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# The key role of Geographical Indications in the governance of ‘terroir niches’. Insights from three Corsican case studies

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**Abstract:** Geographical Indications (GIs) are powerful governance tools for localized agri-food systems, exerting significant but ambivalent influence over local innovation processes. Although some GIs protect endogenous innovation pathways, others play a driving role in the standardization of production methods and tastes. To better understand the regulatory role of GIs, we studied the innovation pathway in three ‘terroir niches’ in the island of Corsica - namely Brocciu, Corsican charcuterie and Corsican clementine - over the past 30 years. ‘Terroir niches’ are understood as sociotechnical niches whose development is influenced by specific rules embedded in the biophysical environment and resources of a given place. For Brocciu, Corsican charcuterie and Corsican clementine, the implementation of GIs respectively led to standardization, fragmentation and differentiation. Cross-case analysis suggests that these terroir niches are opened systems that interact with actors, rules and technologies that are structured at a more global scale. Results also show contrasted effects of GIs on local innovation pathways. GIs influence the niches’ innovation pathways through: (i) The functioning of the GIs’ Defence and Management Organizations; (ii) The trade-offs embodied in the GI specifications, between local and global rules; (iii) The collective learnings developed during GI elaboration; (iv) The changes in the structure of the niche’s actor network provoked by the GI; (v) The protection mechanism provided by the GI.

**Keywords :** Sociotechnical regime, transition theory, Corsica, governance, collective learning

## 1 Introduction

Geographical Indications (GIs) are powerful governance tools, exerting significant but ambivalent influence over localized agri-food systems (Delfosse, 2011). Some GIs protect endogenous innovation pathways, leading to the long term maintain of place-based technical cultures and typical products. Conversely, other GIs play a driving role in the standardization of production methods and tastes (see Bowen, 2010, for a good example).

To give full account of the regulatory role of GIs in local innovation processes, Belmin *et al.* (2017) have introduced the ‘terroir niche’ theoretical framework. This framework has been elaborated by combining insights from regional studies (Casabianca *et al.*, 2011) and from the Multi-Level Perspective (MLP) on transitions (Geels, 2002)<sup>1</sup>. In that framework, we have considered terroirs as sociotechnical niches structured at the local level, in dynamic interaction with the agro-industrial regime and the landscape. More precisely:

- (1) ‘Terroir niches’ are sociotechnical systems whose development is influenced by specific rules embedded in the biophysical environment and resources of a given place (topography, soil,

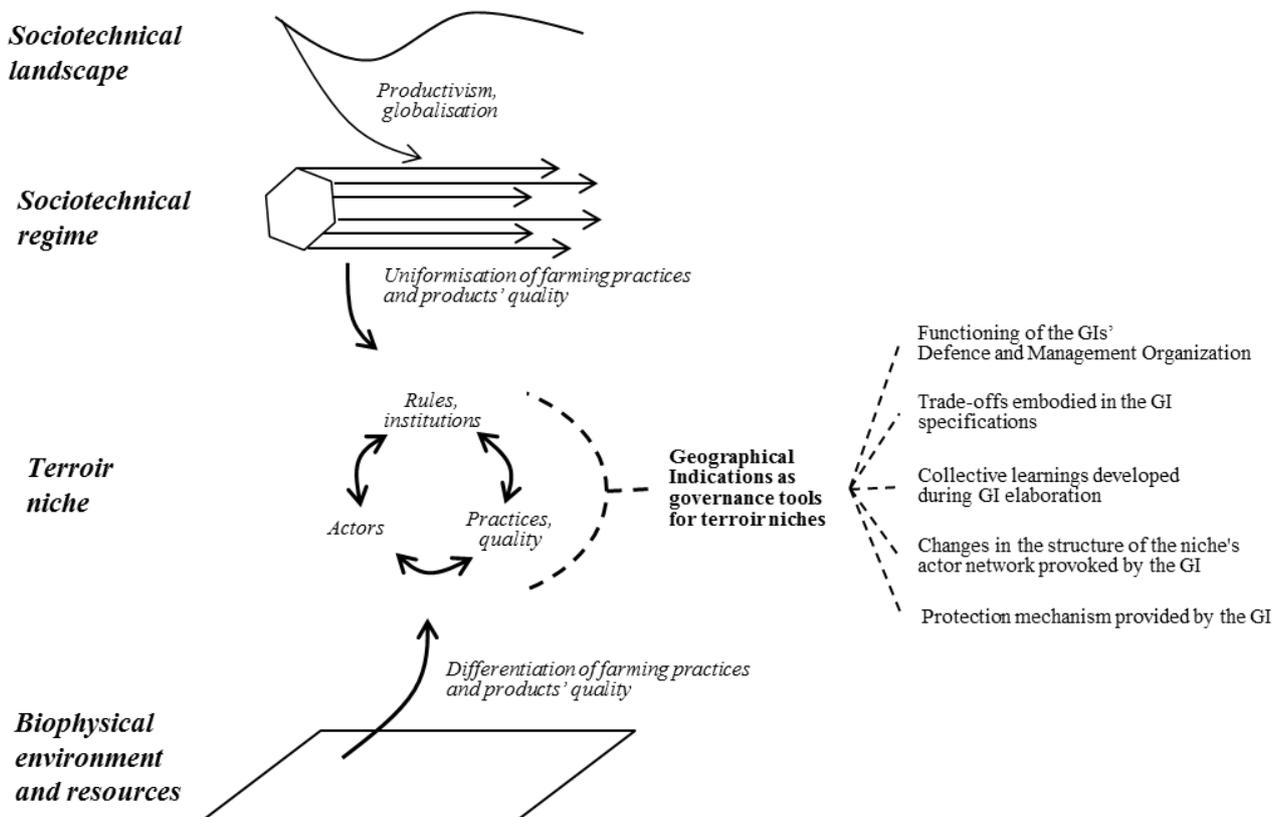
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<sup>1</sup> According to that theory, the technological choices of actors are guided by sociotechnical systems that are structured through three interacting levels: sociotechnical landscape, regimes and niches. Sociotechnical regimes are the loci of dominant practices and related rules. Niches are sociotechnical systems partly emancipated from the regime’s rules, so that radical novelties can emerge. They provide protection mechanisms allowing niche actors to deviate from regime rules. Sociotechnical landscape is an exogenous environment beyond the influence of niches and regimes.

micro-climate, breeds and varieties, etc.) (**Figure 1**, bottom part). In a terroir niche, the actions of actors and the quality of food products are guided by shared know-how, institutions, skills, and cognitive frames that have accumulated over time under the influence of the place's natural features. Terroir niches provide protected space for alternative innovation pathway, enriching our agri-food systems with a diversity of tastes and technical cultures.

- (2) Terroir niches are opened systems that often interact with dominant sociotechnical regimes. The practices of niche-actors are not only guided by specific rules, but also by extra-territorial drivers (**Figure 1**, upper part). The within-niche innovation pathway can be influenced by technologies, breeds, commercial and sanitary standards, visions of future progress and social groups that are structured at a more global scale. Without efficient protection, niche-regime interactions can lead to a standardization of local practices and food products.
- (3) GIs are governance tools for terroir niches, with much influence on local innovation pathways (**Figure 1**, right part). GIs can either provoke a shift towards the mainstream regime or towards place-based differentiation, through five mechanisms: (i) The functioning of the GIs' Defence and Management Organizations (DMO) ; (ii) The trade-offs embodied in the GI specifications, between local and global rules ; (iii) The collective learnings developed during GI elaboration ; (iv) The changes in the structure of the niche's actor network provoked by the GI ; (v) The protection mechanism provided by the GI.

The goal of this paper is to go deeper in these five mechanisms through which a GI can influence the innovation pathways in a terroir niche using a comparative approach of several contrasted cases. Especially, we seek to identify the key components of GI construction that determine the subsequent innovation pathway.



**Figure 1:** The role of Geographical Indications in the governance of 'terroir niches'

## 2 Method

To answer these questions, we studied the innovation pathway in three terroir niches in the island of Corsica (France) - namely *Brocciu*, Corsican charcuterie and Corsican clementine - over the past 60 years. In each case, GI schemes were implemented with deep - and contrasted - effects on sectoral development. The study of innovation pathways is based on the review of 15 studies<sup>2</sup> that have been conducted over the past 30 years by the Corsican centre of the French National Institute for Agricultural Research (INRA). Studies include supply chains diagnosis, GI studies and sociotechnical analysis. We also used participant observation in various meetings that involved the actors of the three sectors.

To analyse the data, we used the 'terroir niche' analytical framework developed by Belmin *et al.* (2017). Based on that framework we tried, for each case study, to address the following questions:

- How has the 'terroir niche' emerged in history, and what are the place-based rules that have determined local practices and products' typicality?
- How have niche and regime interacted, and what have been the consequences of such interactions for the niche innovation pathway?
- What was the effect of the GI on the local innovation pathway? To what extent the five drivers identified by Belmin *et al.* (2017) – DMO functioning, trade-offs in the GI specifications, collective learnings, changes in the actor network, and the protection mechanisms - have influenced the niche innovation pathway?

## 3 Results

### 3.1 The case of *Brocciu*

- ***Emergence of a terroir niche***

*Brocciu* is a traditional cheese stemming from the agropastoral societies of Corsica. It is produced from a combination of milk and whey (the residual juice after coagulation of the milk for cheese making). *Brocciu* has been produced and consumed at the village scale since centuries, by smallholder farmers living in the remote mountainous areas of Corsica. It is used in the preparation of a wide range of local recipes (Prost, 1996), either starters (*Brocciu* pie), main courses (cannelloni, trout with *Brocciu*...) or desserts (donuts, *falculelle*, *fiadone*). *Brocciu* is a seasonal cheese because in the traditional rearing systems, the milk from small ruminants (ewes and goats) is only produced during the wintering, from October to June. *Brocciu* is a white whey cheese with a fat content of 45%, a soft and granular texture. These typical features result from transformation know how (e.g. direct heating of the whey) and from the specific quality of the milk from the Corsican ewes and goats.

- ***Niche-regime interactions***

From 1893, the Corsican sheep production has progressively specialized and intensified under the influence of milk buyers from the Roquefort industry<sup>3</sup>. In the view of raising the production, the sheep breeders used an increasing quantity of external inputs (fodder, feeds...). They were also crossing the Corsican ewe with Sarda breed to increase the milk yield. At the same time, the milk production has shifted from the mountain areas to lowlands, leading to the decline of pastoralism. After the Second World War, virtually all the Corsican ewe milk was supplying 122 industrial dairies owned by 4 Roquefort firms. Despite these deep changes in the local dairy sector, the *Brocciu* production did not stop: the Roquefort manufacturers used to return the whey to the sheep breeders, allowing them to maintain a production of *Brocciu*.

In the late 1970', the Corsican dairy sector entered a crisis period. The Roquefort industry started withdrawing from Corsica because it had enough milk available in its close environment (Millet &

<sup>2</sup> Some of them are cited in the present article.

<sup>3</sup> Roquefort is a sheep milk blue cheese from the south of France (Aveyron).

Casabianca, 2014). Almost all industrial dairies have closed, leaving no more market outlet for Corsican ewe breeders. The sole remaining unit, owned by the brand *Roquefort Société*, diversified its production by making Corsican-kind cheeses, including *Brocciu* (de Sainte-Marie and Casabianca, 1999). In reaction, the local breeder's unions went into a trial with *Roquefort Société*, denouncing an illegitimate imitation of a cultural product.

- **Construction of a Geographical Indication**

In 1983, to solve the crisis, the then president François Mitterrand decided to award *Brocciu* with a 'Designation of Origin'<sup>4</sup> (DO). The DO rules - fresh milk produced in Corsica, use of local breeds, direct heating<sup>5</sup> - were designed in order to prevent the industrialization of *Brocciu*. However, *Roquefort Société* could bypass these barriers: on the one hand, the firm got public support to change its heating facilities; on the other hand, *Roquefort Société* diverted the DO rules to use dried milk<sup>6</sup> in the *Brocciu* fabrication.

In the 1980-90', the local dairy sector has changed remarkably, with new actors and rules entering the game. Corsican industrial cheesemakers have emerged, as competitors of the dairy industries owned by *Roquefort Société*. In the meanwhile, part of the sheep breeders has stopped supplying the dairy industries in order to make their own cheese in on-farm processing.

In 1993, taking opportunities of changes in the European agriculture and food policy<sup>7</sup>, the actors in the Corsican dairy sector embarked a project of 'Protected Designation of Origin (PDO)' for *Brocciu*. At that point, the Corsican industrial cheesemakers had a strong influence on the design of the PDO specifications, with major consequences. On the one hand, most PDO rules directly encouraged the search for high milk yield (low fat content of the milk), the industrialization of cheese making and the alignment with the large-scale distribution requirements (new packaging allowing later expiry date). On the other hand, the PDO rules sustaining the typicality of *Brocciu* (use of Corsican breed, traced origin of milk, limited use of concentrated feeds) were not enforced due to lack of control. The *Brocciu* was awarded a PDO in 1998.

- **Current innovation pathway**

Altogether, industry-friendly rules and lack of controls led to a dramatic decline in the typicality of *Brocciu*. The cheese texture was no longer granular but regular. The fat content has decreased, leading to tasteless product. What was a fresh cheese eaten 48h after fabrication became a 3 weeks conservation product. In the 2000', in a context of quick market expansion, industrial actors have started using imported milk to increase the production of "Corsican" cheese and, by the way, their capacity to produce *Brocciu*. These violations of the PDO rules were enabled by the (intentional) lack of traceability and monitoring by the DMO. The local press unveiled the problem, leading to a major crisis in the sector and a threat on the products' reputation. On the top of that, the DMO is preparing a revision of the PDO rules, in the purpose of allowing an industrialization of cheese making: increase of feeds for livestock, double-wall tank, use of milk powder. This pathway of standardization is the result of the dominant position of industrial actors in the governance of the DMO. In that context of race to the bottom, the major part of artisanal breeders-cheesemakers got out from the PDO: they kept producing their cheese through traditional way, although they could not call it "*Brocciu*" anymore.

### 3.2 The case of Corsican charcuterie

- **Emergence of a terroir niche**

<sup>4</sup> As a non-fermented dairy product, *Brocciu* was not classified as a cheese. Therefore, it could not benefit from a 'Controlled Designation of Origin'.

<sup>5</sup> Industrial dairies were using another heating technology – double-wall tanks – to get higher extraction yield for the serum proteins. However, the use of double-wall tanks lead to deep changes in the product's texture.

<sup>6</sup> The use of dried milk is strategic for the dairy industry since it allows the storing of surplus milk.

<sup>7</sup> Three main changes have occurred: 1) *Brocciu* was recognized as a cheese in 1988 after a change in French legislation; 2) The European regulation on Geographical Indications came into force in 1992, leading to the creation of the 'Protected Designation of Origin' and the 'Protected Geographical Indication'; 3) The Corsican sheep breed was recognized in 1987.

Extensive pig-breeding has always been a component of rural livelihoods in Corsica. Families were fattening one or two pigs in their backyard for their self-consumption. In most villages, one *Purcaghju* was breeding pigs to make deli meat and to sell piglets to the neighbours. Pigs were fatten and finished under oak trees or in the abandoned chestnut grove. They were slaughtered from November to February, when the chestnut and acorn resource were available. Winter slaughtering also provided safe sanitary conditions (cold temperatures) for processing the meat. Accordingly, the production of Corsican deli meat has remained seasonal. The typicality and reputation of the deli meat was the result of specific salting, smoking and tying practices. It also lied in the Corsican pig, a slow-growing breed making a tasteful meat (high intra-muscular lipids) when reared in sylvopastoral systems.

- **Niche-regime interactions**

During the XX<sup>th</sup> century, in the whole occidental area, the pigmeat sector has undergone a remarkable industrialisation. This process was supported by the selection of quick growing pig breeds adapted to closed farming systems, able to produce lean carcasses of 100 kg in 6 months only. However, Corsica has remained outside this trend of modernisation. The model of intensive rearing has failed to succeed due to prohibitive modernisation costs in the insular, isolated and mountainous context of Corsica.

In the 1970-80, family pig farming disappeared in a context of decline of rural lifestyle. For their part, *Purcaghji* continued pig production and deli meat processing, although they brought significant change in their breeding systems. To get heavier carcasses, they crossed the local pig breed with imported ones (Large White or Duroc). This trend was encouraged by the agricultural unit of Casabianda prison, who was spreading sire breeds and piglets. However, pig breeders did not completely align with the modern production standards. This is because they showed little dependency on imported feeds since they could rely on the abandoned chestnut grove to fatten and finish their pigs. Pig breeding were also prevented from industrializing because of the absence of abattoir for pigs in Corsica till 1992. By the way, on-farm slaughter was the rule, and pig breeders-processors were kept outside the formal market.

In the same period, the first industrial deli meat manufacturers established in Corsica. They imitated the traditional process of deli meat fabrication (salting, smoking and tying) in order to obtain Corsican-kind products. However, they only used imported, industrial pig meat in the purpose of supplying the mass market (large-scale distribution, tourism, etc.) with deli meat all year long.

- **Construction of a Geographical Indication**

In the early 2000', the actors embarked a certification process to obtain a 'Protected Designation of Origin (PDO)' for the Corsican charcuterie. Their objective was to follow the example of the Spanish 'pata negra', by identifying a luxury product based on a sylvopastoral system. The PDO scheme was also a way to give value (and to protect) to the *Nustrale* breed. After negotiations involving representatives from each micro-region, they sent to INAO a proposition of PDO specification:

- The Corsican deli meat can be produced from local breed (officially recognised in 2006 as *Nustrale*) or from crossbred animals. This rule was designed to avoid the exclusion of the producers who were using first generation mix breeds.
- The fattening of pigs can be realised with spontaneous resources (chestnut or oak acorn), with barley, or with a mixture of the two. The inclusion of barley was a way to acknowledge the year-to-year variations of spontaneous resources. Moreover, the goal was to include the pig breeders without access to oak-woods of chestnut grove.

Altogether, the rules proposed by the actors of the pig sector gave rise to 4 categories of products, discriminated by the fattening mode (spontaneous resources or barley) and the breed (pure *Nustrale* or mixed). Although it provided some flexibility, the PDO roughly reflected the traditional production system in order to ensure typicality: sylvo-pastoral rearing, seasonal slaughtering, large proportion of subcutaneous fat and intramuscular fat, etc.

However, the French administration in charge of the application (INAO) brought some difficulties. The PDO project would only be granted if crossbred animals and barley finishing were excluded. As a result of that decision, the appellation ended up excluding three of the four categories of products that had been introduced in the initial project. By the way, the PDO was obtained in 2014, but the flexibility and leeway that had been collectively designed by Corsican actors disappeared. In the PDO specifications, some rules were added to normalize the production process, such as the slaughtering in an abattoir or the identification of animals.

- **Current innovation pathway**

The PDO brought division within the deli meat sector, so much that a significant part of the pig breeders did not join the project. There were 3 main reasons for this situation. First, some breeders could not access oak-woods of chestnut grove. Then, not all farmers favoured the pure *Nustrale* breed. They preferred crossbred pigs with higher growth rate and lower fat content of the meat. The controversy over the breed was aggravated by difficult access to the *Nustrale* breed, due to poor management of the distribution of pure breed boars. Third, the transition costs to break out from the informal sector (identification of pigs, sending pigs to an abattoir, normalisation of the rearing facilities, traceability) were too high in the eyes of many breeders (de Sainte-Marie et al., 1998).

In this controversial context, the pig sector has fragmented, so that several warning signs challenge its sustainability. On the one hand, there is a risk of collapse of the PDO project due to lack of commitment of breeders. On the other, the division among breeders-processors opened a space for new certification projects: some unsatisfied pig breeders have applied for a Red Label, while deli meat manufacturers have come up with a PGI scheme. Actually, each category of actors is defending its own production model, while all claim for the right of being recognized as Corsican.

### 3.3 The case of Corsican clementine

- **Emergence of a terroir niche**

In the 1960-70s, the Corsican Clementine developed under the protection of the monopoly over commercialization of fruits with its leaves (Belmin, 2016). This monopoly resulted in a sanitary barrier, which prevented other countries from exporting fruits together with leaves. In Corsica, the objective of having the fresh leaf attached to fruits when marketed had profound implications for the management of harvest and for the product quality. In fact, it prevented storage and ethylene degreening (which deteriorate leaf aspect). Accordingly, farmers had to carry a selective picking of naturally coloured fruits, involving several harvests on each tree. In turn, the leaf-driven harvest model indirectly allowed the expression of the specific sensorial characteristics of the Clementine varieties that had been developed by a local breeder: In the cool but not cold Corsican autumns, the fruits that have just coloured keep green pigments on their bottom part (inducing what actors call "cul-vert"), and the on-tree colouring occurs at a ripening stage where fruits have not achieved acidity drop (inducing "acidulous taste").

At the same time, the leaf acted as a protection to the Corsican model, despite tensions with the competition rules of the citrus sector. The added value provided by the leaf made economically bearable harvest costs and risks. The leaf also hid - both physically and symbolically - the product's specificities (small calibre, acidulous taste, "cul-vert") that were regarded as defects in the mass market. In this protected space, actor network developed under the influence of both agronomical and sensorial implication of the "work with leaf". On the production side, local actors built a "just-in-time" supply chains as a way to mitigate harvest risks and costs. On the consumers' side, the persistence and use of this non-standard product shaped representations among consumers and downstream buyers, leading to the categorization of Corsican Clementine as a singular product. In sum, the "work with leaf" both induced and enabled the emergence of an alternative quality model in tension with the competition rules of the citrus sector.

- **Niche-regime interactions**

In the 1980-1990, Corsican Clementine entered a crisis period. Through a modification of the UE phytosanitary rules, Spain obtained the right of marketing its citrus fruits with leaves, and Corsica lost its "leaf monopoly". In this new context, the insular production was increasingly exposed to international competition, and the specificities of both production model and product became economically unsustainable. Some local actors started to align with Spain, adopting controversial innovations such as ethylene degreening, as well as Spanish varieties characterized by high calibre and very early or late fruiting. These technical changes contributed to an erosion of the Corsican model and related quality. During this period, the commercial difficulties and quality heterogeneity stimulated individual strategies. Local actor network became divided, and marketing function was transferred to wholesalers, who put in competition cooperatives and fostered crisis and quality uncertainties (de Sainte Marie & Agostini, 2003).

- **Construction of a Geographical Indication**

In the late 1990s, after a large debate within the sector, local actors embarked a PGI certification project as a way to solve crisis with a quality strategy. A DMO was created, putting together a variety of actors: cooperatives, independent farmers, organic producers, researchers, breeders, marketers and the regional administration. It took an entire year to draw up the PGI specifications, with weekly workshops attended by representatives of each DMO member body. What resulted from the process was an inclusive "local standard" combining the specific features of the Corsican model with some requirements of the mass market. On the one hand, the PGI was used to define the specific qualities of the Corsican clementine, its unique features. Collectively, the actors accepted the full agronomic and sensorial implications of working with the leaf. Thus, PGI specifications and controls were focused on banning degreening hormones, enforcing staggered harvesting, and recognizing "cul-vert", acidulous taste, and small calibre as typicality attributes (mandatory criteria for the use of the protected name). On the other hand, the PGI was used to enforce generic quality, i.e. ensuring that conventional mass market requirements were met. In particular, the specifications were aimed at ensuring full control of grading, sizing and packaging. These had previously been poorly controlled. In the process, the PGI was used to exclude all fruit whose appearance matched category II of the EEC/UN standards.

- **Current innovation pathway**

The PGI stimulated a reconfiguration of the whole actor network involved in quality management (Belmin, 2017). On the one hand, the consensual definition of quality and good practices enabled the concentration of supply around 3 marketing organizations owned by farmers. On the other hand, the PGI acted as a lever for vertical integration of supply chain, since the distribution trademarks aligned their specification sheet with the PGI one, and relied on the 3 marketing organizations as commercial partners. Because the "local norm" became the shared rule system in the supply chain, downstream actors recognized the Corsican Clementine typicality attributes. In this system constrained by fruits' natural colouring, such change in supply chain organization revealed to be highly strategic for quality management.

Last but not least, the PGI contributed to the strengthening of the Corsican Clementine production model and related quality. On the one hand, enforcement of PGI specifications and control device led to an improved management of quality among farmers and sorting stations. Multi stage harvest model was restored, Spanish varieties were replaced by local ones, and fruit quality was homogenized. More indirectly, the coordination of actor network around the local norm allowed an improved management of harvest and marketing, an increased remuneration of farmers for quality fruits, and an improved management of quality at the level of the whole production basin.

## 4 Discussion

### 4.1 Three Geographical Indications, three contrasted innovation pathways

Results show contrasted effects of Geographical Indications (GIs) on innovation pathways in terroir niches:

- For *Brocciu*, the implementation of the GI has led to standardization of product and production methods. Due to an over-representation of industrial cheese makers in the GI's governance, GI rules have drifted towards regime's rules: *Brocciu* became a 'local generic' product.
- In the case of Corsican charcuterie, the GI has fostered a fragmentation of the innovation pathway into three 'production worlds'. Because too elitist, the GI has provoked a splintering of the local stakeholder network. In that context, various technico-economic models have ended-up struggling for recognition and supremacy.
- For Corsican clementine, the balanced compromise elaborated during the GI construction has supported an overall shift of the innovation pathway towards resource-based differentiation.

In the following discussion, we wonder how have 'terroir niches' interacted with incumbent regimes, and through which mechanisms the GIs schemes have influenced the innovation pathways.

## 4.2 Niche-regime interactions

Our three terroir niches have strongly interacted with dominant regimes, leading to the adoption of rules and technologies that unfit the niche functioning. Cross-case analysis suggests that niches are intruded by three interlinked elements that stem from sociotechnical regimes (**Figure 2**):

- ***Intrusion of rules***

In each three cases, the niche innovation pathway has been constrained by rules, values and vision of quality that are structured at a global scale. For instance, the market rules conveyed by exogenous buyers (large-scale distribution, tourists) have had much influence on the strategies of niche actors. Key market rules included prices scales, contracts, and specifications on the production and processing practices. For instance, in Corsican clementine basin, the price segmentation according to caliber has encouraged farmers to look for high size fruits. It led to deep technical and varietal change in the 1980-90'.

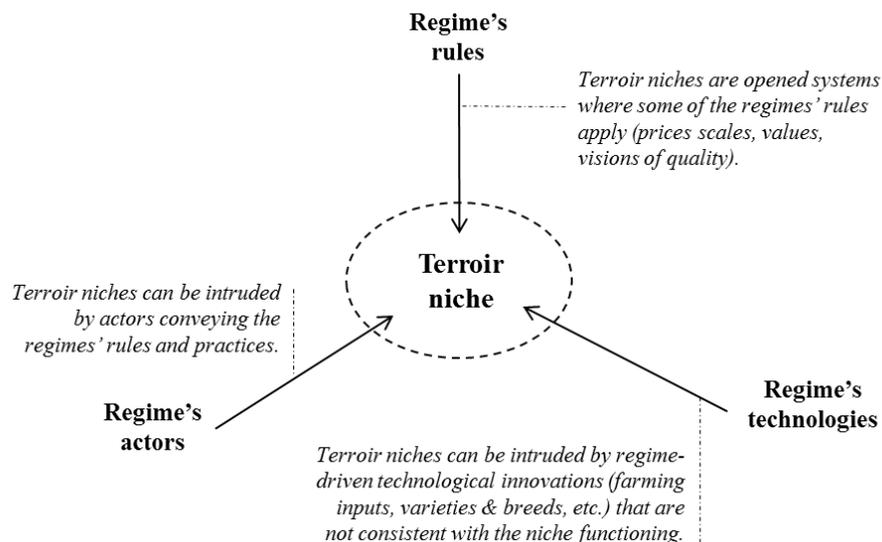
- ***Intrusion of technologies***

In our three cases, niches were intruded by technological innovations (farming inputs, processing facilities, varieties & breeds, etc.) driven by sociotechnical regimes. Behind neutral appearances, these novelties contained encapsulated rules that have deeply questioned the core functioning of the terroir niches. For instance, in the 1980', the local pig breed was crossed with Large White breed. Although it brought some technical progresses (improved growth rate, heavier carcasses), it led to less intramuscular lipids and standardized taste of the meat.

- ***Intrusion of actors***

Regimes have also influenced the niches' innovation pathways through the entry of actors conveying exogenous values and practices. These actors were imitating the reputable cultural product while industrializing the production methods. For instance, industrial deli meat manufacturers established in Corsica in the 1980, using imported pig meat in the purpose of supplying the mass market with Corsican-kind deli meat. In the dairy sector, exogenous firms and local dairy manufacturers both started making *Brocciu* with imported milk and industrialized production process.

In some cases, specific resource has been protecting the niches for a while, by mitigating the effect of regimes' rules. For Corsican clementine, the leaf sold attached to the fruit prevented storage and degreening and it provided added value to the product. For Corsican charcuterie, isolation and the presence of chestnut grove have together contributed to maintain the Corsican pig sector outside modernization.



**Figure 2:** Regimes put pressure on terroir niches through the intrusion of coherent set of rules, technologies and actors.

### 4.3 The role of Geographical indications in the niches' innovation pathways

Based on the five drivers identified by Belmin *et al.* (2017), we here discuss the mechanisms through which GIs have been influencing the niches' innovation pathways.

- **Functioning of the GIs' Defence and Management Organizations**

In each three GI schemes, a new organization - the Defence and Management Organization (DMO) - was set up to conduct the GI application. The certification process also included an arbitrator (INAO) whose role was to guarantee the credibility and legitimacy of the GI scheme. Cross-case analysis suggests that the functioning of this device had strong influence on the subsequent innovation pathway, with at least three key factors playing:

- **The balance of power between the spokesmen of niche and regime.** Our results suggest that this balance is a prerequisite for making decision that do not divert the niche functioning. The *Brocciu* case clearly shows the consequences of an overrepresentation of the regimes actors in the negotiations of the GI's specifications. Not only it led to design rules that were adverse to typicality (e.g. use of dried milk), but it has also paved the way for more influence of industrial cheesemakers in the next round of negotiations.
- **The representation of the within-niche diversity in the negotiation table.** Our study shows the importance of having this diversity represented so that the trade-off that are built could embrace the diversity of constrains met by farmers. In the Corsican deli meat sector, the inclusion of pig breeders from each valley led to build inclusive GI project (this project was then diverted by INAO). In the case of clementine, the GI rules were flexible enough to embrace the diversity of citrus farming systems, leading to an inclusive scheme.
- **The degree of collective action.** As demonstrated by our results, a key success factor for GIs is to build the specifications through a multi-stakeholder process. Lack of collective action can lead to unappropriated decisions. In the three cases studies (exclusive of the first GI for *Brocciu*), actors from the local R&D organizations have played a mediating role in the certification process, by ensuring a sufficient level of collective action.

- **Trade-offs embodied in the GI specifications**

When designing the GI specifications, the actors in our three 'terroir niches' have designed a 'local standard' embodying a negotiated compromise between regime and local rules. Such compromise is crystallized in the description of the GI product (target values for the product's quality), the definition of the production practices (genetic resources mobilized, equipment, link to the local resources, seasonality) and the delimitation of the production area. Hence, in our three cases, the

nature of each compromise had profound effect on local innovation pathways. For *Brocciu*, the GI was clearly regime-oriented (no enforcement of milk traceability, large expiry date of the cheese), leading an increasing part of the *Brocciu* to be produced through standardized methods. For Corsican charcuterie, the final GI specifications were resource-oriented, leading to the exclusion of an important part of artisanal pig breeders. In turn, it has opened a wide space for regime-oriented actors to build counter projects (Red label, Protected Geographical Indication). Kicked-out through the door, the regime came back through the windows! In the case of Corsican clementine, the compromise was quite inclusive, although it provided a barrier against the technologies that dramatically altered typicality (degreening, storage). In sum, the GI rule system have either driven the innovation trajectory towards the mainstream regime or towards place-based differentiation.

- **Collective learnings developed during GI elaboration**

Preparation for GIs has involved collective learnings that led to a shared vision of the product and production system. In the case of Corsican clementine, the shared-knowledge and mutual trust accumulated during the GI construction became the bedrock on which the niche actors have cooperated and coordinated. As opposite, the history of *Brocciu* clearly shows the consequences of lack of collective action during GI elaboration. The GI that was awarded by the French president in 1983, hindering the co-construction of shared knowledge, values and meaning about the *Brocciu*. In the case of Corsican deli meat, the first GI application resulted from a process of joint learning, at the conclusion of which local breeders had found a balanced compromise to ensure the sustainability of their subsector. However, the decision of INAO shifted their shared vision to an elitist project.

- **Changes in the structure of the niche's actor network provoked by the GI**

Implementation of GI schemes led to profound changes in the niches' actor networks. In turn, the new configuration of actors has influenced the niches' trajectory. Cross case analysis suggests that GIs can foster changes in the niche actors' networks through four mechanisms:

- **GIs constrain the strategies of niche actors.** GIs schemes have directly put constraints on the actors' strategies. In our three case studies, local actors have all repositioned their strategies in relation to the GI's rule systems, either to align with it (Corsican clementine), to bypass it (*Brocciu*) or to compete with it (Corsican deli meat).
- **GIs provoke inclusion/exclusion effects:** The choice of GI rules (product description, definition of practices, boundaries of the production area) has provoked either inclusion or exclusion processes. In inclusive projects such as *Brocciu*, the GI implementation led to a race to the bottom, driving the innovation pathway towards the regime and pushing out the producers more aware of typical cheese. In the elitist project of Corsican deli meat, the GI brought division in the subsector, fostering alternative strategies (Red Label, Protected Geographical Indication). Eventually, the clementine case shows that it is possible to achieve both a high level of quality and a low level of exclusion.
- **GIs require costly technical changes.** To become part of the GI, each single actor had to bring costly evolutions to his practices. Technical changes can be either in the purpose of linking the production system to local resources (e.g. developing a sylvopastoral rearing system, coming back to traditional varieties or breeds) or to align with the regime rules that were incorporated in the GI's specifications (e.g. bringing traceability in the pig sector, improving the sorting and sizing of clementines). However, when too drastic, the costs of change may discourage some actors, as it was the case in the sector of Corsican charcuterie.
- **GIs organise the within-niches diversity.** A key element driving the innovation process was the ability of the GI to make parallel production models coexist side by side. With the cases of *Brocciu* and deli meat, we understood that when internal diversity is denied, there is no possible market segmentation between semi-industrial products and resource based products. In turn, it fosters the strategies of regime-oriented actors who benefit lower production costs.

- **GIs build capacities for collective action:** GI elaboration can lead to stronger coordination among niche actors, as it was the case for Corsican clementine. In the two other cases (*Brocciu* and Corsican charcuterie), the GIs have caused the opposite effect, since they have divided the sector.
- **Renew of protection mechanisms**

Eventually, GIs have been influencing the niches innovation pathways through a last mechanism: the renew of the niche protection. As Belmin *et al* (2017) have shown, terroir niches cannot maintain their core structure without protection. Their protection mechanism is based on the propensity of GI to regulate the tensions provoked by the regime presence within the niche. Such tensions can be either exogenous (buyers' penalties and imitation by competitors) or endogenous (propensity of some niche actors to align with the rules of dominant regime). In the case of *Brocciu*, the protection mechanism used in the first GI was very weak (no use of double edge tanks). It has allowed regimes' actors to become increasingly influent on the niche innovation pathway.

## 5 Conclusion

In this paper, we have explored the regulatory role played by Geographical Indications (GIs) in local innovation pathways. To do so, we studied the long-term evolutions of three cultural productions in the island of Corsica (France), namely *Brocciu*, Corsican charcuterie and Corsican clementine. In each case, GI schemes were implemented with deep effects on sectoral development.

We assimilated our three productions to 'terroir niches' (Belmin *et al.*, 2017), that are sociotechnical systems whose development is influenced by specific rules embedded in the biophysical environment and resources of a given place. Because terroir niches are not totally emancipated from the rules of sociotechnical regimes, the practices of niche-actors are influenced by technologies, breeds, commercial and sanitary standards, visions of future progress that are structured at a more global scale. In that light, we have wondered how our three terroir niches have interacted with dominant regimes, and what have been the consequences of such interactions for the niches innovation pathways.

Results show contrasted effects of GIs on local innovation pathways. For *Brocciu*, Corsican charcuterie and Corsican clementine, the implementation of GIs respectively led to standardization, fragmentation and differentiation. Cross-case analysis confirms that GIs have influenced the niches' innovation pathways through five mechanisms:

- **The functioning of the GIs' Defense and Management Organizations (DMO).** These organizations are key players since they are in charge of the design and implementation of GI schemes. Our case studies have highlighted that at least three factors can influence the decision process of a DMO: the balance of power between the spokesmen of niche and regime (*Brocciu*), the degree of collective action (it was high for clementine and charcuterie, and low for *Brocciu*) and the representation of the within-niche diversity in the negotiation table (well represented for clementine and charcuterie).
- **The trade-offs embodied in the GI specifications,** between the rules embedded in the local biophysical environment and resources, and non-specific rules deriving from sociotechnical regimes. In two of our cases, things have gone as would be expected: a regime-oriented compromise has shifted the innovation trajectory towards the mainstream regime (*Brocciu*), while a resource-oriented GI has encouraged place-based differentiation (clementine). In the third case paradoxically, a resource-oriented GI has excluded an important part of artisanal pig breeders, opening a wide space for regime-oriented actors to build counter projects.
- **The collective learnings developed (or not) during GI elaboration;** For instance, in the case of Corsican clementine, the shared-knowledge accumulated during the GI construction has stimulated an improved coordination among supply chain actors.
- **The changes in the niche's actor network provoked by the GI.** The new configuration of actors can in turn influence the future development of the niche. With our case studies, we

understood that a GI can drive such changes through three main processes: (1) the repositioning of the actors' strategies with regard to the GI rules; (2) the inclusion/exclusion effects provoked by the GIs (it results from the capacity of the GI to organise the within-niche diversity while asking for feasible technical changes); (3) the building of capacities for collective action.

- **The protection mechanism provided by the GI.** In some cases, a GI can succeed in renewing the niche's protection mechanism. It leads to a mitigation of niche-regime tensions (see Corsican clementine). By contrast, in cases of weak protection (see *Brocciu*), the niche can be easily intruded by regimes' rules, actors and technologies.

Hence, the terroir niche analytical framework has proved to be useful and robust for analysing long-term innovation pathways in localized agri-food systems, and the strong regulatory role played by GIs.

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