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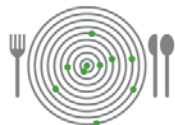
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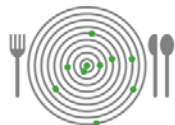


GLAMUR is an EU FP7 project that aims at integrating advancement in scientific knowledge about the impact of food chains to practice, to increase food chains sustainability through public policies and private strategies. This general objective will be pursued through the following specific objectives:

- To develop and validate a performance criteria matrix for assessment and comparison of food chains operating at a range of geographical scales through analysis of how food chain impacts are communicated in different spheres of society.
- To build a database of quantifiable indicators of impact and a set of 20 case studies aimed at understanding how impacts are generated within specific food chains.
- To advance knowledge on methodological problems and trade-offs arising when measuring and comparing the impact of food chains within and between sectors.
- To assess how performance is perceived by stakeholders in different national contexts through participatory assessment and multi-criteria analysis of the different typologies of food chains.
- To assess the actual and potential role of public and private policies addressing food chains and to turn assessment into policy recommendations.
- To build a network that turns the advancement of scientific knowledge into decision making tools for domestic and public consumers, producers, citizens, scientists, policy makers, civil society organisations.

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Synthesis Comparative Report (Deliverable 4.2)

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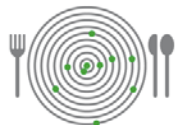
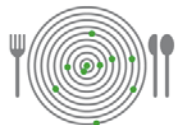


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1. Introduction

This report constitutes deliverable D4.2 of the project GLAMUR –*Global and local food chain assessment: a multi-dimensional, performance-based approach*. The objective of work package 4 is to compare and contrast the economic, environmental, health, social and ethical impact of the identified typologies of food chains (task 4.1), and to discuss the conditions of validity of comparison (task 4.2). This was done for seven products or product groups: apples, berries, bread, cheese, pork, tomatoes and wine.¹

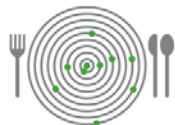
Thematic reports (deliverable 4.1) were written guided by the following questions:

- What is the performance of local chains vs global chains in the studied subset?
- What are the most relevant dimensions in each subset and what are the relations (correlation, trade-offs, dilemmas) between them?
- What are the cross-cutting issues and emerging thematic questions and priorities for in-depth investigation?

This document (deliverable 4.2) provides a synthesis of these results based on the thematic reports. A preliminary version of the document was discussed at the Expert Meeting in Montpellier on June 4, 2015.

Section 2 discusses some methodological issues related to the comparison of cases and proposes a typology of cases to enable comparison. Section 3 gives an overview of all cases and classifies them in the proposed typology. Section 4 provides a synthesis of the case-comparisons by proposing some patterns in local/global differences. Section 5 concludes this document.

¹ The asparagus case is excluded from this synthesis, as it constituted only two chains: a Peruvian global chain and a Belgian local chain.



2. Local to global and back again?

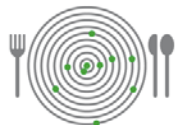
In a subsistence economy all was local: land was cultivated by farmers using locally available resources. For instance, organic matter was harvested in common lands and applied to fields producing food consumed mostly by the farm household. With first and second agrarian revolutions and parallel to the transport evolution, most of farmers in Western Europe were able to produce more than they needed and to sell large quantities outside their regions, such that specialisation took place. Then, the industrial revolution and subsequent advances in science made possible moving forward to more global trade and the synthesis of inputs.

A situation in which all kinds of inputs and global trade came into the system led to disconnection between producers and consumers, and to subsequent incidents and crises. Reaction was more coordination alongside the supply chain, but the implementation of this coordination followed two different pathways: (1) more coordination and traceability through increased control using formalised procedures and (2) more coordination through a relocalisation of the system. In the control pathway, the basic configuration of the system did not change. In the relocalisation pathway, the system is reconfigured resulting in new relationships between producers, processors, retailers and consumers.

GLAMUR aims to compare the performance of different configurations between local and global food chain on a range of issues. Local and global food chains could correspond to these pathways that are not mutually exclusive: hybrid pathways may occur. In fact, GLAMUR identified four key dimensions to define what is local/global:

1. The physical / geographical distance between production and consumption
2. The type of governance and organisation of the supply chain (degree of control of “local actors” and “global actors”)
3. The kind of resources, knowledge and technologies employed
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.

As a result, with regards to comparison between all GLAMUR case studies, two problems arise: (1) variation in these four dimensions gives rise to a potentially high number of typologies of supply chains, and (2) supply chain dimensions and performance attributes may be correlated.



To make the comparison manageable, we make the choice to reduce the amount of dimensions to two:

- Length of supply chain (short to long) encompassing both geographical distance and governance
- Degree of product differentiation (bulk to differentiated) encompassing both resources, knowledge and technologies employed and territorial identity

Combining these two dimensions would give rise to four generic strategies:

	More Bulk	More Differentiated
Long supply chains		
Short supply chains		

However, the cases demonstrate that there are many intermediate situations that can be dynamic. Hence, it is better to depict cases using continuous axes rather than a categorisation, which allows us to depict both trajectories in time and hybrid cases (see figure 1).

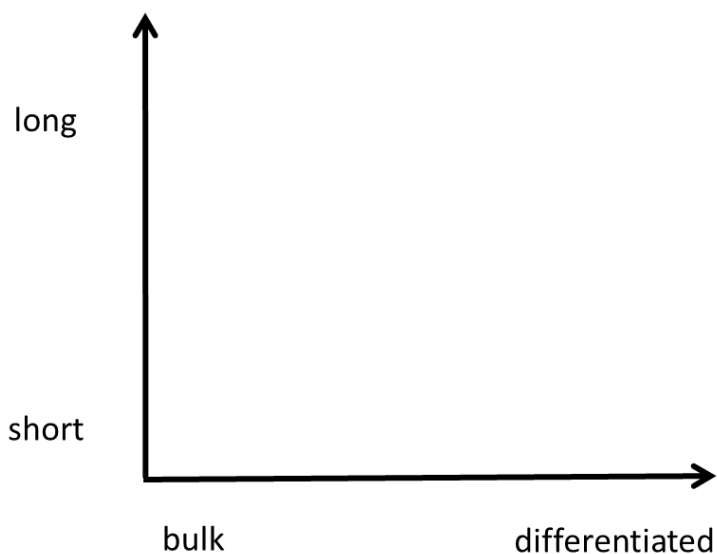
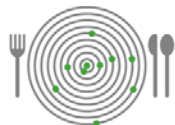


Figure 1

Another methodological issue is that indicators may measure performance at different scale levels that are embedded in each other in a nested way (see figure 2). Following the



MuSIASEM² approach —which is an operationalisation of Georgescu-Roegen's bioeconomic approach to the economic process that explicitly addresses biophysical feasibility and constraints— indicators need to be considered at different scales (Giampietro et al., 2013). The lowest level we consider is the agricultural sector (level n-1), which is part of the food chain or system (level n).³ Food chains or systems are part of a national economy (level n+1) that includes consumers and taxpayers. Finally, the global or world level is captured by level n+2 and refers to activities taking place outside the country under consideration. This will be mainly substitution effects following actions within a country (e.g., imports in a country increase when yields in that country decrease with constant consumption). Given the biophysical constraint of every level, effects at these different scales are always interconnected.

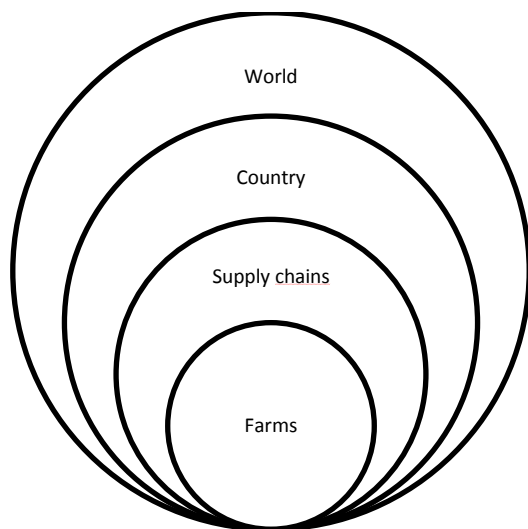
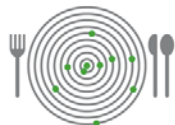


Figure 2: Nested levels of the food system

² Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism.

³ Note that we exclude consumers from the food chain.



3. Overview and typology of cases

3.1. Overview of cases

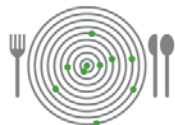
Seven product groups have been investigated. For each product group, a more local and a more global (and sometimes also an intermediary case) were selected in two countries (see table 1 for an overview) following the four criteria identified earlier (distance, governance, resources and territoriality).

Pork

In the **Netherlands**, differentiation is mainly based on resource use and governance. The local chain is represented by the Lupine Pork chain that attempts to re-create distinctive pork qualities based on local feed sourcing, but turns out to be strongly inspired by global knowledge sourcing around how to sustain pork production and to embed it in more global food market oriented farming activities (NL). The global chain is represented by the Good Farming Global Pork chain that is owned by a regional farmer's organisation, but knows a strongly globally oriented corporate business strategy. The 'Keten Duurzame Varkenshouderij' chain is a farmers-led relocalisation of chain governance but remains largely interwoven with global input and output markets. In **Italy**, differentiation is based on territoriality and resource use. The local chain is represented by the Cinta Senese ham chain using traditional local pig breeds with predominantly regional output markets, although increasingly oriented towards more global niche and tourism markets. The global chain is the generic cured ham, characterized by global sourcing of raw materials, but at the same time closely interwoven with the more territory specific features of pork processing infrastructure, competences and skills of the Parma territory. An intermediate chain is the "regional" Parma ham chain that builds upon a historically rooted territorial distinctiveness of pork quality but has nowadays a global reputation and operates in global market outlets.

Bread

In the **UK**, chains are differentiated primarily by distance and resource use. The local chain is represented by family-owned craft bakeries that bake bread using traditional technology. The global chain is represented by an industrial bakery sourcing both locally and globally. An intermediate chain is the in-store bakery that uses modern technology but sources wheat regionally. In **Italy**, chains are differentiated by distance and resource use. The local chain is represented by The Stone Mill, a farm that produces and processes its own wheat into bread and pasta using traditional technology. The global chain is represented by industrial bread produced using modern technology and global sources by Barilla. An intermediate case is the Tuscan Sourdough Bread using regionally sourced inputs and traditional technology.



Cheese

In **Switzerland**, chains are differentiated primarily by area of production, volume of cheese produced and know-how and technology used. The local chain is represented by L'Étivaz, a Swiss ripened hard cheese that is produced on the farm using traditional technology and ripened in a cooperative. The global chain is represented by Le Gruyère cheese that is produced at the creamery and commercialized through retailers. In the **UK**, chains are differentiated according to volume of cheese produced, the proportion of cheese exported, and the degree of mechanisation or industrialisation. The local chain is represented by farmhouse producers of Single Gloucester and cheddar. The global case is represented by creamery producers of cheddar.

Wine

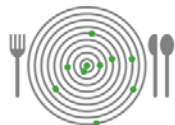
Chains are differentiated primarily by distance, size and governance. In **France**, the local chain is represented by family domains that commercialize a relatively large share of their output through local markets. In the global bulk wine chain, growers sell their grapes to large cooperatives that produce the wine and sell it through a variety of channels. The intermediary case is a global bottled wine chain, in which wine is produced by domains or small cooperatives, but commercialized globally. In **Switzerland**, the local chain is represented by Valais-based domains that grow grapes, produce wine and sell the wine using local outlets. The global chain is represented by the French Global chain.

Tomatoes

In **Spain**, differentiation is based on distance, governance and resource use, while all chains are organic. The local chain consists of a network of small size scale agro-ecological farmers, producing a diversity of seasonal vegetables that are sold directly to the consumer. In the global chain, tomatoes are grown in greenhouses in Almeria and commercialized through various channels. An intermediate chain is characterized by a medium size farmer, producing tomatoes outdoor in semi-diversified farms. Tomatoes are sold through an organic wholesale cooperative. In **France**, the local chain involves outdoor organic production and local sale channels, while the global chain is represented by the Spanish global chain.

Apples

For apples, differentiation is mainly based on distance and governance. In **Spain**, the local chain is represented by small agro-ecological farmers producing organic apples and selling them directly to consumer groups. In the global chain, organic apples are sold through wholesale channels. In **Belgium**, the local chain produces apples organically and sells them to consumer groups. In the global chain, apples are produced using integrated production techniques and commercialized through the cooperative auction.

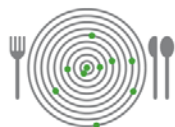


Berries

In **Latvia**, blueberry chains are differentiated by distance, governance and resource use. The local chain is represented by individuals picking and selling blueberries. The global chain is represented by a large, technologically advanced wild blueberry processing enterprise. In addition, an intermediary global grey chain is considered. In **Serbia**, chains are differentiated by distance and governance. The local chain consists of small farms producing and selling raspberries, while the global chain is oriented mainly at the export of frozen raspberries.

Table 1: Overview of cases and country pairs

Product	Country 1	Country 2
Pork	Netherlands Global Farming Good Pork (global) KDV (mixed) Lupine pork (local)	Italy Generic cured ham (global) Parma ham (regional) Cinta Senese ham (local)
Wheat-to-bread	UK Global chain (global) In-store bakery (regional) Craft bakery (local)	Italy Mulino Bianco (global) Tuscan Bread Sourdough (regional) The Stone Mill (local)
Cheese	UK Farmhouse (local) Creamery (global)	Switzerland Le Gruyère (global) L'Étivaz (local)
Wine	France Family domains (local) Global bottled wine Global bulk wine	Switzerland Valais (local)
Tomatoes	France Local	Spain Box scheme (local) Mixed supply chain Almeria (global)
Apples	Belgium Food teams (local) BFV (global)	Spain Box scheme (local) Cooperative (global)
Berries	Latvia Local chain Global grey chain Global legal chain	Serbia Local chain Global chain



3.2. Typology of cases

In table 2, we categorised these cases in a very rough way in the four typologies identified earlier. We consider this a rough categorisation, as some cases are in fact in between categories. For instance, the Spanish mixed tomato supply chain and the UK regional bread supply chains are intermediate (regional) and may show some differentiation (organic). The latter also holds for the Belgian apple case which is considered undifferentiated although organic. Organic production is considered “differentiated” when multiple varieties are used, agro-ecological production methods are employed, additional services are delivered to the consumer, etc.

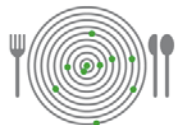
This categorisation allows us to differentiate between pure shortening patterns (S) and combined shortening and differentiation patterns (S+D) in the local chains:

- In a pure shortening pattern, the number of actors involved in the local chain decreases, as farmers sell their products directly to the consumer (or through maybe one intermediary) without changing the way the products are produced. Hence, mainly the characteristics ‘distance’ and ‘governance’ are likely to be different from a global chain.
- In a combined shortening and differentiation pattern, not only is the local chain shorter than the global one, but also more differentiated products are being produced using other methods, such that not only ‘distance’ and ‘governance’ will be different, but also ‘resources’ and ‘territoriality’.

However, also global chains may be subject to these patterns of pure shortening or combined shortening and differentiation patterns, thus complicating the local-global comparison.

Table 2: Categorisation of cases

	More bulk	More differentiated
Long supply chains	BE global apples SE global raspberries LT global blueberries SP global tomatoes FR global bulk wine UK global cheese UK global bread UK regional bread IT global bread NL global pork	FR global bottled wine CH global cheese IT regional bread NL mixed pork



	IT global pork	IT regional pork
Short supply chains	BE local apples SE local raspberries LT local blueberries SP mixed tomatoes	FR local wine CH local wine CH local cheese UK local cheese UK local bread IT local bread IT local pork FR local tomatoes SP local tomatoes

Nevertheless, acknowledging these different patterns is important to understand local/global differences. In making a synthesis of results, we have taken into account these patterns by carrying out the comparison in two ways.

First, performance indicators are compared for the pure shortening patterns only. These apply to the Belgian apples, the Serbian raspberries, the Latvian blueberries and the Spanish tomatoes (mixed).

Second, performance indicators are compared for the combined shortening/differentiating patterns, given that global chains are more bulk oriented. This applies to all other cases. However, for French wine, Swiss cheese, Italian bread and Dutch and Italian pork, either regional cases exist following a differentiation pattern or global chains are differentiating.

3.3. Selection of attributes and indicators

Figure 3 sketches the conceptual framework used in the GLAMUR project and discussed in detail in the WP3 – Guidelines for case studies (Schmitt et al., 2014). Sustainability is considered in five dimensions (economic, social, environmental, health and ethical). WP2 has identified 24 attributes or characteristics of sustainability across these five dimensions (Kirwan et al., 2014). An attribute can be represented by one or more indicators.

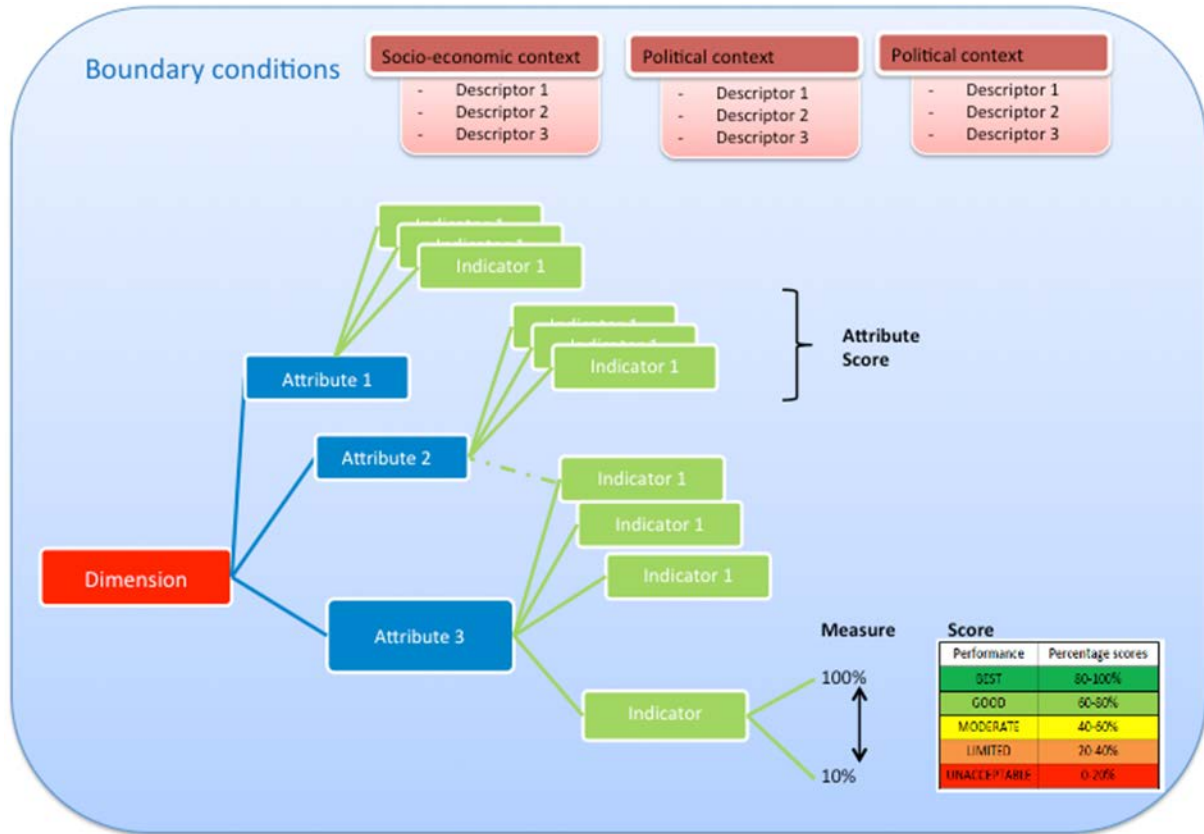
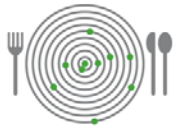


Figure 3: GLAMUR conceptual framework (Schmitt et al., 2014)

Product teams have considered both country-specific attributes and indicators and common attributes and indicators across countries. The synthesis in this report is based on the common attributes and indicators only. Table 3 provides an overview of which attributes have been investigated by which teams. In section 3.2, we discuss each dimension. Note that affordability and availability are considered dimensions of food security and are discussed under the social dimension and that fair trade is considered to be similar to distribution of added value and thus discussed under the economic dimension.

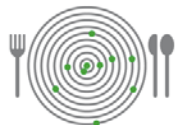
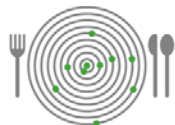


Table 3: Attributes investigated by team

Team	Economic	Social	Health	Environmental	Ethical
Apples	Contribution to economic development	Food security		Resource use Pollution Biodiversity	
Berries	Creation and distribution of added value Contribution to economic development	Labour relations			Governance
Bread	Technological Innovation	Information & communication	Nutrition	Biodiversity	
Cheese	Creation and distribution of added value Contribution to economic development	Information & communication Food security Consumer behaviour	Nutrition	Biodiversity Resource use	Animal welfare
Pork	Contribution to economic development Resilience			Resource use	Governance
Tomatoes	Creation and distribution of added value Contribution to economic development	Food security		Resource use Pollution Biodiversity	
Wine	Creation and distribution of added value	Information & communication Territoriality	Food safety	Resource use Pollution Biodiversity	Governance



4. Synthesis of results

4.1. Economic dimension

The economic dimension was captured by the creation and distribution of value added (4 teams), and the contribution to economic development (4 teams). Resilience and technological innovation were investigated by only 1 team.

Creation and distribution of value added

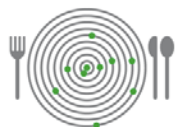
Value added can be created in two ways: either by cutting variable costs by becoming economically more efficient or by adding characteristics (e.g., organic, territoriality, production method, taste) to the product thus generating a higher price. Local chains primarily use the second strategy, while global chains primarily use the first strategy, although they increasingly also use the second strategy. These findings are supported by our cases, as the creation of value added differs across teams: in some teams, local chains seem to create more value (e.g., pork, French tomatoes, Swiss wine), while in others global chains create more value (cheese, Spanish tomatoes).

In all cases considering this attribute (tomatoes, wine, cheese, berries), the farmer in the local chain captures a higher share of the value added in the supply chain. One exception is Serbian raspberries, as localness here does not imply a shortening of the supply chain and as a result, farmers in the local chain do not have more control of the value added capture.

Contribution to economic development

Contribution to economic development is a difficult attribute to evaluate as it encompasses many dimensions. First, there is a difference between looking at value added and jobs. Firms can grow without increasing employment but by using more capital (technology) thus increasing labour productivity. Second, how value added or jobs contribute to economic development depends in the first place whose economic development is to be increased. Global cases may contribute to economic development elsewhere, while local cases may contribute to the local economy.

Generally, the trade-off between economic efficiency and employment is supported by the teams considering this attribute (cheese, wine, apples, tomatoes, berries). Local chains use more labour, but as a result have lower labour productivity. Global chains use less labour and are more labour productive. However, there are exceptions. In the global Spanish tomato case, more labour is used, but particularly in the retail stage. In other words, when the farmer assumes the retail stage herself, this reduces employment elsewhere. In the French tomato case, labour productivity is higher in the local chains.



Technological innovation

Technological innovation provides an important opportunity to increase resource use efficiency. Only the wheat-to-bread team has investigated the impact of technological innovation. Results are mixed and highly dependable on the availability of data.

Resilience

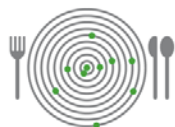
Only the pork team has investigated resilience that was found to be related to product labeling, farm strategies and vertical integration practices. First, localness may protect pork producers against the price volatility than characterizes global pork chains, especially where localness is entangled with consumer appreciated distinctive product quality supported by EU quality signs (PDO). Second, both global and local pork chains might be strongly interwoven with farm-diversification strategies, be it through off-farm income generation or through multifunctional farm-enterprises. Third, vertical integration may have rather different outcomes as resilience building instruments or mechanisms. To conclude, the notion of 'supply chain' excludes actors outside the scope of the chain (e.g., rural development related actors), such that not all relationships between relevant actors may be captured with the chain notion.

Pattern - shortening

Economically, a pure shortening strategy entails farmers keeping on producing the same commodity using the same production structure (table 4). Activities carried out by other actors previously are now carried out by the farmer or the consumer. As a result, farmers will assume a higher share of the value added, but less value added—and thus less jobs—will be created. Consumers may benefit from lower prices, but governments raise less tax revenues. To the extent that some downstream activities created value (and maybe jobs) globally, this value also decreases.

Table 4: Comparison in the economic dimension, shortening pattern

	Local	Global
World (n+2)	Less value added and jobs elsewhere	More value added and jobs elsewhere
Country (n+1)	Low food price Less tax revenues	High food price More tax revenues
Food supply chain (n)	Less value added per kg Less labour employed	More value added per kg More labour employed at retail
Farms (n-1)	High share of lower value added	Low share of higher value added



Pattern – shortening + differentiating

When farmers not only shorten supply chains but also differentiate, resulting in a different production structure relying more on local resources, effects are different. Now, more value added is created, but this value added is embedded in the product itself (higher quality). As a result, low-priced commodities are being compared to high-priced, high-quality products. Using local resources may generate positive externalities, both privately and publicly. Private benefits may be lower costs due to better functioning ecosystem services or higher revenues from non-agricultural activities (e.g., agri-tourism). These may also generate public benefits, through community-level ecosystem services (e.g., off-site erosion control) or the stimulation of non-agricultural activities. Some of the differences between local and global chains disappear when global chains also apply shortening and differentiation strategies.

Table 5: Comparison in the economic dimension, shortening+differentiation pattern

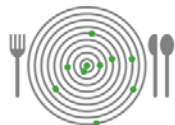
	Local	Global
World (n+2)	Less added value and jobs elsewhere	More value added and jobs elsewhere
Country (n+1)	High food price Non-agricultural benefits (tourism)	Low food price
Food supply chain (n)	More value added per kg at farm level More labour employed	Less value added per kg at farm level Less labour employed, more capital
Farms (n-1)	High share of lower value added Spill-overs to non-agricultural activities	Low share of low value added

4.2. Social dimension

In the social dimension, the attributes Information & communication (3 teams) and food security (3 teams) have been investigated the most. Food security, labour relations, consumer behavior and territoriality have been investigated by 1 team only.

Information & communication (bread, cheese and wine)

Information and communication encompasses two dimensions: communication within the chain and communication to the consumer. The evidence on intra-chain communication is mixed: in some cases there is more communication in local chains (cheese), in others there is no difference (bread). The evidence concerning communication with the consumer is also mixed. In some cases, local chains provide



more information (bread Italy, wine), in other cases, local chains provide less information (bread UK, cheese). The latter is also enhanced by product labelling.

Differences in performance related to information & communication depend strongly on the nature of the relationships between the various actors, including the final consumer, and the marketing efforts of global chains. Moreover, the higher the number of actors involved, the more complex communication processes are. This not only depends on the number of intermediaries, but also on the nature of the product and the size of the chain. As a result, communication may be organised through branch organisations and inter-branch platforms. Advances in ICT have the capacity to strongly improve information exchange both within chains and with the consumer.

Food security

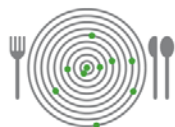
While food security is generally considered to capture four dimensions —food availability, food access, food utilisation and food stability— our research only considered dimensions of access, that is, affordability and availability.

Affordability refers to the price to consumers and is a direct result of the previous discussions: supply chains that are more economically efficient are able to offer their produce at lower and thus more affordable prices, but in local chains there are less intermediaries that need to earn a profit. So the effect depends on the margin captured by the farmer: local chains may charge the same price as in the supermarkets, such that affordability is not affected. In other words, there is a trade-off between affordability and distribution of value added. In fact, the consumer is ignored when discussing the distribution of value added in a supply chain. The teams that have considered affordability find evidence that support these various effects. Global chain cheese is cheaper because of efficiency. Local apples and tomatoes are cheaper, because farmers charge lower prices than supermarkets do.

Availability was captured by the amount of time a product (tomatoes and apples) was available. For apples, no differences were found, as storage is used in both local and global chains. Tomatoes from global chains are available for a longer time, which is a result of difference in production methods (heated greenhouses).

Labour relations

Labour relations have only been investigated in the berries team. Global chains offer official contracts, whereas in grey chains much more employees work without contract and are more often forced to invest their private resources to solve issues emerging in the chains. Also, lack of contracts leave them exposed to possible threats. However, these employees also have a possibility to earn more and are not tied to one specific employer. Global chains tend to be more secure, but offer less possibilities for lower level



employees. Local chains are practically unregulated and there is a lack of institutionalized actors. Thus the involved actors are free to choose how they organize their actions.

Pattern – shortening

A less clear pattern can be observed for the social dimension as for the economic dimension, as effects seem strongly dependent on the number of intermediaries, the nature of the product and the size of the chain. For the pure shortening strategy, informal relations replace formal procedures resulting in different social mechanisms. This may sometimes be to the advantage of the local chain (better communication with the consumer through direct contact) and sometimes to the disadvantage of the local chain (labour more informal and thus less socially protected). Food prices are likely to be lower in the local chain, as there no more intermediaries that take a profit margin, thus potentially enhancing food security (as this depends on the access of poor consumers to local chains).

Table 6: Comparison in the social dimension, shortening pattern

	Local	Global
World (n+2)	na	na
Country (n+1)	Low food price	High food price
Food supply chain (n)	No contracts more likely Trust-based compliance Direct communication to consumer	Official contracts More legal compliance Mediated communication to consumer
Farms (n-1)	Labour conditions more risky	Better labour conditions more likely

na: not available

Pattern – shortening + differentiating

When shortening is combined with differentiating, communication becomes more important. The same observation can be made as in pure shortening strategy, i.e., direct communication and trust-based compliance in the local chain versus mediated communication and legal compliance in the global chain, but this strongly depends on the differentiation strategy. Differentiation often involves labelling, also for the local chain, which formalizes compliance procedures. In addition, reputation becomes more important, such that the likelihood of bad labour conditions decreases. In fact, labour conditions may become more resilient in local chains as exemplified in the Dutch pork case. A differentiated product is per definition more expensive than a bulk product. As consumers have the choice between local and global chains, food security will not be affected.

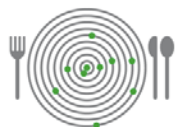


Table 7: Comparison in the social dimension, shortening+differentiation pattern

	Local	Global
World (n+2)	na	na
Country (n+1)	High food price	Low food price
Food supply chain (n)	No contracts more likely Trust-based compliance Direct communication	Official contracts More legal compliance Labels
Farms (n-1)	Labour conditions more likely to be resilient	Better labour conditions

na: not available

4.3. Environmental dimension

In the environmental dimension, three attributes have been investigated: biodiversity (5 teams), resource use (5 teams) and pollution (3 teams).

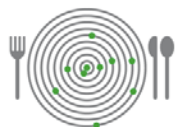
Biodiversity

Biodiversity is captured by various indicators ranging from the level of agrobiodiversity (diversity of crops and varieties) to landscape management practices. For three teams (wine, bread and tomatoes), local or regional chains perform clearly better, although for wine there is a difference between global bottle-based chains (more diversity) and global bulk chains (less diversity). For the cheese and apple teams, there are no differences or differences are small.

Resource use and pollution

Resource use and pollution are captured only by energy use and greenhouse gas emissions (which is strongly related to energy use). A similar pattern is observed as with the employment-efficiency trade-off: global chains tend to consume less resources per unit of product than local chains, due what could be called ecologies of scale. In other words, global chains employ more resource efficient transformation, transportation and cooling facilities resulting in less greenhouse gas emissions per unit of product. This was observed in the cases of apples and tomatoes, while results were mixed for wine, as they depended on the technologies used for bottling and transportation.

The wine cases considered water and material use and also the use of environmental mitigation measures, while the cheese cases considered soil improvement practices, material use and waste reduction and disposal. No significant differences were found, expect for soil improvement practices that were used more by local chains. However, this is to a great extent related to soil type and slope.



For the pork cases, however, different patterns can be observed. In the Netherlands, local chains are more resource efficient when considering the use of water, fossil energy and land, and their contribution to eutrophication potential and greenhouse gas emissions are lower. In Italy, the same pattern can be observed for water use, but not for energy and land use, as global chains use less energy and land and emit less greenhouse gases.⁴

Pattern – shortening

Environmentally, a pure shortening strategy entails farmers keeping on producing the same commodity using the same production structure, but often at a smaller scale. Activities carried out by other actors (e.g., packaging, cooling, transportation) previously are now carried out by the farmer or the consumer. As a result, the higher amount of resources and energy consumed per unit of product in the local chain is likely to compensate any saving in ‘food miles’ (if at all). Differences in on-farm biodiversity and pollution are not likely, as there is no real difference in production method (only scale may be different). In the long run, local chains may have an incentive to invest in good practices, due to their direct relationship with the consumer, while global chains tend to comply with minimum standards imposed by retailers or the state.

Table 8: Comparison in the environmental dimension, shortening pattern

	Local	Global
World (n+2)	na	na
Country (n+1)	More external resources could be depleted per product	Less external resources could be depleted per product
Food supply chain (n)	Low resource efficiency	High resource efficiency
Farms (n-1)	More likely to invest in good practices	Compliance to standards

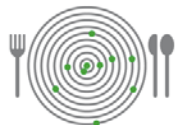
na: not available

Pattern – shortening + differentiating

When local chains also adopt a differentiation strategy, taking care of the environment is likely to be part of the differentiation activities. As a result, local chains are likely to result in more biodiversity, less pollution and less depletion of external resources. However, this results are offset, as generally yields are lower, such that more land needs to be used to produce the same amount of produce. This land may be used elsewhere, leading to a higher depletion of external resources globally.⁵ Like in the economic dimension, these

⁴ Similar results were obtained in the Swiss cheese and wine cases.

⁵ Of course, the relative size of the effect may be very different: the local effect may be significant at local level, while the global effect may be diluted at the global level.



differences will disappear when global chains also start applying shortening and differentiation strategies.

Table 9: Comparison in the environmental dimension, shortening+differentiation pattern

	Local	Global
World (n+2)	More external resources depleted	Less external resources depleted
Country (n+1)	Less external resources depleted More land needed	More external resources depleted Less land needed
Food supply chain (n)	High external resource efficiency Low external inputs Higher biodiversity	Low external resource efficiency High external inputs Lower biodiversity
Farms (n-1)	Low throughput, less environmental stress	High throughput, more environmental stress

4.4. Health dimension

In the health dimension, two attributes have been investigated, but by a limited number of teams, i.e., nutrition (2 teams) and food safety (1 team).

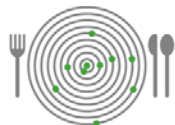
Nutrition

Nutrition refers to salt and fat content in the case of bread, while in the case of cheese also the type of fats and calcium content are considered. Generally, no significant differences were found when comparing local with global chains. Moreover, some differences were related to differences in recipes rather than in localness. The only exception seems to be calcium content in Switzerland, where local chains outperform global chains, and fat content, which is related to different pasture systems.⁶

Food safety

In the wine cases, food safety is captured by two dimensions: the application of food safety standards and controls and the presence of Sulphur dioxide in the wine. While global chains are more likely to use formalized controls and standards, local chains tend to be more based on interpersonal relations and hence trust between producers and consumers. The use of Sulphur dioxide does not differ across chains.

⁶ The Italian bread case also shows that local chains may use certain technologies that are beneficial for nutrition. However, these indicators were not investigated in the UK.



4.5. Ethical dimension

In the ethical dimension, governance has been analysed the most (3 teams). Animal welfare has been investigated by 1 team only.

Governance

Governance relates to both the internal and the external relationships of supply chains. Generally, global chains tend to rely more on formal, standardized relationships, while local chains tend to rely more on informal, trust-based relationships. As a result, some global chains tend to perform better on indicators related to transparency (like in the case of food safety) and complying with global interpretations of good governance (berries). The local pork cases are characterized by a higher degree of self-governance, which implies that farmers are more involved in decision making processes and that local chains more actively engage with external stakeholders, resulting in more institutional support.

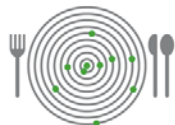
Animal welfare

In the cheese cases, animal welfare is captured by the dimensions animal density, lifetime of dairy cows and grazing time. Grazing time is similar across chains, but cows producing milk for the local chains tend to live longer, which may be due to the smaller volumes produced by each cow, meaning that the animals are under less stress, and animal density tends to be lower. Qualitative research highlighted the seasonal dimension of animal welfare, which tends to differ in the summer season (while grazing) versus the winter season (while in the stable). As dairy cows in the Swiss global chains spend more time inside, farmers supplying for these chains tend to invest more in stables with higher quality living conditions.

4.6. Trade-offs

Cutting across the comparison of local and global cases, trade-offs arise. These trade-offs may be related to a local versus global approach, but this is not necessarily so. The identification of trade-offs was not easy, due to the static nature of the analyses: generally, trade-offs only come to the surface when an actor tries to change one or more parameters. As a result, trade-offs were identified based on the comparison between local and global chains, on an implicit basis. Trade-offs were found both within dimensions and between dimensions.

First, there is the trade-off between **labour productivity** and **job creation**. Higher labour productivity generally leads to lower costs and prices (leading to better food security) and better labour conditions (lower workload due to mechanisation and automation), but



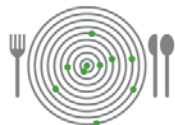
as a result less jobs are created. Local chains tend to employ more people at the farm level (at the expense of employment downstream), but often these jobs involve more hard work, although job satisfaction is likely to be higher.

Second, there is a trade-off between **efficiency** and **diversity**. This is best seen when looking at agrobiodiversity, that is, the amount of different varieties used. Generally, this has better effects on the resilience of the chain and likely also on biodiversity in general, but at the expense of efficiency and thus costs and prices.

Third, there is a trade-off between **price** and **quality**. Higher chain efficiency leads to lower prices, but less attention to product quality. Products may be available year-round (out of season) at affordable prices, but with lower nutritional quality. However, one should be cautious to generalize any differences between local and global chains, as this trade-off depends on what quality attributes are being considered. For instance, nutritional quality (e.g., salt and fat content) may be better controlled in global chains.

Fourth, there is a trade-off between **biodiversity/pollution** and **resource use**. Large-scale operation may save resources and particularly energy and land per unit of product, but at the expense of a high pressure on the land being used, leading to higher pollution and less biodiversity per unit of land.

Fifth, there is a trade-off between **informal trust-based approaches** versus **formal procedures**. Informality may lead to more flexibility in labour relations and in relations vis-à-vis the consumer and even resilience, but may also result in less transparency and even misuse (lack of compliance).

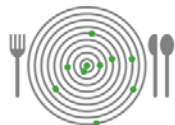


5. Conclusions

The purpose of this document was to synthesize the findings of the comparison of local and global chains concerning their economic, environmental, health, social and ethical impact for seven products or product groups: apples, berries, wheat-to-bread, cheese, pork, tomatoes and wine. Although we suggested some general patterns within the economic, social and environmental dimension, it is difficult to generalize these patterns, as the comparison of local and global food supply chains is not straightforward, mainly due three reasons. First, local and global are no clear-cut categories, as local chains have many global elements and vice-versa, giving rise to many hybrid situations.⁷ Second, chain strategies influence performance evaluation. When chains apply product differentiation strategies, effects between local and global may even be opposite. Third, trade-offs within and across the various sustainability dimensions apply, such that no superior strategy that scores well on all dimensions can be identified. In addition, trade-offs also occur across different scales. Fourth, difficulties related to measuring indicators consistently makes an evidence-based approach very difficult.

Earlier, Edwards-Jones et al. (2008) concluded that natural-science approaches looking primarily at technical and environmental issues should be supplemented with social-science approaches for a holistic assessment of local and global chains. However, the GLAMUR cases have shown that the implications of this conclusion are more far-reaching than the former authors may have envisaged. A holistic evaluation implies that a multi-method approach should be used when evaluation sustainability performance and that participatory approaches and context-specific information are key to correctly interpret results. The various case studies carried out in WP3 provide a more holistic approach than the synthesis in this report that has tried to carry out a meta-analysis. In addition, the involvement of different actors also highlights that different actors have different perspectives on sustainability performance. This calls for an approach that is not only multi-method and multi-scale, but also multi-criteria, allowing for applying different weights to different attributes. Work package 5 will explore such an approach.

⁷ Recently, Smith Taillie and Jaacks (2015) point to the false dichotomy between localism and supercenterism and call for innovative and multisectorial solutions.



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