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# Sense and Non-Sense of Local–Global Food Chain Comparison, Empirical Evidence from Dutch and Italian Pork Case Studies

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**Abstract:** Priority setting between local *versus* global food chains continues to be subject of debate among food, rural and agricultural scholars with an interest in how to support more sustainable food provision and consumption patterns. Recently the FP7 European GLAMUR project targeted to assess and compare the performances of local *versus* global food chains in a systematic way covering multiple performance dimensions. Especially drawing on empirical research on the performances of three Italian and three Dutch pork chains, it will be argued that meaningful performance comparison needs to acknowledge the complex, multi-faceted and time and place specific interaction patterns between (more) global and (more) local pork chains. Therefore, as regards these pork chains, local–global performance comparison is thought to have hardly significance in isolation from complementary “horizontal” (place-based) and “circular” (waste or by-product valorization oriented) assessments. As will be concluded, this methodological complexity of food chain performance comparison doesn’t allow for simple statements regarding the pros and cons of (more) global *versus* (more) local pork chains. Hence, it is recommended to avoid such less fruitful local–global dichotomy and to concentrate on more policy relevant questions as: how to facilitate fundamentally different resource-use-efficiency strategies and how to optimize the place-specific interaction between more “local” *versus* more “global” food systems?

**Keywords:** food chains; global; local; performance assessments; life-cycle analysis; sustainability strategies; pork production

## 1. Introduction

Rural and food sciences know a vivid debate around the distinctiveness, performances and prospects of agri-food initiatives, encompassing notions as *alternative food networks*, *short food chains* and *local food systems* [1–5]. This body of literature scrutinizes from different angles and theoretical stands the characteristics and potentials of new responses to a variety of negative social, cultural, environmental and spatial externalities of globalizing food regimes. More generally, it is increasingly accepted that this does not allow for simple dichotomies in terms of local *versus* global or conventional *versus* alternative. These dichotomies turn out to be less fruitful for a thorough and adequate

understanding of ongoing processes of change in food production and consumption patterns. Often, elements of both are combined, building upon new production-consumption networks in diverse local food economies [6], new roles for “citizen-consumers” [7] and new multistakeholder food governance initiatives [8]. For rural development scholars, these food quality differentiation processes reflect fundamental processes of rural restructuring and change [9–11], whereas political economy inspired scholars perceive these same tendencies primarily as defense lines against or as part of hegemonic food market forces that may not be mistaken for fundamental rural change [12–16]. Others take intermediary positions by underlining that food chain “hybrids”, interfaces between conventional and alternative food markets, are difficult to assess in terms of their potential contribution to rural development [17], or make a distinction between multiple transition pathways towards sustainable food production and consumption patterns, as part of socio-technical network constellations that embody specific promises, expectations and limitations [18].

These insights from agri-food studies may be aligned with what Amin [19] calls “*the politics of place*”, a non-territorial reading of development that acknowledges the shortcomings of theoretical approaches that insufficiently account for the differentiating and contested outcomes of globalization. The same author, therefore, introduces the notions “*politics of propinquity*” and “*politics of connectivity*” to analyze the differentiating and contested nature of spatial development, including the loss of territory bound identities. Escobar [20] argues that it is through place-based values, cultures and social practices that resistance against globalization, modernization and capitalist forces will manifest itself and may result in “*multiple capitalisms*”. Other scholars go beyond this “defense of place” perspective by arguing that localities are agents in globalization with a certain capacity to act, shaped by their position within wider power-geometries. Massey [21], for instance, emphasizes that localities are not just victims of globalizing forces nor always “*politically defensible redoubts against globalization*”. Contrastingly, she theorizes the local as the co-constitutor of the global through complex interrelations that do not allow for an “*exoneration of the local*” or a “*blaming of all local discontents on external global forces*” [21] (p. 14). More recently, Pierce *et al.* [22] argue that “*relational place-making draws on scholars and insights about place, politics and networks by explicitly recognizing the flexible, multi-scalar and always developing meanings of place: meanings that are produced via socially, politically and economically interconnected interactions among people, institutions and systems*”.

In this paper we will apply this growing scholarly awareness of the significance of relational and place-based approaches to pork chain performances in the Netherlands and Italy. As part of the European GLAMUR project (Information on the GLAMUR project is available on [www.glamur.eu](http://www.glamur.eu)), with the overarching, ambitious objective to develop comprehensive, multi-dimensional and scientifically grounded methods to assess and compare local *versus* global food chain performances, overall outcomes of the cross-country comparative analysis will confirm that localness and globalness are not just relative and relational notions but also characterized by highly place-specific interactions and interdependencies, as will be substantiated in different ways. We will start with a presentation of the approach and methodology and a brief characterization of the six selected pork chains in terms of localness *versus* globalness. Subsequently we will distinguish four different interaction processes to illustrate the place-specific and complex nature of local–global interactions and interdependencies. This will be followed by an introduction of the most eye-catching differences in performances between the six selected pork chains and a further explanation of these major differences around a selective number of performance attributes. Building upon a combination of quantitative and qualitative research methods, it will show that localness in the Netherlands is strongly associated with better environmental and animal welfare performances and volume oriented resource-use efficiency strategies, whereas in Italy it is primarily interlinked with territorial and farm-level typicity and high-per-unit added value oriented strategies. Both settings share that localness is closely interwoven with a certain locus of control on chain governance that permits to preserve, safeguard or actively (re-)create distinctive features. In the final section of the paper, it will be argued that more comprehensive assessment methods are required to capture all meaningful components (“the vertical”,

“the horizontal”, and “the circular”) of pork production performances, to avoid reductionism and to cover the normative aspects of performance assessments. As further concluded, current absence of such comprehensive and inclusive performance assessments contrasts with policy expectations regarding science-based priority setting around the pros and cons of (more) global *versus* (more) local food production and consumption systems.

## 2. Methods and Materials

As explained in detail in the introduction of this Special Issue on GLAMUR’s wider methodological approach [23], a multi-criteria matrix has been developed with the purpose to capture the perceptions and representations of food chain performance at different levels. A total of 24 attributes have been identified to describe the performance of the food chains on five dimensions: economic, social, environmental, health and ethical [24]. On that basis, first, a set of relevant attributes is identified for each chain thanks to a participatory approach. Then, the qualitative analysis was primarily based on structured interviews with the main economic actors in each chain. The quantitative analysis is based on different tools according to the kind of data, some of them resulting from direct field analysis of balance sheets, other economic data and environmental performance through a LCA approach. Data were collected at both pig farming and pork processing stages of the chain. For a more detailed description of the case studies, see [25,26] (these reports describe the six cases in detail and can be downloaded at [www.glamur.eu](http://www.glamur.eu)).

In the last section of this paper, we will return to overall methodological approach and some of the intricacies of chain based performance comparison, which started from following distinctive features between local *versus* global food chains: (1) the physical/geographical distance between resources, production and consumption; (2) the type of governance and organization of the supply chain (degree of control of “local actors” and “global actors”); (3) the kind of resources, knowledge and technologies employed; and (4) the way supply chain actors shape product identity with regard to the reference to the territory of production for food plays a relevant role or not.

These distinctive features have been analyzed by comparing pork chains along four performance attributes: (1) resource-use efficiency; (2) added value; (3) chain governance; and (4) resilience. Together these attributes cover multiple aspects of sustainable pork production (its environmental, economic, social and wider sustainability, respectively). Table 1 gives an overview of these attributes and their indicators.

**Table 1.** Used attributes and indicators.

Main Attributes	Indicator
Resource-use efficiency	Water use efficiency Fossil-energy use Land-use efficiency Eutrophication potential GHG emissions
Added Value	Added Value per kg life weight Added Value per kg of cured ham Negative Externalities for own rural economies Positive Externalities for own rural economies
Chain Governance	Trust-based internal relations Trust-based external relations Self-governance capacity Chain-based value governance
Resilience	Farm-level resistance against price-volatility Farm-level risk-spreading Adaptation capacity of farmers through down- and upstream actors cooperation, integration and diversification strategies Intra diversity of chain relations Chain-based adaptation capacity through learning and innovation

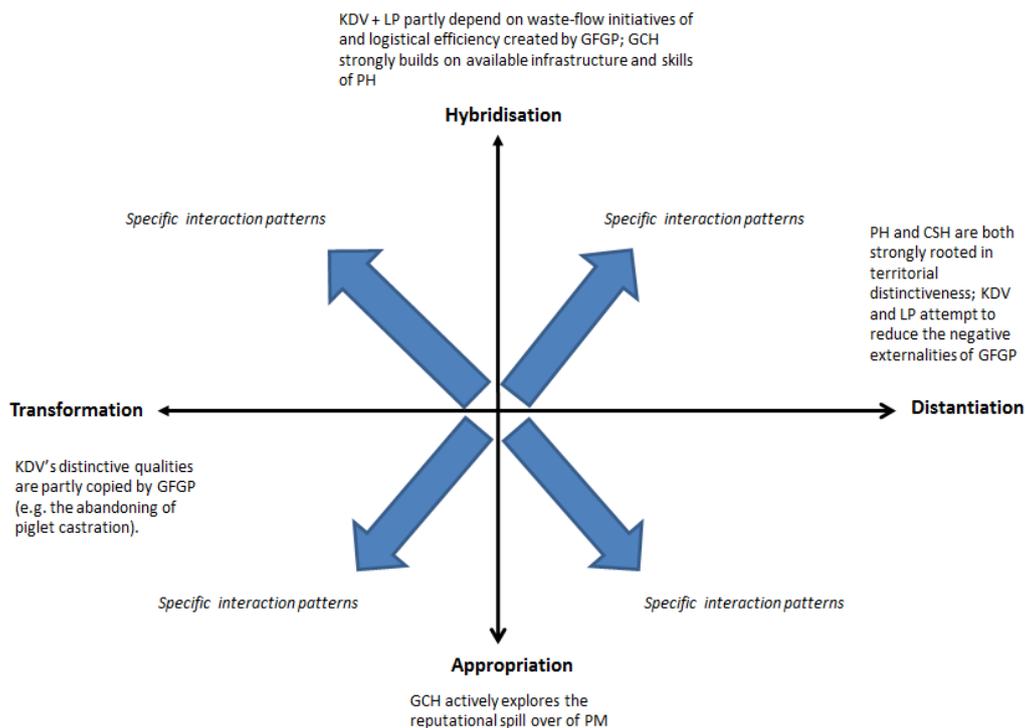
We will introduce here the six selected six pork chains, three Dutch and three Italian, only briefly. The Dutch chains are on fresh meat, while the Italian ones also include cured ham production, being comparability therefore limited to fresh meat.

- (1) Dutch Good Farming Global Pork (GFGP) is a chain of the company VION that is owned by a regional farmer's organization, but knows, a strongly globally oriented corporate business strategy with market outlets in Europe, Asia and America, by applying so-called "nose-to-tail" marketing strategies. About half of the Dutch pigs are slaughtered by VION (*i.e.*, approximately six million pigs). GFGP may be considered as representing the more mainstream bulk, that is primarily price-based competing pork production and thus as a point of reference for the other two Dutch pork chains: KDV and Lupine Pork.
- (2) Dutch "*Keten Duurzame Varkenshouderij*" (KDV) or Sustainable Pork Chain concerns a farmers-led re-localization attempt with the objective to improve, compared to the Dutch mainstream production, national pork chain performances, to enhance animal welfare and environmental sustainability, although still largely interwoven with especially global feed markets. KDV produces about one million pigs a year.
- (3) Dutch Lupine Pork (LP) chain involves another farmers-led, smaller-scale and early-life cycle initiative with the intention to re-create distinctive pork qualities based on local feed sourcing (lupine from the own arable land) and a return to taste as an additional distinctive quality. The development of new animal friendly stable and the conversion of manure into energy are also part of the initiative. Simultaneously, it is strongly inspired by global knowledge and information sourcing on how to sustain pork production and consumption and embedded in other, more global market dependent arable farming activities (feed and arable products that can be used for energy production by means of fermentation). LP is an initiative of one farmer (with about 2500 pigs), but is not "place-specific" and could be used elsewhere as well.
- (4) Italian Parma Ham (PH) chain is the icon of the historically and territorially distinctiveness of ham production in this same Parma province and the rest of Northern Italy, although nowadays with a global reputation and global market outlets. This geographical indication benefits from the EU protected designation of origin (PDO) scheme [26]. Only three breeds of pigs can be used for Parma Ham: Large White, Landrace and Duroc. The Parma Ham pigs are fed with cereal grains and, in some local cases, whey from the production of Parmigiano-Reggiano PDO and Grana Padano PDO cheeses. The 150 processing companies have produced 9,087,000 branded hams in 2013.
- (5) Italian Generic Cured ham (GCH) is characterized by an international sourcing of raw material (fresh hams from the Netherlands and other EU Member States) but builds at the same on a strongly historically and territorially rooted pork processing infrastructure, competences, reputation and skills in the Parma province. An estimated 15 million non-PDO hams were produced in 2009 within the same territory of the Parma Ham [27]. Many of the PDO Parma Ham producing companies also produce non-PDO hams (GCH) [28–30].
- (6) Italian Ham from Cinta Senese PDO meat (CSH) chain concerns another, smaller scale example of territorial rooted product distinctiveness (the production area is located in Tuscany), this time also based on a traditional local pig breed (Cinta Senese) and with predominantly local and regional input and output markets, although increasingly incorporated in a global niche market for quality ham and in globalizing tourism markets [31]. Cinta Senese fresh meat is protected by a PDO regulating the breed and its farming systems, included feed. About 1000 CS sows are registered in the Herd Book.

### 3. Results

#### 3.1. Differentiating Local–Global Interaction Patterns

What became very clear in the case studies is that chains are not static, that there is a lot of interaction between chains and that stakeholders' strategies are difficult to isolate from strategic reactions to other chains [32]. If not positioned in a dynamic perspective a strict comparison between performances of the chains at a certain point in time only has a very limited significance. In order to understand chains and to be able to identify strong and weak points of chains and to identify development perspectives, the identification of these interaction patterns is of crucial importance. In this section, we describe, in analytical terms, four basic interaction patterns between pork chains that we found in practice (see Figure 1).



**Figure 1.** Different types of interaction patterns between pork chains

##### 3.1.1. Hybridization Processes

A first interaction pattern is hybridization. Local and global chains influence each other; the presence of co-evolving food chains goes along with place-specific performance improvement (e.g., through waste valorization). As argued before, the significance of such hybridization tendencies is increasingly recognized in food studies, although without consensus about its transformative potential (e.g., see [16]). For us, this is a reason to analytically distinguish multiple interaction patterns and associate hybridization especially with place-specific benefits. Waste-flow valorization is a typical Dutch example of hybridization that benefits actors operating in different food chains. There are many different forms of waste-flow valorization. Especially, the conversion of the “non-meat” parts of the pigs in a range of products has proven to be profitable (e.g., gelatin, glue, leather, paint brushes, candles, paint, soap, softening agent, etc.). Other examples are energy production through the fermentation of manure and the processing industrial waste into pig feed. Historically closely interwoven with the genesis of GFPG, to which we will return in more detail, but nowadays also KDV and LP bear the fruits of nationally available waste-flow valorization infrastructure, expertise and facilities. A similar sharing of infrastructure, knowledge and skills can be witnessed in Italy, where PH processors are increasingly

also involved in the production of GCH [26–28]. Another Italian hybridization example concerns the co-evolution of multiple logics within the CSH chain. Next to companies deeply rooted in traditional, small scale breeding and processing techniques, other companies involved in cured ham and cold cuts production, due to CSH commercial success, enter in this sector by implementing “modern” breeding and processing practices [29]. Even though Cinta Senese PDO specification put strong limits to intensive methods and to delocalization, products based on Cinta Senese meat (even if outside the PDO) and on other traditional pig breeds raised and processed in more “industrial” ways are increasing, thus confusing consumers. However, in some cases, this hybridization could facilitate the introduction of innovations consistent with tradition and allowing an improvement of technical and economic performances of the CSH chain [31]. These expressions of hybridization through multiple chain involvement can be increasingly witnessed in the Netherlands as well.

### 3.1.2. Distantiation Processes

A second interaction pattern has been classified as distantiation. It refers to activities that aim to (re-)create and/or preserve certain distinctiveness vis-à-vis global pork features as massified pork production and the related perceived negative impacts on safety, environment and trust; *i.e.*, those features that in food studies are debated with respect to their more or less intrinsic relations with localness [5,6]. The outcomes of our Italian-Dutch comparative analysis show that these distantiation processes might appear in rather different ways. The Dutch KDV chain, for instance, actively attempts to distinguish from nationally dominantly present GFGP chain by better animal welfare and environmental performances, whereas LP aims to widen these distinctive qualities by trying to expand with taste as another quality component. The Italian PH case centers on the historically rooted distinctiveness of its taste, based on overall outcome of distinctive features as a higher age and weight at slaughter, special feed requirements and specific, more artisanal processing techniques and—in contrast with the Italian more global GCH chain—guarantees with respect to tradition, origin, absence of non-natural preservatives and quality control (*i.e.*, the PDO specifications). CSH’s distinctiveness resides especially in the combination of a regional typical pig breed, local feed origin requirements, better animal welfare performances, a still largely artisanal ham processing, often managed directly by pig farmers, and more direct information and communication between producers and consumers as principle marketing mechanisms.

On the one hand, there is a clear tendency towards globalization of pork chains, but on the other globalization induces its own countermovement; (re-)localization is often stimulated by a reaction on global trends. KDV, LP, PH and CSH try to keep, utilize, reproduce and renew their specific local characteristics and, by doing so, create some distance to and distinction from the global market. The more globalization makes progress, the more meaning locality gets and the more opportunities for distinction and specific “exceptions” arise [32].

### 3.1.3. Transformation Processes

A third empirically identifiable interaction pattern in pork production refers to the transformative capacity of pork chains, in line with the body of literature on the features and complexity of necessary transition processes to sustain food production and consumption [33]. Again, starting from local–global comparison, this transformative capacity might manifest itself in multiple ways. Global chains may transform their (more) local operating competitors or the other way around: local chains succeed to transform more global chain configurations. Evidence of the transformative power of global forces is omnipresent in agricultural, rural and food studies (e.g., see [34]). In the Netherlands, KDV introduced a ban on castration to distinguish itself further from GFGP with respect to its animal welfare performances. After its proving in practice that a ban on castration could indeed be implemented in an economically sound way, this induced a wider societal debate around the issue of castration in pork production, resulting in a (preliminary) national agreement to introduce a ban on castration as soon as possible also in GFGP. It suggests that re-localization in pork production can function as a “laboratory”

for innovation and might become a transformative force that will change globally operating pork chain actors with respect to their animal welfare performances (and, consequently, possibly loses its local characteristics); a classic example of “diffusion of innovation”.

#### 3.1.4. Appropriation Processes

The fourth interaction pattern represents a kind of mirror image of the previous in the sense that it explicitly recognizes that global operating food chain actors might sometimes “overpower” local actors by appropriation or expropriation of their distinctive features. A telling example of this fourth type of interaction is the imports of Dutch fresh hams for the production of Generic Cured Ham in Italy. Although both in terms of production and processing techniques profoundly different from the original Parma Ham, GCH actively explores (less friendly: appropriates) the reputational assets of the worldwide known and famous Parma Ham. These reputational spillover effects increasingly affect PH’s economic performances, partly due to the fact that PH processors (especially the biggest ones) may opt for multiple product quality strategies and produce GCH as well. Appropriation processes are now starting in CSH chain, where some companies external to the area are entering in the PDO system in order to be able to escape from the strong competition characterizing both Global and Parma ham sectors.

This shows how the four interaction patterns as schematized in Figure 1 may in practice co-evolve and co-exist. The latter underscores again the need to assess food chains performances from dynamic and place-specific perspectives that enable to acknowledge that performances may be undermined, put under pressure for preservation, further distanced as well as transformed, all depending on their spatial interaction with other food chains.

### 3.2. Place Specific Performance Differences

#### 3.2.1. Resource Use Efficiency

Usually resource use efficiency is defined as a technical input-output relation, *i.e.*, the quantity of inputs or emissions per kg product. The main findings about this type of resource use efficiency are:

- (1) Dutch more local pork chains show relatively good performances in terms of resource-use efficiency per production volume (more specifically kg carcass). LP scores best on all five impact categories assessed. Its better scores on land use, global warming potential, fossil energy use and land use mainly results from local feed production and to a lesser extent from the use of on-farm-produced biofuel.
- (2) The higher global warming impact of Italian local pork chains reflects their longer breeding periods (nine and 15 months compared to six months in the Dutch cases). CSH uses more land and is closely interwoven with producing pork in marginal forest areas as part of their wider ecosystem management.

However, resource use efficiency can also be strategically approached and defined in other ways, for instance as the quantity of inputs or emissions per unit of added value. The use of another definition can put a new perspective on the performance of a chain. Especially the Italian local CSH case demonstrates that resource use *efficiency per unit of added value* at farm-level may result in completely different and much more positive outcomes than a comparison based on *efficiency per kg output* (volume). As further detailed in Table 2, this goes particularly for resource use efficiency in terms of land-use, fossil fuel dependency and eutrophication potentials. These results illustrate that a performance assessment of chains or chain attributes always is objective and context dependent.

#### 3.2.2. Added Value

The first economically oriented attribute, value added, raises in pork production the methodological complexity of the most appropriate *unit for comparison*. Whereas the principle “nose-to-tail” valorization

is dominantly present in the logic of Dutch pork chains, in Italy the valorization of fresh or cured ham plays a key role in overall chain organization. Our choice for added value per kg live weight as unit for comparison only partly recognizes these major differences in organizational and valorization logics. As concluded, overall added value per kg carcass differentiates significantly between those cases with sufficient data-availability, accessibility and comparability. In comparison with the more local chains both most global pork chains (GFGP and GCH) perform relatively poor in terms of added value creation at the level of primary production. Going “down” from the global to local, the added value per kg carcass at farm-level increases particularly in Italy. The heavy-pigs typical for the PH chain go along with a higher farm-level added value per kg carcass and as such a better remuneration of farm labor and capital and more rural employment per kg pork. CSH pig farms operate on a niche market, which allows for even higher levels of value added creation at farm-level. The same gradient from lower to higher value added can be noticed in the processing of ham. A lower added value per kg ham forces GCH companies to opt for economies of scale, whereas the pork quality differentiation strategy of PH companies, facilitated by PDO labeling, enables generating extra added value per unit of product [32]. Again, differently, per kg ham more labor is employed, which goes again particularly for the CSH chain, where small companies generate extreme high levels of added value through multiple ways of valorization of strongly locally embedded pork products. A high added value is necessary in order to remunerate specific features at farming and processing stage, such as in the case of Cinta Senese the use of a specific low-productive pig breed and its traditional rearing system as regulated by the PDO Specifications, based on a seasonal pasture in the woods and on a maximum limit on the amount of feed that can be bought on the market.

The principle differences in performances regarding resource use efficiency and added value of the six pork cases are summarized in Table 2.

**Table 2.** Some key findings of the cross-country pork chain comparison.

Indicator	Definition	Unit	The Netherlands				Italy	
			GFGP	KDV	LP	GCH	PH	CSH
Added value*	Average off-farm prices minus non-factor costs over the period 2009–2013 per kg live weight <sup>1</sup>	€/kg	0.18	0.23 <sup>2</sup>	p.m.	0.18	0.26	1.69
Added Value**	Average sales price of cured ham minus non-factor costs per kg uncured ham	€/kg	-	-	-	0.28	0.42	27.9
Water Use efficiency***	Use of water in the total chain per kg carcass weight	m <sup>3</sup> /kg	3.24	2.66	1.92	3.24	2.71	2.45
	Idem per € Added Value	m <sup>3</sup> /€AV	18.00			18.00	10.42	1.45
Fossil energy use***	Use of direct and indirect fossil energy in the total chain per kg carcass weight <sup>3</sup>	MJ/kg	23.5	23.3	13.2	23.5	27.8	27.7
	Idem per € Added Value	Mj/€AV	130.6			130.6	106.9	16.4
Land use efficiency***	Use of land in the total chain per kg carcass weight	m <sup>2</sup> /kg	6.52	5.25	4.24	6.52	6.13	11.48
	idem per € Added Value	m <sup>2</sup> /€AV	36.33			36.22	23.58	6.79
Eutrophication potential***	Total contribution to eutrophication in PO <sub>4</sub> -equivalents per kg carcass weight	kg/kg	0.0311	0.026	0.0184	0.0311	0.0349	0.0360
	Idem per € Added Value	kg/€AV	0.1728			0.1728	0.1342	0.0213
GHG emissions***	Total emissions of greenhouse gasses in the chain expressed in CO <sub>2</sub> -eq. per kg carcass weight	kg/kg	2.86	2.78	2.04	2.86	5.05	4.63
	Idem per € Added Value	kg/€AV	15.89			15.89	19.42	2.74

\* Source: elaborated by CRPA on Interpig data [26]; \*\* Source: CRPA elaboration on representative samples of firm balance sheets [26]; \*\*\* Source: LCA analysis of the six pork cases (see [32]). 1: Value added is in euro/life weight at farm gate but environmental impacts are in impact/kg carcass weight over the whole chain including feed, on farm = pig breeding, slaughterhouse, retail and consumption—but in feed production and on farm stage the largest environmental impacts occur over all five impact categories. 2: KDV estimates that they realize (in 2014) an extra net added value of €0.05 for their pig holders compared with GFGP [25]; this €0.05 is added to the added value of GFGP. 3: Direct fossil energy use includes fuel use for transport and machinery; indirect fossil energy includes fossil energy use for the production of fertilizers, feed and electricity.

To further assess the performances of our pork-chains, two additionally ordinal indicators have been used to capture externalities, be it negative or positive. Thus, qualitative indicators

based on expert evaluation are used that approach the “real economic costs” and “real economic benefits” (The concepts “real costs” and “real benefits” also includes environmental externalities and, thus, imply a kind of integration of the economic and environmental dimensions.) of pork chains from a spatial perspective, with the most global operating Dutch and Italian pork chains as benchmarks. This approach enables to take into account that Dutch re-localization of pork chains is closely interwoven with societal attempts to reduce the “real costs” of globalized pork production, whereas Italian CSH most convincingly shows that pork production may also generate positive economic externalities such as beneficial interlinkages with rural and food tourism and vibrant cultural landscapes (In the same case negative externalities linked to woodlands overexploitation are increasingly controlled by the Protected Geographical Indication Product Specification that impose a limit of pig heads per hectare of pasture land. There where Cinta Senese pig breeders do not join these PGI regulations negative externalities may arise.). However, ongoing scale enlargement tendencies in the other Italian more local chain (PH), faces a similar resistance against its economic and other type of externalities as Dutch GFPG. Interestingly, Italian most global GCH chain performs in this respect relatively good, as the outcome of its peculiar spatial distribution of societal costs and benefits. That is: by importing fresh hams negative trade-offs of pork production as loss of quality of rural life, loss of landscape values, growing public health concerns, *etcetera* are externalized to other places, in this case Dutch predominantly metropolitan rural areas, facing increasingly alternative, competing claims on rural resources that are difficult to align with highly intensive and large-scale pork production. The fact that Italian GCH chain outperforms in this respect both local Italian chains contrasts sharply with the Dutch setting, where the “*raison d’être*” of local pork chains is much more related to minimizing the negative trade-offs characteristic for its GFPG. It illustrates how local–global pork chains may perform also highly place-specific in terms of their wider distribution of economic, environmental and social costs and benefits across space.

### 3.2.3. Chain Governance

The attribute chain governance addresses particularly the social components of sustainability. This attribute is operationalized by four qualitative indicators (see Table 1). The first two indicators, *trust based internal relationships* and *trust based external relationships*, focus on the role of supporting relationships among actors, with a distinction between chain-internal and chain-external. More trust-based relations particularly distinguish Dutch local pork chains from their global operating GFPG competitor. Both KDV and LP actively established new partnerships with societal and food movements and want to create more long-term chain-internal relations, albeit mostly not formalized through contract relations. As time and again emphasized in Dutch debates about the future of pork production, such trust based relationships are thought to be paramount to sustain national pork production and consumption, to restore consumer commitment and to enhance overall *self-governance capacity* of national pork production. This other performance indicator to assess and compare chain governance, reflects neo-liberal preferences for “hands-off” steering approaches characterized by a re-balancing of responsibilities between public, private and civil actors in favor of civil society and the private sector. The renewed attention for spatial proximity in pork production and consumption in the Netherlands, as illustrated by KDV and LP, reflects in different ways new responses to the lack of self-governance capacity that characterizes the globally operating GFPG case in different terms as loss of sensitivity for new societal demands and loss of ability to create non-efficiency related distinctive product qualities. The Italian PH case, on its turn, is characterized by a strong chain-based governance system by the PDO Parma Ham Consortium that is doing efforts to facilitate the collaboration between firms and the interaction between stakeholders. At the same time PH case shows that localness is not by definition characterized by farmers-led self-governance. Its pig farmers are much more in the typical condition of “price takers” and “quality takers” since decisions considering the preservation of product distinctiveness are primarily taken by PH processors. Contrastingly, farmers involved in

the CSH chain are more influential actors in the creation of their territorial distinctive ham qualities. This is also due to the fact that in some cases they are ham processors as well.

It is important to note that *self-governance capacity* is also about the mobilization of institutional support. Whereas Dutch GFGP, especially at the stage of pig husbandry, increasingly faces a loss of societal and policy support to remain competitive in global markets, KDV and LP both illustrate a perhaps slowly, but growing capacity among farmers to mobilize space within prevailing regulatory frameworks for farmers-led transition pathways, often enforced by establishing new alliances and coalitions with environmental-, food- and animal welfare movements. Italian PH and CSH cases demonstrate how local pork chains may be much more historically rooted in facilitating institutional settings that safeguard and protect territory based pork production systems. Examples of this institutional embeddedness are the support by local administrations to the Langhirano district (inside the PDO Parma ham boundaries), the strong institutional support for CSH producers in the recovery of the regional typical breed at risk of disappearance in 1980s and 1990s and in the PDO registration process and—most recently—a strong lobby for EU regulations that permit to protect and enforce product distinctiveness. Ex-officio protection granted by EU regulation on PDO and PGI significantly strengthens the position of PH and CS hams on the EU market. The recently implemented Quality Package (Regulation 1151/2012) allows PH producers to schedule the production in a way that enhances their market intervention opportunity.

However, the historically rooted protective institutional settings may be also subject of conflict and debate, as is clearly illustrated by the PH case. It underscores the importance to acknowledge the dynamic nature of interaction with institutional settings as a co-constituting component of chain specific wider value governance characteristics.

The fourth governance performance indicator, *chain based value governance*, is built upon the distinction between governance models suggested by Gereffi [35], that is market, modular, relational, captive, and hierarchy ones, on the basis of the complexity and codification of transactions and of the competence of suppliers. Italian cured ham chains do not present a single governance model since each phase of the chain (breeding, slaughter and processing) present different networks, dynamics and firms strategies. The GCH case reflects a mixture of Market and Captive models, with relatively instable trade relationships and strong positions for large-scale product purchasers. Trade relations in the PH case are more fragmented since the three chains phase present own specificity in trade and quality relationships among chain members. Relational model is dominant, given the presence of complex interactions between buyers and sellers, which often creates mutual dependence and high levels of asset specificity, but also Captive model is present due to the increasing power big retailers are gaining thanks to PDO specifications and certification bodies that guarantee a basic quality of the product. A dichotomy between relational and captive models characterizes the CSH chain. The majority of farmers and processors are linked by strong, long-term connections that regulate product and process pigs characteristics even if not formalized in written contracts. Some “new” companies adopt a strategy more close to the Captive model since they are dependent from market signal and larger buyers.

With respect to chain governance there seem to be two basic analytic models: a “cooperation model” and a “competition model”. The cooperation model is characterized by equal relations, common interests of chain partners and direct and open communication between chain partners in order to develop a clear own specific identity that enables joint action on the market. This model implies differentiation within the pork sector and competition between chains. The competition model is especially characterized by unequal distribution of power between chain partners (especially weak position of primary producers) and large companies (like VION) who (try to) function as “chain-director”; *i.e.*, there is competition within. This mostly implies a “sector-approach” of “the” pork market (a rather generic and anonymous product) instead of a differentiated “chain-approach” (different specific chains/products). KDV, LP and CSH are examples of attempts to build a chain based on the cooperation model. GFGP and GCH are examples of the competition model and

PH is somewhere in between (slowly moving from chain internal “cooperation” towards more internal “competition”).

#### 3.2.4. Resilience

Resilience, the fourth selected attribute for our pork chain performance comparison is a wider sustainability indicator that covers capacity building in terms of resistance, adaptation and transformation. As such it approaches sustainability from a dynamic perspective, as a key common denominator of the growing body of resilience literature [36–41]. Our analysis focus mainly on economic resilience, making specific reference to the capacity of the pig chains to front price volatility and increasing power unbalances due to the emergence of “big player” in animal feed markets and in the retail phase.

In addition, this fourth performance attribute has been operationalized by a number of quantitative and qualitative indicators. The first two indicators especially address farm-level resilience, with *price-volatility* as an indicator for producers’ ability to manage increasingly price volatile animal feed and pork markets, and *on-farm-diversification* as a wider expression of farm-level resilience building vis-à-vis price-squeeze tendencies by other on- and off-farm income activities. The other resilience indicators, *adaptation through up- and downstream integration; intra-chain diversity of relations; and chain based learning and innovation* enable to position different forms of resilience building in a more chain-based perspective.

This additional set of performances indicators extends the comparative analysis in various ways. Firstly, it reveals that especially a combination of consumer appreciated distinctive pork qualities and facilitating institutional settings, as most prominently represented by the Italian PH and CSH cases, may create a certain resistance against increasingly price volatile globalizing pork markets. Secondly, it turns out that both global and local pork chains might be strongly interwoven with, or perhaps better, depending upon, wider farm-family livelihood strategies through off-farm income generation, as omnipresent in the Dutch pork cases, or farm-diversification, as particularly represented by both most local Italian and Dutch cases. Thirdly, up- and downstream integration tendencies within pork chains might have rather differentiating outcomes. The Dutch GFGP case may be historically involved in a variety of upstream (e.g., feed and other inputs) and downstream (e.g., slaughtering and waste-flow valorization) integration efforts. However, its economic, social and collaborative learning and innovation performances remain rather vulnerable, as recently demonstrated by a narrow escape from bankruptcy. Contrastingly, the Dutch KDV case reflects more successful integration efforts based on chain-internal coordination and establishing more long-term commitment between and relationships with chain partners, including consumers. Thus, instead of ownership as principle integration mechanism (GFGP), a form of resilience that much more builds upon the creation of favorable conditions for pro-active and collaborative learning and innovation.

The resilience of Italian PH resides especially in the processing firms. As core actors in the chain, these are the main organizations responsible for interlinking the following two factors: a product designation of origin (PDO) that links the product to the territory and to consumers and a strong chain-based governance system by The Parma Ham Consortium. However, this resilience seems to be partly realized at the expense of pork producers, as the weakest link in overall chain configuration. Moreover, larger PH processors increasingly start to differentiate their activities by generic ham production. It allows them to operate in multiple markets but may simultaneously menace overall resilience of the PH chain by undermining the position of the most artisanal and traditional PH processors.

The resilience of CSH is especially demonstrated in risk-spreading based on integration of farmers both upstream, in producing feed for pigs, and downstream, in small scale on-farm processing activities, on farm-based diversification strategies and on chain based differentiation. Upstream and downstream integration characterize part of more traditional farmers, bringing to a model of farm where pig breeding and processing is often a part of the business. Some firms that entered CS chain

after the recovering of the breed (in the second part of 1990s) are more specialized in Cinta Senese, and tend to be less resilient. However, this *chain-intra-diversity* may be a source for resilience for the chain as a whole. CS chain actors, similar as in the PH-case, are also more motivated to develop collaborative relationships between them. Together with their territorial and cultural embeddedness this allows for more coordination, less transaction costs, more broadly shared visions and more awareness about the interdependencies with other firms operating in the rural area. These collaborative relationships aims at the preservation and improvement of territorial distinctive product qualities through PDO-based collective trademarks on cured ham and other cold cuts based on Cinta Senese PDO meat, and other territorial initiatives like Cinta Senese festivals that during summer attract many tourists. Other upstream and downstream integration practices are more recently initiated by (groups of) farmers and processors aiming for tailor-made solutions to combat price-volatility, like agreements on feed provision between farmers and pig breeders. Hence, resilience is built through the integration of horizontal and vertical relations by a more collaborative, territory based governance.

#### 4. Discussion: Methodological Intricacies of Chain Based Performance Comparison

The main methodological intricacies are linked to time and place specificities and to the need of complementary approaches.

As has been shown, after a prolonged period of dominant globalization tendencies, in the Netherlands re-localization initiatives in pork production emerge that aim to re-create distinctiveness and to restore societal legitimacy to produce in a rather difficult institutional and food culture setting. Conversely, Italy is more characterized by historical, territorial and institutional rooted local pork chains, although increasingly confronted with globalization effects as reputational spillovers, internal threats and—especially in the case of PH—loss of social embeddedness. Historical tradition in curing ham that characterize both pork meat production and consumption in Italy play relevant effects, because of the greater ease in product differentiation that processed products allow. The acknowledgement and recognition of these time and place specificities are a first crucial aspect of meaningful chain-based comparative analysis.

As far the need for complementary approaches is considered, earlier references to the significance of intra-chain diversity already pointed implicitly to some of the key limitations of chain-based comparison: overall variety and instability of relationships may be sometimes difficult to grasp with the chain notion. Moreover, it is important to note that the chain concept focuses primarily on “vertical” relations with fewer opportunities to cover all their “horizontal” or spatial consequences. Both Italian and Dutch pork cases illustrate the relevance of these “vertical”-“horizontal” relations by their on-going debates on the distribution of costs and benefits of pork production across space (e.g., what about GGFP’s dependency on soy imported from elsewhere?) and among stakeholders (e.g., how fair is the distribution of added value between chain actors? what implies low pork prices for public health?). In these debates differentiating positions can be distinguished. For instance, Dutch GFGP advocates claim that national highly efficient pork production contributes positively to worldwide affordability of pork, global food security concerns and lower emission of GHG. Contrastingly, its adversaries emphasize the narrowness of its underlying efficiency thinking (primarily input-output and volume related), stress its accompanying negative externalities and emphasize that this may go along with loss of prospects for more embedded pork production systems, be it socially, ecologically, economically or ethically. The co-existence of contrasting food chain performance discourses underscores the need for complementary methodological approaches that explicitly problematize and cover the distribution of societal costs and benefits of pork chains among stakeholders and across space. Although tentatively and partially, this is in our overall methodological approach for the comparative analysis reflected in opting for a combination of different methods as LCA, statistical analysis, qualitative analysis of a variety of information sources, in-depth interviews, initiation of a foodlog discussion and the organization of a feedback workshop for stakeholders.

This multi-method approach, as mentioned earlier, amongst others, enabled to identify that pork production remains in different ways interwoven with waste-flow valorization. This significance of this circular performance component is particularly reflected in the Dutch GFPG case. First, its (little successful) globalization strategy of the last decade has been largely financed by a rather profitable waste-flow or “ingredient division” within its leading VION business company. Because of its unsuccessful international expansion strategy VION had to sell in 2014 its Ingredient division. For €1.6 billion, it sold 58 companies that process and recycle residual “products and non-meat” parts of the pigs (gelatin, fats, and proteins *etcetera*). The profitability of these circular activities is partly rooted in state-led regulatory frameworks for animal disease control and, thus, in more “nested rural markets” [42]. It created the opportunity to generate financial resources for a rapid expansion and globalization strategy. Obviously, these waste-flow valorization activities also impact on GFPG’s environmental performances. The differences in resource-use efficiency between our six pork chains as presented earlier, are calculated by using a Life-Cycle Analysis (LCA) with a focus on directly assignable resource use characteristics, implying that wider slaughter-waste material valorization activities are not fully covered. In other words, the applied LCA method does not cover the whole range of GFPG’s relevant environmental performances. Only when waste-flow valorization takes place at farm-level, as in the Dutch LP case through engagement in bio-based energy production, the environmental impacts for byproducts and waste are included in the analysis in line with the economic or revenue allocation as formulated in the Handbook on LCA (See [43]) for a more detailed explanation how the share of upstream impacts are divided between co-products based on their relative value fraction, which, on its turn, is based on the sum of all revenues of all co-products produced in a specific production stage.). This with a partial exception for manure, since its surplus in the Netherlands goes along with negative prices, that is to say: pork producers have to pay to get rid of the quantity of excess manure that they can’t apply on their own land-resources in accordance with the EU Nitrate Directive (There is a maximum kg N that can be applied on agricultural land. Since manure is abundantly available in the Netherlands and strongly regulated by rules with regard its use and application, its current prices do not reflect the value of its nutritional composition. The nutrients present in the excess manure transported outside of the pig farm enters in the LCA of the arable crop farms which receive this manure. This allows the receiving farms to save mineral fertilizer.). A similar need to contextualize LCA outcomes appears in the Italian setting, where Cinta Senese pigs are kept in marginal forest areas for the production of a high quality product with environmental benefits as resource valorization, less waste, less food transports and better management of some uncared forests.

In addition, these context specific LCA shortcomings confirm current absence of comprehensive assessment methods that succeed to integrate the vertical, horizontal and circular components of food performances and to position these in place-based perspective, including stakeholders ideas about how to interpret and perceive local–global interrelations, balances, outcomes and interdependencies. As a response to the wider identified intricacies of chain-based food performance comparison (summarized point by point in Box 1), this brings us to the question as formulated in the title of this paper.

Without the ambition to give the final answer on this question, since this will depend above all on the objectives and pretensions of chain-based performance comparison, we want to finish this section on methodological reflections with a plea for more systemic approaches and discourse sensitive food performance comparison, as currently prominently present in the food security literature [44–47]. Especially in combination with assemblage theory inspired ideas [48,49] on how to understand system-boundaries, micro-macro relations (starting from so-called “flat ontologies” [50] and the contingencies of systemic relations, this may open ways for more fruitful and promising trajectories to theorize and understand food system performances, including their more or less controversial nature.

**Box 1.** The intricacies of chain based performance analysis in pork production.

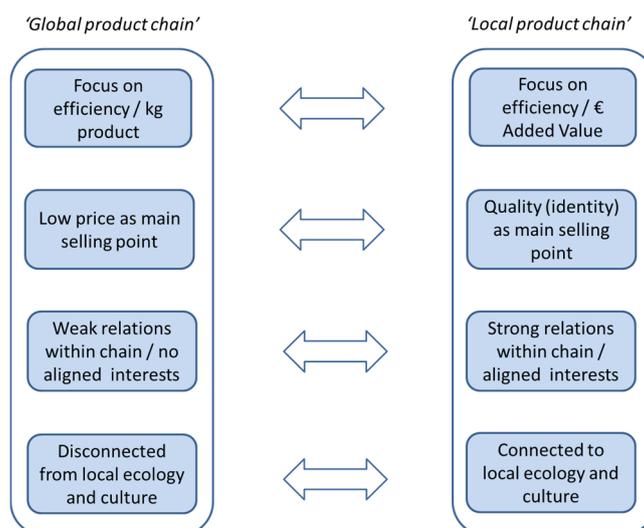
- “Local” and “Global” are relative and relational notions that become especially meaningful in their mutual interrelations and interdependencies.
- The interrelations between local *versus* global pork chains are dynamic, multi-faceted and place-specific.
- Pork chain actors are often involved in multiple chains, making it impossible to assess chain performances in isolation.
- Stakeholder opinions about pork chain performances vary according to sustainability views.
- Pork chain relations are extremely difficult to unravel at the level of concrete products.
- Relations between actors might lack sufficient continuity to speak of chain-based relations.
- Pork chain performances may be intrinsically interwoven with complementary activities (e.g., waste-flow valorization, off-farm income activities; product quality differentiation activities, *etcetera*).
- Pork chain performances are to different degrees influenced and mitigated by territory specific regulatory frameworks.
- Meaningful performance attributes will vary according to contextual differences which restricts the opportunity for chain based-comparison.
- Intra-chain variability might be of more significance than the differences between chains and—both in local and global chains—there often is a wide “performance gap” between the actual and optimal performance.
- Comparison between local and global chains might hide from view (potential) synergetic advantages of the existence of a diversity of chains for the food system as a whole.

**5. Conclusions**

We demonstrated that pork production performance assessment turns out to be intrinsically interwoven with place-specific and multi-faceted local–global interaction patterns and mutual interdependencies. Re-localization initiatives may be a response to globalizing chains, whereas, conversely, global chain actors may re-integrate and re-incorporate “local elements” in their business strategy as specific responses to a renewed attention for their potential societal benefits. Similarly, local chains may incorporate global elements to improve their resource use efficiency.

We also concluded that food chain performance analysis is much more about in-depth analysis of place-specific dynamics, interaction and strategies rather than identifying structural differences or presenting static and de-contextualized performance profiles. Our six selected pork cases represent clearly differentiating strategies, with the Dutch GFGP as most typical global representative and the Italian PH and CSH chains as more ideal typical regional and local product chains. The contrasting features of these local–global ideal types may be visualized as in Figure 2. As analytical abstractions, the ideal types together define the room for maneuver in which pork chains operate and develop their strategies vis-à-vis a mixture of relevant performance challenges (product quality, chain governance, market differentiation, resource use efficiency, distribution of value added, *etc.*).

The Figure aims to stress that under specific conditions local food supply chain actors may be the social innovators that change the way that food is perceived, spoken of and, finally, consumed. In a stimulating environment, these successful innovations may be reinterpreted by conventional food chain actors to meet the newly emerging societal demands triggered by social innovators and as such inducing investments of global operating food chain actors in new technologies and new organizational models. Continuing this line of reasoning, it may be argued that diversity in pork production systems through the co-existence and co-evolution of multiple pork chains may be the best policy option to stimulate innovation, enhance adaptability and preserve flexibility as crucial prerequisites for economic, social and environmental sustainability and consumer freedom of choice.



**Figure 2.** Contrasting ideal typical global and local pork chain logics.

It makes that food performance assessment indeed resembles Amin's "politics of place" [18] with policy actors that will have to downplay their hope on science-led priority setting between global *versus* local food provision systems. This is illustrated by our references to the methodological shortcomings of chain-based performance assessments, our distinction of multiple resource-use efficiency strategies, with their specific pros and cons, opportunities, limitations and threats, and—above all—our recognition of the controversial nature of food system performances in terms of distribution of costs and benefits across space and among stakeholders. Nevertheless, it may be expected from science that in the future contribute more profoundly and adequately to: (a) collaborative learning around how to (re-)shape and optimize the place-based outcomes of co-existing and co-evolving food chains with particular attention for issues as hybridization prospects, opportunities and impacts; (b) place-based mitigation of negative as well as active exploration and facilitation of positive externalities of food provision systems; and (c) a collaborative reflection on the fairness of its accompanying distribution of costs and benefits across space that succeeds to go beyond overly simple local–global dichotomies.

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## Abbreviations

The following abbreviations are used in this manuscript:

CSH	Cinta Senese Ham
GLAMUR	Global–Local Food Chain Assessment: a Multidimensional Performance based Approach
GCH	Generic Cured Ham
GFGP	Global Farming Good Pork
KDV	Keten Duurzame Varkenshouderij
LCA	Life-Cycle Analysis
LP	Lupine Pork

PH	Parma Ham
PDO	Product of Designated Origin

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