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Change drivers across supply chains: the case of fishery and aquaculture in France

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Abstract

Change drivers across supply chains arise either from the production area or from the goods circulation area. A change in production can have a stronger impact on supply chains than a change in goods circulation. In particular, innovations inspired by sustainable development concerns which are firstly introduced within the production system, as some authors point out [Blanquart et al. (2008)], may greatly influence logistical organizations. Their introduction within supply chains requires more time [Roussat and Fabbe-Costes (2014)].

Change drivers may be institutional, commercial, technical, or managerial. Their types and features vary across periods and industries. Some may have quick-impact consequences, others will be slow in showing their effects on the whole supply chain.

Three types of change drivers are currently main issues when consumer goods are concerned. Measures for preserving natural resources, with waste management and recycling of end-of-life products in order to minimize the consumption of non renewable resources, make up the first type of drivers. The second type is the ever wider use of online purchases, which disturbs B to B and B to C relationships as well as urban logistics and the last mile delivery terms. Thirdly, changes in logistical organizations of mass retailers may direct traffic flows via new logistics hubs.

Food products are concerned by these change drivers in a specific way. Although some of them such as schools of fish may be renewable, natural resources must be protected. Reverse logistics processes are mainly confined to packaging because of the very nature of food. Distance purchases are steadily rising. While the market dependency upon mass retail firms is high, short supply circuits relying on local producers also attract consumers. Within the agri-food sector, the industry of fishery and aquaculture products is a major one feeding billion people around the world. In Europe, it employs approximately 267 000 full time equivalent workers [European Union (2014)], provides activity for hundreds of seaports, and positively contributes to local economies in peripheral shore areas. The paper therefore focuses on the situation of fishery and aquaculture products. The analysis highlights the situation of the whole supply chain within this specific food industry, allowing to achieve a non-

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fragmented view of it. It also clarifies, from a qualitative viewpoint, the respective role of sustainable development-based change drivers and the others, allowing to point out those giving impetus to changes.
The analysis relies on a survey of academic literature and specialized publications, and on interviews with experts and key market players. It highlights the specific adaptations of supply chains within this valuable industry fully integrated in a global business world. It points out the first impacts of sustainable development concern decisions compared with those of other change drivers and illustrates how both kinds of impact interact to shape supply chain schemes.

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Keywords: Supply chain; industry; fishery products; change drivers

1. Introduction

Change drivers across supply chains arise either from the production area or from the goods circulation area. A change in production can have a stronger impact on supply chain than a change in goods circulation. In particular, innovations inspired by sustainable development concerns which are firstly introduced within the production system, as some authors point out [Blanquart et al. (2008)], may greatly influence logistical organizations. Change drivers may be institutional, technical, commercial or managerial. Their types and features vary across periods and industries. Some may have quick-impact consequences, others will be slow in showing their effects on the whole supply chain.

Three types of change drivers are currently main issues when food products are concerned. Measures for preserving natural resources which can heavily depend on natural cycles of primary production (time for grain growth, animal growth or breeding time) make up the first type. The second type is the ever wider use of online (remote) purchases. Changes in sourcing choices and in logistical organizations of mass retailers make up the third one.

Among food product supply chains, considering the example of the fishery and aquaculture products deserves special consideration as a case study as the knowledge thereof is still too fragmented, with gaps remaining to be filled and existing knowledge improved. On the one hand, the protection of natural resources (fisheries), fish and aquaculture economics and stakes, international trade and its conditions, price setting and the value chain have been widely examined for decades. On the other side, many logistical works addressing food products do not detail the situation of fish and aquaculture products, except in a few recent publications about the seafood carbon footprints. Generally speaking, works about sustainable supply chains address sustainable change factors without balancing their effects in relation to other factors.

The paper therefore focuses on the situation of fishery and aquaculture products which is a major industry feeding billion people around the world. In Europe, it employs approximately 267 000 full time equivalent workers (European Union, 2014), provides activity for hundreds of seaports, and positively contributes to local economies in peripheral shore areas. The analysis highlights the situation of the whole supply chain within this specific food industry, allowing to achieve a non-fragmented view of it. It also clarifies, from a qualitative viewpoint, the respective role of sustainable development-based change drivers and the others, allowing to point out those giving impetus to changes.

The paper is structured in three parts. The section 2 presents a literature survey and the methodology used. The section 3 emphazises the key issues the supply chain has to deal with, and the key industrial players it has to consider. The section 4 scrutes the influence of main change drivers for this supply chain according to their types.

2. Literature review and methodology

Fishery and aquaculture products have been thoroughly investigated for decades by researchers and parliaments. Many parliamentary reports highlight social and regional influences of these activities, notably in France. The many publications can be divided in five main categories, as recent references demonstrate:

- Protection of natural resources, and the influence of fishing quotas [Morin (2000); Al-Humaidhi et al. (2013); Hentrich and Salomon (2006); Linke and Bruckmeier (2015); Le Floc'h et al. (2015)], issues demanding a multidisciplinary approach [Phillipson and Symes (2013)].
- Production economy [Miret Pastor et al (2014); Van Long and Mc Whinnie (2012); Voulgaris and Lemonakis (2013)].
- Nutritional and political stakes of fisheries and of aquaculture [Cléach (2008); Guédon (2011); Le Loch and Fasquelle (2013)] as well as the relationships between fisheries and aquaculture [Natale N et al (2013)].
- The international trade conditions: determinants [Natale et al. (2015)] trade barriers [Guillotreau and Peridy (2000)], the European Union position [Mulazzani and Malorgio (2015)].
- Price formation [Guillotreau (2004)] and value chains [Fabinyi (2015); Hamilton and Stringer (2015); Jespersen et al (2014)].

These publications allow to identify the key players in the supply chain. They unveil the strong impact of institutional influences on these activities, influences which directly shape productive organizations and, both directly and indirectly, logistical organizations.

Literature specialized in logistics address food supply chain issues. Many authors detailed the situation of agricultural products, such as dairy or fresh products [Ahumada and Villalobo (2011); Glover et al (2014); Vagneron et al. (2009)]. Others stress the globalization of food supply chains (Lorenz et al. (2013); Hsiao et al (2010)]. Other authors examine the situation of time-sensitive products, which is the case of fresh food [Liu (2013)] or the vulnerability of food chains [Vlajic et al. (2012)] or their structuring [Agustina (2014)]. As far as changes in supply chains are concerned, scholars now consider sustainable development-based changes and deal with one or several aspects of them [Folinas et al (2013); Michalsky and Hooda (2015); Zanoni and Zavanella (2012); Soysal et al. (2014); Ala-Harja and Helo (2015)]. Some authors address the waste issue [Dorward (2012)]. In this specialized literature, fish and aquaculture products are rarely considered per se. Research about sustainable supply chains for fish and aquaculture products seem to have just begun [Farmery et al. (2015); Denham et al.(2015)]. Some authors considering productive changes highlight logistical consequent changes [Farmery et al. (2014); Péron et al. (2010); Hermansen et al. (2012)]. As a matter of fact, sustainable production is creeping [O Brien (1999) and Denham et al. (2015)] and having effects on supply chains.

Other types of change can influence supply chains. A strong influence comes from transactional conditions [Guillotreau and Peridy (2000); Livolsi and Camman (2012)]. All these publications also unveil the influence of institutions which can shape logistical organizations and choices of players. This paper then adopts an institutional approach. Many currents and viewpoints characterize institutionalist authors; but generally speaking, institutions are considered as the environment or the framework for organizations [Chavance (2001)]. Without ignoring the numerous debates about the nature of institutions vis à vis organizations [for example, Hodgson (2006)], we adopt the position of North, who considers institutions as the rule of the organizational game: "institutions are the rules of the game in a society, or, more formally, are the humanly devised constraints that shape human interaction" [North, (1990)].

This paper examines three main change drivers impacting this supply chain and highlights the influence of institutional changes on its organizational changes; despite the high interest it also deserves, the way these institutions change, in other words the so-called institutional path, is not relevant for this paper. Of the three pillars of sustainable development, environmental protection has probably prompted the greatest number of initiatives. This type of initiative will hereafter be referred as "green changes".

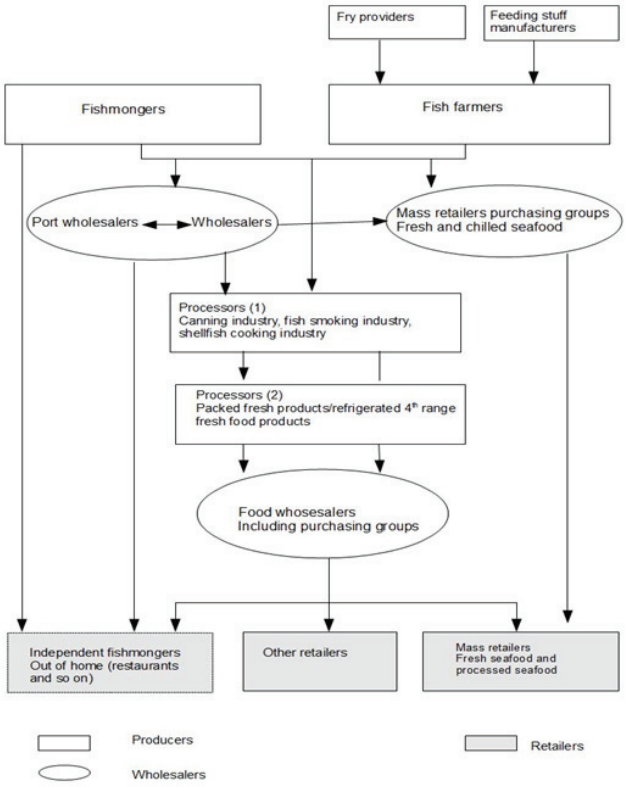
In addition to the literature review, about fifty qualitative interviews were conducted between March 2014 and September 2015. Other points of view were collected thanks to a specialized French conference in June 2015. They gave a better understanding of the strategies of players and draw attention to the actual triggers of changes across this specific supply chain.

3. The seafood supply chain: key facts and players

This paper considers the supply chain for fishery and aquaculture products (European Union -EU- Nace codes: 03.1, 03.2 and 10.20). This supply chain will hereafter be referred as the "seafood supply chain". Fish constitutes a

noticeable part of animal proteins in the human consumption. In 2010, the average fish consumption in the world was 18,9 kilos per person; in Europe, it was 23,1 kilos; in France, it was 35,2 kilos. Although high, it is lower than meat consumption: the French consumer eats three times more meat than fish. In Europe, the largest consumers of fish are the Portuguese: 56,7 kilos per person [European Union, (2014)].

The flows to be optimized are showed in figure 1. They can require any means of transportation, ranging from the truck to the plane. Even the train can be used for (these days) maritime reefers. Figure 1 voluntary omits a few flows which are quantitatively less important: flows between producers (fishermen) and their suppliers (shipyards and others) and flows of by-products and wastes generated by production in stages (1) and (2). The figure 1 displays relations between players whatever the considered area: local area, national area, or world area.



Source: the author

Fig. 1. The seafood supply chain: key players.

Fishermen and fish farmers are both considered as producers, although this qualification is sometimes denied to fishermen who collect rather than produce something. Fishermen and fish farmers are the first stage producers. In the European Union (UE), 6 countries produce 77% of the whole tonnage (captures and farming): Spain, United Kingdom (UK), Denmark, France, Netherlands and Italy. The first three of these represent 44 % of the total production [EU (2014), data 2010]. The processors can be split in two categories; the first is made of canning, fish smoking and shellfish cooking industries. The second category are producers of the 4th range fresh food products. The European fish processing industry numbers 116 000 employees, of whom 18 500 are in the UK, 17 700 in

Spain, 15 600 in France and 15 000 in Poland. Another type of producer is the firm transforming by-products and wastes (this type is not shown in the figure 1). Four types of producers are thus identified.

Wholesalers and mass retail purchasing offices intervene at three different stages: purchase of fresh produces (directly and indirectly), and purchase of processed seafood. A specific French wholesaler is the first purchaser situated in the landing seaports: the "mareyeur" (fish wholesaler operating in a fishing seaport) can also be identified; he played a specific role till recently, but this is going to change (cf section 4). Retailers include the specialized retailers (fishmongers, whether independents or mass retailers), and other retailers including out-of-home channels.

Consumer expenses are split between fresh produce and processed seafood. In France, fresh products represent about 1/3 of the whole budget for seafood, refrigerated 4th range fresh food products 20%, and canned products represent 5% (lower value products). Whatever the market segment (fresh, chilled products, refrigerated products, tinned food), the share of mass retailers is very high: more than 50% in any case, according to France Agrimer.
Retailers other than mass retailers, and out-of-home players are the other channels for seafood. Fishmongers are the traditional small retailers for seafood. They may sell on street markets. The out-of-home players include restaurants and mass catering. It is a significant market for wholesalers. In France (2014), it represents 23% of the consumed fresh tonnage and 29% of the consumed chilled tonnage, which is important enough to generate specialized providers and circuits, with firms oriented toward urban deliveries, and often private vehicles.

Table 1. Breakdown of consumption by channel [net tonnage, 2014 and (2008)].

	Mass retailers (1)	**Fishmongers and street markets (2)**	**Out-of-home channels**		**Total**
			Restaurants	Mass catering	
Fresh products	60 (50)	18 (19)	19 (28)	4 (2)	100%
Refrigerated 4th range products	95 (90)	2 (3)	2 (5)	1 (1)	100%
Chilled products	71 (57)	0	11 (16)	18 (26)	100%
Tinned food	95 (89)	2 (0)	2 (5)	3 (5)	100%

(1) Doorstep sales included
(2) Direct sales included

Sources: France Agrimer, Les Cahiers de France Agrimer 2015/ Chiffres clés pêche et aquaculture, page 34.
France Agrimer/Ofimer 2009.

The growth in fish farming has been accompanying the decline in worldwide and European captures for years, especially since the 1990s. For example, Norwegian production increased elevenfold between 1989 and 2013 (tonnage, according to Food and Agriculture Organization). However the share of aquaculture in the whole EU production seems to have reached a ceiling of about 20% of the total tonnage; aquaculture in France achieves a 30% share of the total production. Nevertheless, this is not sufficient and France, like the EU as a whole, imports to meet the domestic demand. This is one of the reasons why French wholesalers have massively increased their purchases to foreign providers. The trade balance is increasingly negative for EU and for France as well. The various components of the offer are therefore national captures, imported captures, national aquaculture products, and imported aquaculture products. The fishing effort limits imposed by EU have largely contributed the impetus given to aquaculture in Asia. Between 1989 et 2013, Vietnam multiplied its production by 20, Bangla Desh by 9, Indonesia by 7, and Thaïland by 4 (Source: FAO, World Aquaculture production of fish, crustaceans, molluscs, etc…by principal producers in 1998 and in 2013).

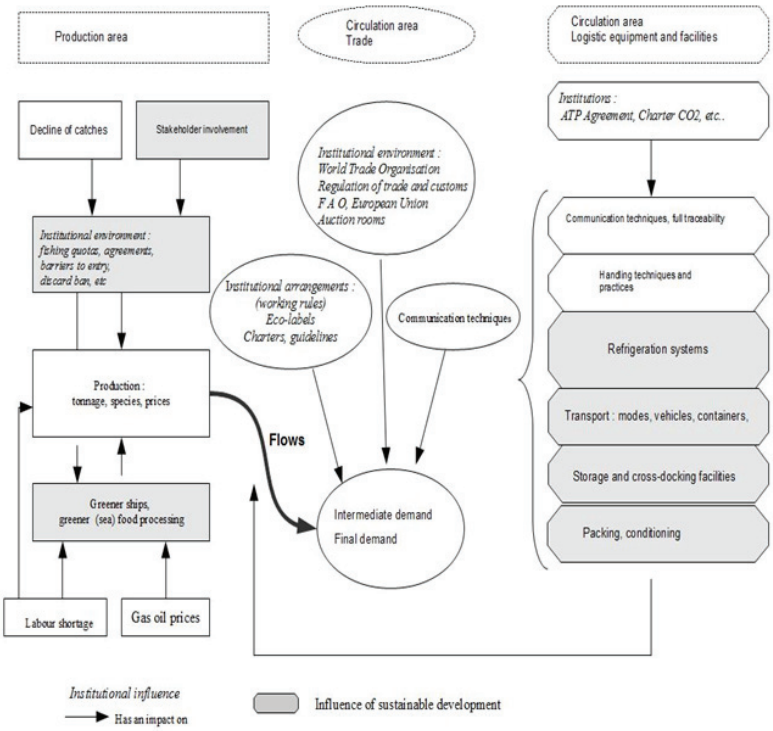
The key factors the seafood supply chain has to cope with are therefore a decline in captures, a ceiling in aquaculture in France and in other European countries. The supply chain is much more subject to stress because of longer itineraries for imported products and this stress is passed on logistics providers. The key players the supply chain has to consider are producers dependent on natural resources and/or natural cycles in animal growth, and mass retailers whose ways of purchasing (sea)food and logistical services have such an influence.

Highly qualified carriers know very well how to manage such demanding flows and to meet shippers' requirements; they have adapted their ways of working to the shippers' demands. However, they do not seem to be

at the curring edge of technical and organizational innovations or production challenges; in the last three decades, they can be qualified as “followers” (albeit quick response followers) rather than innovators. Today, they might be considered as being more pro-active. Section 4 examines the major changes of the last three decades.

4. The change drivers: types and areas

The major change drivers addressed here are those having influenced the seafood supply chain since the implementation of the Common Fisheries Policy in 1983. Some changes derive from institutional drivers, others from organizational drivers. Some are rooted in sustainable development concerns (mainly ecological), others not. They arise either in the productive or in the good circulation area. Figure 2 clarifies the types of changes with their positions in relation to one another and their areas. It seems relevant to divide the circulation area in two parts, one for the transactional conditions (intimately linked to the institutional context for the considered period) and one for the logistical equipment and facilities which enable or curb development according to period and location. The light grey boxes correspond to changes motivated by sustainable development concerns.



ATP Agreement: agreement on carriage of perishable foodstuffs
Source: the author

Fig. 2. Major change drivers according to their types.

4.1. The productive area

On the left side of the figure 2, changes induced by the decline in captures (organizational natural resource constraint) and the fishing quotas (institutional constraint) have encouraged the growth of aquaculture, and

dramatically globalized the seafood supply chain (organizational) thanks to trade liberalization (transactional institutions) as table 2 shows for seafreighted seafood.

The seafood supply chain constitutes a prominent case for which the measures of a very intense institutional environment disseminate in both productive and good circulation areas. In the productive area, the salient measures are the restrictions on captures, ie the fishing quotas as well as the numerous regulations ensuring safety and tracing of food. The strategic orientations of the United Nations Food and Agriculture Organization (FAO, with its Committee of Fisheries) endorsed by the EU are translated country by country in fishing quotas. These quotas influence directly the landed tonnage in European seaports, hence the tonnage of raw food available for domestic processors and the tonnage to be shipped in the hinterlands by road carriers; they directly impact the level of imports. From the organizational change viewpoint, two salient factors emerge. The first is the price of gas oil, which gave birth during the seventies to the practice of relying on advance bases. This practice generates road haulage between Scottish seaports and Atlantic seaports. This first factor feeds research on new propulsion systems. The second factor is a general labour shortage for working on board in a few European countries including France. The possible impacts on the seafood supply chain are not clear for the moment.

4.2. The circulation area

On the right side of figure 2, changes generated by technical innovations for logistical equipment lower the ecological impact of the supply chain mainly thanks to new ways of producing cooling power and to packing improvements (new packing boxes and new tins using less steel, for example). Generally speaking they do not revolutionize ways of shipping. They are necessary but not sufficient to give new impetus. They may derive from other regulations affecting productive and goods circulation areas such as three EU regulations and one French 2009 order which constitute a legal framework for food (of which seafood) safety: EU regulations 178-2002, 852-2004 and 853-2004 and such as the EURO norm for road trucks. In fact they permit the supply chain (even if more stressed) to perform well and to guarantee a fairly good competitiveness to shippers. In other supply chains they are said to have developed trade [Vagneron et al. (2009)].

In the good circulation area, the institutional context also impact transactions (in the middle of the figure 2). Three points closely related to institutional changes deserve particular attention: customs duties, retail trade regulation and wholesale trade de-regulation. These two latter points specifically concern the French economy.

In Europe, the common customs tariff was implemented in February 1960; since this year numerous reductions in commodity tariff have been implemented. The reduction of customs duties for non processed seafood encouraged international sourcing for EU processors and has lead to a sharp increase of imports from other continents such as Asia and America (table 2). As customs duties for processed products are higher than those for non processed seafood, this enables the EU seafood processing industry still to employ thousands of people.

Table 2. Seaborne trade: extra-EU imports (index 100 in 2002).

	NSTR 142		**NSTR 148**	
	UE-28	France	UE-28	France
2002	100	100	100	100
2011	121	180	139	105
2014	117	158	136	99

EU-28: European Union, 28 members.
NSTR: Standard goods classification for transport statistics (revised)
NSTR 142: Fish, crustaceans and molluscs, fresh, frozen, dried, salted or smoked
NSTR 148 : Fish, crustaceans and molluscs, prepared or preserved.
Source: Eurostat

The French law 2008-776 of August 2008 known as the “economy modernization law” impacted patterns of chains supplying mass retailers logistics hub establishments [Livolsi and Camman (2012)]. Finally resulting in more frequent shorter orders, the law has sanctioned cross-docking for each type of food, seafood included, and as a consequence puts the whole supply chain under strain; it has re-directed some flows. At the same time mass retailers have concentrated all the tasks of checking the quality of seafood on these cross-docking logistics hubs (organizational change). The specialized quality employees are therefore working on these dedicated sites [Razafimandimby (2013)]. Bearing in mind the prominent role of mass retailers as a distribution channel in France, the impacted tonnage should not be disregarded. It should be remembered that a top mass retailer may purchase

about 30 thousand tons of seafood each year. As early in 2008 mass retailers purchased more than 50% of the net weight of non processed seafood sold in France (Table 1). Such an additional transshipment within unchanged delivery deadlines between seaports and points of final sales tenses flows and enhances the competitive position of the major hauliers.

For many decades access to French auction rooms was rather restricted as the French institutional context could often be tightened up by local working rules. Following the EU market liberalization, French laws have opened the access to remote purchasers who can nowadays rely on all the Internet advantages [Guillotreau et al. (2011)]. The Internet facilities could not have been used without the lifting of these barriers to entry. A few legislative steps have led to this complete deregulation; finally a 2000 order revoked the French specific notion of "mareyeur" (who was a port wholesaler-shipper). This is how mass retail purchasing groups have been able to enter auction rooms; this is how local and remote wholesalers and processors can more easily arbitrate between different origins once again impacting geography of continental flows. Also in this case the major road hauliers operating a better developed network of liner services are in a more competitive position.

4.3. About institutions: a few comments

The impacts on players of institutional constraints are the same as those of organizational ones (geographical proximity and common ways of managing), but institutional constraints operate in different ways and the magnitude of their effects may differ. Furthermore institutional constraints very often reinforce organizational constraints; they inflect, stabilize, unify ways of doing and limit the scope of possibilities. When it comes to setting up logistical equipment and facilities, institutional constraints reinforce similarities in the ways firms are acting. For example logistical practices evolve toward homogeneity between firms because of the influence of safety and sanitary regulations. As we observe it in this case of food safety institutions may also facilitate and secure transactions thanks to the dissemination of norms and universally-recognized good practice. This illustrates what Commons did outline many years ago: "an institution is collective action in control, liberation and expansion of individual action" (1931).

5. Conclusion

Presenting a comprehensive and unified view of the seafood supply chain the paper shows the body in which blood circulates as Coase could have written it (2000). The approach adopted allows to identify and qualify the sources and specificities of changes: institutional, organizational, productive, logistical; and the players directly or indirectly impacted: producers, traders, logistics providers (including carriers). It outlines the actual role of green changes compared with all the changes impacting this specific supply chain. It points out the first effects of sustainable development concern decisions compared with those of other change drivers and illustrates how both kinds of effects can interact changing supply chain patterns. A decisive interaction between a productive change (institutional, sustainable development with fishing quotas) and a transactional change (customs duties) mainly explains the globalization of the market of fisheries and aquaculture products. Seafood is nowadays massively seafreighted and airfreighted. In addition to seaborne trade, airborne trade deserves attention: for example, fresh fish, chilled and frozen fish as well as crustaceans (of which live crustaceans) transit daily via European airports such as Roissy. Both global shipping companies and airlines benefit from this evolution. Otherwise consumers might have chosen to eat more meat, or algae, or other produces. Some of change drivers may be found in all countries (World Trade Organization orientations, FAO recommendations, EU fishing quotas), others are specific to the French situation. For this food supply chain characterized by mass consumption, green change drivers are important but other change drivers such as transactional changes appear to have structuring effects as important as those of green change drivers. French deregulations have given path to a supply-side concentration: the major road hauliers now form a national oligopoly. In this supply chain institutions act as conversion factors or as incentive factors to conversion. This is particular true for green changes for which institutions act as conversion factors toward a more sustainable development. Henceforth green changes induced by the institutional context (quotas, food safety, ban on discards into the sea, limitation of releases of pollutants) are incorporated in institutional arrangements (eco-labels, charter CO_2…) and in daily ways of working.

In this supply chain, institutions interact with technical and organizational innovations by accelerating –quite often- their dissemination; this is the case of refrigeration systems (longer chains, remote purchases via Internet). Institutions more rarely might hamper innovations. One example of brake was the restricted access to auction rooms

in France, which now belongs to the past. This evolution could change geography of landing choices and of some flows in hinterlands.

We can observe that green changes motivated by the protection of natural resources with their interaction of globalization result in a paradox: because of globalization, the carbon footprint might increase because intercontinental means of transportation are more and more used [Farmery (2015)]; because of the increasing demand for aquaculture products, the external negative effects of aquaculture in Asia and in Europe are criticized. On the consumption side, consumers more and more familiar with all types of electronic trade/online purchases are perhaps going to demand home deliveries even for fresh and refrigerated food products. The new ecological debate thus generated will probably feed discussions about institutional dynamism.

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