs. According to the official data from the WTO, 835 TBT STCs and 585 SPS were raised between 1995 and 2024. In the STC literature, it is assumed that a concern is raised because a TBT or SPS measure is restricting trade, and STCs are indicators of the most restrictive measures (Beghin *et al.*, 2015; Disdier *et al.*, 2023; Fontagné and Orefice, 2018; Fontagné *et al.*, 2015; Kamal and Zaki, 2018; Orefice, 2016).

Once an STC has been lodged, it can be brought up again at subsequent meetings either by the same countries who raised it initially or by new ones joining the discussion. The dates of the complaints are meticulously recorded: the "first raised date" signifies the initial instance when a specific concern was raised against a particular TBT or SPS measures issue. In contrast, the "last raised date" indicates the most recent recorded instance at the WTO. It is worth noting that multiple raised dates may exist within this period. A concern is considered resolved when no new raised dates have been raised for at least two years.

Food safety and animal health cover 66% of the measures subject to STCs, while plant health is less than 1/4 of the STCs (Figure 2 – STCs by objectives).

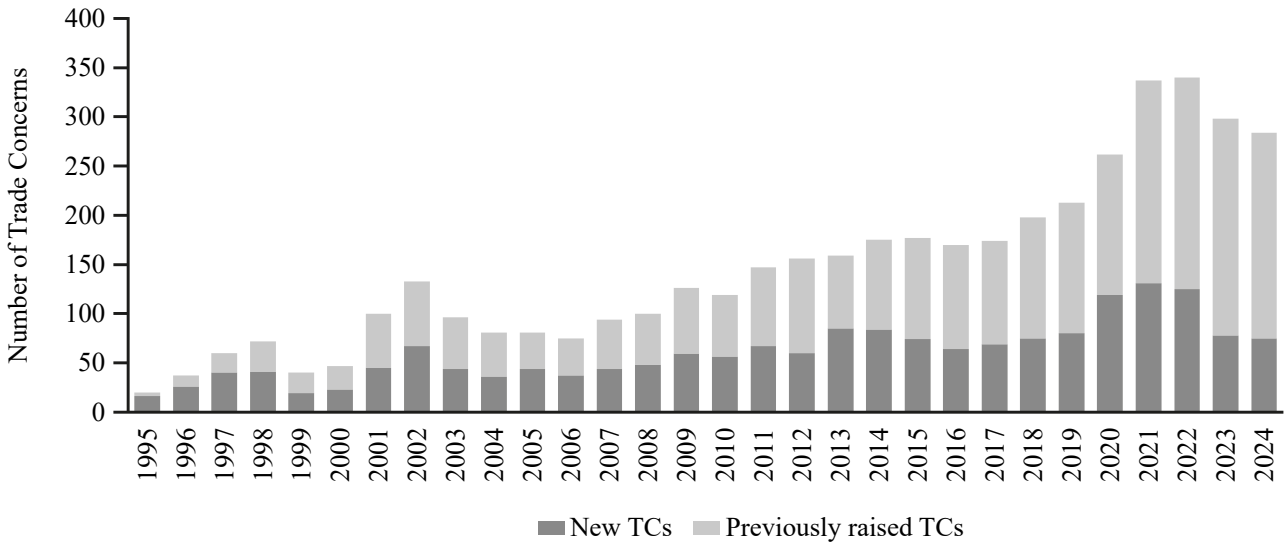

Figure 1: Evolution of STCs over time (1995-2024).
Source: WTO TCs database

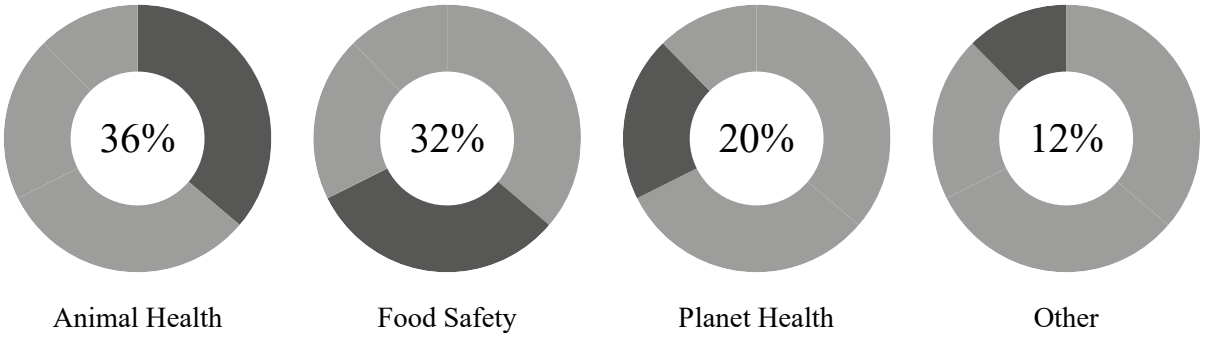

Figure 2: STCs by objectives.
Source: Authors' computation is based on the WTO TCs database

The chapters with the most STCs raised are Chapter 02 - Meat and Edible Meat Offal, which has 189 STCs raised, followed by Chapter 22 - Beverages, spirits, and Vinegar, which has 133 STCs raised. Chapter 08 - Edible fruit and nuts; peel of citrus fruit or melons has 122 STCs raised, and Chapter 04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included has 104 STCs raised.

As we review the notifications and their respective statuses, data analysis indicates that most trade concerns still need to be reported as resolved (82%). This high percentage suggests that many issues must be reported for resolution or updates. Only a tiny fraction is fully solved (13%), indicating that resolution rates might be low or that specific trade concerns take time to address. Even a smaller portion is discussed partially (5%), implying that while some progress has been made, these issues still need to be resolved entirely. This distribution may highlight challenges in the resolution process or a need for better tracking and reporting of these concerns.

The disputes over SPS and TBT measures stem from many reasons, extending beyond protectionist motivations and reflecting cultural disparities. These disputes encompass a wide range of concerns, including issues surrounding the labelling of genetically modified organism (GMO)-free products and other related matters. When we examine the STCs categories using keywords, the analysis emphasises that the primary areas of concern are those associated with human health and food safety.

When analysing keywords, "Human Health" (HH) appears most frequently (19.10%) and "Food Safety" (FS -19.34%) in the STCs, together accounting for over a third of the total (38.44% cumulative). This indicates that these topics are particularly significant and represent the primary specific trade concerns analysed and discussed in the three case studies presented in this article, as shown in Table 1 in the following section. Other significant keywords include Pesticides (6.89%), AH (7.32%), PH (7.20%), and MRLs (6.35%). These keywords collectively cover over 66% of the total entries by the cumulative percentage, highlighting their importance within the data. Less frequent keywords with lower individual frequencies but notable in specific contexts include "Zoonos" (2.47%), "Food Ad" (2.31%), and "Regionalization" (2.32%), contributing to a cumulative total of around 86%.

Finally, comparing the involvement of developed and developing members in raising STCs and the responses from the respective countries indicate that developed members tend to raise STCs more often for developing members or emerging markets. The United States is the most active member, raising 680 concerns, followed closely by the EU with 668 concerns and Canada with 335 concerns. Other notable members raising concerns include China (279), Japan (260), and Australia (222). The EU is the leading respondent, addressing 369 concerns raised by other members.

The United States also frequently responds to concerns, with 172 responses. Other significant respondents include China (157), India (132), Indonesia, the Republic of Korea, and the Russian Federation, each with 63 responses. The analysis of the data reveals some interesting interactions. Brazil and Mexico appear to be active raisers and respondents within the Americas, indicating an engaged dialogue within the region. Asian countries, such as Japan, China, and the Republic of Korea, also show significant activity, often responding to concerns from neighbouring or global counterparts.

The United States has raised numerous concerns (680 in total), with China as one of the primary respondents (157 responses). This reflects frequent interactions where the United States addresses trade issues that may involve China, highlighting common areas of concern like intellectual property, market access, and regulatory standards. Interesting is the case between the EU member states and India (the EU raising 668 concerns, often receives responses from India - 132 responses); this interaction might represent discussions on trade barriers, such as tariffs, sanitary and phytosanitary standards, and compliance with regulatory norms. Another interesting interaction emerges between Brazil, with 208 concerns raised and 172 responses from the United States. This two-way engagement may indicate mutual trade interests, often around agricultural exports, tariffs, and technical standards, where an emerging country like Brazil frequently interacts with a developed trade partner like the United States. These interactions suggest a dynamic relationship between developed, emerging and developing countries in resolving specific trade concerns, often revolving around regulatory standards, market access, and product-specific regulations. Developed countries frequently raise concerns about market entry, compliance, and

safety standards in developing markets, while developing countries address regulatory barriers and trade restrictions in developed markets.

The perception of sustainability behind STCs

In recent decades, the increasing liberalisation of trade and the concurrent interest in promoting sustainability through trade have led to a growing number of NTMs, mostly related to product and process standards. These include SPSs and TBTs, both of which aim to prevent the creation of undesirable barriers to trade. Although most NTMs are non-trade related, changing market access conditions can indirectly impact trade. The direction and magnitude of such effects on trade and welfare are controversial, depending on the type of NTM, the countries/products/standards involved, and the methodology applied (Santeramo and Lamonaca, 2019; Beghin *et al.*, 2012; Roberts and Unnevehr, 2003; Curzi *et al.*, 2020).

The SPS Agreement allows WTO members to "provide the level of health protection they deem appropriate" while ensuring that this does not lead to overly restrictive trade measures. According to Miljkovic (2005), "selecting the appropriate level of protection is an act of sovereignty". Members are encouraged to use international standards but may adopt higher levels of protection if they are based on scientific justification and applied in a transparent and non-discriminatory manner.

The international standards, guidelines, and recommendations referred to in the SPS Agreement are developed by three other international organisations (the so-called "Three sisters"), which have gained importance following their involvement in the SPS Agreement (Roberts and Unnevehr, 2003). The three organisations are:

- the Codex Alimentarius Commission,
- the World Organisation for Animal Health (WOAH),
- the International Plant Protection Convention (IPPC).

The SPS Agreement is based on transparency obligations requiring Member countries to provide all information on the SPS measures they intend to introduce or modify. The system can be described as an inverted pyramid, with a significant number of notifications of SPS measures introduced or designed to be modified at the top and the actual number of disputes at the bottom (Figure 3). This system provides for an ongoing process of consultation between the parties after the notification, which is recognised as an essential step in limiting friction between countries (Posada *et al.*, 2022; Wolfe, 2020). As can be seen, only a limited number of notifications result in STCs, and an even smaller number result in actual trade disputes.

The three STCs analysed differ in many respects: the EU's position in the STC and on trade, the international organisations involved in SPS, the sustainability issues involved, the global dimension of the STC, the number of times the STC was raised, and its status (Table 1).

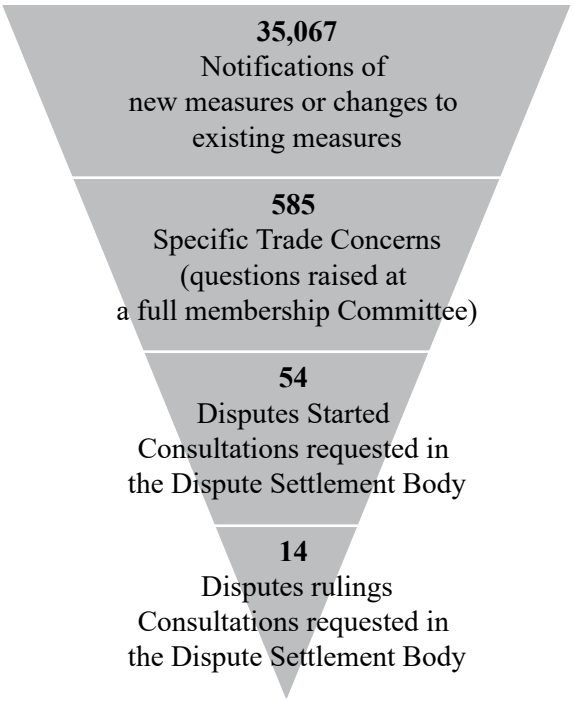

Figure 3: The SPS inverted pyramid (1995 – 31 July 2024).
Source: Authors' Adaptation on WTO
(https://www.wto.org/english/tratop_e/sps_e/sps_e.htm (accessed 27 November 2024)

Table 1: Case studies on STCs.

Case studies	EU-China on ASF (STC m. 392)	EU-India on Fumigation with MBr (STC n. 186)	Senegal-EU on Mango (STC n. 272)
EU position in STC	Raising	Raising with USA Supported by Canada, Chile, New Zealand	Respondent
Number of times STC was raised (until February 2024)	19 (since July 2015)	3 (since March 2004)	1 (June 2008)
International organisations involved in SPS	World Organisation for Animal Health - WOAH	International Plant Protection Convention - IPPC	International Plant Protection Convention - IPPC
Primary subject keyword in STC document	Animal Health	Plant Health	Food safety
Other Keywords (from literature)	Food security	Climate change Food security	Food security
EU position in trade	Exporter	Exporter	Importer
Risk perception on sustainability issues	**China**: Defensive approach for economic and social effects on its territory **EU**: economic concerns in defence of its pork industry	**India**: Trade-off between sustainability objectives (food security vs climate change) **EU**: the effects of MBr on climate change	**EU-Senegal**: Cooperative approach between the two trading partners on economic, social and environmental concerns
The global dimension of STC	Yes	Yes	No
Status of STC	Still unsolved	Solved concerning procedural issues (only with the EU)	Solved

Source: Authors' elaboration

The EU-China case

The first STC deals with Chinese import restrictions from the EU due to ASF. As no vaccine is currently available, prevention is the better way to avoid introducing infected material into ASF-free countries through appropriate import policies and biosecurity measures. To ensure traceability, the measures taken should ensure the identification of animals and products derived, the traceability of the movements, the biosecurity measures in place and surveillance. The EU first raised the STC in July 2015 and has done it 18 more times, most recently in November 2023. China has imposed a country-wide ban on imports of pigs and pig products from EU Member States (MS) where ASF has been detected and does not recognise the EU regionalisation applied by the international standards set by the WOAH. The EU raised concerns about China's ban, considering it overly trade restrictive and inconsistent with China's obligations under the SPS Agreement and WOAH standards (regionalisation). On the other hand, China believes the ban is necessary because of the ineffective control of the disease by the EU MSs with different levels of prevention and control imposed following the SPS Agreement. Regionalisation allows a country to limit the spread of the disease to a restricted area while allowing trade to continue in the rest of the territory. The key element of the approach is the clear epidemiological separation of the animals and herds or flocks belonging to sub-populations of zones from other animals and all factors presenting a risk. Only a few countries partially or fully recognise the EU regionalisation measures for ASF. In contrast, many countries do not recognise the EU regionalisation measures at all. However, the range of products affected by the ban on imports from the EU is very broad and varies from country to country[1]. ASF is a highly contagious infectious disease affecting domestic and wild animals of all breeds and ages. Its spread worldwide has become a primary global source of crisis for the pork industry, with a high socio-economic impact on the affected countries due to restrictions on meat exports and limitations on local forest activities (Sánchez-Cordón *et al.*, 2018). Furthermore, its proliferation poses a severe problem for global food security, as pork meat is one of the primary animal protein sources and is expected to account for 34% of all the protein from meat sources by 2030 (OECD/FAO, 2021). China is both the largest producer and consumer of pig meat in the world, accounting for over 40% of the total in 2021.

The EU-China case study highlights the different perceptions of risk associated with food safety and food security between the two trading partners. The perceived failure to accommodate legitimate differences in food regulations is a crucial element that can increase resistance to trade liberalisation and lead to unanticipated policy decisions (Roberts and Unnevehr, 2003). China and the EU take divergent positions on regionalisation's impact, an issue widely discussed in the WTO. According to the EU Commission, under the umbrella of the Animal Health Law legal framework, which provides for strict measures to apply regionalisation based on scientific evidence, entirely in line with international standards and based on risk mitigation measures in areas affected by animal disease, the Special ASF control rules have proved to be effective in preventing/controlling/slowing down the spread of diseases, while allowing safe trade to continue without lowering the safety level of traded/exported commodities (European Commission, 2019, 2021). On the other hand, considering the spread of the disease in the EU, China encourages bilateral applications for export licenses from EU MSs. In December 2021, a regional management agreement for ASF was signed, which is the first EU recognition of regionalisation. The deal allows France to export pork from unaffected regions, even if ASF has occurred elsewhere in France.

The different positions on the impact of regionalisation, in turn, reflect the different expectations for achieving sustainability goals in both trading partners. China's highly defensive position shows a high sensitivity to socio-economic concerns (food security) in a country characterised by a strong separation between pork production and consumption area (Yao *et al.*, 2022). For its part, the EU seeks to protect its pig industry for economic reasons, as it is the world's largest exporter of pigs and pig products and the second largest producer in the world after China, with a high concentration of pig meat production in a few MSs. The sector accounts for 8.5% of the total EU-27 agricultural output, the highest share of any meat sector (Augère-Granier, 2020). The STC shows a divergent perception of sustainable issues between the trading partners, one more pronounced on food security and the other on economic concerns. The length of STC, its recurrent nature, and the more general question of recognising regionalisation for managing outbreaks are clearly attributable to broader geopolitical tensions. The STC is still unsolved.

The EU-India case

The second STC concerns India's Phytosanitary import restrictions, due to the requirement of fumigation of plants and plant material with Methyl bromide (MBr). The STC was raised by the EU and the US (three times, all in 2004), supported by Canada, Chile, and New Zealand. MBr, as a fumigant, is recognised as an essential tool for controlling some quarantine pests of plants and plant-derived materials. At the same time, MBr is a powerful ozone-depleting gas. For these reasons, MBr is regulated by two Multilateral Agreements: the Montreal Protocol on Substances that Deplete the Ozone Layer and the IPPC. The production and consumption of MBr has been phased out worldwide by 2005 for developed countries and by 2015 for developing countries. There is an exemption to the ban for MBr for Quarantine and Pre-Shipment (QPS) use, considering the need for its use where there is no alternative. However, countries are encouraged to use options to MBr where they are technically and economically feasible. In the EU, the production and consumption of MBr for QPS purposes has been banned since March 2010, and MBr fumigation is not allowed for agricultural exports/imports. In 2004, a new import regulation came into force in India, requiring

[1] For details on trade barriers affecting EU exports to non-EU countries by the type of measures and by the product affected, see the DG Agri website https://trade.ec.europa.eu/access-to-markets/en/content/trade-barriers.

pre-shipment fumigation treatment with MBr for most plants and plant products. Because of the ban, India allowed fumigation on arrival in India until 2017. However, due to the thinning of the ozone layer over the country, India first withdrew and then reinstated permission for fumigation at Indian ports. Since 2017, periodically (every six months), India has been granting a waiver from using MBr in exporting countries and allowing fumigation on arrival, subject to payment of a penalty by exporters. Concerns have been raised about procedural issues – lack of predictability and transparency of import procedures, extra costs for paying penalties – and India's reluctance to accept alternatives to MBr.

The analysis of the EU-India STC looks at the trade-off effects of the SPS implemented by India, which focuses more on food security than climate change. In this sense, although the STC was formally raised due to problems with the harmonisation of procedures (including the imposition of penalties on exporters), the underlying sustainability issues reveal a different level of awareness/needs of the two partners. Continuous dialogue between the EU and India was conducted to resolve the STC regarding the procedural issues (payment of penalty lifted in 2022).

The Senegal-EU case

The third STC was raised by Senegal (once in 2008) for problems with control, inspection and approval procedures. It concerns the EU's restriction of mango imports from Senegal due to the interception of the fruit fly (an invasive pest considered the primary threat to the horticultural industry in Africa) in imports from Senegal. The mango sector in Senegal has grown dramatically in recent years, both in terms of production and exports. Still, its potential remains under-exploited due to the weakness of the production structures in the central Senegalese-producing regions. To strengthen measures to prevent the introduction and spread of harmful pests and diseases in the EU, a revised EU phytosanitary regime entered into force in December 2019, imposing additional requirements on all countries exporting mangoes to the EU (one of these is the submission to EU of a dossier detailing the "effective treatment" that is intended to be applied to all mango exports to ensure they are free from fruit flies). The EU and Senegal are working together to modernise the mango sector, make it compliant with the new EU SPS regulation, and continue exporting to the EU.

The case of Senegal is an example of cooperative behaviour between the two partners. Both partners are aware of the mango sector's importance in contributing to Senegal's sustainable economic growth and its potential to provide employment opportunities, particularly for women and young people, and to support rural communities by reducing poverty and ensuring decent work (Maertens and Swinnen, 2009; GIZ, 2021; COLEACP, 2022). The STC has been declared solved.

The analysis of the three STCs reveals that the two partners have different levels of awareness and needs regarding the underlying sustainability issues.We have identified three different behaviours regarding sustainability:

- divergent (EC-China case), because the two trading partners pose divergent sustainability goals on the same issue (regionalisation), China more pronounced toward food security and the EU on economic concerns (the defence of its pig industry) in an ongoing and not yet concluded discussion;
- negotiable trade-offs (EU-India case), because India presents a trade-off between sustainability objectives (food security vs climate change), focusing more on food security (the control of some quarantine pests of plants and plant-derived materials) while the EU on climate change (the effects of MBr on ozone layer); the two-trading partner reached a compromise solution on trade aspects;
- cooperative (Senegal-EU case) because the two trading partners share the same sustainability goals, that is, the importance of the mango sector in contributing to Senegal's sustainable economic growth. The STC is considered solved.

The next step will be to outline a path towards WTO modernisation in relation to sustainability through STCs, increasing the participation of less developed countries, following the principles of the ToC.

A way to WTO modernisation: the ToC

The second objective of our study is to present a pathway for modernising the WTO by investigating the links between trade and sustainability through a constructive and ongoing process of cooperation and consensus-building aimed at overcoming trade-offs and developing win-win situations.

This part of the work has been developed according to the logical framework of the ToC, which has dominated the institutional construction and capacity buildings of the major international agencies and agreements over the last decades (Vogel, 2012). The ToC is a methodology that assists organisations in planning, implementing, and evaluating initiatives to create social and environmental change (Lambert, 2023). It is conceived within the large framework of institutional change, and it is intrinsically connected to transition economics and economic development (Kingston and Caballero, 2009). This theory is beneficial for understanding, analysing and contributing to resolving international frictions. The key points of the ToC can be summarised as follows: 1) the theory attempts to hold together concepts such as context, actors and a sequence of logically-linked events leading to long-term change, although there may be many combinations and differently developed applications of these; 2) the approach is easily adaptable according to the nature, scope and level of detail of the change being implemented in different organisations and agencies; 3) the ToC is seen as a more realistic and flexible thinking tool than other current logical framework approaches. Following this theory, the main objective is to identify accelerators and enablers, bottlenecks and solutions to address bottlenecks to enhance the country's ability

to prioritise actions to achieve sustainable issues along the three pillars of sustainability: economic, social and environmental.

Developing a comprehensive ToC requires a deep understanding of the underlying causes of a specific social issue. At the same time, it is important to acknowledge the diverse interventions addressing such causes. Practitioners should articulate their assumptions regarding how these interventions will lead to the desired outcomes. Additionally, they must create a precise plan for measuring and evaluating the impact of these interventions over time.

Furthermore, the ToC needs to be communicated to stakeholders. This is one of the most common issues raised in the good implementation of the ToC since it ensures that everyone involved in the project comprehends the strategy for effecting positive change in the system. Many stakeholders' inability to support and enhance linkages between activities and outcomes raises significant problems for the evaluation design (Connell and Kubisch, 1998). One of the most relevant factors in determining the feasibility of the ToC is the capacity of stakeholders and evaluators to identify, prioritise, and measure the key activities and contextual factors. The challenge posed by the theory of change approach is to theorise prospectively about these issues.

The construction of a specific ToC should drive organisations to identify risks and challenges associated with a particular initiative, create the conditions for mitigating those risks, and evaluate the impacts. So, the crucial point is that there is not a generalised ToC but a context-specific identification of a process: from the inputs to the outputs and the final outcomes of an evidence-based central activity (Figure 4).

The IPPC has also adopted the ToC approach, which aims to a deeper integration between the actors involved,

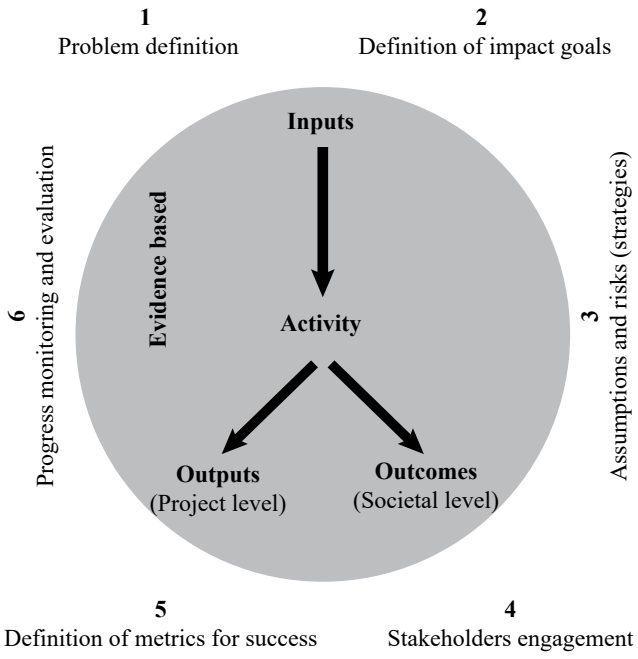

Figure 4: The theoretical representation of a context-specific ToC.
Source: Authors' elaboration

with a view to introducing the principles of environmental and social sustainability and meeting the UN Millennium Development Goals. To achieve this, the only fruitful way is to analyse specific cases, set up a process of learning from experience, build some good practices to inspire and lead the way to further steps (Wolfe, 2020).

The foremost step of the ToC can be summarised in the following (Lambert, 2023):

1. Definition of the problem. Determine the causes of the problem and its main consequences. This phase involves research, stakeholder participation, and data collection to better understand the problem's causes.
2. Definition of impact goals and strategy (mapping solution). Once the problem has been identified, objectives and possible solutions must be defined through a logical model that defines the initiative's inputs, activities, outputs, and results. The model should be based on data collected and identify connections between activities and expected outcomes.
3. Identification of assumptions and risks. For the model to work well, it is important to identify all assumptions underlying the logical model and any potential risks that could affect the initiative's success. This will help develop strategies to mitigate risks.
4. Stakeholder engagement. Throughout the ToC's design process, it is important to involve stakeholders and collect feedback on their approach.
5. Definition of metrics for success. To monitor the initiative's progress and assess its impact, it is important to define evaluation metrics. This can be achieved through both quantitative and qualitative measures, such as the number of people reached, changes in behaviour or attitudes of those involved, improvements in health or well-being, etc.
6. Progress monitoring and evaluation. Once the ToC is implemented, monitoring and evaluating progress over time is important. This will help identify all areas where the approach can be adapted and where action can have the most significant possible impact.

Discussion of the results

Considering the consensus on how to improve the use of STCs to reduce trade disputes to modernise WTO (Wolfe, 2020; Fabri *et al*., 2023; Posada *et al*., 2022) and keeping in mind the goal of fostering positive linkages between trade and sustainability, we try to add new evidence on the use of STCs to manage conflicts within the WTO following a ToC framework.

The STC mechanism is a process that has the potential advantage to enhance cooperation, transparency and surveillance, promote policy learning and best practices, engage economic diplomacy to clarify misunderstandings, create a dialogue between experts, and thus provide a space for cooperation (Santana and Dobhal, 2024; Fabri *et al*., 2023). So, our goal is not to apply a ToC framework to our cases but to read, through the lens of the ToC, the strengths and weaknesses of STCs as a conflict management tool in the WTO when sustainability issues are considered.

From the analysis of Table 2, in which the coherence of the three case studies examined with the steps of the ToC is highlighted, it emerges that the only case coherent with a ToC approach is the Senegal-EU, confirming the cooperative behaviour identified previously, in which the sustainability issues underlying the STC emerged from the very early steps (Problem definition). In this case, stakeholders (both public and private) of the two trading partners have cooperated to contribute to Senegal's sustainable economic growth by modernising the mango sector and making it compliant with the new EU SPS regulation. The clear understanding of the problem on which the two partners converge has allowed them to identify the correct strategy involving, also through technical assistance programmes, local actors and small producers. This is the only case solved of the three presented regarding sustainability issues. It is worth noting that many international development organisations developed a ToC to build a logical framework under which to develop a specific project (USAID, 2017; CORAF, 2018; World Bank, 2021) or to evaluate the program (IEO UNDP, 2023; Ministero degli Affari Esteri e della Cooperazione Internazionale, 2021).

EU-China and EU-India cases both appear inconsistent with the ToC framework. While the EU-India case is resolved on the trade side, it is not on the sustainability side, where the behaviour of negotiable trade-offs has emerged from the analysis in the above section. Both cases show weakness already in the definition of the problem (first step of the ToC), where it would be necessary to consider the (different) sustainability objectives of the two trading partners. This issue affects the subsequent steps regarding stakeholder engagement, as well as the definition of assumptions, risks, and strategy. The EU-China case is far from a solution both from a trade and sustainability point of view (it is the case where divergent behaviour emerges from the previous section). In both cases, there is a need to raise the level of ambition in bilateral economic and trade relations for sustainable development, involving stakeholders of a higher political level.

Table 2: Coherence of the three case studies with the ToC framework.

	EU-China (African Swine fever)	**Coherence with the ToC**	**EU-India (Fumigation)**	**Coherence with the ToC**	**Senegal-EU (Mango)**	**Coherence with the ToC**
1. Problem definition	Bring out the sustainability issues underlying STC	No	Bring out the sustainability issues underlying STC	No	Bring out the sustainability issues underlying STC	Yes
2. Goal definition and strategy	Goal definition Restart trade flows, responding to concerns about the safety of trade This contributes to achieving the sustainability objectives of partner countries (economic sustainability for the EU and food security for China)	Partial	Goal definition Restart trade flows, responding to concerns about the safety of flows while respecting EU concerns about climate change This contributes to achieving the sustainability objectives of partner countries (climate change for the EU and food security for India)	Partial Attention focused on trade barriers	Goal definition Contributing to Senegal's sustainable economic growth and its potential to provide employment opportunities, particularly for women and young people, and to support rural communities by reducing poverty and ensuring decent work	Yes
	Strategy - Enhancing cooperation and exchange of information - Increasing the level of ambition in bilateral economic and trade relations for sustainable development	Partial China promotes a Regional management agreement for ASF (like that signed with France in December 2021). This represents a point of vulnerability because China circumvents the problem by switching from a multilateral to a bilateral approach	Strategy Bring the discussion regarding climate change to the table	No Attention focused on food security only.	Strategy Modernise the Senegalese mango sector and bring it into compliance with the new EU SPS regulation.	Yes
3. Assumptions and risks	- Widespread scepticism about the effectiveness of regionalisation applied by the EU (many countries do not recognise EU regionalisation) - Spread of ASF in the EU Member states despite the regionalisation system	Yes	- Delays regarding the approval of alternative methods/products to MBr - Deriving from the fact that for India, the concern about short-term risks (pests) is predominant compared to medium/long-term risks (climate change)	Yes	Weakness of the production structures of the main Senegalese producing regions	Yes
4. Stakeholders engagement	Technical and political level of institutional stakeholders	No	Technical and political level of institutional stakeholders	No	Public and private sectors along the supply chain Local actors and small producers NGO and donors	Yes
5. Definition of metrics for success	STC is not solved on both the trade and sustainability sides, and recurrent	Elimination of the country-wide ban on imports from EU MSs where ASF was detected	STC partially solved on the trade side but not on the sustainability side	Reduction of MBr production and consumption for India's QPS purpose	STC solved both the trade and sustainability side	Continue exporting to the EU
6. Progress monitoring and evaluation		STC definitively solved		STC definitively solved		STC definitively solved

Source: Authors' elaboration

Conclusions

In recent years, the reduction of tariffs has been accompanied by an increasing use of NTMs in agri-food trade. SPS measures, which dominate in this field, are primarily intended to protect human, animal or plant life or health. Their trade-distorting potential causes increasing friction between countries that question the national implementation of SPS measures. Under the SPS Committee, a crucial role in defusing potential trade conflict is played by STCs considered a useful tool to be strengthened to modernise WTO.

For these reasons, exploring the sustainability issues underlying STCs and the different perceptions of these issues by trading partners through three case studies with the EU as a trading partner is crucial to identifying potential problems that standards and their implementation pose for trade with view sustainability issues. This topic is particularly relevant to the EU, given its central role in global trade and its particular sensitivity to the issue of sustainability in trade.

The analysis investigates the linkages between sustainability concerns in STCs and trade. One innovative element in pursuing this goal was applying the main steps of the ToC framework, which mainly highlights the processes through which change occurs. Through this lens, we could see and assess the effectiveness of building a link between trade and sustainability and to what extent this paves the way to further steps towards a synergic relationship between the two.

As SPSs are trade-restrictive measures introduced by a country to provide the level of health protection considered appropriate, the three case studies illustrate the importance of considering the sustainability issues underlying STC.

The analysis reveals three different behaviours: divergent, negotiable trade-off and cooperative. The exercise of reading the case studies through the lens of the ToC confirms the importance of taking sustainability issues into account to resolve STCs while contributing to reaching coherence among institutional levels and integration among different political fields. As a matter of fact, as shown in our study cases, only the cooperative behaviour between Senegal and the EU has proven to be more consistent with the application of a correct ToC. Correctly identifying the problem and engaging stakeholders in a participatory, collaborative and coordinated process could further improve the link between trade and sustainability and enable international trade to contribute to sustainable development. The other two cases seem inconsistent with the ToC framework, starting from defining the problem (first step) and affecting the subsequent phases. These two cases are the ones that have been going on the longest, have been raised numerous times and still remain unresolved (or partially solved but only from the trade point of view).

By definition, STCs bring with them sustainability issues, and if properly grounded to fully consider these issues, they can contribute to the resolution of frictions more easily and quickly. In this context, the ToC could be a way to manage STCs that brings together both trade and sustainability aspects, representing a path to dispute resolution and WTO modernisation through an incremental endogenous process of institutional change.

The work has been developed through a qualitative approach and a limited number of case studies. This limitation, however, is balanced by the diversity of the proposed cases, which are examples of three different behaviours of the trading partners, and by the possibility of applying the ToC to specific situations. The ToC is, in fact, built on this specificity and would not allow for a generalisation of the results. As reported in the introduction, the ToC is rather an analytical process rather than a complete and unique body of theory and a methodological framework. Future development of the work should focus on understanding the sustainability issues underlying STCs and how this can be used to resolve frictions between countries and prevent trade disputes, contributing to the modernisation of the WTO. Our analysis marks a significant advancement in developing a new approach to linking trade and sustainability. The preliminary results are not only promising but also suggest strong potential for further validation through additional research.

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Appendix

Table A1: An application of the ToC to our case studies dealing with trade and sustainable issues.

ToC steps	EU-China (African Swine fever)	EU-India (MBr Fumigation)	Senegal-EU (Mango)
1. Problem definition	The outbreak of ASF has impacted the world pork market and led to trade tensions between the EU and China. China imposes a country-wide ban on imports of pigs and pig products from EU MS where ASF has been detected, not recognising the EU regionalisation applied in accordance with WOAH. Currently, no vaccine is available. Prevention is the best way to avoid introducing infected material into ASF-free countries with adequate import policies and biosecurity measures. Consequences: • The ASF outbreak and trade restrictions have disrupted the global pork market, leading to a worldwide pork shortage, driving up prices, and affecting consumers worldwide. • The trade dispute has caused economic losses for both the EU and China, with declining exports, reduced revenues, and job losses in related industries. • Food safety is being questioned due to disruptions in the global pork market, particularly in regions that heavily rely on pigs as their protein source.	Due to India's strict import phytosanitary measures, particularly the use of MBr, countries willing to export plants and plant materials to India have faced unfavourable circumstances. Such barriers have also led to exporters' suffering in terms of additional costs and time. Consequences: • Cost increase: The use of MBr fumigation for exports to India, the regulatory issues involved, and the possible delays will adversely limit the returns from such exports. • Decline of the export market to core Countries: The sourcing market of exporting nations for plants and plant materials has shrunk because of India's phytosanitary barriers. • Fumigant-based MBr phase-out: The use of Mbr in fumigation due to the depletion of the ozone layer has also raised pertinent questions, and there is a clamour for its replacement with safer substances. • Damage to countries where India focused on extending trade relations	Senegal has endured losses and livelihoods for farmers and exporters due to the EU ban on mango imports from Senegal due to fruit flies. Consequences: • Losses: The EU ban caused massive losses to the Senegal mango export industry, farmers and exporters, and related businesses. • Livelihoods: Loss of income from mango exports has affected thousands of people in Senegal, mostly in rural areas. • Trade tensions: The trade dispute between the EU and Senegal has created tensions and strained relations.

ToC steps	EU-China (African Swine fever)	EU-India (MBr Fumigation)	Senegal-EU (Mango)
2. Definition of impact goals & Strategy	Objectives: • Acceptance of the regionalisation principle • Control ASF Outbreak. • Restore Trade flows Logical Model: • Inputs: Funds invested in Research, development, and Maintenance, cooperation among international organisations and governments, and biosecurity. • Activities: Research and development of ASF vaccines and diagnostic tools. Establishing biosecurity protocols on pig farms. Monitoring and surveillance of outbreak occurrences. Negotiating for ratifying treaties and common ground for regionalisation principle. • Outputs: New vaccines for the control of ASF and diagnostic tools, agreed biosecurity protocols, ongoing trade measures and consequent evaluation of trade recovery. • Results: Control of ASF outbreak. Ensuring a balanced pork market worldwide improves food security and animal health.	Objectives: • Remove trade barriers • Promote alternatives to MBr • Enhance regulatory efficiency, reducing delays and uncertainties. • Enhance bilateral cooperation Logical Model: • Inputs: Research and development of alternative pest control methods; coordination among international organisations and governments; evolution of regulatory infrastructure. • Activities: Research and development of sustainable pest control alternatives; harmonisation of phytosanitary standards to international best practices; streamlining regulatory procedures; training and capacity building of regulatory authorities; information about climate change risks. • Outputs: Sustainable and efficient pest management methods; reduced use of MBr; simplified and transparent regulation process; enhanced trade opportunities of India with other countries fetching national excise. • Results: Reduced trade barriers for plants and plant material; enhanced environmental sustainability; strengthened bilateral relations and food security and agricultural development.	Objectives: • Eradicate fruit fly infestation. • Meet EU SPSs. • Restore trade relations. Logical Model: • Inputs: Agricultural research, development and extension services; mango production and export infrastructure; Senegal-EU cooperation. • Activities: Research on fruit fly control methods; implementation of good pest management practices; upgrading of export facilities and quality control systems; negotiation and implementation of trade agreements. • Outputs: Fruit fly eradication in mango production areas; compliance with EU SPSs; capacity of Senegal's mango export industry; resolution of trade disputes and expected trade flows. • Results: Increased mango exports from Senegal to the EU; improved livelihoods for farmers, rural areas and exporters; strengthened bilateral relations; food security and agricultural development.
3. Identification of Assumption & risk	Assumptions: • The successful development of effective ASF vaccines and diagnostic tools is achievable. • The implementation of stringent biosecurity measures can help to prevent disease from spreading entirely. • The ASF outbreak and trade war battle will be won by international unity and collaboration. • The trade crises between the EU and China will be solved to restore business as usual. Risks: • The likelihood of new strains of ASF virus that existing vaccines or diagnostics cannot control. • Ineffective disease control procedures for pigs kept in farms that would no doubt trigger an outbreak. • There is an increasing level of trade discord and retaliatory actions among the EU and China. • Status quo on the recognition of regionalisation. • Adverse impacts on the economies of both regions, such as loss of employment opportunities and fall in consumer confidence.	Assumptions: • Alternative pest control methods can be developed, improved and effectively implemented. • India is committed to reducing its reliance on MBr and improving its phytosanitary regulatory framework. • International cooperation and collaboration will be sufficient to address the phytosanitary concerns, climate change issues and trade barriers. • Both India and exporting countries are willing to compromise and find mutually beneficial solutions. Risks: • The development and improvement of alternative pest control methods may be challenging or time-consuming. • India may face resistance from domestic stakeholders to changes in phytosanitary regulations. • Trade tensions may escalate if the issue is not resolved promptly. • The prolongation of the concern may results in an increased risk of climate change consequences	Assumptions: • The fruit fly control strategy can be successfully established. • Senegal's mango export industry can be brought to a new level of development and compliance with EU standards. • The EU and Senegal are committed to improving the supply chain. • The EU and Senegal are committed to solving the trade dispute and restoring expected trade flows. • International cooperation and collaboration are good enough to handle the fruit fly infestation and trade barriers. Risks: • The emergence of fruit fly strains resistant to control methods might be problematic. • Senegal's mango export industry may have problems complying with the EU SPSs requirements. • The trade dispute may get worse. Hence, the economic losses for Senegalese farmers and rural areas might increase, and the bilateral relations might be even more strained. • Climate change may worsen the fruit fly problem and make control efforts more difficult.
4. Stakeholders engagement	Stakeholders should participate in the process. In particular: • Government officials of the EU and China who are in charge of agriculture, trade and health. • Pork industry representatives: Producers, processors, and exporters in both regions. • Science experts: Scientific and veterinary workers involved in ASF and animal health research. • International organisations and NGOs. • Consumer groups and environmental associations.	Stakeholders should participate in the process. In particular: • Government officials of the EU and India who are in charge of agriculture, trade and environment. • Agribusiness representatives: Producers, exporters and importers from both regions. • Science experts: Pest control researchers and plant pathologists. • International organisations and NGOs. • Consumer groups and environmental associations.	Stakeholders should participate in the process. In particular: • Government officials of the EU and Senegal who are in charge of agriculture, trade, rural areas and the environment. • Mango industry representatives: Producers, exporters, and importers in Senegal and the EU. • Science experts: Researchers and entomologists specialising in fruit fly control and phytosanitary measures. • International organisations and NGOs. • Local community representatives. • Consumer groups and environmental associations.
5. Definition of metrics for success	Quantitative measures: • ASF prevalence rates in the EU • Pork production and consumption levels in China and the EU • Trade volumes between the EU and China • Economic indicators, such as GDP growth and employment rates Qualitative measures: • Level of compliance with biosecurity protocols • Effectiveness of ASF vaccines and diagnostic tools • Stakeholder satisfaction with the resolution of the trade dispute. • • Improvements in food security and consumer confidence	Quantitative measures: • Use of MBr in India for phytosanitary purposes. • Compliance rates with phytosanitary regulations. • Trade volumes between India and exporting countries for plants and plant material. • Economic indicators, such as GDP growth and employment rates. Qualitative measures: • Effectiveness of alternative pest control methods. • Stakeholder satisfaction with the resolution of the trade dispute • Improvements in bilateral relations and cooperation. • Environmental impact of phytosanitary measures.	Quantitative measures: • Fruit fly infestation rates in mango production areas • Trade volumes between Senegal and the EU for mango. • Economic indicators, such as GDP growth and employment rates • Compliance rates with EU SPSs. Qualitative measures: • Effectiveness of fruit fly control methods • Stakeholder satisfaction with the resolution of the trade dispute • Improvements in the quality and safety of Senegalese mango exports • • Strengthened bilateral relations between Senegal and the EU

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6. Progress monitoring and evaluation	Evaluation Methods: • Data: Collect data on ASF prevalence rates, trade volumes, economic indicators, biosecurity measures and regionalisation recognition from governments, industry associations and research institutions. • Surveys and interviews: Conduct surveys and interviews with stakeholders on STC, effectiveness of regionalisation measures and satisfaction with regulatory processes. • Case studies: Analyse case studies of specific trade flows to identify challenges and opportunities of STC and regionalisation. • Expert reviews: Get expert opinions from scientists, economists and trade specialists on technical and economic aspects of the issue. Adaptive Evaluation: • Regular monitoring: Monitor the evaluation metrics to track progress and identify trends. • Data analysis: Analyse the data to identify areas of concern and improvement opportunities. • Feedback loops: Establish feedback loops with stakeholders to incorporate their inputs and suggestions into the evaluation process. • Adjustments: Be prepared to adjust STC, regionalisation measures or biosecurity protocols based on the evaluation results. Key Areas for Adaptation: • Regionalisation recognition: Continue to promote recognition of EU regionalisation by other countries through bilateral negotiations and international cooperation. • Biosecurity: Strengthen biosecurity in EU Member States to prevent further spread of ASF and improve regionalisation. • Trade facilitation: Find ways to facilitate trade between the EU and China, e.g., simplify regulatory procedures, and improve communication and cooperation. • Risk assessment: Conduct regular risk assessments to identify and address emerging threats to the pork industry, including new ASF variants or other diseases.	Evaluation Methods: • Data: Collect data on trade volumes, compliance rates, economic indicators and environmental impacts from government agencies, trade associations and research institutions. • Surveys and interviews: Conduct surveys and interviews with stakeholders to get their views on phytosanitary restrictions, alternative measures and satisfaction with the process. • Case studies: Analyse case studies of specific trade flows to identify challenges and opportunities with phytosanitary restrictions. • Expert reviews: Get expert opinions from scientists, economists and trade specialists to provide insights on the technical and economic aspects of the issue. Adaptive Evaluation: • Regular monitoring: Monitor the evaluation metrics to track progress and identify trends. • Data analysis: Analyse the data to identify areas of concern and opportunities for improvement. • Feedback loops: Establish feedback loops with stakeholders to include their insights and suggestions in the evaluation process. • Adjustments: Based on the evaluation findings, be prepared to adjust phytosanitary restrictions, alternative pest control methods, or the regulatory process. Key Areas for Adaptation: • Alternative pest control methods: Speed up the development and implementation of more environmentally friendly and effective alternative pest control methods. • Regulatory reform: Simplify and streamline phytosanitary regulatory procedures to reduce the burden on exporters and improve efficiency. • International cooperation: Work with exporting countries and international organisations to address phytosanitary concerns and find sustainable solutions. • Risk assessment: Conduct regular risk assessments to identify and prioritise emerging pest threats and develop mitigation measures.	Evaluation Methods: • Data: Collect data on the levels of fly infestation, trade indices, economic factors in the market, compliance rates, and production capacity from the government bodies, industry associations, and research institutions. • Surveys and interviews: Conduct surveys and interviews with stakeholders to get their views on the STC, the level of effectiveness of the phytosanitary measures, and the extent of their satisfaction with the regulatory processes. • Case studies: Analyse case studies of mango exports in order to pinpoint the issues and examine the ways of advancement caused by the STC and phytosanitary regulations. • Expert reviews: Get expert opinions from entomologists, economists, and trade specialists to probe the technical and economic aspects of the problem. Adaptive Evaluation: • Regular onitorimng: Monitor the evaluation metrics to track progress and identify trends. • Data analysis: Analyse the collected information to detect problematic regions and possibilities for improving the system. • Feedback loops: Establish feedback loops with the stakeholders to include their insights and suggestions in the evaluation process. • Adjustments: Based on the evaluation's findings, be prepared to adjust STCs, SPSs, or production processes. Key Areas for Adaptation: • Fruit fly control: Boost fly control measures through, among other things, the application of integrated pest management techniques and the development of new control technologies. • Production modernisation: Support the renewal of the Senegalese mango production sector through infrastructure, technology, and training investments. • Regulatory cooperation: Senegal's and the EU's cooperation will be enhanced to facilitate the SPS procedures and reduce trade barriers. • Sustainability: Promote sustainable practices in mango production, including using environmentally friendly inputs and conserving natural resources.

Source: Authors' elaboration