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**AGRO-FOOD CHAIN: AN INNOVATIVE PARADIGM
FOR FOOD AND RURAL POLICY ANALYSIS AND
AGRO-FOOD CHAIN SEGMENTS' SYSTEMIC PERFORMANCE AT
REGIONAL LEVEL**

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Abstract:

The food chain concept is an increasingly common theoretical instrument for food and rural development policy and many countries adopt the so-called “new rural paradigm”, so to integrate different sectoral policies. This paper aims at adopting the food chain paradigm in order to analyse the regional agro-food system and to sustain the design and delivery of consistent inter-sectoral policies. It adopts the netchain concept (Lazzarini et al, 2001) and the theory of governance patterns in global value chains (Gereffi et al, 2005). Results show this innovative approach contributes to better understand and stimulate economic performance of the whole agro-food network.

Keywords: rural policy, region, agro-food chain, performance, intersectoral approach, O18, Q18, R11, R58

1. Introduction

The regional dimension of the economy has attracted increasing attention both from academics and public institutions’ officials. European Union policies’ focus on regions positively influenced the emergence of theories, approaches and instruments aimed at analysing sub-national socio-economic dimensions. Within this framework rural regions and rural development became important policy issues. Its practices varied across Europe and lead to different approaches to policy programming, implementation and assessment. Many European and international countries are increasingly adopting a so-called “new rural paradigm”, a place-based approach to rural policy, that “emphasises investments rather than subsidies and that is able to integrate different sectoral policies and improve the coherence and effectiveness of public expenditure in rural areas” (OECD 2006). Among the various policy shifts embedded in this approach, the following deserve specific attention:

- “from a sectoral to a territorial policy approach, including attempts to integrate the various sectoral policies at regional and local levels and to improve co-ordination of sectoral policies at the central government level.
- from an approach based on subsidising declining sectors to one based on strategic investments to develop the area's most productive activities” (OECD 2006).

Moreover, recent research show that the food chain concept is increasingly adopted as a theoretical instrument for food and rural development policy within current EU-15 rural development programming documents (Bertazzoli et al, 2009). In particular, the interconnecting relations between the agricultural-rural world and the industry, retailer and consumers have gained stronger policy attention. Still, the food processing and distribution dimensions have become a targeted analytical dimension and, therefore, legitimacy only within some rural development approaches, and often as consequent and necessary aspects of the rurality dimension (Marsden 1999). In addition, a consistent and comprehensive approach to the whole agro-food system, going from the first to the last stages of the chain is still to be structured both politically and academically. Finally, also in the programming documents widely adopting the food chain paradigm, there seems to be a gap between the context analysis of the territory and the defined strategy. Whereas the first focuses only the first chain stage, that is the agricultural and rural dimension of the territory, the second involves all chain stages, including also processing, retailers and consumers.

The present paper draws some light on this issue and aims is to adopt the food chain paradigm in order to analyse the regional agro-food systemic dimension and to sustain the design and delivery of consistent inter-sectoral and systemic agro-food and rural policies at regional level. The food chain becomes the overarching innovative paradigm, and also instrument, in order to integrate a cross-sectoral dimension to the place-based approach in rural policy. In addition, thanks to the integrated

representation embedded in the food chain concept, it can be a powerful instrument for strategic choices over key productive investments¹.

2. Theoretical background

Regions are “locus of untraded interdependencies” (Storper 1995). The territory within the region and the processes leading to regional development and competitiveness derive “from the interaction of subjects and material and non-material components of the territory” (Maccani et al., 2010). These components become interdependent and create assets, peculiar to that territory. So that the region’s material and non-material networks become instruments to the development of a given territory. Using Markusen wording (Markusen, 1996), a competitive territory could be define *sticky* and its non-material assets are mostly untradeable.

Networks are the linking structures within a regional territory. Networks allow information to circulate and network players to exploit them (Gambardella, 1992). Interdependent cooperative networks are often perceived as a creator of competitive advantage (Omta et al. 2001). The role of networks are crucial when competitiveness is the objective of a group of small and medium enterprises, since networks allow to “build critical mass, facilitate their specialisation, learn from each other” (Ifor Ffowcs-Williams, 2000). Often material and non-material assets become competitive, thanks to network relationship established and by way of a competitive “supply relation between companies (...) having one or more common objective” (Kulmala et al 2002). The main reason to networking is to find new competitive advantage in order to respond to challenges set by globalization” (Kulmala et al 2002). Networks allow to work in an entrepreneurial environment “by extending the individual entrepreneurial asset base of human, social, market, financial and technical capacity” (Jack et al 2008).

If networks are the “total of actors within one industry and/or between related industries” (Omta 2001) whose cooperation bring value to customers, chains include “actors in these networks which vertically work together to add value to customers” (Omta 2001). Many are the field of studies and the theories which have used the concept of chain. Jackson et al (2006), Raikes et al. (2000), Omta (2001) provide detailed analysis of the development and evolution of such concept within the agro-food studies and economic geography. According to Wallerstein’s (1974, Hopkins and Wallerstein 1986, 1994) world systems theory, a commodity chain is a “network of labour and production processes whose end result is a finished commodity” (Hopkins and Wallerstein 1986). Global Commodity Chain (GCC) analysis went a step forward considering the globalisation dimension of the chain. In particular, participation in a GCC provides access to otherwise unreachable markets, both for raw materials and for distribution. Chain involvement allows to improve companies’ status.

Friedland’s food chain approach mainly focused on how the technological change in agriculture impacted on labour, involving also the power relationships of agro-food systemic dimensions (Friedland et al 1981). This wider approach of analysis was then used for understanding international and globalised food chains during 1980s and 1990s. In early 1990s, Fine and Leopold’s approach focused on the system of provision that each chain represents (Fine and Leopold 1993, Fine et al., 1995). This view meant to interconnect all the linkages going from production to consumption.

Along studies focusing on this wider geographical dimension, the food chain concept has been increasingly used as a paradigm to effectively analyse shorter chains and tighter relationships. The food chain concept became central to many studies specifically focused on rural development and regional economies focused on food production (Maye&Ilbery 2006). Murdoch (2000) contributed in

¹ The present paper is partly based on the results of the project “Le supereccellenze della filiera agro-alimentare della regione Emilia-Romagna”, funded by Regione Emilia-Romagna, through SPRINT-ER. The aim of the project was the identification of the top-class and excellent companies within the five most significant regional chains (habitat, wellness, agro-food, mechanics, fashion) in the perspective of promoting internationalization initiatives and was carried out between 2005 and 2009. SPRINT-ER (Regional Unit for the Internationalisation of SMEs) is the operational tool of the Emilia-Romagna Region for the development and support of the regional manufacturing system internationalisation. It provides enterprises with information, support and consulting services on how to use (promotional, financial and insurance) internationalisation tools. Authors would like to thank also Matteo Michetti and Celeste Pacifico, as ERVET workgroup, for their important contribution in the original project.

effectively conceptualising the distinction between *vertical* and *horizontal networks* within a rural development perspective. Whereas *vertical networks* “link rural spaces into the agro-food sector” (Murdoch 2000), *horizontal networks* are “distributed network forms that link rural spaces into more general and non-agricultural processes of economic change” (Murdoch 2000). Marsden and Murdoch strongly sustained the need to interconnect the concept of food chain with regional and rural development processes at regional and local level (Marsden et al 1999). Further, alternative supply chains and networks and *short food supply chains* became central approaches in rural development at European level (Marsden et al 2000). This conceptualisation seems to progressively move away from the industrial system of production, favouring the natural and local embeddedness of food products and embracing a values-based dimension of the rural production.

The most common element of the various food chain approaches sustains that a chain includes all the processes and transactions necessary in order for a good to be created starting from the raw materials, going to the processing stage, distribution and finally consumption. The chain becomes the conceptual framework necessary to capture the vertical relationships within a network. The vertical dimension gives the “length of the network (which) reflects the number of echelons until the end-user” (Omta 2001). This vertical relation has become an analytical framework mostly adopted in its extremes, either as the shortest possible, or in its global and international length. A fully-grounded regional analysis of the food chain as instrument for a regional development approach, so to include also the rural world, as initiator of the necessary raw materials for the following *echelons* of the food processing and then distribution, needs further attention.

Given the aims of the present paper, the most effective theoretical instrument of chain relationship is the “concept of netchain - a set of networks comprised of horizontal ties between firms within a particular industry or group, such that these networks (or layers) are sequentially arranged based on the vertical ties between firms in different layers” (Lazzarini et al 2001) (See Figure 1)

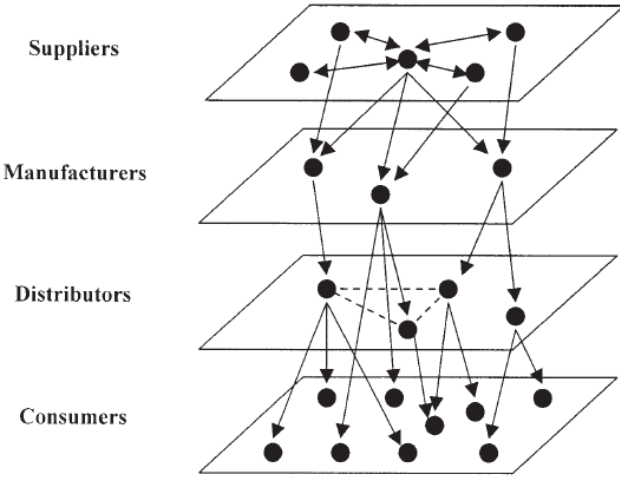


Figure 1: Conceptualisation of net-chain (Lazzarini et al 2001)

This concept allows to view the horizontal and vertical systemic relations, so to understand “how agents in each layer are related to each other and to agents in other layers” (Lazzarini et al 2001). This approach was adopted in other works, which extended it to define the concept of Food Supply Chain Network (Van der Vorst 2006). This suggests an evolution of Lazzarini’s approach based on the view that the supply chain is a complex network of food chains.

The present paper applies the netchain concept in three dimensions: netchain horizontal segments, netchain vertical segments, and overall netchain. Among the horizontal segments, the paper will exclude the consumers and will include all the segments which provide goods and services to the following segments, that is agricultural input providers, farm machineries, etc. (see figure 3). This choice is based on the perspective that the successful upgrading of the competitive position of firms can be improved also through activities with other market segments or sub-sectors (Gereffi et al, 2005). Finally, since the paper aims at applying the above theoretical dimension within a given systemic territory, the overall netchain boundaries are represented by the region.

3. Methodological approach

The research followed three main methodological steps, as presented below.

Step 1. Agro-food system mapping

The research carried out a comprehensive agro-food chain mapping, so to represent the systemic relations of the relevant economic *netchain* segments identified at regional level. This step used many sources of information: academic studies, grey literature on previous studies, international organisation guidelines, etc. Then, Emilia-Romagna regional government officers were interviewed to validate the mapping, and provide further information and support for the following steps. The agro-food chain mapping was based also on the analysis and selection of the Classification of Economic Activity codes which belonged to the regional agro-food system. Following the final validation, the whole agro-food system was mapped through the above mentioned codification system.

Step 2. Agro-food system economic and productive analysis

The agro-food system map was analysed using various sources of information. The analysis focused on four main regional agro-food aspects: institutions, research and innovation services, socio-economic dimension, export, productive dimension. This exercise was carefully developed, because the different sectoral dimensions of the agro-food system, forced to use differentiated sources of information. This differentiation concerned the geographical dimension, the reference years, the methodology of data collection. In particular, the agricultural stage (or network layer, according to Lazzarini naming) of the agro-food system, was analysed through the Association of Chambers of Commerce data (years 1991 and 2001), focused on local units. The industrial and retailing system was represented through the National Census data (years 1991 and 2001). The export was based on National Statistics Office – Coeweb database (years from 2000 to 2007). The productive dimension was analysed thanks to AIDA (years 2003-05-07), a database containing all Italian companies financial statements managed by Bureau Van Dick.

The analysis included the dimensional quantification of the different aspects. In addition, the productive dimension was quantified including SMEs present in the AIDA database and belonging to the selected Classification of Economic Activity codes (micro companies, that is the ones with annual turnover below 2 Meuro, were not included). A total of 1753 companies were selected and grouped in the agro-food segments identified in the map.

Step 3. Agro-food system companies' performance assessment and analysis

Step 3.1. Identification of excellence companies

The third step of the research was the selection of highly performing agro-food companies (*excellence* companies) in each chain segment and in each of the three years 2003-2005-2007 through a multicriteria approach based on economic dimension, profitability and reliability synthetic index indicators. This analysis bases on the financial statements of 1753 companies, as reported in AIDA database. In particular, the selection of the *excellence* companies is carried out on quantitative criteria referring to all companies' financial statements, aimed to identify the enterprises which have a significant minimum dimension, hold requirements of high profitability and high financial health. In specific, companies get the *excellence* status if:

A) Satisfy the Dimensional Criteria :

- *Dimensional Criteria (Necessary and sufficient condition)*: The companies which have an annual turnover exceeding the threshold of the first decile group of the enterprises belonging to the same chain segment are considered *excellence*.

OR

B) Satisfy both Profitability Criteria AND Financial Reliability Criteria

- *Profitability Criteria (alone this criteria is necessary, but not sufficient)*. Indicators considered:

➤ Return on Equity (ROE): $\text{Net Income (Loss)} / \text{Average Shareholders' Equity}$

- Return on Investment (ROI): Added Value / Total Assets
- Return on Sale (ROS): Operating Income / Net Sales

In order to use the various data, the research carried out, first, the *normalization* of each company values regarding each single indicator with the result of obtaining a marker which positions each company. Then, the calculation of the *arithmetic mean of the normalized values* for each of the 3 indicators, getting for each company the relevant profitability synthetic index. *The companies exceeding the average* of the total number of companies in the same chain segment were satisfying this profitability criteria.

- *Financial Reliability Criteria (alone this criteria is necessary, but not sufficient)*. Indicators considered:

- Liquidity ratio: Operational cash flow – Total stocks/Current Liabilities
- Financial independence ratio: Total Shareholders' Equity /Total debts

This criteria allowed to include companies which show a synthetic index of financial reliability exceeding the average of the total number of companies in the same phase/branch. The average was calculated, as explained in the previous criteria, with normalised data for each company considered.

If companies were satisfying this criteria *and* the profitability criteria, they could be considered as *excellence*.

Step 3.2. Identification of top-class companies

This exercise was carried out on all agro-food system companies in each of the three years 2003, 2005 and 2007. If the company was keeping the status of *excellence* in all three years, it was labelled as *top-class* company.



Figure 2: Methodological approach to *top-class* company selection

The *top-class* companies of each chain segment create clusters whose economic and financial performance was cross-compared so to highlight the performance of each chain segment in relation to the overall system.

4. Main results

4.1. Emilia-Romagna agro-food system mapping

The first important result of the research is the Emilia-Romagna agro-food system mapping. This agro-food system includes seven sub-chains, twenty segments, and various economic sectors across the different production stages, thus creating a wide systemic framework. There are cross-cutting segments which interact and support the activity of vertical sub-chains – vegetable and animal productions. The regional chain mapping allows to detect the productive interrelations of all segments, and to identify the ones directly connected with the agricultural segments. As shown, there are

agricultural productions which have no representation, i.e. olive oil production, and therefore in the years apparently they did not stimulate corresponding segments in manufacturing and service provision.

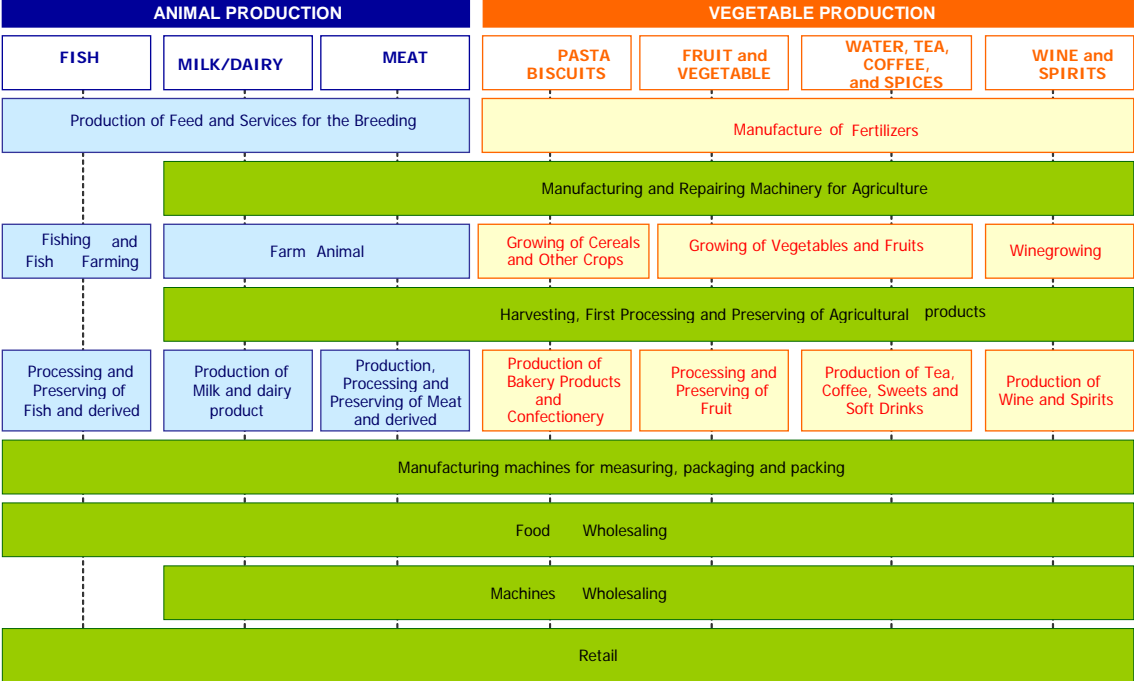


Figure 2: Agro-food system mapping

4.2. Emilia-Romagna agro-food system analysis

Emilia-Romagna agro-food system economic analysis

The macro-economic dimension of the chain counts 146.464 employees (excluding agricultural activities) and 92.854 local units (including agricultural activities) in 2001. The territorial distribution of employment is rather homogeneous among provinces, with the prominence of Bologna province. In addition, 1991 and 2001 data show that there is a strong decrease of employment in Emilia-Romagna agro-food system over time.

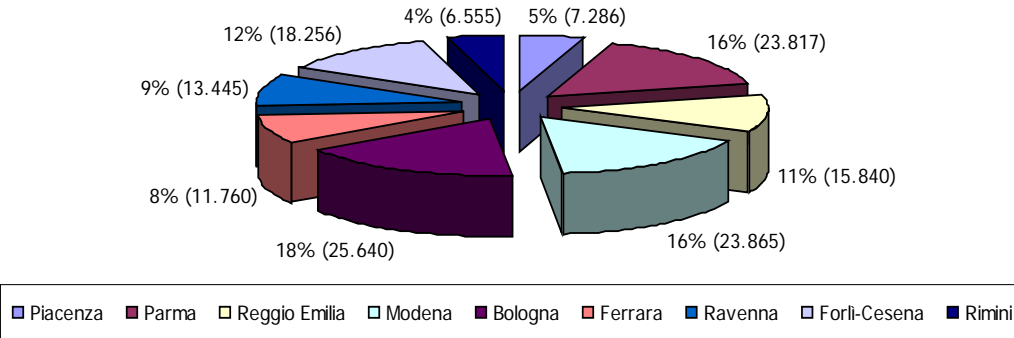


Figure 4: Emilia-Romagna agro-food system employees per province

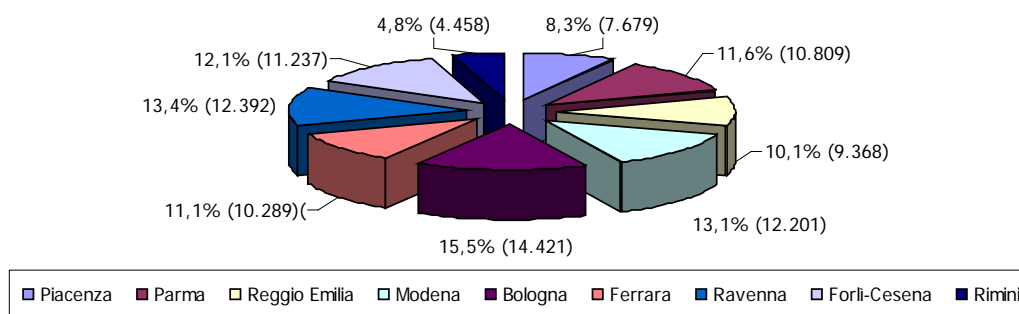


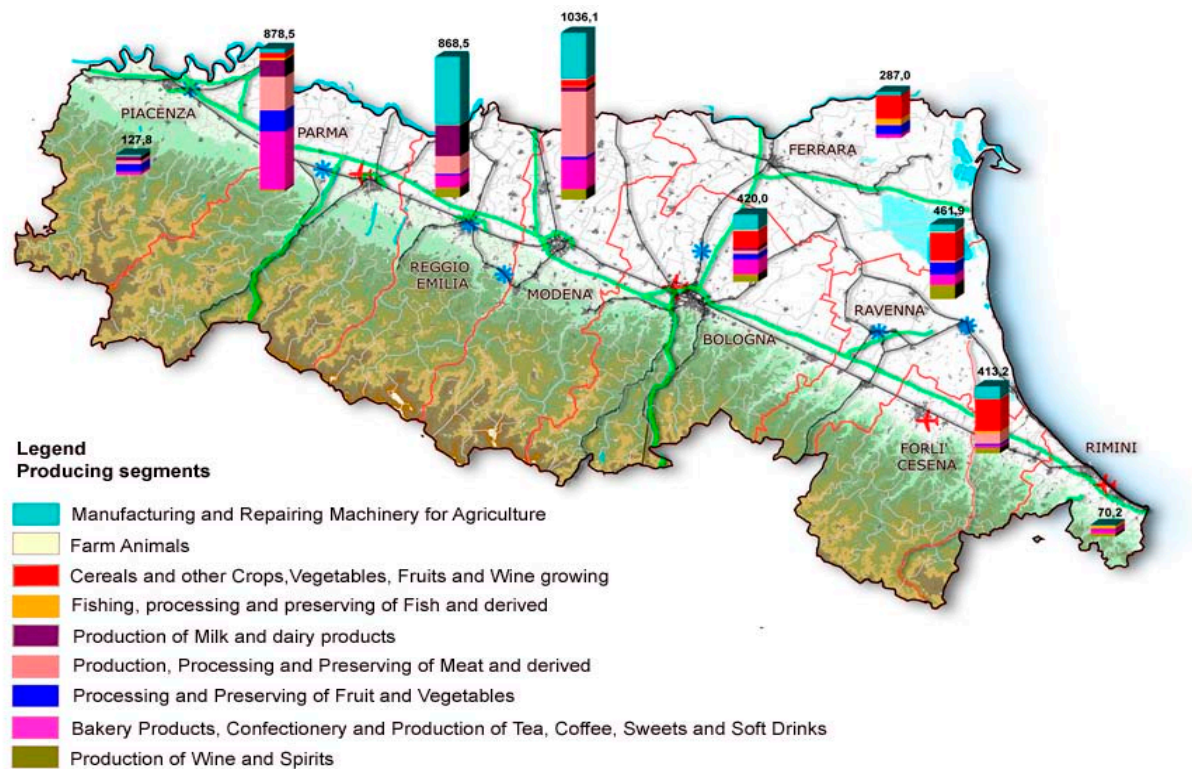
Figure 5: Emilia-Romagna agro-food system local units per province

Table 1: Emilia-Romagna agro-food system employees and local units variation

Province	Employees (var. % 01-91)	Local Units (var. % 01-91)
Piacenza	-9,0	-9,3
Parma	-3,3	-8,3
Reggio Emilia	-8,4	-10,8
Modena	-6,7	-13,1
Bologna	-17,1	-25,7
Ferrara	-23,7	-9,7
Ravenna	-14,2	-13,4
Forlì - Cesena	19,9	-5,0
Rimini	-2,5	1,4
Emilia - Romagna	-8,2	-12,3

Source: Elaboration on ISTAT data – Industry Census

Exports were analysed with the innovative methodological approach defined above. Therefore, Emilia-Romagna export was represented using the agro-food system segments (or netchain layers). In 2008, the overall regional export is equal to: 48 BEuro. The figure below shows that Modena and Parma provinces are the most dynamic, respectively with export value above 1 BEuros and 876 MEuros. Each hystogramme shows each province segments' amount. Emilia-Romagna exports' main destination is the European Union (70% of agro-food chain export). This analysis shows that Emilia-Romagna export is pulled by some segments: *Manufacturing and repairing machinery for agriculture, Bakery products etc., Meat production and processing, and Cereals, vegetables, fruits, wine growing*. Should the chain approach be adopted also for the strengthening of rural and regional economy, policy makers could invest on some segments which show higher dynamism and higher capacity to stimulate the agricultural segments of the regional chain.



Source: ERVET processing on AIDA and Bureau Van Dijk data

Figure 6: Agro-food chain: Exports per province and production segment (Meuro, 2007)

Emilia-Romagna agro-food system productive analysis

The regional agro-food system counts 1.753 companies with annual turnover above 2 MEuro (equal to 12,1% of the regional total number and 16,3% of regional turnover). The figure below shows the number of each system grouping over the years. In 2007 the total number of agro-food chain companies increased 24%, compared to 2003, equivalent to 342 firms, reaching a total of 1753 companies. Cross-cutting segments show the most relevant increase (31%), equivalent to 243 firms. The ratios of three aggregations are constant through the years. *Cross-cutting* segments are the most significant reaching around 59% of the total, followed by *animal productions* with 25% and *vegetable productions* with 16%².

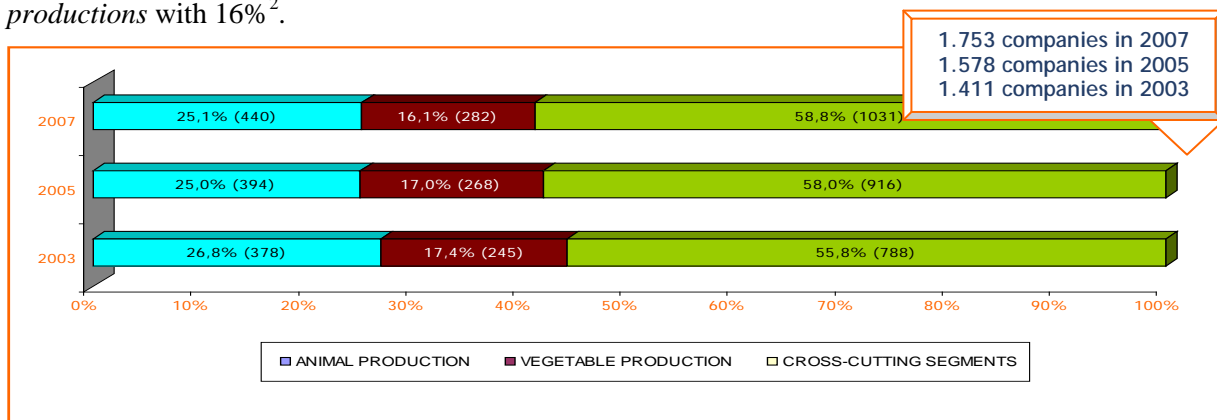


Figure 7: Agro-food chain companies - universe

4.3. Emilia-Romagna agro-food system companies' performance assessment and analysis

² The study included a detailed analysis of each chain segment for employees, local units, export, number of companies. It cannot be reported due to the limitations of papers' maximum length.

The universe of the agro-food companies was assessed according to the methodology explained above, in order to select the highly performing agro-food companies (*excellence* companies) in each chain segment and in each of the three years 2003-2005-2007. The multicriteria approach adopted included economic dimension, profitability and reliability synthetic index indicators. First of all, results show that only 26% of the universe in 2007 are *excellence* companies, equal to 459 companies. Analysing the different agro-food chain groupings, 1 out of 3 animal production and vegetable production companies is an *excellence* company, whereas only 1 out of 4 of the cross-cutting segments companies. The *excellence* segments are: *Processing and Preserving of Fruit* (38%), *Processing and preserving of fish* and (37%), *Farm Animals* (36%). The least performing segments are: *Winegrowing* (18%) and *Harvesting, First Processing and Preserving of Agricultural Products* (18%).

This analysis shows that the agricultural segments perform on average compared to the rest of the agro-food regional system. However, the wine sub-chain shows signs of limited economic performance. Data show that there is some interconnection in the problems outlined by the agricultural sector and the wine manufacturing. In other words, problems in the manufacturing might impact on the agricultural and rural world, and an intersectoral approach to the problem could positively favour the overall rural and economic situation.

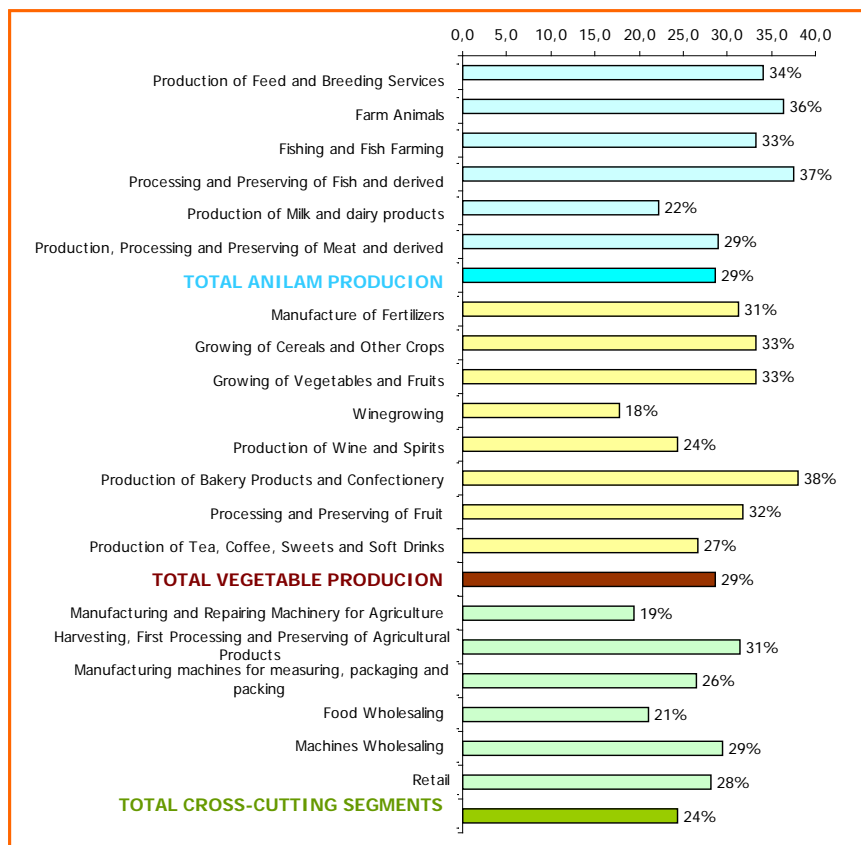


Figure 8: Agro-food system: universe vs. *excellence* companies (2007)

Following, in order to identify companies whose high performance was stable over the three years, the three single years were cross-checked. The stability of their *excellence* status over the three years allowed them to be considered *top-class* companies. Results show that *top-class* companies are 45,3% of the *excellence* companies in 2007, equal to 206 companies. Among vegetable productions, 1 out of 2 *excellence* companies is a *top-class* company, while in animal productions and cross-cutting segments only 1 out of 2,3 *excellence* companies is a *top-class* company. Some segments are particularly well performing. In the following segments all *excellence* companies in 2007 become *top-class* companies: *Fishing and fish farming*, *Processing and preserving of fish and derived*, *Winegrowing*. Among *top-class* companies other well performing segments are: *Manufacturing and Repairing Machinery for Agriculture*, *Growing of Vegetables and Fruit*, *Manufacture of Fertilizers*, *Growing of cereals and other crops*.

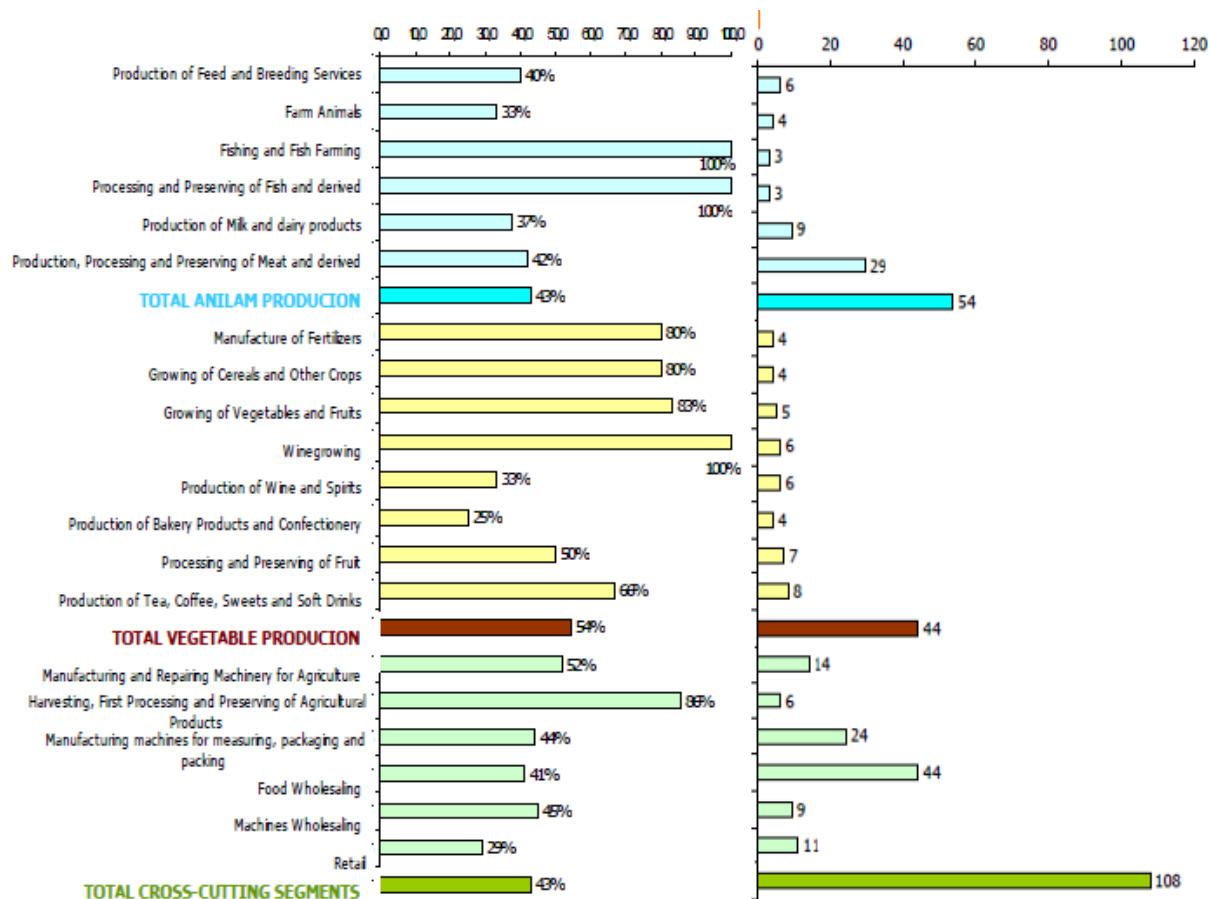


Figure 9: Agro-food system: *excellence* vs. *top-class* companies and number of *top-class* companies per segment

This overtime analysis leads to small numbers in the single segments, which might induce to biased consideration. Yet, data clearly illustrate that over the three years the agricultural segment of the wine sub-chain performs better compared to the manufacturing wine producing segment. Again a cross-sectoral approach to this chain could lead to beneficial effects to the wider economy of the given territory.

Economic and financial performances

The performance of *top-class* companies was analysed through a wide set of economic and financial indicators as reported in the Figure below. This exercise was carried out in all 20 net-chain segments, grouping segments in three clusters: Animal Production, Vegetable Production, and Cross-cutting segments. Then, the benchmarking exercise put in relation each segment with the rest of the agro-food system in order to identify the most performing segments within the regional economy analysed. Below a synthesis of *top-class* companies.

Animal Production 54 <i>top-class</i> companies 5,7 Beuro, equal to 20% total agro-food system revenues	Vegetable Production 44 <i>top-class</i> companies 4,7 Beuro, equal to 16,4% total agro-food system revenues	Cross-cutting segments 108 <i>top-class</i> companies 18,2 Beuro, equal to 63,7% total agro-food system revenues
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The Figure below shows the detailed analysis of the Animal Production segments.

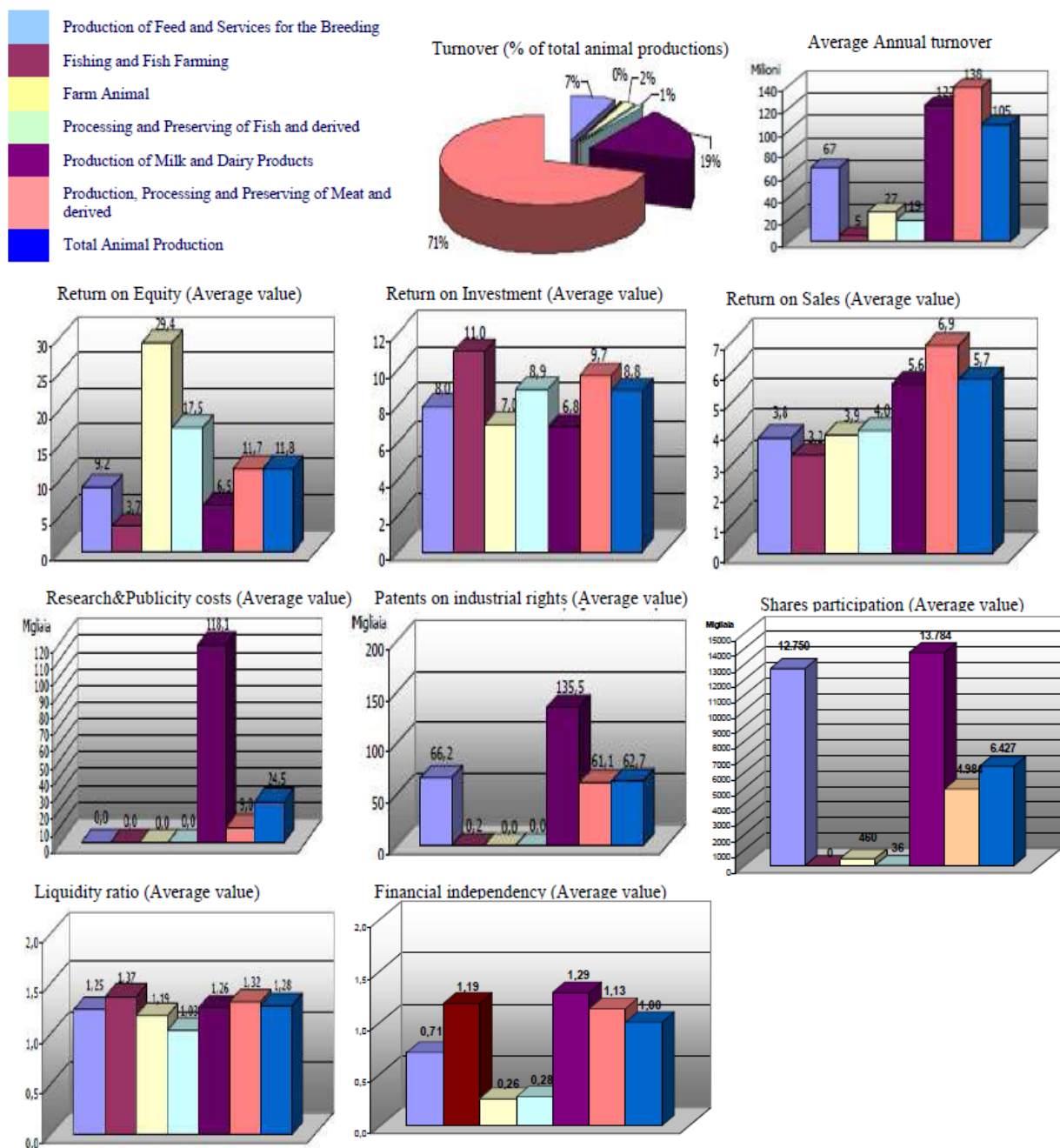


Figure 10: Animal Production segments' economic and financial performance (example)

Due to paper length, a synthetic figure shows the overall Emilia-Romagna agro-food chain performance. Considering all indicators, the five most performing segments are *Production of milk and dairy products*, *Production, processing and preserving of meat and derived*, *Production of bakery products and confectionary*, *Manufacturing and repairing machinery for agriculture*, *Manufacturing machines for measuring, packaging and packing*. None of these belongs to the agricultural sector. Still, these are the agro-food chain segments immediately following the primary sector, and which, potentially, could play the role of “chain captain” or “focal company” within the wider netchain. Therefore, policies aimed at promoting rural development should carefully consider the performance of potentially naturally receptor of the raw material produced on the territory. This means that in Emilia-Romagna - the case analysed in the present paper - animal production for milk and meat and cereals productions have good potential to find initiators of competitive projects based on the food chain approach.

AGRO-FOOD SEGMENTS		Economic dimension	Profitability	Research, Publicity, Patents	Shares participation	Financial stability
ANIMAL PROD.	Production of feed and breeding services					
	Fish and fish farming					
	Farm Animal					
	Processing and preserving of fish and derived					
	Production of milk and dairy products					
	Production, procesing and preserving of meat and derived					
VEGETABLE PROD.	Manufacturing of fertilizers					
	Growing of cereals and other					
	Growing of Vegetables and fruit					
	Winegrowing					
	Production of bakery products and confectionary					
	Processing and preserving of fruit					
	Production of tea, coffee, sweets and soft drinks					
CROSS-CUTTING SEGM.	Production of wine and spirits					
	Manufacturing and repairing machinery for agriculture					
	Harvesting, first processing and preserving of agriculture					
	Manufacturing machines for measuring, packaging and packing					
	Food wholesaling					
	Machine wholesaling					
	Retail					
Legenda		High performance	Good perform.	Medium	Low	

5. Concluding comments

Policy programming documents and academic research are showing increasing interest towards innovative approaches to regional and rural development, able to capture the real economic dynamics within a given territory. Local phenomena are the results of a number of agents belonging to various sectors and bearers of different material and immaterial competences. These create networks which get the opportunity of interacting searching for the mutual benefit. The agro-food chain is one of these kinds of networks.

The agro-food chain is intrinsically intersectoral and this makes it close to the concrete productive dynamics which a given territory creates. Whether it is short (face-to-face direct selling) or it is long and international (globalised supply chain), actors belonging to different economic frameworks often get in contact. All economic agents which allow to reach the consumer, on one side, and to obtain services or goods to be used in the production of food produce, on the other, could facilitate or jeopardize efforts concentrated in the agricultural and rural worlds. The systemic view can provide a better socio-economic context understanding and, therefore, better policy programming and implementation. The adoption of the innovative systemic and policy approach of agro-food chain could favour the activation of a higher number of horizontal and vertical economic connections. These could multiply and amplify the creation of economic value in a given territory. In other words, this approach contributes to stimulate economic performance of the overall network.

The present paper attempts to provide a concrete conceptual application of the agro-food chain at the systemic regional territory. The approach adopted overcomes the traditional sectoral approach to rural development, so to highlight the quantity/quality of the rural connections with the other agro-food segments'. In particular, the focus is on the economic and financial performance of each component of the regional agro-food economy, with specific attention to the interconnections created by the agriculture. This performance analysis allows to identify the chain puller, who then can become the promoter of chain initiatives, which go at the advantage of the whole territory. If the agriculture

aims at becoming competitive, policy makers have to focus on its intersectoral connections. At times agriculture and rural world can be chain puller/captain, in others other chain segments are better placed for such initiatives. This is particularly evident when, for example, agro-food produce are to be traded on international markets,

Future analysis could embrace further economic sectors, such as tourism, hotel, café & restaurant, catering, etc. These have a key role in their interconnecting function with the final consumer and could be the best interlocutor for some farmers and their associations and for some agro-food produce.

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Annex 1 – Top-class companies by groupings of segments

