Hapres | Journal of Sustainability Research

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Strengthening Sustainable Food Systems through Geographical Indications: Evidence from 9 Worldwide Case Studies

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ABSTRACT

Geographical Indications (GIs) refer to products with specific characteristics, qualities, or reputations which result from their geographical origin. Geographical Indications are Intellectual Property Rights that are defined in international agreements (WTO-TRIPS, WIPO Lisbon agreement) as well as in multilateral (European regulation, and other regional laws), and national laws.

This paper presents research results from a collection and analysis of data on the economic impact of GI processes worldwide. GI "processes" are understood as the interconnections between products which have a strong reputation, the relevant stakeholders, especially the producers (farmers and processors), and the public authorities in charge of the registration and the protection of the use of the related geographical name.

Nine case studies have been selected to ensure a range of diverse situations by country, agricultural sector, market, size of the value chain, legal protection framework (*sui generis* or trademark), and type of strategy (promotion or protection).

This analysis shows that there are various mechanisms which support the positive effects of the GI process on price, regardless of the type of product, the region of origin, and whether the GI is long established or recently registered. GIs generate a higher value distribution to primary producers, and have a positive influence on production, especially in the long term. GIs enhance market access, and they can be useful tools for building resilient value chains, especially by boosting the diversification of markets. Through a domino effect, GIs can also have a substantial positive impact on other sectors of the economy.

Open Access

Received: 29 March 2020
Accepted: 17 July 2020
Published: 04 August 2020

KEYWORDS: Geographical Indications; economic impacts; Intellectual Property Rights; agriculture; strategy of differentiation; value chain; value added; agri-food system; developed and developing countries; impact pathway

ABBREVIATIONS

CoP, Code of Practice; GI, Geographical Indications; IPR, Intellectual Property Rights; PDO, Protected Designation of Origin; PGI, Protected Geographical Indication; SFS, Sustainable Food System; TM, Trademark; WTP, Willingness To Pay

INTRODUCTION

Geographical Indication (GI) refers to the labelling of products with specific characteristics, qualities or reputations resulting from their geographical origin. This differentiates products based on unique local features, history or distinctive characteristics linked to natural and human factors, such as soil, climate, local know-how, and traditions. Geographical Indications (GIs) may be considered as tools for the development of sustainable food systems, thanks to the territorial anchoring of GI products and the collective strategy of producers to promote, guarantee, or protect their origin-linked quality product and preserve their local resources. In the context of global losses of biodiversity and disappearance of traditional food systems, GIs can contribute to preservation of specific local species and varieties. Geographical Indications (GIs) are based on the use of local resources and traditions. By definition, they are supposed to respect local, fair, and consistent practices. This means that they are not based on a logic of mining resources, importing raw materials, or massive fossil energy usage, but on a logic of valorisation of natural resources and local know-how. If this is not the case, over time, any GI production system loses its roots, identity, and value. Thus, by defining and respecting the code of good practices, GI producers' groups are assumed to contribute to the sustainable development of their territory. Small farmers often have difficulties in accessing export markets. Most of the GI value chains include small farmers, the "guardians of traditions". Some GIs address urban demand for specific quality products, contribute to diversifying diets, and preserve traditional dishes and products (Albayrak and Gunes, 2010 [1]).

The anticipated effect of GIs is an increase in producers' income through a higher selling price, greater competitiveness (differentiation strategy), and commercial advantage (reserved use of the name) (Jena & Grote, 2010) [2]. The definition of specific origin-linked characteristics (i.e., connected to natural and cultural resources) is a way of preserving the local heritage linked to this production. GIs are implemented in different countries, as development tools that allow better recognition of products, the boosting of producers' organizations and their power in negotiations

within the value chain, and improved market access, as a number of technical assistance projects have shown. However, donors and other partners often require economic data relating to the development of GIs.

Little work has been done to analyse the economic impacts of GIs in developing countries. Some studies exist for developed countries and show that GIs are able to generate value added (Cei et al., 2018 [3]; AND-International, 2019 [4]), although more studies are needed to back-up the findings. The main reason for the lack of data is the difficulty of distinguishing between the impact of the legal protection of GIs and other factors such as the organization of the value chain, power relations, marketing strategy, or producers' skills. Another reason lies in the relatively recent development of GIs, especially in developing countries, or countries in transition, so that there has not been enough time to obtain the full picture needed for analysis of the major impacts.

The purpose of this paper is to assess the economic impacts of instituting a GI, and the resultant causal relationships, as a protective mechanism or tool, through the analysis of 9 case studies of products in various regions of the world that have GI recognition and meet the identified conditions of success, such as justification of their specific qualities link to their origin, their heritage and collective dimensions, and their potential for differentiation. The aim is to measure the capacity of the GI as a protective tool to generate economic effects in terms of price, income for producers (and hence redistribution of value down to the first link in the chain), and market access, for products already recognized as GIs which have proved their ability to meet consumers' expectations in terms of authenticity and specific quality. The scope of the paper is the economic impacts of GI "processes", understood as the interconnections between products with strong reputations, the group of concerned stakeholders especially the producers (farmers and processors), and the public authorities in charge of the registration and the protection of the use of the related geographical name.

The rest of the article is structured as follows. Section "**STATE OF THE ART AND OBJECTIVES OF THE PAPER**" presents the state of the art and the objectives of the paper. In Section "**METHODOLOGICAL CONSIDERATIONS**", we explain the methodological framework and the selection of our 9 case studies, and we give details about the four-stage procedure we carried out to collect data, to evaluate economic impacts, to identify causal relations, and to share the results with the stakeholders, followed by Sections "**RESULTS**" and "**DISCUSSION**". The last section concludes.

STATE OF THE ART AND OBJECTIVES OF THE PAPER

Geographical Indications may be implemented as a tool for fostering the sustainability of food systems, in particular in projects of rural development that are supported by donors (e.g., FAO, UNIDO, UNCTAD, AFD, etc.). A Sustainable Food System (SFS) is a "food system that delivers

food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised" (High Level Panel of Experts on food security and nutrition (HLPE, 2014) [5]. Economic aspects of sustainability are not easy to estimate. Stakeholders and policy makers often ask for economic data on GIs, especially in terms of impacts. Although the economic impacts of GIs have been well documented by various researchers (Moschini et al., 2008 [6]; Josling, 2006 [7]; Zografos, 2011 [8]; Rangnekar, 2004 [9]; Jena & Grote, 2010 [1]; Barjolle, 2015a [10]) empirical demonstration of the net benefits of GIs is relatively sparse, especially in countries outside Europe where GI procedures are more recent. Therefore, the objective of our study was to develop a methodological framework (i.e., a common approach), to assess the main economic impacts of the process of engaging in the formal recognition and protection of a geographical name, as well as the protection itself. The economic theory background behind the idea of economic nature and impacts of protecting the name and labelling of product is threefold:

First, is the *corpus* of theories about asymmetry of information between agents, when a buyer is not able to assess quality at the time of buying. The seller may hide faults, and this hinders the good functioning of the market, and the consequences have already been explored in the particular case of GIs (Moschini et al., 2008 [6]; Mérel & Sexton, 2011 [11]; Mérel, 2011[12]). Therefore, standardising, controlling and labelling are processes that balance this malfunctioning, because GIs refer to this kind of "quality" which cannot be assessed easily enough at first sight at the point of sale by the consumers.

Second, the economic impacts rely on the "reputation effect" of the name of the GI product, which is very similar to a trademark effect. Consumers know about the name because of the investments in promoting it and its quality level, and the guarantee for the consumers of getting the desired quality when buying the product which has the name. The combination of "product/quality/guarantee/brand" increases consumers' willingness to pay (WTP). This value added by the value chain actors in offering high quality, not deceiving consumers, and investing in brand advertising, has a "return of investment", which generates a financial flow that may go back to the producers (Deselnicu et al., 2013 [13]).

Third, the value created by these two mechanisms (standardising/controlling/labelling and the investment in the branding) varies a lot from case to case. In the particular situation where the name is a geographic one, where the product has long history, especially if the quality of the product is linked to the particular set of natural and human factors around it, it has a good chance to benefit from a high value added. However, it has been proved by previous researches that this is not always the case. From the rural development perspective, the expected economic impacts are that the value added moves up the value chain and supports the economic welfare of the farmers, and the processors at each stage of

the value chain. By using a value chain approach, it is possible to make an analysis of this mechanism (Fitter & Kaplinsky, 2001 [14]; Mancini, 2013 [15]; Barjolle, 2015a [10]; El Benni & Reviron, 2009 [16]).

In short, what is important is that the costs and benefits are balanced in a way that allows the producers' and consumers' welfare to be at equilibrium. Previous interdisciplinary researches (Vandecandelaere et al., 2010 [17]; Tregear et al., 2007 [18]; Belletti & Marescotti, 2011 [19]; Quiñones et al., 2014 [20]; Durand & Fournier, 2017 [21]; Barjolle et al., 2009 [22]; Barjolle et al., 2007 [23]; Barjolle, 2015a [10]; Barjolle & Jeanneaux, 2012 [24]) have allowed identifying key points. Producers mainly control and influence: (1) How to gain, and (2) How to retain the WTP of the consumers at a cost covered by the selling price.

For a GI to work well, some key success factors have been identified: (1) the effective "link to the terroir" (the French word "terroir" means the characteristics of the product which are linked to the natural and human factors) (Casabianca et al., 2011 [25]); (2) the "translation" of "terroir" into a consistent Code of Practice (CoP), which standardises, controls, and allows definition of the "character of the product"; (3) the information that the consumers get thanks to the advertising of the actors. The main factors that influence all those elements are the governance within the value chain and the institutional framework and support (Barjolle, 2015b [26]; Barjolle & Jeanneaux, 2012 [25]; Barjolle & Sylvander, 2002 [27]; Quiñones Ruiz et al., 2015 [28]). Investment and financial capacities are also key elements for the economic development of a GI.

As a literature review showed that economic impacts are dependent on these conditions, we deliberately chose products for which these conditions are met and decided to focus on well-established GIs. In this research, we aim at measuring, when they exist, the nature and importance of the effective economic impacts.

Taking into account the various previous researches, the principal objective of this paper is to assess the main economic impacts of the process of engaging in the formal recognition and protection of a geographical name, as well as the protection itself.

Apart from the identification of the economic impacts of the GI process, a secondary objective is to discuss their accuracy, and to identify other factors that influence them.

So, to reach these objectives, some general questions were applied to each case study, while specific questions were defined by taking into account the context and the specificity of each case. The two general research questions were as follows:

- *First question*: What are the economic impacts of the GI process?
- *Second question*: What are the causal relations that can explain the impacts observed?

METHODOLOGICAL CONSIDERATIONS

The methodology adopted is to measure the capacity of a GI process to generate economic impacts for both companies and value chain in terms of:

- price and income (and hence redistribution of value to the first link in the chain),
- production volumes,
- market access,
- impact on sustainable development in terms of resilience.

The analysis is based on a series of 9 case studies (see Table 1), which provide empirical evidence and were selected to cover a range of diverse situations.

Selection of the Cases

At the beginning of the research, criteria were set to select the 9 case studies. The 3 groups of criteria were as follows:

First, we selected GIs with the specific characteristic of products strongly linked to *terroir*. This is a basic element of the reputation and it is what justifies registration of the GI as an intellectual property right (justification dimension).

Second, we selected groups with existing effective governance of the GI (code of practice, monitoring, and collective promotion of the GI as a sign of quality). The producers involved in producing or processing the GI product and their involvement in the management of its quality are at the heart of the process. As the heirs and guardians of the specific quality (link to know-how and use of natural resources), they are the people in a position to define the production and processing criteria in the code of practice. The criterion here is the existence of some form of organization (formal or informal) which collectively takes decisions on aspects relating to the GI (at least those linked to production, but maybe also to marketing) and brings together all those involved in the value chain. The management of the GI requires a local association of the stakeholders in the value chain who are involved in the GI with regard to the criteria in the code of practice (heritage and collective dimension).

Third, we checked that the GI has a market. The GI is a tool for protection or marketing, or both; to have an impact, the establishment of the GI should take the market into account. The criterion here is the existence of a collective strategy for promoting products with a GI (market placement) and hence the involvement of all those involved in marketing (economic dimension).

Based on these selection criteria, the authors selected the following cases (Table 1):

Table 1. Presentation of the characteristics of the 9 cases.

GI product	Product description	Size	Location	Markets	Producers' organization	Registration	Objective of the GI approach
Colombian coffee	Arabica coffee, green or toasted beans etc.	More than 560,000 coffee growers; approx. 13,000,000 60 kg bags produced	The whole country, but the main production is on the Andean Cordillera	International	Fedecafé (coffee growers, cooperatives, Cafécert, Almacafé, Cenicafé)	1980: trademark *sui generis* approach 2004: national GI 2007: PGI in Europe	Promotion
Darjeeling tea	Green, black, white or Oolong tea coming from 87 gardens	87 gardens, producing approximately 10,000 tonnes	17,820 hectares in the Darjeeling area in North-eastern India	Domestic and international	Tea Board of India and Darjeeling Tea Association (87 Darjeeling gardens)	1986: trademark in India; trademarks in various other countries. *Sui generis* approach: 2004: national GI 2011: PGI in Europe	Protection
Futog cabbage	Fresh and sour green cabbage	35 producers, producing 460 tonnes	5000 hectares delimited area, PDO Futog cabbage only on 22 hectares in the Danube plain in northern Serbia	Domestic with few exports	Futog cabbage association (producers, processor and supporters)	*Sui generis* approach: 2009: national PDO 2012: first certification	Protection
Kona coffee	Arabica coffee, green beans	700 to 900 growers, producing approximately 1500 tonnes	West coast of Hawaii's Big Island—Kona district	International	Kona Coffee Farmers Organization; Kona Coffee Council	2000: trademark	Protection
Manchego cheese	Cheese aged for 60 days to 2 years from Manchego sheep milk	785 milk producers, producing 11,000 tonnes of cheese	La Mancha region	International	Manchego Cheese Designation of Origin Regulatory Council (milk producers, cooperatives, cheese factories)	*Sui generis* approach: 1982: national GI 1996: European PDO	Protection

Table 1. *Cont.*

GI product	Product description	Size	Location	Markets	Producers' organization	Registration	Objective of the GI approach
Penja pepper	Generic variety well adapted to the *terroir*. Mainly white, but also black, green or red pepper	200 producers under the PDI scheme, but about 5000 local farmers have pepper plants in their farms. Between 200 and 300 tonnes produced	Mungo district in south-western Cameroon	Domestic and some international niche markets	GI Managing Group (nursery, producers and distributors' organizations)	*Sui generis* approach: 2013: PGI	Protection
Taliouine saffron	Unground or ground saffron filaments	About 2300 producers, producing approx. 3000 tonnes	Tailiouine and Taznakht towns in the Souss Massa Drâa region	Domestic & international	FIMASAFRAN (defence and management body): PDO and non-PDO are all represented	*Sui generis* approach 2010: national PDO	Protection and promotion
Tête de Moine cheese	Semi-hard cheese with a special tool for its consumption	269 milk producers, producing 2200 tonnes of cheese	Northwest region of Switzerland	International	Tête de Moine Inter-professional Association (milk producers, cheese-makers, ripeners)	*Sui generis* approach: 2001: national DO 2011: PDO in Europe and Russia	Promotion
Vale dos Vinhedos wine	Red, white and sparkling wine	1900 hectolitres of wine produced since 2012. Approx. 26 wineries, 9 of which produce under the PDO scheme	Vale dos Vinhedos district, in the Serra Gaucha region of southern Brazil	Domestic	APROVALE (wineries and other enterprises working with tourist activities)	*Sui generis* approach: 2002: national PGI 2012: national PDO	Firstly promotion and secondly protection.

Source: authors' elaboration based on data gathered for the study in 2015/2016.

Methodological Approach

The effects of the protection are closely linked to the effects of the commitment of, and efforts made, by all the actors in the GI's value chain, and the stakeholders around them. We have taken these two aspects as a single one, what we call the "GI process", and the objective is to assess a first set of economic impacts. In effect, it is extremely difficult to assess the economic impact in an exhaustive manner across a large variety of case studies, for several reasons. In particular, the context is very different from case to case, and the availability of data and the access to primary data are also very different, because the willingness of the actors in the value chain to collaborate strongly influences the access to data. For these reasons, the methodological approach proposed here was set up in a pragmatic way, proposing some key indicators (Prices, Capacity of GIs to reduce transaction costs, Farmers' income, Volumes of GI products, Number of producers, Market access, Competitiveness, Market diversification, Price and volume of non GI products), but allowing flexibility in an implementation that had to be adapted to each specific context.

The research was done at two main levels: meso (value chain of the GI product) and micro (businesses). The meso level required a standardized data collection and analysis to make cross analyses based on comparable data. The micro level was adapted to the context, available data, and resources.

Some general questions were applied to each case study, while specific research questions were defined by taking into account the context and the specificity of each case. The two general questions were as follows:

First question: What are the economic impacts of the GI process? (cf. stage 2)

In order to collect data to answer this first general research question, the analysis of the economic impacts was carried out at the three levels mentioned above (value chain, businesses, and resilience of the GI system).

In order to explain the differences in economic performance among GIs themselves, and between GIs and their substitute products, the influence of various factors was taken into account.

Second question: What are the causal relations that can explain the impacts observed? (cf. stage 3)

The search for causes that would explain the impacts observed was one aspect of the in-depth study undertaken by the Master's students. This second level was adapted during the definition of the specific research questions and hypotheses.

In order to answer these two questions, an approach divided into four stages was defined, constituting our methodological framework: (1) Description of the product and its value chain, (2) Economic impact evaluation, (3) Causal relations, (4) Discussion with the stakeholders.

Stage 1: Description of the product and its value chain

This analytical presentation of the context is important, since it provides the framework for the study and the basis for comparison. The critical point is to identify the characteristics of the product that give it its special quality and which are the basis for consumers' recognition of a level of specific quality. Sources of information were face-to-face interviews with key people selected for their good knowledge of the product and such documents as the existing specifications or code of practice applied for the product (See Table 2). For each case, we met from 10 to 20 key people and 20 to 70 stakeholders, and for some cases, we carried out a survey and collect data from 90 to 970 farmers. We met around 500 people. These information are archived into the nine reports and appendix that were produced by our team.

The mapping of the value chain and its stakeholders, operations, and flows of materials and capital, was done to carry out a functional analysis of the productive structure of the value chain. The way GI value chains are organized varies widely, with some being fairly integrated (with varying degrees of formality), while others operate more informally. The number of links in the value chain, their importance and the way they are coordinated influences transaction and information costs, as well as the strategic choices made by the stakeholders, who, as (Perrier-Cornet & Sylvander, 2000 [29]) state, are interdependent and work together to monitor specific advantages, but keep their autonomy and their property rights.

The task here is to describe the dynamics of the system, then to determine the role of each link, the relations connecting the operators to each other, and how these relations can increase the market value of the product for consumers. The methods were value chain and actor mapping. The sources of data were face-to-face interviews with experts and stakeholders in the value chain, and secondary data (official and grey literature, internal datasets of the producers' group, statistics, etc.). Experts are people who are not directly involved in the GI local food system. They are researchers, civil servants, members of NGOs, etc. They were familiar with the GI system in question and could give their point of view. The tools usually used are maps of stakeholders in the wider sense, that is, the economic players directly involved in upstream and downstream exchanges of the reference product (the GI studied), and also the institutional players or organizations that have a role in its development (producers' organisation, research, agricultural development organisation, etc.).

Table 2. Synthesis of the data and methodologies used for the 9 case studies.

GI Product	Source of data: in-depth interviews and/or surveys	Benchmark substitute or product before GI certification	Type of analysis
Colombian coffee	Fedecafé; Cenicafé; ICO; CE DOOR 25 farmers; 3 cooperatives; 4 municipal committees; 2 state bodies; 1 educator; 4 exporters; 6 traders/roasters; 5 supermarkets; 7 experts	Café de Colombia before registration Brazilian mild	Descriptive analysis Synchronic analysis Synthetic control Cointegration test
Darjeeling tea	5 Tea Board of India officials; Tea Board of India: accounting data and archives; Tea statistics agency; 4 tea researchers; 21 tea gardens out of 87; 20 small-scale tea planters; 12 traders	Darjeeling tea before registration Assam, Dooar and Nepal	Descriptive statistics Diachronic evaluation Synchronic evaluation (Assam, Dooar and Nepal) Mean difference test
Futog cabbage	Statistical Office of the Republic ; Official site of the Futog Cabbage Association 20 growers, 1 processor and 2 potential growers of Futog cabbage, 22 growers and 2 processors of Bravo cabbage Consumer survey: 15 closed-ended questions with 301 consumers	Futog cabbage before registration Bravo, the main hybrid	Descriptive analysis Diachronic evaluation (since 2010) and synchronic evaluation (Bravo, the main hybrid) Analysis of the consumer survey Mean difference test
Kona coffee	USDA and HDOA 16 boutique farms, 3 processors, 1 cherry farmer; 2 industry leaders	Kona coffee before registration	Descriptive statistics Diachronic evaluation Cointegration test
Manchego cheese	National Association of Manchego, Sheep Breeders, Spanish Ministry of Agriculture, Manchego Cheese Regulatory Council, Manchego Cheese Museum, Provincial Technical Agricultural Institute, CRDOQM 75 milk producers, 5 traditional cheesemakers, 3 industrial cheesemakers, 2 cheese experts and 2 ripeners	Manchego cheese before registration Idiazabal and Zamorano cheese	Diachronic evaluation (since 2000) Synchronic evaluation (with Idiazabal and Zamorano cheese) Descriptive statistics Mean difference test
Penja pepper	Major producers' price data (PHP and Plantations Metomo, 2009–2015), IPC, GRIGPP representatives, public and private partners (development agencies, research centres, government departments) and experts (agricultural researchers) 50 growers (40 GI, 10 non-GI), 20 GI distributors, nurseries 2 farmers' focus groups Survey of 974 farmers GRIGPP census dataset (120 GI growers)	Penja pepper before registration	Diachronic analysis Cost structure of the typical GI farm Descriptive statistics Mean difference test

Table 2. *Cont.*

GI Product	Source of data: in-depth interviews and/or surveys	Benchmark substitute or product before GI certification	Type of analysis
Taliouine saffron	Moroccan Export Bureau 91 farmers, 27 cooperatives, 2 companies and 3 consortia, 17 local retailers, 20 supermarkets	Taliouine saffron before registration	Analysis of production costs using the typical farm model Descriptive statistics Diachronic analysis Mean comparison test
Tête de Moine cheese	Federal Office of Agriculture, Swiss Centre for Agricultural Advisory and Extension Services, Inter-professional association, Swiss Milk Producers Union 14 cattle breeders and 7 horse breeders, 14 cheese milk producers, 9 processors, 11 industrial milk producers, 2 ripeners	Tête de Moine cheese before registration	Modelling of a theoretical average farm Synchronic evaluation Diachronic evaluation Descriptive statistics Mean difference test
Vale dos Vinhedos wine	APROVALE, IBRAVIN, Business France and Euromonitor 2 grape producers, 13 wineries, 9 wineries under PDO	Vale dos Vinhedos wine before registration	Diachronic evaluation Descriptive statistics Mean difference test

Stage 2: Economic impact evaluation

The bases for comparison are the GI product and one or more substitute products (See Box 1). The three levels of economic impact evaluation defined previously are meso- (value chain), and micro- (businesses) levels, and resilience. Indicators were set in 5 dimensions, as follows. The variables to explain were (1) Economic dimension and (2) Resilience. The explanatory variables were the legal protection, the governance and the quality management.

Methods: Quantitative data are given priority for each indicator, for at least 5 years, but if possible much longer, to allow a discussion of price transmission, market power transmission, market stability, and the control of volatility which is an essential point in stabilizing stakeholders' expectations.

Sources of data: statistics if available. Analysis of long-term series (e.g., over 20 years). Where possible, data for at least 5 years was to be obtained. Qualitative information was to be collected from a representative number of stakeholders (or experts) in such a way that they can be converted into scales (e.g., the Likert scale). Apart from collecting data on prices at different points in the value chain, information was to be collected on the way prices are set at the various points.

Box 1. Statistical method of GI Impact evaluation.

An evaluation was carried out through in-depth quantitative analysis with a search for correlation explaining the economic impacts. To provide detailed outputs on the economic impacts of the GI process methods are based on comparative time series (the diachronic method - before and after the GI process), or between the GI product and its non-GI substitute (the synchronic method), through econometric methods (mean comparison test, synthetic control and cointegration test). The methods used depend on the availability of data. The bases for comparison are the GI product and one or more substitute products. The 3 levels of economic impact evaluation defined previously are the meso level (value chain), and micro level (enterprises), and resilience. Indicators have been set as follows:

- variables to be explained relate to economic performance (price, income, volume of production, exports) and resilience;
- explanatory variables relate to legal protection, governance, and quality management.

A descriptive statistics approach was also adopted for each case.

Mean comparison test

A mean test was conducted to compare GI producers' performance before and after adoption of the GI, when we cannot implement synthetic control because of the lack of control groups. Generally, two types of variables were used: economic variables, which include number of farmers, marketing, price and income; and physical variables, which include acreages and yields. For each variable, a mean test is performed in order to compare the mean value before the GI and the mean value after the GI. To put it another way, the null hypothesis of no difference before and after the GI is tested. A t-test was conducted. If the null hypothesis of no difference before and after the GI is rejected at the significance level of 5%, the results indicate that variables have significantly increased after adoption of the GI. This increase may be partially, but not wholly, explained by adoption of the GI.

Synthetic control

Previous studies evaluating the impact of GIs used either a diachronic approach (before and after GI registration), or a synchronic approach (comparison of two similar products, one with a GI and the other without) (Hughes, 2009 [30]). However, one drawback of these approaches is the difficulty of separating the impact of GIs from other factors such as technological advances, quality control, advertising or policy dynamics (Bramley, 2011 [31]). The synthetic control method introduced by Abadie and Gardeazabal (2003 [32]), followed by Abadie *et al.* (2010 [33]; 2011 [34]), was proposed because it is primarily designed to overcome the limitations pointed out above. It provides a data-driven procedure to build a synthetic control unit based on a convex combination of comparison units that approximates to the characteristics of the unit that is involved in the GI process. The synthetic control approach consists of 5 steps:

(1) Select the outcome variables
(2) Select the relevant predictor variables so as to better match the treatment unit (GI product region) to control regions (or countries)
(3) Select the period during which the difference between treatment unit and synthetic regions is minimized (two periods are distinguished: the first, known as the input period, represents the pre-treatment period)
(4) Identify a pool of potential control countries from which the synthetic group is constructed (potential control regions or countries should not include regions or countries where the introduction of PGIs has taken place)

(5) Robustness checks (falsification test and mean squared prediction error test).

Cointegration test

For resilience evaluation, there are two approaches underlying this concept in the present study:

- first, by considering the GI as a tool to de-commodify agricultural products: it can be assumed that a GI can help to build a resilient production system by limiting the transmission of international price fluctuations to the domestic price; in econometric time series language, it can be said that the two markets are not cointegrated; the Engle and Granger two-steps approach (1987, [35]) was used to analyse the transmission of the international or domestic price to the local growers' price;
- second, by testing the ability of the GI market to absorb price shocks: this method uses the same approach as in price transmission; however, unlike price transmission analysis, a horizontal relationship is involved, analysing the price at the same market level (in this case at world level).

Stage 3: Causal relations

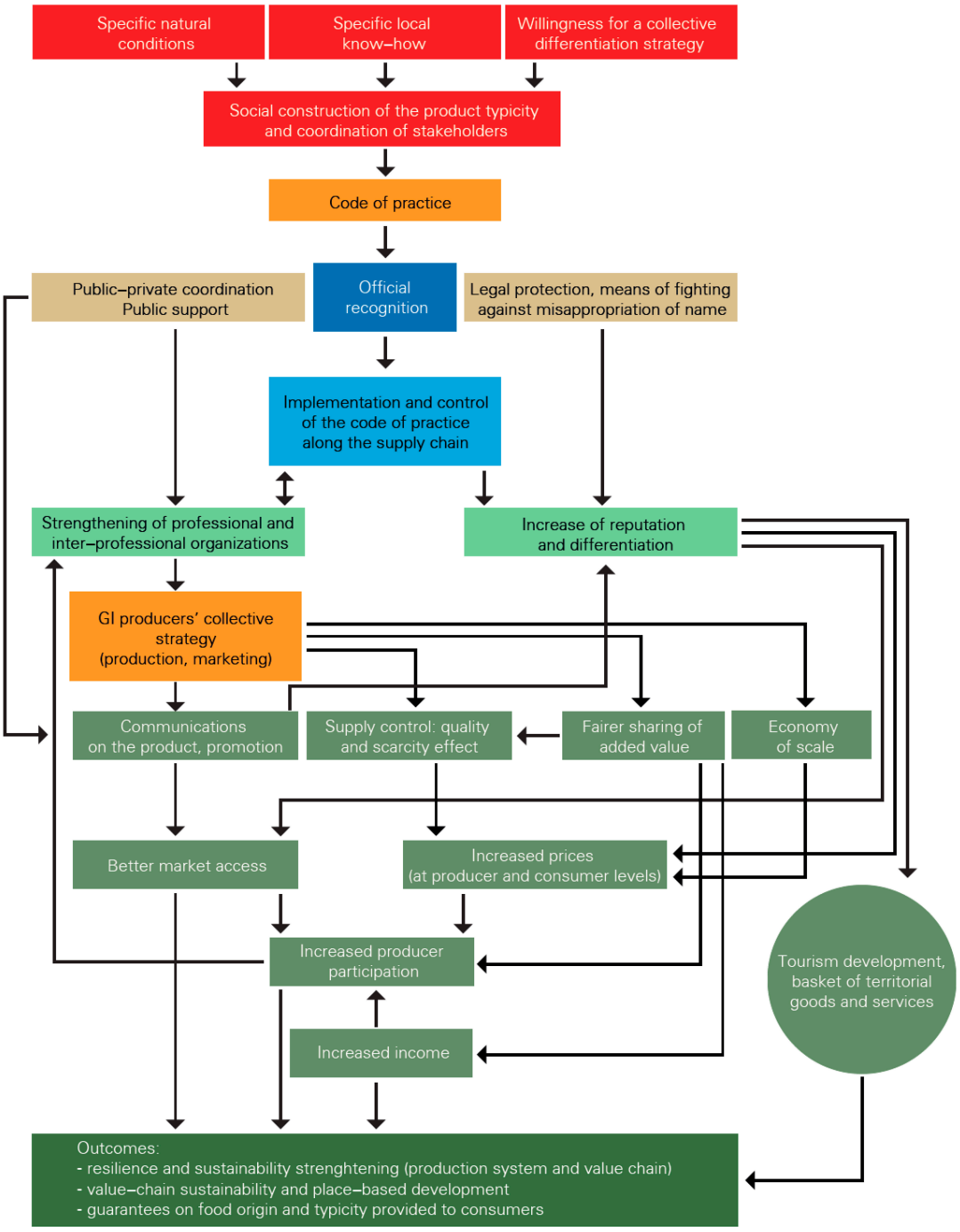
At this stage, the objective is to set up a causal diagram, which describes the links between explained and explicatory variables, in a narrative way (and if possible with a diagram, Figure 1 below). The objective is to link the effects observed at the economic impact level (economic status and resilience), with the causes, which can be identified in many aspects:

- The local setting around the GI (composed by both the natural and human factors of the territory, which confer specificity to the product);
- The history of the GI (in the two dimensions of the history of the product and of the social construction of its quality, including its registration as a formal GI);
- The other explanatory variables that have been pre-identified for all cases, like juridical protection, quality, and governance;
- Any other cause, which could be very case-specific.

Stage 4: Discussion with the stakeholders

The aim here is to see what the advantages of these systems are from the stakeholders' point of view, and also their perception of the levers of economic and territorial development. The stakeholders to be included are those directly involved in the value chain, but also, more broadly, other economic actors who may have a connection with the GI, including actors from other economic sectors (such as tourism) or political actors such as local communities or support institutions (bodies involved in research, agricultural advice, regional development).

A priority here is a discussion of the analysis of economic and territorial impacts, based on the views of experts and other stakeholders in the system. This discussion may be filled out with analysis of the specific contributions of each case, compared with the results found in various bibliographical references. This allows a validation of the conclusion and critical comments on the approach.



Source: authors' elaboration

Key:

- The mechanisms at work raising the GI process: red
- "Coordination tool": orange
- Institutional impacts: grey
- Economic impacts: green (light to dark for the direct, indirect and final impacts)

Figure 1. Potential of the economic impact of the GI process.

RESULTS

The GI Products and Their Related Value

The GI products and their related value chains have been described in 9 Masters' theses and their main characteristics are presented in Table 3 below:

Table 3. The 9 case studies.

Case study	Main characteristics
Café de Colombia (Colombia)	This GI applies to a flagship product on the international market. The strong reputation of Colombian Coffee is the result of a long strategy of differentiation, based on quality management linked to the branding of "Colombian Coffee" since the introduction of the Juan Valdez trademark in the 1980's. The governance, political legitimacy and (minimum) price setting were put in place before GI protection. Small producers get a premium. It also contributes to the strengthening of Colombia's global reputation. The governance of this GI is very effective: the national Coffee Federation strengthens its political legitimacy notably through its efforts to promote coffee in Colombia, as well as the setting of a minimum price paid to producers.
Kona Coffee (USA)	This GI has a strong reputation and shows significant positive economic impacts that benefit the small coffee growers. Two visions of the GI coexist in this case, which is a source of tension between the actors in the sector: • The GI as a tool of differentiation in the international market for a high-quality coffee, a niche product based on a solid reputation, though allowing Non-Kona and Kona blending even if there is a risk of name usurpation and fraud; • The GI as a territorial development tool, with the maintaining of small farms and the development of farm-shops, integrating all the tasks from production to marketing, and offering 100% origin "Kona" to informed and demanding consumers.
Taliouine Saffron (Morocco)	This GI's approach aims at encouraging a flagship product development within a territorial dynamic, to boost local development and to stop rural migration in an economically marginalized zone. It is based on a set of specifications incorporating traditional practices, being very open, and all producers have the status of GI-users. The introduction of the GI has a positive economic impact on their income. This approach has a leverage effect on the structuring and professionalization of the value chain. A strong public policy to support small-scale agriculture contributes a lot to that structuration, especially by the creation of a 35 cooperative network. The lack of strong empowerment of the actors impacts negatively on the economic impact.
Futog Cabbage (Serbia)	This recent GI targets local production with a dual objective of preserving a local plant variety and enhancing economic development. As the reputation of the Futog cabbage was well established in Serbia, the effect of certification on prices was immediate and positive for producers. A single processing unit gives a strong positive effect to the GI-process, but is not paying back the farmers proportionally. The relatively young institutional framework implies a certain collective learning of the new system, mainly in order to perfect procedures and sensitize all actors, in particular producers and consumers.

Table 3. *Cont.*

Case study	Main characteristics
Queso Manchego (Spain)	The registration of Queso Manchego as a GI has allowed the protection of a specific sheep breed and know-how recognized for a long time. As a result, the cheese makers were able to face strong competition and all risks of usurpation. This old GI is well organized, sustained, efficient, and largely open to export. Recently the value chain has faced a crisis. The resilience of the value chain was very good. The stakeholders have been able to access new markets, especially the American market. As a consequence of the fast growth of the market demand in the US, the producers' organization has taken a decision to change the code of practices, relaxing some requirements, to be able to produce more quickly. Therefore, tensions have emerged between the "old traditionalists" and the "new entrepreneurs".
Tête de Moine (Switzerland)	The development of a technical innovation to serve the cheese made it possible to revive the Tête de Moine cheese value chain in the 1980s. This product has a very strong reputation. It occupies a seasonal niche market (in winter), with a high price premium. Farmers and processors incomes are supported by the diversification of cheese factories in another PDO cheese and other specialties. The agricultural sector and the GI itself are strongly supported by public actors and all this support consolidate the positive impact of the GI process. The various professions involved are well organized and effective in promoting the product.
Darjeeling Tea (India)	This GI was set up to protect the very well-known name of an old export commodity, and to develop new markets. This strategy, led by the State, is more a response to usurpation, and to cope with the raising demand of sophisticated consumers in the international market, than to an endogenous dynamic. The impact of the GI process on the economic welfare of the producers, and on the improvement of the social standards for the employees are positive.
Penja pepper (Cameroon)	The implementation of the GI has had a prime mover/driver effect on the entire pepper value chain (GI and non-GI) in the region and beyond, allowing significant technical upgrading in terms of productivity and quality, as well as an important impact on local development. The GI strategy has put an emphasis on including farmers in the governance, in reducing usurpation of the name, and in paying the premium achieved on the remunerative European markets to the producers. The role of the new inter-professional body, which brings together producers, nurseries and distributors, is decisive for developing collective action, in particular by ensuring an annual minimum price for pepper from Penja paid to producers. The certification is not yet completely achieved.
Wine Vale dos Vinhedos (Brazil)	This GI approach was initiated in response to competition from foreign wines. It was based on the identity of the valley and contributed strongly to its touristic development. It has also had a driver effect on wineries, which have adopted innovative practices in the valley and beyond, which has had a negative impact by increasing the risk of usurping the name "Vale dos Vinhedos". The evolution from a Protected Geographical Indication (PGI) to the Protected Designation of Origin (PDO), which is more demanding on farming practices, has led to the exclusion of certain farms but also contributed to the adoption by new PDO users. This PDO product is positioned as the flagship of the Valley and is a driver effect for rural development. An indirect effect has been the increase of land prices, leading to new tensions in the region and supplementary costs for the producers. The GI approach has increased the incomes of the wine-producing establishments, and the role of the producers' organization (APPROVALE), which is strongly supported by public players, is key in its development.

The search for the economic impacts of these GIS has been done according to the methodological approach described above. The results are summarized in Table A1 in the Appendix below. GIs generate a higher

value distribution to primary producers, and have a positive influence on production, especially in the long term. In general, price paid by the consumer and paid to producers have increased. GIs enhance market access, and they can be useful tools for building resilient value chains, especially by boosting the diversification of markets. Through a domino effect, GIs can also have a substantial positive impact on other sectors of the economy.

The identification of the key elements of their economic performance has been done through econometric analysis, presented in detail in 9 separate reports, which are the basis for the quantitative assessment. When additional material has been collected and analysed, it has been reported and interpreted in Table A1 in the Appendix below.

The Potential of the Economic Impact of the GI Process

Building on the 9 cases, the economic impact and key steps in the GI process, starting from local resources and a willingness for collective action to obtain benefits for the whole area, can be synthesized in a roadmap (or impact pathway) leading from the potential of a GI product in a given area to economic impacts and externalities for rural development. The potential economic impacts of a GI process are shown in Figure 1 above.

The GI process starts with the social construction of the product typicity when local stakeholders, particularly farmers and processors (the "producers' group"), decide to develop a collective strategy to preserve and/or promote their origin-linked product (in the diagram "social construction of product typicity and stakeholders' coordination"). The producers' group first discusses and defines the common rules. Existence of specific natural resources, specific know-how and willingness to act collectively are the main pillars which support the emergence of the GI process. All these elements (in red) are preconditions for official recognition and registration of the GI (in blue). During the GI process, two "coordination tools" are the main outputs of the discussions between the local stakeholders: specifications (a code of practice) and the GI producers' collective strategy concerning production and marketing (in orange). The specifications lay down rules as to the level of agricultural production and post-harvest techniques and define the production area.

The registration and official recognition of GIs have two institutional impacts. They formally bind local economic operators to governments that recognize the GI, bringing (i) public/private coordination (and, depending on country and policy, some public support, even financial, to facilitate GI development) and (ii) legal protection of the GI, with possible action to counter misappropriation of the name and the misleading of consumers.

Induced impacts derived from implementation and control of the specifications in the supply chain (light green rectangles in the diagram) are as follows:

- Increased reputation and differentiation: the struggle against misappropriation and misrepresentation can boost the product's reputation and differentiation, which may have been tainted by possible counterfeiting. Associated with effective control of the specifications, this may provide consumers with stronger guarantees on the geographical origin and characteristics of the product, so that they are then inclined to pay a higher price for the original product. In cases where the GI did not have a previous reputation, registration supports the creation of this reputation. Consumers can recognize a specific quality through such a signal, and their willingness to pay may also increase.
- Strengthening of profession and inter-profession coordination within the GI value chain allows the development of a GI producers' collective strategy, covering all the GI system components. This collective strategy allows coordination of action in the fields of production, communication and pricing policy, resulting in efficient promotion of the product, control of the supply, and a fairer sharing of added value.

These mechanisms lead to economic impacts (in green). The price increase makes the GI more attractive for local producers, who may initially be reluctant to pay certification costs and in some cases to change their practices to comply with the specifications. The increase in the number of producers, and their contributions, and in the quantity of certified products may provide the GI organization with additional financial resources for (i) establishing efficient monitoring and traceability systems and (ii) carrying out promotional and communication activities on the product. The reputation of the product grows through these two processes, and a virtuous circle appears.

Collective agreements made within the formal GI organization may create economies of scale and bring about changes in the distribution of added value in the GI sector (fair sharing) and collective supply management to ensure quality, avoid crisis overproduction (supply control), and sometimes create a scarcity effect to push the price up. Both phenomena make the GI sector more attractive in the eyes of local producers, who then adhere to the GI in greater numbers, reinforcing the virtuous circle. The increase in GI prices can have significant effects on producers' income, even after the potential additional production and transaction costs are deducted.

Other economic operators in the area, or outside it, may also benefit from a higher income. The GI value chain can have externalities for other local goods and services, these effects being particularly substantial if the reputation and consumer recognition of the GI product are strong. The GI product can participate in such elements of territorial strategy as "baskets of territorialized goods and services" (Hirczak et al., 2008 [36]) that generate other externalities for the area in relation to tourism and local consumption. This can lead in turn to a local development phenomenon able to slow down the rural exodus and the marginalization of rural areas.

When it works, a GI can be a powerful regional planning tool. Outcomes also cover consumer welfare, with guarantees of food quality and origin, and the preservation of dietary diversity.

DISCUSSION

The analysis of the 9 cases allows confirmation of the success factors identified in the literature: the specific quality formalized in the code of practice, the collective action organized in a structure with good governance, the effective marketing strategy, and the legal/institutional framework.

The Specific Quality Defined in the Code of Practice

Quality differentiation is identified clearly as a pathway for generating positive economic impacts to farmers, especially in terms of price (see the results: in all our cases, the prices for the GI products are higher than their respective benchmarks). Based on our results, the income of farmers or processors is positively impacted, because the production costs remain below the selling price (true for the four cases analysed from this perspective).

The positive effect of the GI on prices (and incomes) is at least partially, directly or indirectly, due to the quality effect that allows the consumers to identify a real advantage for them when buying the product. Besides this consumer effect (increase of the willingness to pay by the consumers), the effect on price is also linked to the higher protection of the product through the Intellectual Property Rights protection. The risk of the product being degraded through imitation and so confusing consumers is lower. Such risks appear when producers, who do not respect the same conditions of production and therefore do not face the same costs of production, offer similar products to consumers at lower prices. This unfair competition exerts pressure on the producers offering the quality that satisfies the consumers and supports the reputation building process of the product. The price premium is better maintained because the code of practice requires competitors located in the area of origin to fulfil all conditions, so they therefore face the same costs, to enter the GI system, and from competitors localized elsewhere are totally excluded (Barjolle and Jeanneaux, 2012 [24]).

The key element is to offer the expected quality to consumers. Quality has a broad sense in this perspective (Allaire, 2003 [37]). This quality is not only linked to superior characteristics like better texture, appearance, or taste (material attributes of quality). It includes other characteristics linked to the specific origin, for example specific cultural features (like traditional meals or events: symbolic attributes of quality). The specific quality that origin provides to a given product is the basis of the differentiation strategy for the product to enter place-based or territorially-differentiated niche markets (Bramley, 2011 [31]). From this

perspective, typicity represents a unique market positioning opportunity in a globalized market.

The strength of the specific quality linked to origin as a key driver of any differentiation strategy also depends on the type of GI strategy as developed by the producer group. When the strategy has a "defensive" perspective it aims more at defending a strong reputation against unfair competitors, this is different from the "offensive" perspective where the strategy is to better establish the reputation of the GI product. In the defensive case, reputation has been established for a long time, and in our cases, is linked to specific practices, all already put in the code of practice. For example, for Colombian Coffee or Darjeeling Tea, the premium price pre-existed the registration of the name of the product as a Geographical Indication: the consumers already know the quality linked to the product. In the offensive case, the reputation has to be strengthened, the registration and then the certification often mean that the code of practice introduces innovative practices to upgrade the quality, as in the cases of Penja pepper and the Vale dos Vinhedos wine. The economic impact is then clearly linked to these steps in the implementation of the GI.

In the case of the "Tête de Moine", the economic impacts were linked to another type of innovation. In this case, the innovation was linked to the way of consuming the GI product, and occurred after registration. This innovation was the introduction of the Girolle, a tool to eat the cheese.

Collective Action and Governance

The local resources provide the basis both for differentiated physical components of the final product and for intangible and symbolic attributes (Barjolle et al., 1998 [38]); Belletti et al., 2015 [19]), and such an activation of the local resources to define the typicity represents a social construction process (Casabianca et al., 2011 [25]) based on the producer's collective willingness and coordination for a collective differentiation strategy. These local resources are diverse and many are uniquely combined in the production. For example, for Queso Manchego, among the different local resources, one which is particularly important and specific is the breed of sheep. For Kona coffee, the island situation with the specific local climate and the volcanic soils provide particular organoleptic characteristics. In general, the code of practice contains details about what the local resources are and helps to protect them to ensure that they are passed on to future generations.

Because of its collective nature, the GI process strengthens collective action in the territory by bringing together different stakeholders, as observed in all cases. The level of governance can be associated to the type of actions and levels of economic impacts.

On the one hand, horizontal coordination allows for a shared vision about the quality definition and management, and economies of scale in terms of production/processing and marketing. On the other hand, when stakeholders share their vision vertically along the value chain, the

distribution of the added value strategy (fixing of minimum price, as in the case of the Colombia coffee and Penja pepper) is allowed. In the Penja case, the GI organization (putting together input suppliers, producers, and traders) is very young but already leads to an agreement on minimum price, collective purchase for production, etc. Some cases demonstrate clearly the running of well-established multi-profession bodies, like for "Tête de Moine" cheese, "Manchego" cheese, and Colombian Coffee. Formal "inter-profession bodies bring together vertical and horizontal organizations, ensure coordination among stakeholders, and provide a strong governance structure with powerful effects. These organizations have clear rules of functioning, and provide an important list of advantages to their members. This formal organization of the collective decision-making process has led to services for their members in five dimensions:

(1) Quality upgrading. A strong GI organization enhances the certification independently from the national context and size of the GI system. In many cases, they take a role in quality management. Especially, they provide excellent traceability and guarantees systems, as demonstrated by Darjeeling tea, Colombia coffee, Futog cabbage, Tête de Moine cheese, Manchego cheese, and Vale dos Vinhedos wine.
(2) Ensuring bargaining power of a group of actors, in particular producers towards downstream actors.
(3) Market information. The GI organizations may organize transparency on the market, as it is the case for the Colombian Coffee where *Federación Nacional de Cafeteros de Colombia* (Fedecafé) publishes regularly green coffee prices on the market to farmers.
(4) Allowing economies of scale in providing services or goods (in the production, or the promotion so to reinforce the signal component of GI).
(5) Getting public support. In some countries, public aid can depend on the existence of an organization of producers (example of Saffron de Taliouine case for the support to certification to cooperative).

Nevertheless, the bargaining power of producers towards downstream segments of the value chain is not always strongly manifested. For example, in the case of Futog cabbage, the unique processor is in a monopoly position and this may weaken the GI system if the main part of the added value is kept at the processor level. In the case of Manchego cheese, the recent change in the market strategy to benefit large-scale actors instead of the smaller and traditional ones, makes the link to origin less strong and potentially less sustainable in the long term. In the case of Colombia, despite the national Federation being very strong and fair towards the small-scale producers, long series of data show that the increase in the international price is passed on with less impact on producer's price than when the international price falls.

This sheds light on an important aspect: the strength of the organization is not sufficient to lead to positive economic impacts. A good illustration is the case of Taliouine Saffron, where public support was given to improve the structuration of the value chain and to establish a strong GI organization: the number of cooperatives from 2010 and 2014 multiplied by 7, and an overall GI organization was created (including all cooperatives, economic associations ("groupement d'intérêt économique"), and businesses. In the case of Talioune, the public support stressed the structuration, and the empowerment of the producers may be not really as strong as it should be, which may weaken the long-term organizational capacity. An important ingredient for governance is trust and solidarity among actors, to lead to the necessary local combination of cooperation and competition (the "coopetition") (Dagnino & Padula, 2009 [39]).

Finally, it is interesting to see how in the case of Colombia coffee, the GI process, both at national and European levels, may have also played a direct role for the organization in terms of reinforcing legitimacy (Barjolle et al., 2017 [40]).

Effective Marketing Efforts

One key role of the GI organization is to define and manage the collective part of the marketing strategy. This collective action is complementary to the individual efforts of the GI's actors, who continue to manage their own marketing strategy in parallel.

Through our study, we can observe how the stakeholders' engagement in the marketing efforts influences the economic impacts.

(1) Branding the GI—Many case studies show that the capacity to build agreements with downstream actors is key for the economic impacts. It strengthens the visibility of the GI product, and the correct use of the registered name of the product at the point of sale. This is particularly important in the cases where the GI system has been essentially developed among producers, either because the GI essentially cover a commodity while processing take place outside of the production area (e.g., Colombia coffee or Darjeeling Tea), or because farmers and processors are not directly selling to consumers and the retailers are not interested in the GI strategy to retain their bargaining power. An interesting example of how to better activate the signal to consumers is given by the strategy of the Coffee Colombian Federation. First, the code of practice covers the final coffee—without being specific on the quality requirements at this stage. Second, the use of the GI by the final market actors depends on an agreement between the Federation and the business, so as to ensure some compliance to the branding strategy (use of the name linked to the compliance with the code of practice).

(2) Exclusivity strategy—Our case studies show that the marketing strategy is driven by the kind of GI approach (offensive, defensive) and the market channel (niche or mass). The best economic impacts in term of price are when the GI organization adopts a strategy where the prices are not reduced by big volume increases, which exceed the demand. The "exclusivity strategy" refers to the definition of the level of requirements in the CoP that determines the quality level compared to non-GI product, and consequently a certain inclusiveness of producers as a result of their capacity to meet the requirements. To illustrate this, we can refer to two opposite examples: on the one hand, the Saffron of Taliouine has adopted the non-exclusive strategy: the CoP accepts all existing practices, allowing all saffron in the area to use the GI. Two "commodity" cases (Colombia coffee, Darjeeling tea) have big volumes on the global market and the objective of benefiting all producers. They are therefore not following the "exclusivity strategy". On the other hand, the "Tête de Moine" cheese is exclusive: the code of practices accepts only cheeses with raw milk coming from less than 25 km far from the dairy and matured for 60 days. The Futog Cabbage is another example of this "exclusivity strategy" which is associated with a specific low productive variety, or the Vale dos Vinhedos wine PDO which accepts only winemakers who have invested in the *palissage* system with a restricted number of varieties and lower yields. In addition, the Kona coffee is developing a positioning on niche markets, direct consuming and selling, and therefore "exclusive". In the middle of these two positions, we have cases where the strategy is not yet clear. For instance, Penja pepper could still decide to invest marketing efforts towards a niche market, positioning the origin pepper as an exclusive product (like the Kampot pepper from Cambodia which targets chefs), or to continue competing on the pepper commodity market. Exclusivity is associated with lower volumes and potentially higher prices, but that benefits fewer producers compared to a non-exclusive strategy. Depending on the situation, one strategy or the other may be more suitable, or could depend mainly on the decision of producers engaged in the strategy.

(3) Access to new markets—Thanks to its long existence, the Manchego case illustrates how the code of practice can serve an evolving marketing strategy. Initially developed by small-scale producers to differentiate their cheese from the others made from more productive sheep, and preventing usurpation, the code of practice has evolved more recently to serve the objective of reaching new markets. To be able to meet the demand, the producers' group has chosen to change the conditions of production in the code of practice. The new code of practice now allows feeding the sheep with more concentrates. New large-scale actors have entered the production, and this has supported a rapid development of the export markets, especially in the USA. This has resulted in an increase in volumes.

The Legal Framework and the Role of Public Sector

A sound legal system for Intellectual Property Rights protection is a key success factor. As a protection of an Intellectual Property Rights, the GI process improves market efficiency by reducing asymmetric information, through providing information to consumers and by limiting unfair competition and free riding behaviour, thanks to the enforcement of the GI's legal provisions.

Kona coffee is an example of the failure of the legal framework to protect producers and consumers against misleading use of the name. The name is registered under a trademark with some basic rules for its use (except the localization in the Kona area, i.e., the larger Hawaii island): this leads to different types of product under the GI "Kona": containing from 10% to 100% of Kona coffee, which provide different types of "Kona coffee" for consumers. These basic rules and product definitions bring conflicts in the value chain. The success seems not to be directly linked to the protection of the name related to a set of properties/requirements. Although premium price is effective for all "Kona" coffee (compared to other Hawaii coffee), we can assume this premium to be lower than if the GI was reserved for 100% Kona coffee. Currently, the farmers promote the low volume reserved for 100% Kona coffee, hoping for a high price, and they do not care if the turnover for the entire supply chain is low. Wholesalers promote a high volume reserved for 10% Kona coffee at lower price, but with a small premium, giving a relatively high turnover for the whole supply chain. Now the wholesalers control the situation on behalf of the economic advantage for Hawaii State. Therefore, the success factor for producers appears to be important niche markets which value the cultural assets associated with the Hawaii production area: firstly the domestic market with direct sales and tourism ("boutique farm"), and secondly for wholesalers the driver of their success is the strong market demand in Japan and other American states.

On the contrary, for the "old European" cases, Manchego cheese, Tête de Moine cheese, as well as for the Darjeeling tea and Colombia coffee cases, the legal and institutional frameworks seem to provide all the necessary functions and clear information to users, so as to protect producers and consumers in an efficient way. The fact that the GI legal and institutional frameworks are ancient has allowed stakeholders to learn collectively so to reach a fluid functioning.

For the other cases, the legal and institutional frameworks are more recent and a learning process is ongoing at the institutional level. The main difficulties appear when it comes to the GI use and certification of the product; for example the long period needed to establish the certification system for Penja pepper; the reduced number of producers involved in Futog cabbage in Serbia, because many of them prefer to "wait and see" to better understand the advantages and constraints as the official procedures may not be sufficiently clear at the moment; the lack of clarity about the simultaneous use of PGI and PDO in the case of the Vale dos

Vinhedos wine. These weaknesses in the functioning of the implementation of the GI legal dimensions have been identified as hindering factors for the economic impact of the GI process.

Another function of public actors is the support to GI development to enhance its contribution to public goods (FAO, 2009 [41]). Three main situations can be observed regarding the role and importance of public intervention:

(1) *Public support to the GI promotion by local and/or national authorities*: this is the case for Tête de Moine cheese for which the inter-professional body gets significant public financial support for the advertising, and gets as well the legal enforcement of its decisions, when by majority vote, if needed. Vale dos Vinhedos wine gets support for the development of the PGI and the PDO. Kona coffee has been strongly supported by the Hawaii department of agriculture for creating and registering the Trademark (TM). In the cases of Futog cabbage and Penja pepper, strong public aid was given during their establishment phase, as public authorities (Serbian government, the Intellectual Property African organization) participate in the cooperation project that support their development. It is important to note that, in a broader perspective, Serbian and Cameroon GIs do not benefit at the moment from public GI support policies.

(2) *Strong public/private coordination in the GI management*: this is the case for Colombia coffee where the export fees are managed by Fedecafe to be invested in the value chain, and the GI strategy has been discussed and approved by public authorities; also in the case of Manchego cheese, local authorities are members of the regulatory body.

(3) *Direct involvement of public actors in the GI process decision making*: the Darjeeling tea case is unique, public authorities, through the national Tea Board, directly manage the GI system, in collaboration with the Darjeeling association that was created in a second stage. The saffron of Taliouine may be also part of this category, as local authorities (who presented the request for registration) and national authorities (through important funding and their conditions) have shaped the GI system.

These observations show that public authorities always play a role at some point and in some levels, in the support to GI development, taking different forms according to the context and history of the case, as has already been identified in other contexts (Biénabe & Marie-Vivien 2015 [42]; Fournier & Durand 2012 [21]; Barjolle et al. 2017 [40]). Such involvement is beneficial for GI development, especially in the initial stage (to support the first certification costs, like Futog cabbage or Saffron of Taliouine). From a long-term perspective, the empowerment of the local actors is crucial, otherwise, reality shows that low understanding and/or

decision power over the GI system from the producers lead to strategic failure, like in the case of Saffron of Taliouine or Darjeeling tea.

Investment Capacity, Territorial Dynamism and Size

As highlighted above, investment capacity and territorial dynamism can also be considered as success factors for GI impact, although not independent from the governance and policy support aspects.

The importance of local support and investment, as a key element to initiate the GI process, is particularly demonstrated in the cases of the Penja Pepper, Taliouine Saffron, and Futog Cabbage. The territorial dynamism was not the focus of our research, but we have identified strong governance at local level as necessary for scaling up the reputation effects of the GI. The capacity of the GI organization and producers to coordinate with local actors may boost rural development, with impact on the other local activities (production of other goods and services, tourism). In this regard, the Vale Dos Vinhedos wine is very interesting as it shows how such a strategy can pre-exist and determine the GI process. In the case of Darjeeling Tea, the expansion of tourism around the Tea garden, linked to the splendid landscape offered by the Tea plantation and the Tea "culture" is exemplary of what can be developed in that sense.

Another dimension is the impact on preservation of local resources: specific characteristics are often strongly determined by a local variety or breed. For example, in the case of Futog cabbage, the specific local variety determines the organoleptic characteristics (thinness of the leaves and sweetness) of the final product. In that case, the code of practice, as formally examined by public authorities and included in the registration process, is an important tool for the *in situ* conservation of such a less productive and fragile cabbage variety.

CONCLUSIONS

This paper presents the economic impacts of 9 GI "processes". The research shows that the economic impacts are positive in all cases. This is an important result because it highlights that when a GI meets the legal definition of a GI and is really in use (code of practice, group of producers, market), the economic impacts always occur. An important element to highlight here is that the 9 cases are very diverse—different types of products, different local contexts, different strength of the link to origin: some can be considered as "terroir products" (raw material is also produced locally, the interactions between human and natural resources is strong, such as in the case of PDO), but others have mostly a reputational link (because of the dimension of the area which does not allow specific "terroir effect" like in the case of Colombian coffee or Darjeeling tea). We have understood formal institutions protect GI products against usurpations, but formal institutions result from collective action. Therefore our methodological framework seems relevant to analyse non-

terroir based productions linked to a specific place by a localized traditional know how.

The pathways to impacts were analysed and confirm the key elements found in the sparse literature, which play a role in contributing to achieving positive economic impacts. The first element which contributes to impacts is the existence of specific characteristics linked to the geographic place where the product comes from. The transcription of these characteristics in the code of practice and the quality management system, both contribute to the consistency of the differentiation strategy over time. Therefore, the second element is related to the existence of effective collective decision-making processes, made by a strong producer organization. This organization is the one which decides precisely the content of the code of practice. Also, other collective decisions may strengthen the effectiveness of the differentiation strategy, like quality upgrading, market information, lowering of certain collective costs like research, access to public support, etc. The main additional dimension that has a direct influence on the economic impact is the marketing strategy, both at individual and collective levels of the GI value chain. An effective marketing strategy is a mix between the branding that may increase the notoriety of the product, the positioning of the product on the market, and the access to new markets. Adaptation of the content of the code of practice may be necessary to adapt to market changes. In addition, public support is a major component that may boost or hinder the GI process, and therefore has a strong influence on the economic impact. The aid given by the public sector may be enhanced by the private sector, in efficient public/private partnerships. The limit of the state's involvement is certainly the lack of empowerment of the value chain actors that weaken the long-term efficiency of the producers' organization.

Thanks to their link to origin, GI products can be the pivot for implementation of an origin-linked, quality virtuous circle (FAO, 2011 [43]): the market tool can indeed also provide positive externalities to contribute to the preservation of local natural and human resources, and therefore to the three pillars of sustainability. Official GI recognition and registration act as incentives, both for value chain stakeholders (producers and downstream actors) to create perceived values, and for public authorities to generate and enhance public goods (Vandecandelaere, 2016 [44]). Such a strategy is particularly relevant for remote or fragile areas (Colinet *et al.*, 2006 [45]), where intensification of agricultural techniques is not a valid option and where a GI process may represent the only means of generating price premiums to cover high production costs and therefore maintain production and economic activity (Barjolle *et al.*, 2011 [46]; Parrot et al., 2002, [47]; Jeanneaux, 2018 [48].

GIs provide an appropriate basis for sustainability thanks to the link to origin and the capacity for "the reproduction of local resources" (FAO, 2011 [43]), i.e., preservation of the territorial, natural, and cultural assets which underlie the origin-linked quality and reputation of the product. We

see GIs as tools to signal to local communities that their traditional food systems are sustainable and strategic for local development because they are able to provide food autonomously. Even if a single product in a region becomes a GI, it is a signal for raising awareness among local communities in developing countries about the value of their traditional food system. For example, the Penja pepper in Cameroon is not a traditional food system but only an ingredient in it. If foreign consumers buy this product, it means that this product has great value and can help local producers understand that their traditional food system is valuable. The GI is therefore a driving force to preserve the traditional local food system and to avoid importing an external food system which threatens self-reliance and increases dependence on others. However, economic development, environmental preservation, and social welfare may sometimes be seen as having trade-offs. The key therefore is to provide local stakeholders (producers, but also facilitators and local authorities) with the information and tools to make the necessary assessment and decisions, looking to the future of the GI system, including local resources. From this perspective, producers should think of sustainable development as a strategic orientation for preparing their own future by considering two important factors:

- sustainability of local resources: in the long term, over-exploitation of natural and human resources will damage the GI system itself and its viability;
- sustainability is increasingly being requested by consumers and is becoming a condition for market access, while negative impacts on environmental and social aspects could damage the image of a GI product and the GI category of products.

For further details, we suggest to look the report as follows: Vandecandelaere E, Teyssier C, Barjolle D, Jeanneaux P, Fournier S, Beucherie O. Strengthening sustainable food systems through geographical indications: an analysis of GI economic impacts. Rome: Food and Agriculture Organization of the United Nations (FAO) and BERD. 2018. 135p. [49].

AUTHOR CONTRIBUTIONS

EV was the general supervisor of this study with the collaboration of CT. The whole authors designed the study. They were in charge of one or two case studies and supervised MSc Students.

The details of this article can be found in the report: Vandecandelaere E, Teyssier C, Barjolle D, Jeanneaux P, Fournier S, Beucherie O. Strengthening sustainable food systems through geographical indications: an analysis of GI economic impacts. Rome: Food and Agriculture Organization of the United Nations (FAO) and BERD. 2018. 135p. [49].

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

This research was supported by the Nutrition and Food System Division and the Investment Center, under the FAO/EBRD cooperation.

ACKNOWLEDGMENTS

The authors wish to acknowledge the key contributions of Patrick Jeannot Ngoulma Tang and Aliou Baguissa Diallo who provided key contributions in assessing the economic impacts through statistical analysis and to Giovanna Michelotto-Pastro who drafted the fact sheets of the case studies presented in this publication.

The authors also acknowledge the important roles of master's and doctoral students in collecting field data and providing a qualitative analysis for each case study: Clement Charbonnier (Penja pepper, Cameroon), Axel Magnan (Tête de Moine cheese, Switzerland), Giovanna Michelotto (Vale dos Vinhedos wine, Brazil), Rossman Mutarambirwa (Taliouine saffron, Morocco), Elena Ovchinnikova (Futog cabbage, Serbia), Sophia Ponce (Manchego cheese, Spain), Aparna Sridhar (Darjeeling tea, India), Paulo van der Ven (Colombian coffee) and John Woodill (Kona coffee, United States). Thanks are extended to Herman Comoé who provided assistance in reviewing the literature on the economic impacts of GIs.

APPENDIX

Table A1. Summary of the economic impacts of the GI process, for the 9 case studies.

Case studies	Price	Costs, profit
Café de Colombia	A premium of 38 cent US$ compare to non-GIs coffee producers, between 2007 and 2012. Premium price between 30% et 50% higher than the non-GIs coffee (from 2009 to 2012).	Costs increased by 28% between 2009 and 2014, mainly due to high fertilizer prices and an increasingly limited and difficult labour force in rural areas.
Kona Coffee	The price of *Kona coffee* appears to be two to three times higher compared to other coffee from the Island of Hawaii, and five times compare to world price. Premium price between 20% et 50% higher than the «standard» Hawaii coffee price.	The income of all Kona producers increased almost fivefold between 1991 and 2008, from $4.5 million to €21.1 million. By way of comparison, the income of all other island producers, KMH (Kauai, Maui and Honolulu), rose from $0.31 to $8 million over the same period.
Taliouine saffron	Increase of prices paid to producers outside cooperatives: +40% between 2000 and 2014. Prices evolved from roughly from 11,500 Dh/kg in 2000 to roughly 16,000 Dh/kg in 2014. Increase of prices paid to producers via cooperatives: +500% between 2000 and 2014. Prices evolved from roughly from 3300 Dh/kg in 2000 to roughly 17,000 Dh/kg in 2014.	

Table A1. *Cont.*

Case studies	Price	Costs, profit
Futog cabbage	Mean increase of the fresh cabbage price paid to producers on the green market: +57%. Mean increase of the fresh cabbage price paid to producers by wholesalers: +53%. Mean increase of the fresh cabbage price paid to producers in front of house: +70%. Mean increase of the fresh cabbage price paid by the processor: +1.6 RSD/kg (from 7.5 RSD/kg to 9.1 RSD/kg) after the AOP registration, roughly +21%. Mean increase of the fresh cabbage price paid on the road: +26%. Premium price of Futog cabbage compared to its substitute, the Bravo cabbage: Between 2006 and 2011, the prices of the two cabbages are similar; From 2012 (when Futog cabbage became the first certified AO in Serbia under the new law on GI), the price difference between the two cabbages is increasing. 2012: premium of 18% compared to the substitute (fresh and fermented). 2013: +20% compared to the fresh substitute and 24% compared to the fermented substitute. 2014: +16% compared to the substitute (fresh and fermented).	In the economic approach of the «Model Farm», costs of production are quiet comparable between GI and non-GI cabbage, therefore, the effect on income of the premium is significant.
Queso Manchego	Cheese price: Increase of the price paid by the consumer: +45% before/after the European PDO (1996) (roughly 10.6 euros/kg before to roughly 15.3 euros/kg after)—Increase of the price paid by distributors to retailers: +45% before/after the European PDO (1996)(roughly 7.8 euros/kg before to roughly 11.3 euros/kg after). Increase of the price paid by distributors to direct distribution: +45% before/after the European PDO (1996)(roughly 6.3 euros/kg before to roughly 9 euros/kg after). Increase of milk price at farm gate: +5.5% between 2005 and 2010: increase of Manchega milk price from 0.91 euros/L in 2005 to 0.96 euros/L in 2010.	
Tête de Moine cheese	Milk price evolution: Tête de Moine milk price higher than Tilsiter milk price (non-PDO Swiss cheese) and up to 10 cents higher than the milk price for other local cheeses: 0.43% in average by year between 1999 and 2014—27% after the PDO registration (2001): 96.36 CHF/100 kg before PDO and 70.09 CHF/100 kg after PDO—Cheese price: +57% between 1999 and 2014 at the EU level (exportations) (from roughly 15 €/kg in 1999 to roughly 24 €/kg in 2014). Continuous increase at the national level: +4% between 2001 and 2004: from roughly 20 €/kg in 2001 to roughly 21 €/kg in 2004. +5.13% between 2004 and 2014: from roughly 21 €/kg in 2004 to roughly 24 €/kg in 2014. Wholesalers price stable: 14 €/kg between 1999 and 2014.	
Darjeeling Tea	Premium compared to substitutes: Between 1991 and 2013, in average a premium of 60.4 INR/kg and of 66.9 INR/kg respectively compared to substitute Assam and Dooar teas: Almost twice higher than substitute Assam and Dooar teas those last years—Price increase: Significative increase of prices after 2011, European Union PGI registration date. Price increase of 4% between the before PGI period and the after PGI period	

Table A1. *Cont.*

Case studies	Price	Costs, profit
Penja pepper	Beginning of harvest prices have increased in average by 118%, from 6200 FCFA to 13,500 FCFA between the periods (1995–2013) and (2013–2015)—End of harvest prices have increased in average by 129%, from 3375 FCFA to 7750 FCFA between the periods (1995–2013) and (2013–2015). The average prices of GIs Penja pepper are higher (25% to 40%) compared to international price (from International pepper community) after the registration in 2013.	Average increase in profits between 2006 and 2015 through the adoption of new technologies for farmers moving from "basic" techniques to new techniques proposed in the GI: In 2006: gain of 565%, going from 620,000 to 4,120,000 FCFA/ha/year—In 2015: gain of 528%, going from 1,420,000 to 8,920,000 FCFA/ha/year
Wine Vale dos Vinhedos	Average increase of PDO wine Vale dos Vinhedos prices: In 2015, PDO wine price varied between 19.90 €/L and 25.00 €/L, as non PDO wine price was between 13.75 €/L and 18.00 €/L	Average increase in production costs following the PDO specification: +50% for PDO wine vs non-PDO wine—In 2015, the cost of producing PDO wine averaged €15.55/L compared with €10.50/L for non-AOP wine. Increase in the net margin of the PDO wine: +115% for AOP vs non AOP wine—In 2015, the net margin of PDO wine was 6,60 €/L compared to 3.15 €/L for non-PDO wine. Average increase in income of wine-producing establishments in the PGI and then in the PDO: Between 2010 and 2015, +186% for small establishments and +56% for large establishments

Case studies	Production and number of producers	Market Access
Café de Colombia	Punctual reduction of 33% between 2008–2012	
Kona Coffee	An increase of production of 250%: from 1000 tons in 1995 to 3500 tons in 2015. Number of producers has increased of 36%: from 609 in 1991 to 830 producers in 2012	Important volumes sold as Kona. Quantities assembled: Confidential information. 4040 tons of roasted coffee exported (most of which is Kona coffee) in 2014. 2080 tons of exported green coffee (most of which is Kona coffee) in 2014. Access to new markets has been improved thanks mainly to online sales of boutique farms on the domestic market but also for export (+60% between 2011 and 2014).

Table A1. *Cont.*

Case studies	Production and number of producers	Market Access
Taliouine saffron	Decrease in quantities sold by non-cooperative producers: 26% between 2000 and 2014 (From 856 kg in 2000 to 631 kg in 2014)—Increase in quantities sold by cooperatives and private enterprises: +1075% between 2000 and 2014 (From 29 kg in 2000 to 341 kg in 2014) The number of cooperatives increased from 5 cooperatives in 2010 to 35 in 2014.	PDO sales in the supermarkets of coastal cities (Casablanca, Agadir and Rabat) benefited from a 137.5% increase between 2010 and 2014, export managed by cooperatives and companies increased and finally, local stores were created.
Futog cabbage	Production reduction of -76.60%: from 2000 tons in 2010 to 468 tons in 2014	
Queso Manchego	An increase of 83%: from 5890 tons in 2001 to 10757 tons in 2013—Concentration of farms of 44%: from 1430 farms in 2000 to 798 in 2013	Increased market share of Spanish GI cheeses: +5% between 2001 and 2013 (From 50% in 2001 to 55% in 2013)—Exports: Access to new markets: USA. Multiplication by 14 between before and after the European PDO (1996): 165 tons before/2320 tons after
Tête de Moine cheese	An increase of 300%: from 565 tons in 1986 to 2262 tons in 2014—A significant and rapid increase in volumes is verified in the years following the introduction of the AOC in 2001: from just over 1400 tons in 2002 to more than 2000 tons in 2006	Exports (mainly France and Germany): +2427% between 1986 and 2014. (From 55 tons in 1986 to 1390 tons in 2014)
Darjeeling Tea	Relatively stable: Average production of 10,500 tons between the period before the PGI and that after its establishment	Exports: Stability and diversification. About 70% of the production (about 7000 tons) destined for export between the period before the PGI and that after its establishment. Diversification of exporting countries: from 35 countries in 2004 to 45 in 2013. Type of contract: Approximately 55% of auctions and 45% of direct sales
Penja pepper	An increase of 328%: from 70 tons in 2010 to 200-300 tons in 2015—An increase of number of producers of 1900%: from 10 producers in 2011 to 200 producers in 2015	
Wine Vale dos Vinhedos	Average increase in production of the grape variety Vitis vinifera: Between 2001 and 2013, an increase of 47.8% (From 50 million kg in 2001 to 73.9 million kg in 2013)—Average increase in production of the variety of American grapes/hybrids: Between 2001 and 2013, an increase of 40% (From 384,900 tons in 2001 to 537,300 tons in 2013)—Average decrease in certified AOP quantities: Between 2012 and 2014, the actual certified production of wine decreased by −78% (From 262 kl in 2012 to 49 kl in 2014)	

Source: Authors elaboration.

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How to cite this article:
Vandecandelaere E, Teyssier C, Barjolle D, Fournier S, Beucherie O, Jeanneaux P. Strengthening Sustainable Food Systems through Geographical Indications: Evidence from 9 Worldwide Case Studies. J Sustain Res. 2020;2(4):e200031. https://doi.org/10.20900/jsr20200031