**A comparative case study analysis of disruptive technologies in the agri-food industry in Europe**

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**Abstract:**

Meat production is the most polluting industry of the agri-food sector, but the emergence of cultured meat gives environmentalists some hope for the future of meat alternatives. Cultured meat can be considered a disruptive technology (DT), as it is likely to disrupt an entire sector once it enters the market. This paper retraces the route of past DTs from the agri-food industry in the European Union (EU) to better understand and plan the future of cultured meat. It looks at aquaculture, which emerged as a solution to over-fishing and ocean pollution in the 1970s, and genetically modified organisms (GMOs), which emerged to alleviate world hunger and help poorer parts of the world develop. Both can be considered DTs as they disrupted existing industries (capture fisheries and conventional agriculture respectively), the EU regulatory framework, and the relationship between interest groups and institutions. This paper investigates the role of interests and institutions in either abetting or constricting the ability of DTs to achieve market uptake in the EU. I use a typical case study analysis and within-case process tracing to compare how the European market, legal framework, and various coalitions of interest groups reacted to the emergence of aquaculture and GMOs. I find that unlikely alliances of interest groups – sometimes called 'Baptist-Bootlegger' coalitions – helped shape regulatory outcomes and allow both technologies to achieve more scale in the EU market. European institutions were significantly influenced by interest groups from various Member States but also acted as trust-enabling actors in a way that allowed DTs to scale up quicker. The key implication of this research is that to be successful in Europe, DTs (like cultured meat) will depend on obtaining support from diverse interest groups with differing objectives.

**Résumé:**

La production de viande est le secteur le plus polluant de l'industrie agro-alimentaire, néanmoins, l'émergence de la viande cellulaire comme solution à ce problème, donne espoir en le futur des alternatives à la viande. La viande cellulaire peut être considérée comme une technologie de disruption, puisqu'il est fort probable que son ascension bouscule grandement l'industrie de la viande. Ce dossier, retrace le chemin d'ancienne technologie de disruption provenant de l'industrie agro-alimentaire en Europe afin de prévoir et planifier l'arrivée de la viande cellulaire sur les étagères de nos supermarchés. Nous utilisons les exemples de l'aquaculture, émergeant comme une solution à la surpêche et la pollution océanique dans les années 1970, et les OGM, introduits en 1990 comme une solution aux famines et au sous-développement de certaines régions du globe. Ces deux technologies ont non seulement bousculé divers industries préexistants (pêche et l'agriculture traditionnelle), mais aussi les régulations et normes Européennes ainsi que la relation entre groupes d'intérêt et institutions Européenne. Ce dossier analyse le rôle des groupes d'intérêts et des institutions dans l'ascension ou la déchéance de ces deux technologies de disruption, en faisant une étude de cas typique. Les résultats sont clairs, lorsqu'ils s'allient bien qu'ayant différentes valeurs, les groupes d'intérêts sont plus forts et atteignent leurs buts (théorie « Baptist & Bootlegger »). Les institutions ont elles aussi eut un rôle important puisqu'elles ont agi comme acteurs de confiance créant des *dispositifs de promesse* et de *jugement,* permettant aux technologies de disruption une entrée sur le marché plus paisible tout en rassurant les consommateurs. Ainsi, pour atteindre le succès espéré, la viande cellulaire devra majoritairement obtenir l'approbation des divers groupes d'intérêts.

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**Introduction:**

Disruptive technologies (DTs) like cultured meat and electric vehicles are often viewed as solutions to sustainability challenges like climate change and air pollution. This paper retraces the route of past DTs from the European Union agri-food sector to better understand the conditions that allow DTs to gain market uptake. It looks at aquaculture, which emerged as a solution to over-fishing and ocean pollution in the 1970s, and genetically modified organisms (GMOs), which emerged to alleviate world hunger and help poorer parts of the world develop. Both aquaculture and GMOs can be considered DTs as they both disrupted existing industries (capture fisheries and conventional agriculture), the EU regulatory framework, and the relationship between interest groups and institutions. In both cases, European interest groups cooperated with other interest groups with diverging beliefs and acted as soon as regulations or projects were being drafted, leading to quicker and more efficient scaling of DTs. These coalitions were, additionally, very representative of the public's ideas. Institutions also had a significant role because they acted as "trust enabling agents" in two different manners: first, they reassured future entrepreneurs to take the risk and start an aquaculture business by providing financial help; second, they reassured consumers on the safety of the products by creating mandatory standards and labels for companies to follow in order to be commercialized in the European Union (Delemarle, 2013).

This thesis' main research question is: under what conditions will DTs gain market uptake most quickly? It investigates the role of interests and institutions in either abetting or constricting the ability of DTs to achieve market uptake in the European Union. I use typical case study analysis and within-cases process tracing to compare how the European market, legal framework, and various coalitions of interest groups reacted to the emergence of aquaculture and GMOs. I find that unlikely alliances of interest groups – sometimes called 'Baptist-Bootlegger coalitions –helped shape regulatory outcomes and allow both technologies to

achieve more scale in the EU market. European institutions were significantly influenced by interest groups from the various Member States but also acted as trust-enabling actors in a way that allowed DTs to scale up quicker. The key implication of this research is that to be successful in Europe, DTs (like cultured meat) will depend on obtaining support from diverse groups with differing objectives.

## I. Context

### A. Background and Definitions

The term "disruptive technology" (DT) or "disruptive innovation" was popularized by Clayton Christensen in 1997 when he published *The Innovator's Dilemma* to address market disruptions in established markets when an innovation is introduced (Christensen, 1997; Christensen, Anthony, & Roth, 2004; Rowan, 2020). This work built upon a 1995 article in which Christensen and his colleague Joseph Bower discussed how "older" companies (also called incumbent companies) should react to an emerging disruptive innovation (Christensen & Bower, 1995, Si & Chen, 2020). DTs have been conceptualized differently by scholars over time. In one conceptualization, DTs are imagined as a cycle. Denning (2016) explains: an "unobtrusive competitor eating away the low end of an incumbent's market with a lower quality product" while the established company focuses on usual "higher-end" clients' demands (Denning, 2016; Rowan, 2020). The disruptor then improves the quality of its product until they get the "higher-end" customers of the incumbent company (Denning, 2016). Once established, the ex-disruptor will become an incumbent company, ready to be replaced by the next disruptive company (Christensen & Bowers, 1995; Denning, 2016).

However, over the past twenty years, management scholars have further developed and refined the definition (Si & Chen, 2020, Rowan, 2020). The disruption does not only occur on

the market, “innovations” can also be interpreted as disruptive when they take over established ideas, such as scientific revolutions, which often induce violent paradigm shifts like the discovery of the atom or penicillin (Kuhn, 1962). DTs can also shift our legal and regulatory settings. In the past, DTs have challenged laws because of the uncertainty surrounding them (and the lack of experience of policymakers in the domain); this is the case with the rise of companies like Uber and Airbnb, for instance (Schuelke-Leech, 2018, Rowan 2021). Regulating DTs can be challenging because DTs are often somewhat established and embedded in consumer or industry practices before they attract the attention of regulators (Schuelke-Leech, 2018, Rowan 2020).

Twigg-Flesner (2016) and Sowers (2019) use the term "law-disruptive technologies" to describe a more global approach to the issue of disruptive innovations. According to Sowers, a law-disruptive technology needs to have three characteristics: 1- it needs to be a brand-new technology or an improved version of something that existed before; 2- it must make a significant economic or societal impact; and finally, 3- a law-disruptive technology does not fit into the current legal framework, making it harder to regulate for policymakers (Sowers, 2019, p. 196). Scholars focus on regulation struggles stemming from the market entry (or future market entry) of disruptive innovations in the political science literature. Sowers uses the examples of autonomous vehicles and 3D printing, which respectively challenged driving and patent laws (Sowers, 2019). Twigg-Flesner and Cartwright use the example of Uber or Airbnb using independent contractors to avoid contract laws and employee regulations (Twigg-Flesner, 2016; Cartwright, 2021). Nonetheless, "new" does not always imply "disruptive" because particular innovations are very similar to others. For example: "a new type of knee implant likely falls under the same statutory scheme regulating all current joint implants" (Sowers, 2019, p. 196). A law-disruptive technology does not fit within the current legal paradigm

perfectly (or at all), and thus, poses a dilemma: should we create new laws or incorporate DTs into existing laws (Sowers, 2019, p. 199)?

### B. Normative Position

While DTs are inherently contentious, this paper positions itself in favour of DTs because they could help address the climate crisis and the social and environmental challenges associated with it. Cultured meat, for instance, will likely replace a part of the "animal meat" market and thus lead to a reduction of Greenhouse Gases (GHG) in the atmosphere associated with animal agriculture (Tuomisto & Teixeira de Mattos, 2011). Although already well established in certain parts of the globe, GMOs helped farmers reduce their pesticides and water consumption for certain crops (principally maize, corn, soy, and wheat) while expanding crop yield and feeding more people (Brooke & Barfoot, 2017). Aquaculture emerged as a solution to overfishing in the 1970s when ocean scientists realized that the world's fish population was decreasing too rapidly (Cousteau, 1973; Zhou, Wang & Wang, 2013). The case of aquaculture, however, is not as clear-cut as cultured meat. The sustainability attributes of aquaculture quickly dissipated as large aquaculture plants took over the sector (especially in Northern Europe) and were reported to over-produce fish and endangering wild species. All of these innovations, although not perfect, could have, had, and will benefit the ecosystem. For these reasons, the degree to which DTs with sustainability attributes can achieve scale is an important area of research for scholars of environmental politics.

Although this paper presents a positive view of DTs, it is essential to recognize that the ethics of some innovations are not always evident and should be investigated. For instance, scientific innovations like genome editing (CRISPR) carry ethical ambiguities. Ethics and Bioethics scholars emphasize the role of the government in regulating such scientific creations

for them not to be misused in other areas "what is known as the "*dual-use*" problem" (Newson & Wrigley, 2016). Drones were also considered disruptive once, and the US government's use of drones in the army for "drone strikes" sheds light on the ethical problems around this new technology (Dunn, 2013). Finally, the rise of Artificial Intelligence (AI) has also triggered many debates in the ethics and bioethics community (Chesterman, 2020). Blockchain technology and big data have also given rise to significant ethical and privacy issues (Tang et al., 2019). The ethics of aquaculture production and GMOs remain blurry, as previously mentioned. Notwithstanding the ethical issues surrounding DTs, most environmentalists concur that technological change is a prerequisite to addressing the climate crisis. Consider the potential impact of technologies like electric vehicles, solar power, and carbon capture and storage (CCS). In these cases, the fate of human civilization may depend on the ability to get these technologies embedded in markets before global GHG emissions set us down an irreversible path. For this reason, a study of when and how DTs can achieve scale is both timely and relevant.

## II. Literature Review

### A. Interest

In The Innovator's Dilemma, Christensen explains the demise of several high-profile companies by DTs. He showed how embryonic technologies, although not competitive initially, could quickly overturn successful and established companies. He termed these embryonic technologies "disruptive" - as they turned out to be for the companies that were their "victims." Christensen thus already evokes the conflicts of interests likely to arise between incumbent companies and new disruptive companies. A large part of the literature on DTs in political

science focuses on this issue. In 2000, Christensen and colleagues wrote the first article on this problem in which they investigated the case of an entrepreneur who created a portable x-ray machine in the 1990s. This machine could have saved millions of dollars to hospital, insurance companies, and the state, but unfortunately, never entered the market because established medical appliances companies lobbied against it, (Christensen, Bohmer & Kenagy, 2000). Conflicts of interest prevented innovation from taking off.

The way policymakers decide to regulate a certain innovation dramatically depends on the influence of interest groups (Cook, 2018). Gilens and Page (2014) give four overarching theories to explain more generally how different actors can influence US politics: Majoritarian Electoral Democracy, Economic Elite Domination, Majoritarian Pluralism, and Biased Pluralism. They all predict which actors (average citizens, economic elites, and interest groups – more or less powerful) will shape public policies the most (Gilens & Page, 2014). The two latter (Majoritarian Pluralism and Biased Pluralism) emphasize the power of interest groups, whether broad and representative of the majority or representing a small but very influential group of elites (Gilens & Page, 2014). In the mid-1960s, Mancur Olson and William Connolly criticized Majoritarian Pluralism and Pluralism, highlighting the power of small and focused interest groups in achieving policy outcomes that favour them in the US (Olson, 1965; Connolly, 1969; Gilens & Page, 2014). After conducting a thorough statistical analysis using a sample of 1779 policy cases between 1981 and 2002, Gilens and Page confirmed Olson's idea and found that Biased Pluralism and Economic Elite Domination were the most applicable theories to US politics, for instance (Gilens & Page, 2014).-For the purpose of this research, I will mainly focus on Majoritarian and Biased Pluralism, which presupposes that corporations, business associations, and professional groups have the most power in the political sphere. Interest groups are thus a naturally important topic in political science.

Thus, research shows that interest groups can influence regulatory outcomes, but it remains unclear which stage is best for them to get their preferred outcome (Cook, 2018). Jeffrey Cook interviewed 64 interest group representatives and found that the earlier they tackle the issue, the better the results. That is, when interest groups get involved in the pre-proposal stage of regulations, they have better chances to achieve their desired outcome (Cook, 2018). Such situations are happening in the United States and Europe these days regarding cultured meat (DT): meat lobbies fight against the market entry of cultured meat (before its commercialization), focusing mainly on the marketing aspect. They lobby against using specific code words in the ads and packaging of future cultured meat products and current vegan meat-substitute (Sachs & Kettenmann, 2019; Taylor, 2020). Skogstad (2020) also discussed the rivalry between interest groups of established and disruptive companies using the example of renewable fuel (DT) in the US.

There is often a feedback loop forming between policymakers and interest groups before legislation is fully enacted (Cook, 2018; Skogstad, 2020). To illustrate her theory, she uses the 2005 and 2007 Renewable Fuel Standard (RFS and RFS2), which required American domestic fuel companies to include minimal renewable fuel volumes annually (Skogstad, 2020). The first RFS demanded small enough volumes not to pose any threats to petroleum companies, which led the project to be successful and self-reinforcing: more corn-ethanol was produced (Skogstad, 2020). This success led to the RFS2, which required higher volumes of different renewable fuel to be produced and led to much anger from petroleum companies who contested the new standard and we able to influence the regulation: "As the US RFS illustrates, regulatory contexts that require formal opportunities for public comment on draft rules enable organizations with appreciable informational resources to influence rulemaking, especially on matters where administrators lack prior expertise." (Skogstad, 2020, p. 367). Interest groups and industry organizations thus can modify regulations before they are enacted, especially when

there are knowledge asymmetries between policymakers and industry organizations. These two examples show that interest groups can act against the rise of a DT but institutions can also help DTs become successful, like in the case of the RFS.

The interaction between interest groups in policymaking is, however, not always that simple. The "Bootlegger and Baptist" theory suggests that a regulation or directive is more likely to be adopted if interest groups with divergent (or simply different) goals endorse it (Smith & Yandle, 2014; Stagnaro, 2020). The case of e-cigarettes (DT) regulation illustrates this phenomenon: Adler *et al*. (2016) applied the Bootlegger and Baptist theory (two groups with diverging interests become allies against a common threat). Here, health organizations hostile to e-cigarettes and cigarettes have allied with tobacco companies to (successfully) tighten regulations around e-cigarettes (Adler *et al*., 2016). In the past, public health advocates lobbied against the advertisement of cigarettes and were backed by cigarette producers who wanted to reduce their advertising expenditures and prevent future competition (Adler *et al*., 2016). Sharing Businesses also bring much debate about how they should be regulated: Airbnb and Uber, for instance, got Baptist and Bootlegger together for a common cause: in the case of Airbnb, hotel companies were the bootleggers, firmly against Airbnb. The Baptists came to be the politicians wanting to please their constituencies by positioning themselves against Airbnb causing rents to increase. They rallied interest groups from both sides (hotels and Airbnb), creating a more intense political climate, helping them in their election, and won the case by implementing an Airbnb tax (Stagaro, 2020). The power dynamics between interest groups and policymakers are complex, and established interest groups tend to be more successful in reaching their goals (in the case of RFS2 and e-cigarettes). Nonetheless, although it is not always straightforward, these examples show that there are possibilities for DTs to become successful with the help of institutions.

Interest groups thus hold major power in the policymaking process and have the power to help or block DTs become more established in certain conditions:

*H1: DTs will have difficulties gaining market share when interest groups lobby against them at the early stages of the regulatory process (Cook, 2018)*

*H2: DTs will have difficulties becoming gaining market share when interest groups with diverging interests cooperate together and lobby the government against them (Baptist and Bootlegger Theory).*

### B. Institutions

The relationship between DTs and regulatory institutions is a tight one. The past decade has witnessed the exponential rise of new technologies and, thereby, the rise of new regulations. Political scientists have thus jumped on the topic and wrote several articles analyzing current trends in regulations to build new models of analysis and theories (e.g., Brass & Sowell, 2020; Kouroutakis, 2020). Brass and Sowell (2020) use the Internet of Things (IoT) as an example of DT to push a new regulatory response model combining three important modes of regulations. The first one is self-regulation, i.e., businesses using the technology regulate themselves using standards). The second is light-touch regulation (similar to soft-law), i.e. when the government intervenes on the private standards setters to homogenize them. Finally, centralized risk regulation (similar to hard-law or command-and-control approach), when the government entirely intervenes on the matter, creates an agency in charge of the regulations (Brass & Sowell, 2020). The issue of who should be in charge of regulating disruptive innovation is heavily studied.

Kołacz, Quintavalla, and Yalnazov (2019) attempted to answer whether judges or legislators should regulate DTs (Kołacz et al., 2019). Thus, which institution is best suited to

control disruptive innovations, the judiciary or the legislative branch? The authors illustrate their case with autonomous cars. The early-stage approach to regulate innovations is to adapt existing laws. Nonetheless, legislators will face challenges as certain laws do not fit the innovation perfectly, and some legal issues that were not planned for will inevitably arise as time goes (Mandel, 2017; Kołacz *et al*., 2019). The researchers bring a new theory by classifying new technologies as risky (example: self-driving cars) and uncertain (example: 3D printing). A risky technology "poses an obvious [immediate] risk" and will likely end up in court for litigation. Thus, judiciaries are better suited to regulate it (in the short run) because they acquire more information on the topic faster than other institutions (Kołacz et al., 2019, p. 2). An uncertain technology, however, does not present a current threat. However, the future risks are very uncertain: "Uncertain technologies [...] can be harmful in ways which cannot be foreseen at the time of the technological innovation" (Kołacz et al., 2019, p. 2). Thus, regulations here must be based on the "subjective preferences about the degree of uncertainty that society should tolerate," which the legislative branch is better suited to handle. Courts are better suited to handle risky innovations because they can act faster: "because litigation is the most cost-effective method of funnelling information from litigants to the lawmaker" (Kołacz et al., 2019, p. 18). However, the rules emanating from a court trial are not representative of the people (like laws stemming from the legislative branch would be), so the judicial branch's "regulation" only works in the short term. With uncertain technologies, the risk is not immediate, and the problem becomes one of the aggregating of social preferences about uncertainty around the product; thus, in this case, the legislative branch is superior (Kołacz et al., 2019, p. 19). Kouroutakis applies Kołacz's theory to analyze the UK and Germany's regulatory responses to autonomous vehicles. He concludes that legislative regulations are necessary, although slow, and should maybe be implemented internationally. He also predicts

that once autonomous vehicles become mainstream, legislations will be complemented by judicially created laws and self-regulation (Kouroutakis, 2020).

In addition to regulating, institutions can also act as a "trust enabling" agency when faced with a DT: Delemarle (2014) demonstrates two ways institutions and policymakers can support innovation, help their market entry, and popularization. DTs struggle to enter the market because of the uncertainty surrounding them (Courtney, 2001; Delemarle, 2014). Without help from institutions, disruptive companies sometimes lack credibility making it complicated to become an established business. According to Delemarle, institutions can use two trust enabling mechanisms to help disruptive businesses grow to become mainstream (Brousseau, Geoffron and Weinstein 1997; Karpik 1996; Delemarle, 2014). The first one is the "promise-securing" mechanism, used to reduce opportunistic behaviours that outside parties could display because of the uncertain circumstances (Delemarle, 2014). This mechanism protects the business from ill-intentioned outsiders. Working groups of scientists to assist innovators and financial help to create a project are both promise securing examples. The second one is the "judgment-enabling" mechanism to increase transparency between two parties involved in the exchange (Delemarle, 2014). Standards and labels are judgment-enabling mechanisms, as they enhance transparency between consumers and producers, allowing consumers to make more informed choices and be reassured of the quality of a product. She concludes that public policies act both as a promise securing and judgment enabling mechanism because they support spreading knowledge about a niche concept to a larger community (promise-securing) and help establish a new dominant design while paving for its market entry (Delemarle, 2014, p. 33).

Due to the uncertainties and risks revolving around DTs, policymakers don't always know how to control them. Scholars have thus preconized several models of regulation for institutions to follow, for instance, leaving the judicial branch to deal with risker innovations.

Nonetheless, institutions' role is not always to control and supervise DTs; they can also act a trust enabling agents and help DTs come to the forefront, so they become established more rapidly. I thus hypothesize:

*H3: DTs are more likely to gain rapid market uptake when institutions endorse them and thus act as "trust enabling agents" and use "promise securing mechanisms" such as subsidies and grants (Delemarle, 2013).*

*H4: DTs are more likely to gain rapid market uptake when institutions create "judgement enabling" mechanisms such as standards that establish transparency and build trust among customers (Delemarle, 2013).*

***Summary***

DTs have, therefore, a global impact on societies; they influence cultural habits but can also change the economy of a country by impacting the job and housing market drastically, like in the example of Airbnb. Institutions are likely to be influenced heavily by incumbent companies' interest groups to regulate DTs more strictly, especially if these interest groups act as soon as a regulation project is being drafted (H1: DTs will encounter difficulties gaining market share when interest groups lobby against them at the early stages of the regulatory process). Other methods like cooperating with interest groups with diverging interests (but have the same nemesis) can be very successful too (H2: DTs will have difficulties gaining market share when interest groups with diverging interests cooperate together and lobby the government against them - Baptist and Bootlegger Theory). It remains, however, unclear which method is the most efficient and if combining both would lead to a successful outcome. Institutions also have a role of their own in helping DTs enter the market, as per Delemarle, they can act as *promise securing* agents, providing financial help and subsidies to innovators

and entrepreneurs (H3: DTs are more likely to gain rapid market uptake when institutions endorse them and thus act as "trust enabling agent" and use "promise securing mechanisms" such as subsidies and grants). Institutions can also act as "judgement enabling" by implementing mandatory labels and strict standards in order to reduce information asymmetries between consumers and producers (H4: DTs are more likely to gain rapid market uptake when institutions create "judgement enabling" mechanisms such as standards which establish transparency and build trust among customers). In the following section, this paper will test these four hypotheses using the cases of aquaculture and GMOs in the European Union. It will test if the EU acted as a trust-enabling agent for both examples and if interest groups allied against or in favour of both innovations.

## III. Methodology

This paper uses use *typical case study analysis* and *within-case process tracing* (Seawright & Gerring, 2008). Typical case studies focus on cases showing a stable cross-case relationship; here, aquaculture and GMOs are both typical cases of DTs in the agri-food sector in Europe. Both led to a change in the relationship between European interest groups and institutions and led to new regulations created because of interest groups' actions. In addition to looking across cases, this paper also uses within-case process tracing to better explore the causal mechanisms that enabled (or not) the market entry and scaling of DTs. Aquaculture and GMOs both demonstrate the ever-increasing close relationship between interest groups and institutions. Policymakers often turn to interest groups with more expertise on the new DT to help them draft regulations but also act in consequences of interest groups' demands (Siddiki & Goel, 2017). The main goal of this paper is to investigate how interest groups and institutions affected the regulations of GMOs and aquaculture in the EU.

To compare these two cases, I used primary and secondary sources publicly available online. Primary legal sources about the EU were found on the European Commission's Website and EurLex, where all EU regulations and directives since 1957 have been made available.[1] I supplemented my primary legal sources using the French government's law website: *Legifrance* and secondary sources documenting much older texts often unavailable to the public.[2] Primary sources on interest groups' actions were found on various interest groups and advocates' websites (sometimes with the help of the WayBackMachine), where the organizations explained their cause and fight and the results of their actions. I also draw upon secondary sources such as academic articles and book chapters where about GMOs and aquaculture. I then compared the differences in interest groups' behaviours and institutions' regulations for both cases: GMOs and aquaculture. My research remained fairly concentrated around the same time period for GMOs, the late 1990s and early 2000s, because interest groups and institutions acted during this time. However, the case of aquaculture was sparser, and the analysis took place between the 1970s and 2010s (institutions acted mostly in the 1970s and interest groups in the 2000s). This methodology allows for a thorough analysis of both cases to better identify patterns of behaviours among institutions and interest groups in the specific region of Europe – the goal being to prepare for the future of cultured meat in the EU.

[1] EurLex: https://eur-lex.europa.eu/homepage.html?locale=fr

[2] Legifrance: https://www.legifrance.gouv.fr/

# IV. Results

## A. Aquaculture in Europe: the role of the European Community and Interest groups

Aquaculture accounts for 50,2% of global fisheries production globally, mainly thanks to China and Indonesia, providing each 58% and 14% of the aquaculture output, respectively (EUMOFA, 2017). In Europe, aquaculture remains a minority of fish production: the Union provides only 1,3% of total global aquaculture output while being the second fish consumer worldwide (after China) (EUMOFA, 2017; EU Science Hub 2018). Production peaked in 2017 with 1,37 million tons of farmed fish, against 5,25 million tons of wild catches; since then,

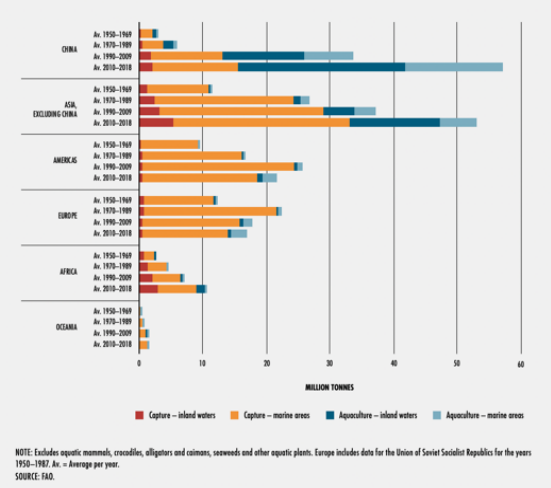


*Figure 1: Regional Contributions to the World Fisheries and Aquaculture Sector*
*Source: FAO 2018*

aquaculture production stabilized at around 1,30 million tons per year (EUMOFA, 2019; EUMOFA, 2020). The establishment of aquaculture in the EU as an alternative fish consumption began in 1964 with the establishment of the Common Agricultural Policy (CAP). Aquaculture had a very slow rise and cannot be considered to be a successfully scaled DT in Europe, contrary to Asia, for instance. The following section explains why.

## 1. European Interest Groups

This section highlights the problems faced by the aquaculture and fisheries industry leading to the slow rise of aquaculture in Europe. It demonstrates that after the Common Fisheries Policy (CFP) reform in 2002, the EU favoured large aquaculture plants over small-scale fish farms, which contributed to the unpopularity of the practice and united groups with diverging interests such as ENGOs and fisher associations to work against aquaculture plants in different countries (H2).

In 2002, the CFP was reformed to include better the interests of aquaculture companies (through the Regional Advisory Council RACs, for instance). Instead of helping small fish farms (which represented 80% of the aquaculture business), the EU chose to finance and approve projects from large aquaculture companies that threatened small fisher businesses in Ireland and Scotland. Individuals from various (sometimes diverging) backgrounds (NGO members, tourism companies, fishermen organizations, locals, public administration, energy sector) quickly organized against the rise of massive aquaculture powerplants damaging their local economy. Interestingly, when interviewed, these groups were usually in favour of aquaculture but not in their community (Not In My Back Yard problem - NIMBY) (Ertör & Ortega-Cerdà, 2015). In Ireland, fishers cooperated with the local population to prevent the installation of an aquaculture salmon farm in Bantry Bay in 2012 and created a website for their cause, "Save Bantry Bay," where they continue to petition against the installation of fish farms in England. The locals won the Bantry Bay fight, who petitioned their commissioners to object their proposed salmon farm planned by Marine Harvest. The chairman of the organization, a fisherman, challenged commissioners by pointing out the lack of public participation in the project: "the project had failed to make good on Bantry Bay Charter's commitment to comprehensive public participation in relation to significant developments in Bantry Bay. This requires that agreement is reached within local communities before any further development

takes place." (Save Bantry Bay, 2012) The website confirms Ertör and Ortega-Cerdà's hypothesis about NIMBY mentality as it states: "Save Bantry Bay does not oppose fish farms in general but insists on no further salmon farm to be set up in heavily used and impacted Bantry Bay […]" (Save Bantry Bay 2012). In 2014, Save the Bantry Bay supported a meeting between environmental groups, locals and the tourist industry against the expansion of salmon cages around Galway, promoted by Bord Iascaigh Mhara (Irish Sea Fisheries Board). Actors opposed the project because the humongous salmon farm project would lead to income and job losses (as the farm would be mostly automated), is damaging for salmon's quality of life (each cage could contain 14.4 m salmons) and the use of pesticides to kill diseases and parasites from such huge numbers of farmed salmon, will kill wild fish around the area such as lobsters, crab and shrimp, which fishermen depend on (Save Bantry Bay 2014). The Irish Sea Fisheries Board abandoned the project in 2015, proving the local coalition to be successful. Similar situations happened in Greece (Mente et al., 2007), France (Goulletquer & Le Moine, 2002), Norway (Christiansen, 2013) and many other countries in Europe (Ertör & Ortega-Cerdà, 2015). These two examples prove the Baptist and Bootlegger theory: individuals from diverging backgrounds, such as environmental NGOs and fishing companies, can work together to prevent the implementation of certain projects. This situation proved the failure of the EU to include voices from all actors impacted by aquaculture farms after the CFP reforms (2002 and 2013): the focus has been turned too drastically towards competitiveness and economic growth (Ertör & Ortega-Cerdà, 2017). Environmental sustainability has also proven to be a challenging goal since it needs to encompass the social and economic situation of certain regions to be successful (which was not the case in Galway nor in the Bantry Bay). Once participation of all parties is at the forefront of the CFP, then challenges will likely disappear.

The power of interest groups in influencing the CFP makes the Baptist and Bootlegger hypothesis (H2) plausible. In this case, diverging interests joined together against a common

threat and were able to change the European agenda (van Hoof & van Tatenhove, 2009; Wakefield, 2009). However, this section finds less evidence in support of H1: established interest groups from the fishing industry did not cooperate in the 1970s to counter the rise of aquaculture, likely because this rise was so slow that it did not represent a threat for the fishing sector (van Hoof & van Tatenhove, 2009). Further, the EC created advisory committees in 1970-2010, such as the ACF, ACFA and RACs that all targeted the fishing industry's interests (van Hoof & van Tatenhove, 2009; Wakefield, 2009). The capture fisheries sector continues to dominate the market. Thus, it did not need to counteract the rising competition from aquaculture.

## 2. European Institutions

Although the rise of European aquaculture was slow compared to Asia, between 1960 and 2017, the EU went from producing 8% of fisheries through aquaculture to 25% in 2017. This section shows that institutions acted as *trust* and *judgement enabling* agents by giving financial incentives to ensure work and quality of life standards to future producers (H3 and H4). Although the European Community was slow to establish a strong aquaculture industry and remains far behind Asia in terms of production, its ratio capture fisheries to aquaculture are on par with the Americas and Africa (Figure 1). The European Community (EC) developed three


*Figure 2: Example of labelling requirements for aquaculture*

main financial assistance programs between 1964 and 1986. Regulation no. 17/64/EEC established a 25% financing program for aquaculture projects in any member state of the EC until 1978. Between 1971 and 1977, the EC had spent 5.53 million of ECU (European Currency Unit) on these projects (OECD, 1980; Churchill, 1987). The Inshore Fishing Industry Program (IFIP), under the responsibility of the European Agriculture Guidance and Guarantee Fund (EAGGF) (created in 1964 under Regulation no. 17/64/EEC), provided grants financing between 25% and 50% (above 25% was only for disadvantaged areas) of the cost of aquaculture projects in the Member States (Churchill, 1987). The IFIP spent 23 million ECU on 109 different projects, most located in Italy and Ireland. These programs were undeniably efficient in the rise of aquaculture production in Europe; nonetheless, most of the change happened in the mid-1980 (Figure 2). The post-1982 increase is likely due to the UN Convention on the Law of the Sea, which shed light on the depletion of ocean fish stocks and the urgency to stop relying on capture fisheries (UN, 1982). This led to, a year later, the official creation of a Common Fisheries Policy (CFP), which implemented programs in favour of the aquaculture industry and catches restrictions with Total Allowable Catches (TACs) to reduce capture fisheries (Wakefield, 2009; Churchill & Owens, 2010). Council Regulation (ECC) no. 2908/83, financed 34 million ECU for aquaculture projects between 1983 and 1986. These projects were primarily located in Italy and Ireland as well (ECC 2908/83; Churchill, 1987). Regulation 3760/92 intended that the CFP shall provide "coherent measures" on the "conservation, management and exploitation of living aquatic resources [….] [and] aquaculture." (Churchill & Owens, 2010, p. 19). In practice, the Commission demanded its Scientific Technical and Economic Committees to provide annual reports on the state of fisheries and aquaculture (Article 16), the Commission also created the Management Committee for Fisheries and Aquaculture to represent the interests of fisheries in all Member States. Finally, in addition to financial aid programs at that time, the EC embedded compulsory Common Marketing Standards for

Member States in the CAP (which also targeted fisheries) laid out in the Rome Treaty of 1957 (implemented in 1962) (Treaty of Rome, Article 40(3), 1957). These standards integrated the CFP in 1983, and soon after, the EC implemented quality and transparency regulations specific to aquaculture (e.g., Regulation EEC 3759/92 and Regulation EC 3318/94). Council Regulation No 2406/96, for instance, asked aquaculture farmers to collaborate with private organizations from their country (approved by the Member States and the Commission) to grade their products according to EU standards in order to reassure consumers that aquaculture products are substitutable with wild-caught fish (Council Regulation (EC) No 2406/96). These standards are often updated, as seen in Figure 2.

The European Committees' role in implementing regulations and directives to help the development of the aquaculture sector is undeniable. These results confirm hypotheses one and two as the Community acted as trust enabling agents for individuals and small businesses interested in beginning their aquaculture plants by providing financial help through different programs (creating *promise securing mechanisms*). The Law of the Sea Convention in 1982 pushed EU institutions to act on limiting capture fisheries by creating TACs (which had been in discussion and negotiation since 1976 but were never fully implemented) and new regulations emphasizing aquaculture production (Da Conceição-Heldt, 2006). The EC also acted a judgement enabling by bridging capture fisheries and aquaculture standards to reassure individuals on the quality of aquaculture products, as seen in Figure 3. Although the EC was very involved in fishery policies during the 1960s to 1990s, most of the changes in the sector took place recently (Figure 1) with the restructurations of the CFP in 2002 and 2013, both emphasizing sustainable development of aquaculture and participation from smaller companies in the regulator. For instance, between 2000 and 2006, the Commission invested €351 million in aquaculture alone, and in 2006 the European Council created the European Fisheries Fund

(EFF) to financially assist small and medium scale fish farms,[3] and between 2007 and 2014 the fund invested 27% of its €4.3 billion budget to aquaculture development (EC 1198/2006; Eurostat, 2008; Churchill & Owens, 2010; Skerritt et al., 2020).

Thus, the EC clearly acted as a trust enabling agent for fishers and individuals willing to take the risk and create their own aquaculture company, by creating promise securing mechanisms. The EC also acted as a judgement enabling agent by ensuring quality products to clients sometimes skeptical about buying raised instead of wild-caught fish. Thus, there is some evidence in support of H3 and H4.

### B. GMOs in Europe: the role of the European Union and Interest groups

In 1994, the first Genetically Modified tomato was commercialized in the United States. GMOs are now widely used around the globe but remain heavily criticized. In Europe, GMOs began being regulated in 1990, EC regulations take place at the European Council level and depend on three principles: harmonization of Member States Laws, the protection of the environment and the CAP. The Council regulates the commercialization and labelling of GMOs, nonetheless, Member States are allowed to contest these regulations. National interest groups thus are likely to influence GMOs regulation at the EC level. Like aquaculture, GMOs had a very slow rise in the EU and eventually faced a wall in 2003, when the EU enacted very strict measures to trace and control the production and commercialization of GMOs.

#### 1. European Interest Groups

[3] That is less than 750 employees and with a turnover lower than €200 million.

In Europe, GMOs began being regulated in 1990, EC regulations take place at the European Council level and depend on three principles: harmonization of Member States Laws, the protection of the environment and the CAP. The Council and Commission regulate the commercialization and labelling of GMOs. Like aquaculture, GMOs had a very slow rise in the EU. Eventually, they faced a wall in 2003, when the union enacted stringent measures to trace and control the production and commercialization of GMOs.

This section highlights the importance of national interest groups that worked together against GMOs from the moment regulations drafting began. These examples confirm that when interest groups and lobbyists target DT's regulations at the drafting process, they can efficiently shift the future and success of said DT (H1). Like aquaculture, interest groups with different interests like ENGOs and Chefs cooperated to push for stricter GMO regulations in Europe (H2). Due to the structure of European law, Member States are allowed to contest and demand changes on subnational directives and regulations, especially when it comes to matters of public health and environmental policy. National interest groups from these domains thus have the power to change the fate of such subnational regulations. In the case of GMOs, anti-biotech coalitions arose as soon as the first directive governing the market entry of GMOs came out. However, their actions took off in 1996 when the US Monsanto RoundUp Ready™ soybean was approved to be imported to Europe (Schurman, 2004). Organizations from all Europe organized in 1996 when Monsanto refused to label its GM soy as such and mixed it with regular soy when importing the products to Europe: this lack of transparency angered many activists who cooperated and started the violent campaign against Monsanto and GMOs more generally (Charles, 2001; Schurman, 2004). Most coalitions were composed of consumers associations, ENGOs, small farmers and chefs' associations and worked to forbid GMOs market entry in Europe in 1996 (Kurzer & Cooper, 2007). The motive for these coalitions differed by country: in France, the rationale was cultural and culinary; in the UK, animal protection organizations

led the movement; in Austria, the justification was health-related. The Confédération Paysanne, for instance, fronted the movement in France, arguing that "French delicacies such as Roquefort, truffles, and foie gras, and the small family farms which produce them, were at risk of disappearing" due to the Americanization of the French society (Kurzer & Cooper 2007). In the UK, however, the motive was animal protection; the Royal Society for the Protection of Birds (one million members) warned that GM crops would reduce the variety of birds in the country by reducing their food supply. Greenpeace UK was highly active in the fight and attempted the blockships carrying GMOs from the US to land (Schurman, 2004). Similar organizations, such as Friends of the Earth UK and Women's Environmental Network, simultaneously started consumer-based activism, aiming to educate and debate with consumers about GMOs. Later, they pressured private supermarket companies to drop all products containing GMOs from their shelves. These campaigns were very successful as, a couple of years later, in 1998-1999, companies like Iceland Food, Carrefour or Tesco (and many others) dropped all GM foods from their supermarket shelves. In terms, the Labour government sided with the coalition and opposed the use of many other GM crops like beet and spring rap (Moss, 2004; Kurzer & Cooper 2007). One by one, these interest groups coalition demanded changes to their national government, who then contested European directives every time a new one would be implemented. In terms, the EU drastically hardened its GMO regulations, as is discussed in the next section. Thus, this section confirms that interest groups were efficient in changing the future of GMOs in Europe by acting as soon as GMO regulations were being drafted and as soon as they were being commercialized. The evidence of interest groups with divergent interests acting together is not as clear; nonetheless, interest groups with very various interests did cooperate in fighting the same cause (chefs, farmers and ENGOs), which likely helped the cause as they all attracted different sections of the population: by 2001, 58% of Europeans (EU-15) were worried about GMOs (Eurobarometer 55.2, 2005)

## 2. European Institutions

This section will show that the Council attempted to act as a trust enabling agent by enacting strict rules to control the quality of GMOs allowed in the EU (H3) and as a judgement enabling agent by implementing strict labelling rules to foster transparency between companies and consumers (H4). Although the public was still extremely skeptical, the Council adopted its regulations to Europeans' demands by enacting stricter regulations. The following part thus describes the first GMO directive and its adaptations, which is an example of the Council being a "trust enabling" agent. The following regulations following public demands about traceability and labelling are examples of the Council being a "judgement enabling" agent.

The Council implemented the first GMO related regulation in 1990: Directive 90/220 defines GMOs as "genetically modified organism (GMO) means an organism in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination." (Council Directive no. 90/220; Grossman & Endres, 2000). The directive governs GMOs for experimental purposes "outside of the laboratory" and anticipates the rules for market entry of GMOs. It establishes that before market entry, products containing GMOs will need to be notified and approved by the Commission (Council Directive No. 90/220/EEC). Due to the harmonization principle in the then EC, Member States had to be compliant and not restrict commercialization of GMOs approved by the Council (Council Directive No. 90/220/EEC; Grossman & Endres, 2000). However, each Member State is required to set up a competent authority to help carry out the Directive (Grossman & Endres, 2000). Companies wishing to commercialize or use GMO products must notify the national authorities, who will notify the Commission and be analyzed by relevant committees before being approved. However, article 16 of this directive allows member states to contest the Council Decision:

Member States are allowed to contest the commercialization of GMOs in their borders: for instance, Luxembourg and Austria countered the sale and use of GM corn seeds in their country because of environmental concerns. These claims are analyzed by the relevant EC committee, in that case, the Scientific Committee for Plants, who determines if the claims are valid or not (Grossman & Endres, 2000). Member States' interests thus play a role in the commercialization of GMOs at the European level, as will be discussed in the next section.

Article 8 of Regulation 90/220 lays the ground for labelling requirements, making it mandatory for companies to indicate modified organisms in their products. Commission Regulation 298/97/EC adds to Regulation 90/220/EEC on labelling rule to increase transparency with consumers. The Regulation requires labels to mention *what* "makes an ingredient no longer "substantially equivalent" to an existing food or ingredient and to inform consumers about material not present in an existing equivalent foodstuff that has implications for health (e.g., allergies) or raises ethical concerns (e.g., religious dietary laws)." (Council Regulation No. 90/220/EEC; Commission Regulation No. 298/97/EC; Grossman & Endres, 2000). Finally, in 1998, the Commission allowed companies to market GM soya beans and maize, which was not permitted previously (Council Regulation No. 1139/98/EC). Two years later, the Commission also allowed food products containing up to 0.9% of GMOs not to be mandatorily labelled (Commission Regulation No. 49/2000/EC). Due to the harmonization principle, Member States should apply the rules without contestation; however, here too, some countries opposed the regulation. France did not accept GM soy and maize marketing in its own borders because of pressures from interest groups (Grossman & Endres, 2000). Thus, the power of member states' national politics was still extremely important in pushing European and National institutions to be judgement enabling agents.

The evidence gathered above thus suggests that following public demands, the Council adopted its GMO laws by acting as a trust enabling and judgement enabling agent, thus lending support to H3 and H4.

### C. Summary:

To conclude this section, the cases described in the above section confirm the four main hypotheses: for both aquaculture and GMOs, European institutions like the European Council and Commission acted as trust and judgement enabling agents by enacting directives and regulations enhancing the entrepreneurial spirit for fishers interested in starting an aquaculture business (*promise securing mechanisms*) and tightening rules around GMO control to reassure consumers (H3). The evidence also shows that institutions created promise-securing mechanisms to reassure agents willing to take the risk and start a business in the domain (for the case of aquaculture, by giving away grants to entrepreneurs). In tandem with these regulations, European institutions also enacted judgment enabling mechanisms through the use of labels to reduce information asymmetries among consumers. In the case of aquaculture, labels are used to inform clients where and how their fish were farmed, in the case of GMOs, labels are used mostly to track how much GM ingredients are contained in a food product (H4). These labelling rules, however, were often the result of interest groups' demands, especially in the case of GMOs, where interest groups targeted GM food regulations as soon as they began being drafted (H1), which was, however, not the case for aquaculture. Finally, in both situations, interest groups from various and sometimes diverging backgrounds allied against a common cause (GMOs or aquaculture plants) to get their demands met, thus strongly supporting H2. H1 is slightly less supported, in the case of GMOs, interest groups acted on the issue as soon as regulations began being drafted and were successful at achieving their

demands. In the case of aquaculture, no interest group coalition demanded stricter regulations in the 1970s (as the industry arose). However, there is evidence suggesting that when interest groups act in the early stages of an aquaculture plant project (like in the example of Scotland and Ireland), they can be successful at cancelling the project.

**Table 1:**

| **Case studies:** | **Aquaculture** | **GMOs** |
|---|---|---|
| H1 | Mixed evidence | Strong evidence for regulation |
| H2 | Strong evidence | Strong evidence |
| H3 | Strong evidence of trust-enabling for entrepreneurs | Strong evidence of trust-enabling for consumers |
| H4 | Strong evidence | Mixed evidence |

## VI. Discussion

### A. Interpretations: linking the results to the literature review

#### 1. Christensen's Definition: failure to consider other actors than incumbent companies

Christensen's predictions on incumbent companies' reaction to DTs arising does not precisely apply to aquaculture and GMOs in the EU. In both cases (aquaculture and GMOs),

the expression "incumbent *companies*" does not apply well to the situation; "incumbent *sectors*" (or "traditional *sector*") seems more appropriate since aquaculture and GMOs threatened an entire sector of the food industry (traditional capture fisheries, and traditional agriculture). Nonetheless, there were still no significant pushbacks from the threatened incumbent *sectors*: most of the rejections to these innovations stemmed from coalitions between interest groups from the following various backgrounds: the incumbent *sector*, ENGOs, consumer organizations, tourism associations; and many other actors. The incumbent sectors were far from being the only ones working against the DTs. Christensen also predicts that DTs will take over the market, starting by seducing lower-end customers and slowly working their way up. These predictions are not supported by the evidence discussed in the previous section: aquaculture production increased in Europe between 1970 and 2010 but has since been stagnating (the majority of the fish Europeans eat and produce comes from capture fisheries); further aquaculture continues to be a lower-end cheaper option did not seduce "higher-end" fish customers, usually because of the ideas surrounding the healthiness and quality of wild-caught fish (e.g., Verbeke *et al.,* 2007; Claret *et al.,* 2014). The case of GMOs is a bit more complex as GMOs never really took off due to the public pushback in most Member States, leading to tighter regulations in the Union (Christensen, 1997; Christensen & Bower, 1995). GM foods continue to be perceived in a bad light in Europe. Popular supermarket chains like Carrefour and ASDA still do not sell GM products, and conglomerates like Unilever and Nestle do not process GM products. These factors make GMOs harder to access for most people in Europe; it is thus complicated to assess which type of consumer buys GM foods. Nonetheless, research suggests that people concerned about their health and the environmental impacts of their food consumption tend not to consume GMOs (Montuori *et al.,* 2012; Boccia & Sarnacchiaro, 2015). Thus, although GMOs and aquaculture did disrupt the market, they did not take it over, as Denning and Christensen theorized (Christensen, 1997; Christensen &

Bower, 1995; Denning, 2016). In fact, GMOs and aquaculture disrupted the European political and legal status quo more than the European market, as is discussed later.

## 2. Pluralism and interest groups

As described in the Result section, small interest groups' coalitions were central to GMOs and aquaculture regulations in Europe. These coalitions, in both cases, fit Majoritarian Pluralism theory. Gilens and Page (2014) define Majoritarian Pluralism as "majoritarian pluralist" theory since they imply that the wants or needs of the average citizen tend to be reasonably well served by the outcomes of interest-group struggle" (Gilens & Page, 2014m p. 567). In the case of GMOs and aquaculture, small interest groups allied to represent their interest while remaining representative of the public's ideas. This is especially the case with GMOs; nonetheless, a large part of the European population now admits their doubts about aquaculture (e.g., Verbeke *et al*., 2007; Claret *et al*., 2014). The theory of Biased Pluralism, predicting that large companies would lobby against their opponent, does not apply for these two cases in Europe but applies to the US, as will be discussed below. Naturally, industries threatened by GMOs and aquaculture participated in the coalitions, but they were far from the only actors as many other interest groups from various backgrounds joined. In many examples, ENGOs were actually the most prominent actors: Greenpeace was very influential in the European anti-biotech colation, and various ENGOs supported the Bantry and Gallway Bay fights (Ertör & Ortega-Cerdà, 2017). The evidence presented above also supports Jeffrey Cook's theory on interest groups being more efficient when tackling an issue at the early stages of its regulatory process. This is evidently the case with GMOs: interest groups cooperated as soon as the first directive was implemented and successfully pushed for stricter regulations. Nonetheless, examples show that the interest groups cooperated during the early stages of an aquaculture plant project (like in

Scotland and Ireland) successfully stopped the project. Unlike Skogstad hypothesized, there does not seem to have been a feedback loop between institutions and the GM-foods and aquaculture sectors in Europe, demanding less restriction like the case in the US when regulating oil production. Nonetheless, there seem to have been a feedback loop with the interest groups demanding more restriction on GMOs, which culminated in the creation of the European Food and Safety Authority (EFSA) in 2002, which continuously cooperates with national food and safety organizations: thus supporting the importance of national interest groups in forging European politics. The evidence is, however, not as much supported for the case of aquaculture. Finally, and as discussed throughout this paper, the evidence also supports the Baptist Bootlegger theory. In both cases, interest groups from various backgrounds, sometimes diverging but not always, cooperated to stop the rise of aquaculture plants and GMOs. The results are not as clear-cut as Stagnaro 2020 and Adler *et al*. 2016 (giving the examples of Airbnb and Uber); nonetheless, evidence shows that interest groups with diverging or varied motives ally, they are successful (Smith & Yandle, 2014; Adler *et al*., 2016; Stagnaro, 2020). The theory of Majoritarian Pluralism thus better explains how interest groups interacted with the rise of GMOs and aquaculture in Europe (Gillens & Page, 2014). This will, however, not likely be the case for other agricultural DTs like cultured meat.

### 3. Institutions:

As per the previous paragraph, interest groups have had a significant impact on how the European Council and Commissions decided to regulate GMOs and aquaculture. When looking at the regulatory outcomes from European institutions, the evidence does not support all of Bras and Sowell's regulations models (Brass & Sowell, 2020). Bras and Sowell hypothesized that there are three main ways to regulate an innovation: self-regulations (private standards,

companies regulate themselves privately); light-touch regulation (soft law) — government standards or cooperation between the public and private sector to create standards; and finally, centralized risk regulation (command-and-control) — institutions create agencies to monitor a certain matter. Neither aquaculture nor GMOs companies self-regulate their practices. In both cases, regulations stemmed from the Council or the Commission, either through a command-and-control approach or "centralized risk regulation" (e.g., tracking GMOs, creation of the EFSA) or a soft-law approach or "(e.g., subsidies and grants to the aquaculture sector). National governments also controlled GMOs under the demands of the EU. Centralized risk regulation best fits the EU approach to GM foods after the pressure received from interest groups. In contrast, the light-touch regulation model fits the response to aquaculture better, especially in its early days, as the EC provided many financial incentives in the form of grants and subsidies to promote the emergence of the industry (this approach goes in tandem with the idea that institutions can be "promise securing" to help DTs enter the market). While Brass and Sowell look at how DTs should be regulated, Kołacz, Quintavalla, and Yalnazov (2019) question which institutional branch should regulate innovations. The authors argue that institutions from the judiciary branch are better suited to regulate risky innovations and the legislative branch for uncertain innovations (i.e., 3D printing). A risky innovation is defined as presenting an immediate risk and needing to be acted on and regulated rapidly; the judiciary branch is thus better suited to control these types of innovations as many of them cause issues that will be brought to court. An uncertain innovation could be harmful and challenge certain liberties and values, such as 3D printing posing copyrights problems. Arguably, GMOs fit the risky innovation narrative because they were perceived as an immediate threat by the interest groups that lobbied against them (using arguments about the dangers for the planet and human health). Nonetheless, the judiciary branch did not take over the matter, and the European Council quickly reacted: this is likely due to the complaints filed by Member States demanding stricter

GMO regulations through the European system. Since the EU allows Member States to review and modify directives and regulations, the judiciary branch never stepped in. The case of aquaculture is much simpler as it is closer to an uncertain innovation and is controlled by the legislative branch when it comes to labels and quality control. Kołacz, Quintavalla, and Yalnazov's theory can only be partially approved, as in the example of GMOs, when complaints and demands are filed through the legislative system, the judiciary branch does not need to step in, at least in the case of Europe. Finally, and as discussed throughout this entire essay, Delemarle's theory of *promise securing* and *judgement enabling* institutions is more than supported by the evidence: the European Commission and Council both acted as promise securing and judgement enabling by creating standards and quality control institution both for GMOs and aquaculture. The Commission also mostly acted as a promise securing agent in the case of aquaculture by providing subsidies to the sector during its early stages.

## 4. New definition: disruptive in their consequences and not their essence:

Although aquaculture and GMOs do not perfectly fit Christensen's 1997 definition of DTs, it is likely because his definition focuses on the market impact of DTs. Arguably, aquaculture and GMOs had a more significant impact on the European legal and political system and should be considered law and politically DTs. They both caused much turmoil among citizens, leading institutions like the European Council and Commission to change their regulatory framework (Twigg-Flesner, 2016; Sowers, 2019). When the European Council created the first GMO-related directive, it was quickly met with concerns and demands for stricter regulations. When aquaculture became a priority for the EU (post-2002), small fisher companies allied with ENGOs and consumer organizations to demand more representation of their interests and

tighter regulations for aquaculture plant locations (Sowers, 2019). Both DTs were disruptive, not so much in their essence (referring to Christesen's definition), but rather in their consequences. The disruption was caused by the reaction of the society, more importantly, not just the incumbent sector. This reaction forced EU institutions to be more representative, rearrange their regulations and reroute their goals. The disruption did not stand from incumbent companies panicking about their hegemony being shadowed; rather, the disruption came from small interest groups' coalitions. As seen in both cases, the incumbent sector was far from the only actors asking for stricter regulations, and groups with diverging interests (fishers and ENGOs, e.g.) allied to demand stricter regulations. Thus, aquaculture and GMOs likely shaped European institutions and regulations more than European institutions shaped DTs. They led to small interest groups allying and winning their case for stricter regulations and more representations, which is not the case in other places or with other industries.

GMOs are more widely accepted and sold in the US because large companies like Monsanto and Bayer worked closely with the government in the 1990s and early 2000s. Monsanto spent around three million USD per year between 1998 and 2005 on lobbying Washington and was the second most generous lobbyist of the Agricultural Sector in 1998, when the company started commercializing its own "golden leaf potato" (Center for Responsive Politics, 2021[1-2]; Boccia & Sarnacchiaro, 2015). Monsanto remains the hegemonic GM seeds company and heavily funds many Congressmen and Representatives (Center for Responsive Politics, 2021[3]). This was not the case in the EU, as the union did not have a hegemonic firm like Monsanto, providing 90% of the world's GM seeds in the early 2000s. Similarly, in other sectors, industry associations in the US seem to be much more powerful than in Europe. The meat industries, for instance, lobby and fund many Congress-people and representatives, and in certain states, were able to ban the use of the term "meat" to qualify meat-alternative products (Sachs & Kettenmann, 2019; Taylor, 2020). Europe handles the rise of GMOs and aquaculture

in a much different way than the US. Thus, the disruption from these two innovations came from the society rather than the products themselves.

## B. Implications: why do the results matter?

### 1. Practical implications

These results matter because they anticipate the future of cultured meat. Cultured meat will likely be the next agricultural DT entering the market, and institutions need to be ready to respond adequately to the public and industry's reactions. It is presented here as a solution to mitigate the consequences of climate change as; meat has the highest environmental impact of all foods (Figure 3). It is thus necessary to anticipate its market entry knowing the potential impact cultured meat could have on our race against climate change. The agri-food sector is currently the second-highest emitter of Green House Gases (GHG) after the energy sector: scientists estimate it to contribute up to 26% of all GHG emissions worldwide, occupy 50% of global habitable land, and use 70% of available freshwater (Ritchie & Roser, 2020). It is commonsense that the meat industry is the most polluting within this sector, with half of food-GHG -stemming from livestock and fisheries (31% from manure and pasture, 6% from crops for animal feed and 16% from land use) (Poore & Nemecek, 2018). The animal product industry emits around 14-15% (depending on sources) of total GHG worldwide, and this does not

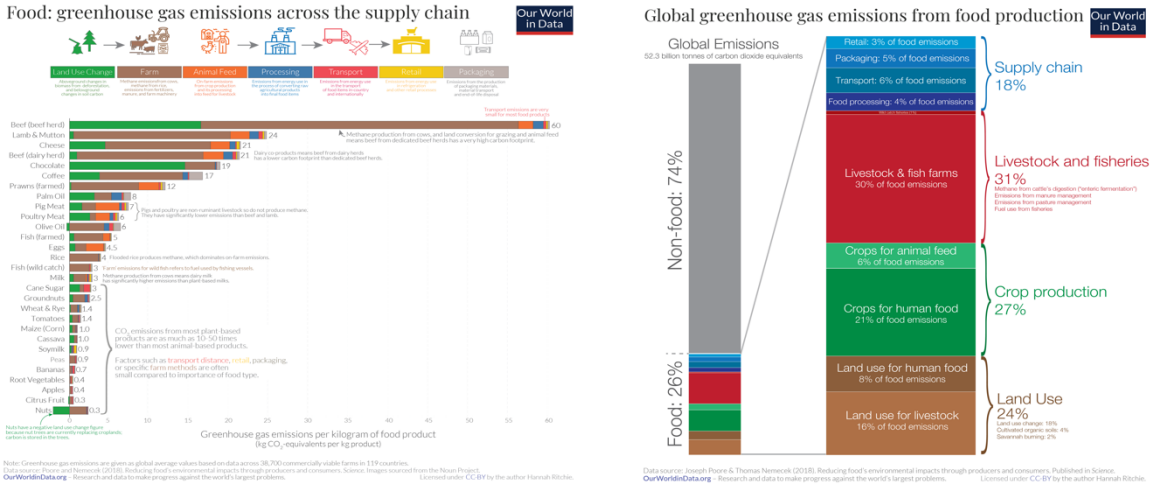


*Figure 3: Greenhouse gas emissions from different food products.*
*Source: Ritchie & Roser (2020). Our World in Data*

include the emissions from the entire Global Value Chain (GVC) – i.e., transportation from the farm to the slaughterhouse (when necessary), the processing, packaging and shipment of meat around the globe, and commercialization (Alexander *et al.,* 2017, Poore & Nemecek, 2018). Fourteen percent does not appear as a threatening number at first; nonetheless, the demand for meat and dairy products is on the rise as the world's population grows. Scholars estimate that by 2050, crop production will need to double, and the demand for meat and dairy products will have to rise up to 133% to feed 10 billion people (Tilman *et al.,* 2011 Alexander *et al.,* 2017, Chriki & Hocquette, 2020).[4] Pollution from factory farms is another important concern: cattle farming is notorious for its nefarious consequences on groundwater pollution, land degradation, and methane rejection (Willett et al., 2019; Turner-McGrievy et al., 2016). Thus, reducing our consumption of traditionally farmed meat appears like an easy way to reduce GHG and increase arable land without impacting human health. Scientists estimate that high meat diet rejects around 7.19kg CO2 equivalent per day in the atmosphere; on the other side of the spectrum, a vegan diet rejects only around 2.89 kg CO2 equivalent per day (Scarborough et al., 2014). All in all, reducing meat production is estimated to be equivalent to reducing transportation GHG emissions by 50% (Berners-Lee, Hoolohan, Cammack, & Hewitt, 2012).

In addition to GHG emission, the meat sector is extremely wasteful in terms of land, feed and end product. According to the most optimistic estimates, we eat around 60% of an animal we kill for meat; however, we most times only consume about 40% of the animal (Saner & Buseman, 2020, Gerhardt *et al.,* 2020). In addition to the "animal waste", livestock production requires huge amounts of grains for animal feed, and, according to the FAO, 46% of global crops are grown for this sole purpose. To give some number, to produce 1kg of live weight beef, 7kg of dry grain are necessary; 4kg for 1kg of pig meat; and 2kg for 1kg of poultry

[4] Most pessimistic estimations. More conservative scholars expect meat and dairy consumption to rise only by 62% by 2050. This massive growth will be likely attributed to the rise of the middle class in very populated countries like India and China -- as meat consumption increases as a country gets richer (Graça *et al*., 2015; Macdiarmid *et al*., 2016, etc.).

meat (all in live weight) (Gerhardt *et al.,* 2020). Once fed and raised for several days or months, 40% to 60% will be removed after being processed, as it is considered "live weight"[5], which needs to be removed to become eatable meat. In the end, 7kg of grains only produces 400 grams of eatable beef meat (Gerhardt *et al.,* 2020). Moreover, calorie-wise, meat does not have much interest because it contains the same calorie by kg ratio as maize, wheat, rice or soybeans, "meat adds less than 7% to worldwide available food calories" (Gerhardt *et al.,* 262, 2020). Nonetheless, although they have the same calorific profile, these foods have different nutrient content: meat is richer in certain proteins and nutrients like iron, which are harder to find in plants and are necessary for human health. Although meat comes with more nutrients than maize and other grains, it also comes with very undesirable things such as antibiotic residues, potentially harmful bacteria and eventual *pandemic-worthy* viruses.

Our current meat supply chain makes it easy for zoonotic diseases to emerge. Pandemic Zoonoses are infections or diseases transmissible from animals to humans under natural conditions. Meat, especially poultry, is the focal point of zoonoses-related articles. Poultry factory farming is considered public health hazard/risk because the livestock is handled in a very concentrated environment where a zoonotic disease can spread faster than normal (Speier *et al.* 2011; Khokhar *et al.*, 2015). In 2013, 136 cases of "bird flu" (H7N9) were detected in China, and, to mitigate the spread of the disease, the Chinese government closed all live bird markets, which scientists consider to be the main source of H7 viruses. In the long term, scholars agree that a restructuring of the poultry meat supply chain is necessary. Solutions include implementing traceability of the meat from production to distribution and favouring large-scale factory farming with standard hygiene and slaughtering practices (Khokhar *et*

[5] Live weight is the weight of the animal before it is slaughtered for meat

*al*., 2015). Pandemic zoonoses like SARS-Cov-19 could therefore be easily avoided if we produced cultured meat instead of traditional meat.

Cultured meat could be the solution to many of the problems we will face in the future and thus needs to be anticipated by institutions to respond adequately once the products enter the market. Certain countries like Israel and Singapore already produce cultured meat; the product has yet to conquer the Western market. Although the results presented in the previous section are inconclusive for the success of cultured meat in Europe, they can help anticipate the debacle likely to happen once the product enters the market, like it was the case for GMOs.

### C. Theoretical implications and Limitations

This paper confirms and reinforces the theories presented about interest groups, as they have had a significant impact on the success or failure of agricultural-DTs, especially in Europe. However, this study suffers from low external validity: the results found may not transfer to other areas of the globe as food safety regulations and the relationship between institutions and interest groups can vary widely across countries (Gilens & Page, 2014; Lau, 2015). For instance, in the United States, the theory of Biased Pluralism more accurately describes the relationship between interest groups and institutions. Other industries' interest groups may have a different relationship with institutions even in Europe: the dairy industry, for instance, successfully banned the use of the term "milk" to describe plant-based milk-like beverage, although the public's opposition to this (Gamber, 2019). The results thus only confirm the theory of Majoritarian Pluralism in the case of GMO and aquaculture in Europe. The salience of interest groups' coalitions with divergent values, however, remains indisputable in this case and can be applied to many other sectors and countries (Smith & Yandle, 2014; Adler et al.,

2016; Stagnaro, 2020). Institutions, however, may not have had as large of a role as theorized by Delemarle since many of their responses to GMOs and aquaculture were demanded and highly influenced by interest groups coalition (i.e., GMO tracking and the creating of the EFSA). Interest groups thus seem to have preceded the power of institutions in creating change.

The main limitation of this study comes from the motives behind interest groups' actions. These actions do not exist in a vacuum: interest groups share common beliefs and ideas that push them to act a certain way, considering motives and ideas, although beyond the scope of this paper is important. In both examples, interest groups and the public shared a common belief when forming the anti-biotech coalition (Richardson, 2005; Varzakas et al., 2007; Cairney, 2009). In this case, ENGOs, chefs and small farmers organizations, and the civil society all believed that GMOs were a threat to the ecosystem and human health, which pushed them to cooperate and form the anti-biotech coalition (Boccia & Sarnacchiaro, 2015). In the case of aquaculture, the beliefs superseding the interest groups coalitions against the installation of aquaculture plants stemmed from the fear of job loss from fishers and that farmed fish was and remains seen as a threat to the marine ecosystem and less healthy for consumers (Claret et al., 2014). Vivan Schmidt theorized the importance of ideas in relation to interest groups' power on the institution, calling it "discursive institutionalism" (DI) (Schmidt, 2010). DI provides insights into "the dynamics of institutional change by explaining the actual preferences, strategies, and normative orientations of actors." (Schmidt, 2010, p. 2). She gives the example of the "Save the Whale" movement's discourse in the West, which was pushed by activists who changed the vision of whales as dangerous to endangered species and enacted concrete change (Schmidt, 2010). The anti-GMO fight fits discursive institutionalism quite well: like the "Save the Whales" campaign; the anti-biotech coalition took over the discourse around GMOs picturing GMOs as dangerous for human health and the ecosystem. For aquaculture, the discourse takeover was rather based on killing small businesses and threatening the marine

ecosystem. Thus, ideas are at the root of interest groups' actions and need to be investigated more as part of GMOs and aquaculture policies in the EU.

Lastly, this study did not consider the potential problems coming from cultured meat once the product will enter the market. Chikri and Hoquette (2020) critically assess the efficacy of cultured meat to reduce GHG, and its nutritional profile. Although unlikely to bring problems such as antibiotic resistance like traditional meat, cultured meat will likely never have the same nutritional profile as traditional meat and may need to be supplemented with micro-nutrients such as iron and B12, which are necessary to human health (Chikri & Hoquette, 2020). Second, cultured meat will require production factories which will necessitate energy and thus will also reject CO2. Lynch et al. (2019) found that cultured meat production will have a lower impact than traditional production initially but will likely have a similar impact after a couple of years because traditional meat production rejects mostly CH4, which is not stored in the atmosphere as long as CO2. This is especially true when considering that the feeding period of farmed animals has shrunk and the time spent between birth and slaughter has been reduced, making the impact of each animal lesser. Although these findings do not consider the impact of the whole production and supply chain of traditional meat, they demonstrate that cultured meat will not be the end solution to meat consumption.

### D. Recommendations for Future Research

Future research should consider the role and impact of ideas on institutional change in the EU and other countries across different industrial sectors. Ideas likely have a significant influence on interest group alliances, and plan of action, which subsequent will impact policy outputs. The role of ideas may differ from one country to another depending on the relationship

governments have with interest groups and the affected sector (i.e., which pluralist theory corresponds the most to a specific country: Majoritarian or Biased Pluralism?) (Gilens & Page, 2014). Ideas may hold a larger role when a country's institutions fit the Majoritarian Pluralist theory and allow democratic communication channels between institutions and the society. If these channels are biased towards one particular industry, like it is the case in certain US states with the meat industry, ideas will likely hold a much smaller and less representative role. Future research could thus consider the impact of ideas and values in different countries fitting different Pluralist theories.

More recently, DTs from the agri-food sector such as plant-based meats and plant-based milks have stirred much turmoil among institutions and interest groups from the incumbent sector, while being widely successful now (unlike GMOs and aquaculture in Europe). Future research could thus address the difference between these cases and assess which Pluralist theory fits the facts best. In the case of plant-based milks, the dairy industry sued smaller plant-based milks companies, successfully banned them from using the term "milk" and prevented them from being placed in the dairy aisle, in Europe (Gambert, 2019; Taylor, 2020). These products however are increasingly successful in Europe. Thus, agri-food DTs can be successful in Europe despite interest groups rallying against them, but why? The role of ideas here would likely be salient to investigate since consumers' choices and values likely had an impact on these products' success (Stolle, Hooghe & Micheletti, 2005).

## VII. Conclusion:

This thesis began by posing straightforward question: under what conditions will DTs gain market uptake most quickly? After looking at the cases of aquaculture and GMOs in the EU, the results are clear: interest groups play a significant role in influencing the regulatory

outcomes, and consequently, the ability of a DT to gain market uptake. In both cases, interest group actions restricted the scale of the DT. Interest groups acted as soon as a regulation was being drafted, making them more successful in their fight against aquaculture and GMOs (Cook, 2018). Interest groups from diverging backgrounds and with different interests allied in a joint fight against aquaculture and GMOs and were highly successful. These findings confirm the Baptist and Bootlegger theory and my second hypothesis.

I also found some evidence that supportive institutions can help a DT achieve market uptake. In both cases, institutions acted as trust enabling agents by enhancing trust among entrepreneurs about starting an aquaculture project (*promise securing mechanisms*) and consumers by reassuring them about the quality of the products, this evidence supports hypothesis three. They also acted as judgement enabling by creating mandatory labels companies had to follow in order to commercialize their products in the EU. However, these labelling rules were often the result of interest groups' demands, especially in the case of GMOs, where interest groups targeted GM food regulations as soon as they began being drafted, granting only partial support for hypothesis four. The significance of interest groups is thus non-negligible when looking at European regulations in directives. Hypothesis one – the idea that incumbent industries can make or break a DT – remains the least supported of all because of divergent patterns between my cases. Interest groups acted fast in the case of GMOs in order to tackle regulations but did not do the same with aquaculture. When the EU began pouring subsidies into aquaculture, the incumbent capture fishing sector did not voice strong opposition, only small local fisher businesses who cooperated with other small interest groups opposed specific aquaculture plants projects.

It is important to underline that interest groups' actions stem from common beliefs which likely precede their action. Ideas and values thus plausibly have a significant role in forming cohesive and efficient interest groups. Although the role of ideas in the successful market entry

of DTs was beyond the scope of this paper, research suggests that, in both examples, the European public had strong negative ideas about aquaculture and GMOs (Claret *et al.,* 2014; Boccia & Sarnacchiaro, 2015). Future research thus needs to investigate the influence of ideas and values in the success or failure of DTs in Europe. Finally, this paper remains a specific case study located in a very small part of the globe, making it harder to generalize to other countries. Future research could thus reproduce this research in other countries and with other sectors than the agri-food industry in order to generalize, or not, these results.

The market entry of cultured meat is thus likely going to be challenging in the EU, especially if specific interest groups and the broader public take action together against the new technology as was the case for GMOs. Since cultured meat threatens the meat industry like plant-based milk threatened the dairy sector, industry lobbies and interest groups will likely act together to counter the rise of cultured meat by asking for tighter regulation. This is already the case in certain US states where the meat industry is the leading sector of employment (Sachs & Kettenmann, 2019). This is worrisome for averting climate change because GHGs stemming from cultured meat production are much lower than those coming from the conventional meat supply chain. If the cultured meats share a similar pattern as GMOs and aquaculture, then a Baptist and bootlegger coalition may be necessary to ensure broad market uptake.

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