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The role of NGOs in the transition towards more sustainable and innovative agri-food GVCs

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ABSTRACT

Multinational Enterprises (MNEs) in the agri-food sector are continuously transforming their Global Value Chains (GVCs) to address sustainable development challenges of food security (SDG 2) and climate change (SDG 13). However, the central role of Non-Governmental Organisations (NGOs) in (re)creating GVCs across multilevel stakeholders through innovative approaches to solve sustainability challenges remains under investigated. Our explorative study investigates how international NGOs influence the transformation of large-scale industrial animal agriculture to a more sustainable (cell-based) agri-food GVC. We conducted a case study on the Good Food Institute (GFI), an international NGO, that has been an active player in the transition to alternative sources of protein to solve animal-based agriculture sustainability issues. Our results show that an international NGO can contribute to the transition to a more sustainable GVC and can enhance the GVC's innovation capabilities.

Keywords: Cultivated meat, MNEs, innovation, international NGOs, sustainable GVCs, SDGs

1. INTRODUCTION

Studies on the influence of Non-Governmental Organisations (NGOs) have focused mostly on NGOs' activism and pressure strategies, the development of standards and guidelines (e.g., animal welfare and sustainability standards), their interfaces with private and public sectors, or see NGOs as one stakeholder among many others that influence organisations (Kourula & Laasonen, 2010). However, their role in reshaping MNE-led Global Value Chains (GVCs) in order to solve complex sustainability challenges – such as in conventional animal-based meat chain – has been overlooked. International NGOs have proven to have outgrown their historically constrained role and now increasingly address issues of global concern that can be more effective in advocating for sustainability improvements in a global scope, and mediate multinationals' market and non-market activity (Fee & Gray, 2013; Lambell et al. 2008; Teegen, Doh & Vachani, 2004).

In addition, the GVC literature has mostly addressed the governance exerted by major MNEs in leading and shaping GVCs. However, Ponte (2014) calls for research that expands the view that GVC governance relies only on interfirm coordination led by MNEs. This chapter addresses the idea that NGOs may have an important role in this regard, especially in nascent high-tech industries such as in the case of the alt-protein landscape. Broadly, alt-proteins (e.g., plant-based and cell-based proteins) reflect the role of innovation in substantially transforming industrial animal-based agriculture for the better, reducing its environmental footprints and animal suffering (Gerber et al., 2013; Stephens et al., 2018; Nobre, 2022). To this end, the adoption of alt-proteins (in substitution to animal-based meat) can support the progress of the UN's Sustainable Development Goals (SDGs) 2 and 13 of food security and climate change, respectively (Nobre, 2022). Thus, in the paper we aim to understand how international NGOs can have a leading role in reshaping the agri-food GVCs through innovation, by focusing in the case of the meat GVC, towards sustainability. We thus, explore the following research question:

How do international NGOs influence innovation and impact the transition of large-scale industrial animal agriculture to a more sustainable agri-food GVC?

We answer this question through an extensive case study of an international NGO, the Good Food Institute (GFI), which has been an active player toward the transition to alternative sources of protein to solve animal-based agriculture sustainability issues. In-depth interviews were conducted with representatives of GFI's subsidiaries from all over the world. Our results add to the International Business (IB) literature that explores on the NGOs and MNEs' partnerships in sustainably addressing environmental and social problems (Ghauri et al., 2021; Liu et al., 2020) by showing the new roles and scopes of action that international NGOs can take in the transition to more sustainable GVCs by participating actively in the innovation process.

2. LITERATURE REVIEW

2.1 Global food systems, GVCs and innovation

Food systems have garnered increasing concerns in relation to their impact on food security and environmental sustainability (Mergos & Papanastassiou, 2017; Hoek et al., 2021). According to a recent study by Crippa et al. (2021) food systems were estimated in 2015 to be responsible for 34% of total GHG emissions, being meat production, especially cattle, by far the most important cause of these emissions. OECD/FAO projected, meat consumption will increase 29% by 2029 (compared to the base period of 2017-2019) with Brazil, China, the European Union, and the United States to account for 60% of meat production by 2029 (OECD/FAO, 2018). According to IPCC (2019), dietary changes could reduce global CO_2 emissions by up to eight billion tonnes per year. Moreover, meat production is also related to other important issues such as deforestation, zoonoses spread and amplification, antibiotic resistance, and animal suffering (Kelly et al., 2021). These problems are likely to have a greater negative impact in the planet in the coming years, as the demand for meat advances. Therefore, it is evident that there

is a need to decarbonise this industry and to mitigate its effect on climate change in coming years.

At the same time, food systems are contained in complicated GVCs that are mostly led by MNEs, creating a close link between trade and foreign direct investment (FDI). The global agri-food industry is becoming "increasingly dominated by value-chain relationships in which leading firms exercise vertical coordination" (Humphrey and Memedovic, 2006: 7) with the top 100 agri-food and beverage MNEs accounting for one-third of global food production and more than one-half of the technological activities. The impact of MNEs in shaping agri-food GVCs and in particular the industrial part of the GVC, i.e., the food and drink sectors are then strongly confirmed (Scoppola, 2021; Narula & Wahed, 2017).

Furthermore, there is extant literature on the mapping of agri-food GVCs where emphasis is on upgrading as it reflects how MNEs' innovative activities are organised among global and local stakeholders (Lee, Gereffi & Beauvais, 2012; Lee & Gereffi, 2021). Recent work by Ambos et al. (2021) further analyse how innovation is organised in MNE-led GVCs and raise attention towards an interactive and open model of innovation where connectivity between MNEs and local suppliers, in an interdependent mode, generates knowledge and innovation in GVCs (Strange & Humphrey, 2019). However, in recent years it has been acknowledged that innovation in GVCs extends beyond binary relations between MNEs and suppliers and more complex ecosystems are developed where different stakeholders are involved (Papanastassiou, Pearce & Zanfei, 2020). The richness of the GVC innovation ecosystem is, thus, becoming evident where issues of sustainability are raised and need to be addressed (Golgeci, Makhmadshoev & Demirbag, 2021).

2.2 GVCs and the role of international NGOs

Agri-food MNEs, in particular, have been pressed by international and local regulatory bodies, NGOs, and civil society, to adopt more sustainable approaches in their production (Tran et al.,

2013). Moreover, there is an increasing consumer demand for new dietary practices (vegans, vegetarians, flexitarians, climatarians) reflecting a transition to more sustainable consuming behaviour (Taghikhah et al., 2021). In response to these developments, we are currently witnessing the growth of the so-called "meat substitutes", that are alternative sources of protein, aiming at producing animal meat or meat-like products, without the need of raising and slaughtering animals. This is a compelling case of innovation that may dramatically change the conventional meat production value chain. These products may be plant-based or obtained through the in-vitro cultivation of animal cells (GFI, 2021; Godfray et al., 2019). Although plant-based meat products have already gained track in the global food marketplace with an increase in retail sales by 27% in 2020 in the US (Plant Based Foods Association, 2021), it should be noted that they are not actually animal meat. Plant-based alternatives are produced from vegetable proteins and basically are aimed at "mimicking" meat appearance, taste and texture – they even look as fresh raw meat – using plants as building blocks (e.g., pea). Cultivated meat, in turn, is a highly promising product since it is truly animal-based meat; it involves animal cells cultivation in a bioreactor (from cattle, chicken, fish, etc.) and is identical to conventional meat.

Gereffi and Fernandez-Stark, (2016) recognise the importance of chain governance in shaping GVCs' structure and dynamics. Gereffi et al. (2001: 4.) define governance as "*non- market coordination of economic activity*". As in most agri-food GVCs, the meat chain has a high degree of concentration with a set of major downstream global producers and supermarket chains leading and coordinating upstream players (Gereffi & Fernandez-Stark, 2016).Its governance is highly hierarchical, i.e., buyer-driven, with meat MNEs and major retailers influencing upstream actors in several aspects, from efficiency management to codes of conduct adoption. In this context, the role of NGOs in animal-based GVCs is mostly in line with the compliance-based model (Lund-Thomsen & Lindgreen, 2014) which assumes that NGOs exert

pressure on firms to improve issues related to sustainability, human rights, and working conditions, among others; as a result, it is expected that MNEs develop codes of conduct and guidelines for more socially and environmentally responsible operations. Firms-NGO partnerships may arise in this context as well, as a means for solving key sustainability issues (Bitzer & Glasbergen, 2015; Mousavi & Bossink, 2020). It also involves NGOs setting their own sustainability guidelines and standards that may eventually be disseminated throughout the chain (Kourula & Laasonen, 2010). Reis and Molento (2020), for instance, show that emerging country meat-processing multinationals incorporate several animal welfare standards of international NGOs while they internationalise to more developed countries. They may also engage in advocacy and operational activity (filling local voids) along the chain (Teegen et al., 2004) and have active and political initiatives in NGO-business-government relationships aiming for sustainability development. It should be noted that the agri-food GVC mostly involves well-established commodities trade and global relationships between players (and regions) that perform distinct value-adding activities and have inequal value capture capacities; most importantly, it involves power asymmetries between actors of the chain (Dallas, Ponte, & Sturgeon, 2019).

NGOs provide several guidelines and standards addressing sustainability and animal welfare, such as the Free Farming and the Sustainable Agriculture Network (SAN) Sustainable Agriculture Standard (Hajjar et al., 2019; Ransom, 2007). In sum, NGOs frequently engage in normative, advocacy, pressure, political, and advisory activity in the case of animal-based agriculture. However, their role in generating new technology and embracing innovation is still underexplored, as this is the domain where usually MNEs play a central role.

3. THE CONTEXT

Cultivated meat, also known as cell-based meat and cultured meat (Reis et al., 2020a), is an alternative meat production process that does not require the raising and slaughtering of

animals. Animal cells are instead cultivated and multiplied in a bioreactor to produce edible meat (Heidemann et al., 2020). As the technology rapidly improves (Bonny et al., 2015) more cultivated meat MNEs – meat cultivation startups and culturing system suppliers – have flourished worldwide (Froggatt & Wellesley, 2019). In addition, research on consumer attitude has shown that cultivated meat is likely to achieve great acceptance. In Brazil, 63.6% of the participants of a survey stated they would eat cell-based meat (Valente et al., 2019); moreover, 45% of Brazilian consumers are likely to try and 31.5% highly likely to try cultivated products (Bryant & Krelling, 2020). In the UK consumers are 40% likely to try cultivated meat (Szejda, Bryant, & Urbanovich, 2021). These outcomes suggest this innovation has a high potential in terms of reshaping meat production and consumption systems.

This innovation may dramatically improve the conventional meat production GVC and contribute effectively to climate change mitigation and improve food security concerns. For instance, Tuomisto and de Mattos (2011), indicated that 99% less land would be needed to produce cultivated meat while GHG emissions might be 78–96% lower depending on the product (beef, poultry, etc.). Swartz (2021), in turn, identified that cultivated meat could decrease global warming impacts by 17%, 52%, and 85-92% compared to conventional meat production. Furthermore, it also prevents other severe issues related to intensive meat production such as increasing antibiotics resistance, zoonoses spread and animal suffering. As shown in a systematic literature review conducted by Nobre (2022), alternative sources of protein, like cultivated meat, can also help the advancement of environmental and health-related SDGs (UN, 2015). Table 1 shows how cultivated meat can help to improve sustainability in the meat chain and how the transition is likely to support the progress of UN's SDGs.

'Table 1 insert here'

Consequently, while sustainability improvements in the meat chain basically involve incremental innovation, e.g., reducing water waste and pollution, (Gerber et al. 2013) and

normative improvement, e.g., adopting animal welfare standards, the transition to cultivated meat will lead to radical innovation (Dahlin and Behrens, 2005) since it has the potential to promote a breakthrough change in the meat value chain as a whole. As some aspects of this technology are still under development, and new players (e.g., startups, regulatory agencies, meat-processing MNEs, equipment suppliers, and investors) are still coming on board, these developments pave the way for the emergence of a novel NGOs' role and activity in promoting innovation.

4. METHODOLOGICAL APPROACH

4.1 Data Collection

In this qualitative single case study research (Eisenhardt & Graebner, 2007), we are focusing on an international NGO, the Good Food Institute (GFI). GFI was founded in 2016 and it aims to support the development of alternative proteins around the globe, by creating and sharing knowledge about cultivated-meat, plant-based meat, and fermentation. Apart from the headquarters in the United States, GFI currently operates in five different regions namely, Brazil, Europe, Israel, India and Asia Pacific (GFI, 2022). Furthermore, GFI has initiatives in three key areas: (1) advancing science and technology research in alternative proteins; (2) mediating business relationships, engaging companies, and investors internationally in order to advance alt-protein innovation and scale the value chain; and (3) advocating for policy-making and public research funding.

Therefore, we interviewed key decision makers in GFI headquarters and in all international branches to obtain a global perspective of the activities developed by the NGO. Our data collection covered at least three respondents in each GFI unit, reflecting the structural division and area of expertise of their personnel i.e. – Science and Technology, Policy, and Industry

(Corporate Engagement). Therefore, we will present a single case study within an embedded unit of analysis suitable for theory building (Yin, 2018).

Interviews were conducted by two of the researchers of this study during May to early June 2022, through MS Teams. They were our main source of data. We decided to have semi-structure interviews (Wengraf, 2001), since there was a need to guide the conversation towards innovation and sustainability, but open-ended questions to allow them to express their opinions and insights. Some executives were identified and approached through LinkedIn. For others we followed the snowball sampling strategy by GFI members in order to facilitate access to respondents within the same location and across expertise (Emmel, 2013).

The 19 interviews lasted 8 hours and 54 minutes and we were able to generate 137 pages of transcript. Two interviews were composed of more than one member since they shared responsibilities. We used the Trint software to support the transcription of the MS Teams recordings (consented by all interviewees) of the 21 respondents and for the language translation from two respondents who were more comfortable speaking in their non-English native language i.e., in the case of Brazil. Since the respondents were working closely together within their region and within their roles across the regions, they were knowledgeable of each other's circumstances. This cross-functional and cross-regional duplicated knowledge allowed us to determine to have reached data saturation (Marshall, Cardon, Poddar, & Fontenot, 2013). Table 2 shows the interview summary table split by region, number of interviews and the period in which the interviews were conducted.

'Table 2 insert here'

Secondary data was collected from February to June 2022. It included annual reports, specific studies and publications shared by GFI members, access to their data bases, GFI's newsletter, McKinsey's reports, main business newspapers, such as Forbes and the Economist. It created

a data base of 41 documents. The insights from the secondary data were important to create a general view of the organisation, especially because most part of the interviewees were hired in the last 24 months due to the expansion of GFI worldwide.

Since the notions of validity and reliability are applied in quantitative research and are not suitable for qualitative research, we applied a variety of alternative techniques in order to increase trustworthiness through credibility, transferability, dependability and confirmability (Hajro, Gibson, & Pudelko, 2017; Lincoln & Guba, 1985; Shah & Corley, 2006).

We carried out an extensive in-depth analysis based on regional industry reports, slides and press releases to enable corroboration and triangulation of the evidence (Yin, 2018). The archival material allowed us to have a broader range of GFI's activities along the last 5 years, compliment the other data and reduce the potential bias from the interviews (Eisenhardt & Graebner, 2007).

In a nutshell, we developed a case study protocol and interview guide to structure the data collection and analysis. Finally, to establish an appropriate understanding of our key constructs, we used multiple sources of evidence, mainly internal documents published by GFI, but also newspaper articles and industry reports (Zhao et al., 2020).

3.2 Data Analysis

The data analysis followed a data-driven inductive approach best suited to obtain rich and detailed descriptions that enable linking causal explanations and adding context to theory generation (Birkinshaw, Brannen, & Tung, 2011). Two researchers jointly analysed and proof-read the individual transcripts and began the data analysis by marking texts and paragraphs line-by-line to generate initial first-order codes guided by our research questions (Miles et al., 2014). We analysed GFI's stakeholders, individual goals, achievements, past challenges that were overcome, current challenges that are still being faced, and future agenda in addressing the

current challenges in driving forward a sustainable value chain with cultivated meat. Most of the first-order codes were in vivo codes that allowed to convey the original words and expressions used by the respondents (Corbin & Strauss, 2015). The first-order coding process was extended to six secondary data reports to complement and confirm the initial first-order codes and therefore strengthen the data quality. Each interview or document was broken down in order to deliberate the significance to support the themes resulting in 24 first-order codes (Gioia et al, 2013).

In the next step, we identified relationships across the primary and secondary first-order codes and consolidated them into second-order themes related to GFI's activities in influencing and forming the cultivated meat value chain. This process resulted in six different second-order codes. After we have formed the aggregated second-order codes, we have further condensed them into four different overarching theoretical themes. The coding process required the co-authors multiple times to iterate between the collected data and previous studies, leading us to search for additional literature and reshaping our research question (Miles et al., 2014).

'Table 3 insert here'

5. RESULTS

Our results demonstrate how GFI has had global influence in advancing innovation and orchestrating the transition towards a more sustainable agri-food GVC. We have identified themes based on their research activities in the science and technology field, advocacy for new governmental regulations, and their engagement with new smaller and established larger industrial players in the meat industry. The three themes relate to the development of the cultivated meat industry, identifying and articulating regulatory issues, and liabilities in the nascent value chain. Table 3 depicts the results that have emerged during this inductive and iterative data analysis process.

5.1 Developing the industry's GVC

GFI has been leading a proactive role in the development of the cultivated meat industry by providing resources and influencing educational institutions to establish new alternative protein programmes and promote research funding. Moreover, GFI has been active in building up a cultivated meat network through stakeholder engagement across the value chain and uniting them in an alternative protein community.

5.1.1 Education and research infrastructure

Cultivated meat is a nascent industry that has yet to develop the capacity in the workforce and research infrastructure to keep up with current demands and facilitate future growth. GFI recognises the need for capacity building as highlighted by the Vice President for Science and Technology:

"*…we don't have… people trained or… experts right in the field [across industry and academia]. So, it's super important to develop capacities… (and influence) universities to developing courses and lectures… and other events.*" (BR-SCI)

GFI has acted upon the need and has started internally developing educational materials that have been used within educational institutions and with other stakeholders in order to educate them about alternative proteins.

"I provide the courses on alternative proteins in a several Israeli universities (and outside of Israel) and I… also provide the lectures, develop some resources in the field." (IS-SCI)

The format for disseminating cultivated meat knowledge can be through in-person lectures at the educational institutions or through online webinars that are accessible to different interested stakeholders to get involved.

The collaboration with universities is not limited to lectures but aims to develop the educational field on alternative proteins and specifically on cultivated meat. This includes building up educational programmes on alternative protein that is contributing to satisfy the increasing demand for a larger talent pool. The University Innovation Manager explains:

"*GFI is activating a new generation of scientists and students to see themselves working in the alt protein field, collaborating as a networked team, and hastening a global protein transition in our lifetimes… we are focused on really building scientific and engineering education and training pathways and advancing scientific research*" (US-CE)

One way of establishing the collaboration with universities has been successful through a global Alt-Protein Project that currently includes 16 universities and will have grown to 32 universities across the U.S., Europe, Asia, and Africa. The Alt-Protein Project has been a means to develop student groups on campus and link them to an academic ecosystem.

Moreover, to promote cultivated meat topics in educational institutes, GFI is working closely with international funding bodies to advocate for funding opportunities in the area of cultivated meat and disseminate them to relevant groups. The funding opportunities are necessary to further develop this nascent area and strengthening commercial feasibility. Besides education, GFI has developed a robust influence on several stakeholders. The NGO plays a role in the industry as a catalyser for new opportunities for MNEs and start-ups as well as integrator for different actors. As an independent body, its collaborations throughout the value chain legitimise the engagement towards a more sustainable industry.

5.1.2 NGO's engagement

GFI has a strong influence in the current commercial developments of cultivated meat together with small firms and MNEs, globally. In the Brazilian context, GFI has a strong relationship

with large MNEs that are now increasing their portfolio with alternative proteins as well as the supporting the creation of new start-ups as indicated by the Corporate Engagement Director:

"We are involved in the JBS and BRF cultured meat projects and several other projects. We helped to create the alternative protein sector here in Brazil. We arrived here in 2017 and in 2019 we launched here Fazenda Futuro…. So, I provide the sector with information so that it can make the decision in the most assertive manner. I'm never going to tell a MNE to go on that route [acquisition of start-ups] or go this way [internal business unit] …. I show all the options for him to build a strategic plan... if he wants to know how to build a business unit, for example, I give him the inputs to do it". (BR-CE)

The current landscape of commercial players globally is small, specialised and decentralised. To promote more innovation within cultivated meat, GFI has actively supported start-up growth in the industry. One example in facilitating early commercial development and financially supporting entrepreneurs is explained by the Senior Innovation Manager in India:

"*My role is focused on building out the early-stage entrepreneurial ecosystem for plant-based, cultivated and fermentation derived meat, eggs and dairy…. from ideation up until the time that start-ups launch in the market...The one (start-up) in cultivated beef (is) MyoWorks and we've just supported them on sort of understanding space opportunities as well as supporting them on the grant. We are on (board) of a (grant funding programme) committee to evaluate progress*." (IN-CE)

The engagement is not limited to support individual start-ups and entrepreneurs with specific advisory and funding support, but also to facilitate interconnectivity between the different companies. The development of an eco-system helps them to utilise each other's expertise within and across different regions.

As engagement requires interface with different actors, it was pointed out the need to master regulatory issues. Investors will feel comfortable to provide additional funding when they can perceive the products will be available to consumers in the near future. Moreover, consumers would help on advocating for a more sustainable source of protein once they understand the benefits and it is safe buying it.

5.2 Articulating market and regulatory issues

5.2.1 Raising Awareness

One of GFI's challenges was raising the awareness on about alternative proteins. In the beginning, it was difficult for several employees in the organisation explaining to regulators, potential investors and consumers what kind of technology was involved in the process of producing cultivated meat as illustrated by the Corporate Engagement Manager in Europe

"*Understand organisations in Europe that focus on alternative proteins. Bringing the companies together and facilitate partnerships. Guiding companies to focus on top priorities and raising awareness, educating, engaging*". (EUR-CE)

It was necessary educating stakeholders and show the benefits for mitigating climate change. As the Policy Specialist in Singapore mentioned, his work was connected to include alternative proteins in discussions about sustainability in several events in Asia:

"*…parts of my work that I do is to raise awareness, definitely to try to put all the proteins on the global agenda because everybody keeps talking about global emissions*". (SG-POL)

One of the reasons that increasing awareness on alternative proteins was difficult worldwide is related to the fact that there was not a clear definition of it. Specially for cultivated meat, a common terminology would be helpful for its acknowledge and acceptance. Terms like cultured, clean and lab-grown are widely employed in newspaper articles (GFI, 2021).

Encouraging a universal nomenclature can be important for the industry and research development, as well as funding from regulators as mentioned from the Science and Technology Manager in Europe:

"*Another issue is around the definition of alternative proteins. So, especially in Europe, the definition of alternative proteins is generally clumped based on fermentation, cultivated, and plant-based but also insects, and it also generally refers to alternative proteins for animal feed; this is something that the EU funding generally includes in scope.*" (EUR-SCI)

In order to make sure that regulators will be creating a positive regulatory framework for alternative proteins, GFI works closely to several health agencies around the world and state-level institutions when required. It provides resources and counselling to them and support a deeper understanding on this innovative industry.

5.2.2 Contribute to institutional development

Policy is one of the main pillars that sustains GFI's activities. Supporting the establishment of a fair and efficient regulation is gigantic task that specialists in every unit is contributing to increase the understanding of alternative proteins and building a global regulatory framework. As indicated from the USA Policy Director, it is a defensive work:

*"...to make sure that these products are regulated fairly and efficiently and safely, sort of on an even playing field with their conventional counter*parts" (US-POL)

GFI wants to ensure that alternative proteins are considered in the policy discussion worldwide regarding climate change mitigation and global health (GFI, 2020). In order to actively influence different stakeholders to consider different angles of this new industry, GFI provides government and industry advice by commenting on current studies, developing internal resources and even industry reports. We could see the broad scope of GFI's advisory coverage by the involvement of different members in India, Brazil, and Israel:

"*…then it comes to government advice, for example, we've provided comments on multiple calls for comment, for public comment in committee as well as in the policy space*". (IN-POL)

In order to boost the association of different stakeholders, GFI recognises that it is important to achieve a common voice in the industry when talking to the public sector.

5.3 Liabilities in the GVC

5.3.1 Chain development on a global basis

The distinguished group of scientists at GFI tries to figure out the most complex bottlenecks for the development of alternative proteins. After analysing the industry in depth, they support on filling research gaps by proposing solutions and funding additional investigations. The lead scientist in the USA is focused on identifying those bottlenecks and how to alleviate them:

"*My role is mostly focused on identifying and articulating the technical and economic bottlenecks that are facing the cultivated meat industry. Coming up with potential solutions in terms of how we go about alleviating those bottlenecks. Research or training programs, that's the bottleneck that we really need to solve here"* (US-SCI)

Furthermore, the industry now needs to proof that it's feasible producing cultivate meat into large scale in proper manufacturing units and not university laboratories. After the approval for selling cultivated meat in Singapore, it is expected to see meat companies (traditional MNEs in the meat industry) investing in construction of pilot facilities in the area (GFI, 2021). One of the largest multinational companies in the world in the agri-food industry signaled that it would go to market by 2024, which accelerated the confidence of supply chain in reduce the costs and reach consumers soon as declared by one of Customer Engagement Analysts in Singapore:

"*The biggest one is kind of proof of concept. And I think that was that good. The good meat facility just launched in Singapore a few days ago and that's really trying to show kind of conviction that the cost can come down because the biggest criticism of cultivated meat is that will never be kind of reached price parity*". (SG-CE-2)

5.3.2 Reduce Bottlenecks

During the interviews it was clear the current challenges industry was facing. GFI members had suggested in the future agenda some relevant barriers need to be surpassed in order to move ahead in the scaling up the production of cultivated meat. One of the next steps in the forefront in the industry is labelling. There is a concern about the impact of damaging labelling restrictions on cultivated meat as the plant-based meat is already facing in relevant markets such as the European Union and the United States. Therefore, they are also investing in advocacy strategies:

"*…one person is focusing on labelling. So, ensuring that there is no sort of like harmful labelling restrictions*" (EUR-POL)

The key challenge in this value chain is creating infrastructure for scaling up. It requires not only a large amount of investment, but also government support and incentives. In order to reduce the costs, it is necessary to scale up infrastructure and technology in competitive regions.

"*…if we don't start building factories now to produce cultivated meat, then we can all work on developing the best formulation, bringing down media prices. But we're not going to be able to actually produce anything at scale. And then we're also kind of not addressing the challenge*". (EUR-CE)

In addition, the products should taste better and be affordable to consumers. They need to be convenient for most people to buy them and to be successful. One of the ways to do that is working with the existing supply chain for meat related products. The SciTech Specialist from Europe emphasised the priorities required to develop economic viable production:

"*…bringing costs down and making the products better. Those are the two core priorities for us, since basically that's all we're trying to do on our science and technology work is help the industry scale and help them improve actual biomimetic kind of mimicry of these products, so they genuinely taste the same meat and cost the same or less*". (EUR-SCI)

A secure global food system is a recognised interest of national governments. Once commercialisation of cultivated meat is viable, it will be proved that advances in food technology by producing meat from animal cells can reduce climate impact (GFI, 2022). Finally, it will only be possible to propel this new industry forward with additional research funding. Public investment in this area is limited in comparison to electric vehicles or renewable energy.

6. **DISCUSSION**

It is evident that the nascent cultivated meat technology represents an opportunity to examine how innovation can lead to the development of a more sustainable meat chain. Aligned with the interactive and open model of innovation advocated by Ambos et al. (2021), the cultivated meat case, sheds light on how an international NGO can also have a lead role in the development and transition to a new and more sustainable GVCs through engagement in innovation.

As shown in our results, this role may have a broad scope, involving the simultaneous coordination of a diversity of initiatives, such as investing in technology development, lobbying, facilitating firms' engagement with the new chain, showing active presence in regulatory initiatives, education, and knowledge sharing, among others. Moreover, these activities involve the orchestration of several stakeholders, like startups, MNEs, other NGOs, universities, research institutions, government bodies, and venture capital firms as mentioned by interviewees. In addition, it was also observed that with the support of their overseas subsidiaries, the studied NGO has also an extensive geographic scope of influence addressing both, local issues (regulatory, and local developments) and the articulation of the chain on a global basis e.g., facilitating MNEs and startups interaction. These efforts aim to develop technological capabilities at not only a national level but also ultimately attempt to leverage the development of the cultivated meat industry at a global level.

In particular, three main aggregate themes were identified: developing the industry, articulating market and regulatory issues, and addressing liabilities in the value chain. The first theme involves the development of technological capabilities that are required for the transition; thus, there are efforts to advance cultivated meat products and process upgrading (Morrison et al., 2008; Lee & Gereffi, 2015). As shown in the literature, upgrading in GVCs requires engaging firms, investing in infrastructure, and developing human capital (Gereffi & Fernandez-Stark,

2016). It also requires access to education and training, funding and finance, and the participation of research institutions as catalysts. In this case, we could note that GFI initiatives focus both at the firm level (supporting single startup development, collaborating with MNE) and industry-level (connecting different stakeholders; stimulating sectorial development, e.g., bioreactor suppliers' development) compared to MNEs which focus only on the firm level for upgrading. For instance, in some regions, the NGO's subsidiaries may focus on developing courses or garnering initial government funding while, in others, initiatives may focus on advanced technology development efforts (e.g., developing bioreactors with greater capacities).

As for the second theme, articulating market and regulatory issues, since regulation is a major bottleneck for the cultivated meat to advance (Stephens et al., 2018), several NGO initiatives are focused on securing the approval of cultivated meat products for production and sales in other countries than Singapore, especially in larger markets such as Europe and the US. Successful approvals are likely to affect the cultivated meat GVC shape reflecting in which markets downstream firms, especially meat MNEs that have invested in the technology (e.g., BRF, JBS, Tyson), are going to operate.

Finally, the third theme, addressing liabilities in the value chain, shows how NGOs can have a governance role in GVC, i.e., assuring resource and activity flows, as well as interfirm relationships, through formal and informal coordination mechanisms (Gereffi and Lee, 2012). The NGO may adopt a GVC perspective to identify technology and capabilities development bottlenecks on a global basis (e.g., creating conditions for scaling up production, reducing costs, and improving product quality worldwide). However, differently to the governance exerted by MNEs in conventional agri-food systems, which are largely dependent on buyer-suppliers power asymmetries, we contend that NGO governance is relational (Gereffi and Fernandez-Stark, 2016). Thus, the governance benefits actors' interactions and it depends on complex information sharing and collaborative knowledge development; such relationships tend to rely

more intensively on ingredients such as reputation, access to knowledge, and trust. Therefore, we can infer that NGO governance may address GVC's market specificities as conventional MNEs, however it will also target on the expansion of industry needs. In order to figure out and clear up bottlenecks, GFI not only shares information among stakeholders, but also creates the bridge for their interaction to further industry advancement.

7. CONCLUSION

Our content analysis provided fine-grained details on how an NGO can influence innovation in GVCs and contribute to the transition to a more sustainable (cell-based) agri-food chain in addressing SDG2 and SDG13. This role is commonly led by MNEs, known for their innovative nature and large resources to affect value chains, whereas institutions and non-firm players act as partners in co-shaping it to support social and environmental evolution (De Marchi et al, 2020). However, as postulated by Ambos et al. (2021) an interactive and open innovation model should be the basis for understanding innovation in GVCs. Therefore, our research further extends Ambos et al. (2021) as it shows that international NGOs, like GFI, may have an extended protagonist role in facilitating and creating innovation in GVCs such as in the context of alternative proteins.

MNEs are counting on GFI's expertise to evaluate their activities in this field, when developing an internal business unit or acquiring a promising start-up. Education and raising awareness about cultivated meat to academic, business, and governmental stakeholders were frequently mentioned during the interviews as key activities for GFI. Furthermore, regulators and investors seek counseling based on GFI's independence. The transparency and open access for published research also provides reliability to its developed resources and databases. Therefore, our findings suggested a significant change in the cultivated-meat GVC's governance, which is orchestrated by an NGO. GFI coordinates the transformation to a more sustainable agri-food sector (Gereffi, 2001; Ponte, 2014) by facilitating relationships across the value chain and foster

connections to enhance innovation. Different from MNE's governance model, which is focused on the firm level upgrading, the NGO ultimate aim is to develop a strong alternative protein community.

This study is not without limitations. The challenges and future agenda for the development of this innovative and sustainable industry described in this chapter are based on qualitative data with method-related limitations to generalisation. Even though we covered all the regions and at least three GFI respondents per unit supplemented by secondary data, our findings focus exclusively on GFI's perspective on its role and activities. Further studies must also incorporate different stakeholders along the alternative protein value chain such as MNEs, start-ups, regulators, and investors to provide contrasting perspectives.

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TABLES

Table 1 – How the transition to cultivated meat innovation relates to the UN's SDGs.

How cultivated meat can improve sustainability in the meat chain	Environmental UN's SDGs that relate to cultivated meat's sustainability improvements
Enhanced food security and sustainable agriculture Reduction of GHG emissions Less land use Better water use (less waste and pollution that affect biodiversity and aquatic species) Less energy use Biodiversity preservation (terrestrial and aquatic)	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture Goal 6. Ensure availability and sustainable management of water and sanitation for all Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all Goal 12. Ensure sustainable consumption and production patterns Goal 13. Take urgent action to combat climate change and its impacts Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
How cultivated meat can improve sustainability in the meat chain	Health UN's SDGs that relate to cultivated meat's sustainability improvements
Control of pathogen contamination Reduction of zoonotic diseases Risk mitigation of cardiovascular, cancer, and obesity diseases Reduction of pandemic social problems in low and high-income nations.	Goal 3. Ensure healthy lives and promote well-being for all at all ages.

Sources: Nobre (2022), UN (2015).

Table 2 – Interviews summary

Region	Number of Interviewees	Period
USA (HQ)	4 (2 interviewees from Corporate Engagement) US-POL = Policy Coordinator US-SCI = Lead Scientist for Cultivated Meat US-CE-1 = University Innovation Manager US-CE-2 = Senior Investment Engagement Specialist	May 2022
Brazil	4 (2 members from the Policy team) BR-POL-1= Vice-President Public Policy BR-POL-2= Policy analyst BR-SCI= Alternative proteins Science & Technology Vice-President BR-CE= Corporate Engagement Director	May and June 2022

Singapore	4 (2 members from the Corporate Engagement) SG-POL= Policy Specialist SG-SCI= Science & Technology Specialist SG-CE-1= Corporate Engagement Specialist 1, for start-ups and universities SG-CE-2= Corporate Engagement Specialist 2, for MNEs	June 2022
India	3 (one from each pillar) IN-POL= Senior Policy Specialist IN-SCI= Science & Technology Specialist IN-CE= Senior Innovation Specialist	May 2022
Europe	3 (one from each pillar) EUR-POL= Policy Manager EUR-SCI= Science Technology Manager EUR-CE= Corporate Engagement Manager	May 2022
Israel	3 (one from each pillar) IS-POL= Director of Strategic Alliances IS-SCI= Senior Scientist IS-CE= Business Analyst	May 2022

Source: Authors

Table 3 – Data presentation

1st order codes	**2nd order themes**	**Constructs**
Capacity Building	Education and research infrastructure	Developing the industry
Talent development of relevant technical staff		
Disseminate funding opportunities to relevant academics		
Created academic alternative protein course		
Form student groups on campuses to create talent pipeline		
Build a regional alternative protein community	NGO's engagement	
Connect different stakeholders		
Counselling some firms that are now operating in the market		
Collaboration with big companies and set up partnerships and formalised collaborations		
Facilitate relationships across the value chain and foster connections		
Increase awareness about alternative proteins	Raising Awareness	Articulating market and regulatory issues
Acceptance of cultivated meat and terminology		
Support fair, efficient regulation and safety of alternative proteins	Contribute Institutional development	
Provide government and industry advisory		
Achieving a common voice in the industry		
Support firms on talking to public sector		

Alleviating the bottlenecks by means of internal analyses of the industry, fill research gaps and propose solutions and fund research	Chain development on a global basis	Liabilities in the Value Chain
Proof of concept showing the feasibility of this product by launching manufacturing units		
Labelling	Reduce bottlenecks	
Managing to create infrastructure for scale up		
Bringing costs down (scale) and making the products better (taste)		
Strengthening Food security		
Funding – lack of public investment		

Source: Authors