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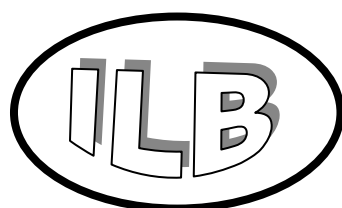
System Dynamics and Innovation in Food Networks 2010

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Value Sharing and Food System Dynamics for Milk, Tomato, and Cereals Food Chains

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Abstract

The aim of the paper is to analyse value sharing and food system dynamics of milk, tomato, and cereals food chains, so to explore the agro-food enterprises capacity to be competitive and sustainable. The paper is based on the functionalist approach of Malassis and the notion of the system of the General Systems Theory. The methodology is aimed at creating a consolidated financial statement for each food chain so to re-create the chain value and identify how this is shared among the different food chain stages. The analysis is carried out on primary and secondary data: around 2400 financial statements concerning 480 enterprises from 2003 to 2007 and stakeholders' interviews. Results show that value is usually created in the processing and distribution stages, to the detriment of the primary sector, and that the retail managing practices tend to impose damaging structural changes on farms whose profitability is at times becoming sustainable only thanks to European subsidies. To conclude, there is evidence of inadequate definition of strategic and network alliance along the chain. Competitiveness is still a concept achieved by single food chain stages against others and food chain internal competition entails a declining sustainability of small farms and enterprises.

Keywords: *food chain, value system, economic performance, potato, fruit, cheese*

1 Introduction and objectives

Higher competitiveness, increasing global competition, capacity to follow market trends, power to negotiate the increasing influence of some segments of the food chain represent some of the challenges that farmers and agro-food companies have to face. These dynamics require innovation and efficiency, but also chain actors' coordination and cooperation. Network relationships can become an instrument in order to achieve a competitive advantage and to respond to challenges by extending the individual entrepreneurial skills with complementing human, social, market, financial and technical capacities. Coordination among companies could ensure better performing interactions among firms and farms along a chain in terms of organisation and strategy. The impact and assessment of a coordinated and cooperative chain can be measured by the increase in value of a particular foodstuff during its journey through the chain, that is the added value, created either by upgrading the quality of the products or by the improvement of the production process. The aim of the paper is to analyse the systemic dynamics that the agro-food system is experiencing by analysing the patterns of value sharing within the milk, tomato, and cereals food chains of Emilia Romagna region over five year time 2003-2007. This allows to explore the agro-food enterprises capacity to be competitive and sustainable, to identify areas of action of each stage performance and to understand different chain stages mutual interactions, thereby creating systemic relations among companies.

2 Theoretical framework

The researchers that investigate about the value chain inevitably will meet some difficulties in obtaining a unique definition of the concept and a shared approach of analysis. This

difficulty is generally related to the heterogeneity of terminology adopted during the researches as well as the frequently overlapping of concepts related to the same object under investigation. It is evident as the word “chain” have been used as synonymous of terms like “networks”, “system”, “sector” and “stage”. This plurality of terminology represents the desire of the authors to define new paradigms with which to systematize the concept and the approach of analysis of value chain (Malassis, 1973; De Muro, 1982; Porter, 1985; Gereffi, 1994; Scarano, 1997; Contò, 2005).

Following the proposal of Raikes et al. (2000), it is possible to identify three different concepts used to describe what value chain is. The first concept is referred to the seminal works of Porter (1985), in which the author distinguishes two different elements that characterize the values chain: the different stages of the economic system linked with functional relations and the overcoming of the microeconomic concept of value chain considering also the inter-linkage with other value chains. The second concept frequently used in economic agricultural literature to approach the study of the value chain is the concept *filiere* by Malassis (1979). Many researches on value chain analyses in agrifood sector were based on the functionalist approach of Malassis, particularly the analysis of the process of integration in French agrifood sector. This concept of value chain is characterized to stress the emphasis on the input-output relations between firms (or cluster of firms that represent a specific stage of the agrifood sector) in the local economy (national, regional or others sub-regional levels), and consider into the economic system also public institutions. The third concept referred to the value chain is the Global Commodity Chain (GCC) introduced by Gereffi (1994), characterized by the normative usage of the concept as well as to identify the power relations along the chain. In depth the interpretations of the concept of the Gereffi's value chain, and the related approach of analysis, tend to stress the political perspective of the concept. Moreover, the concept of the GCC is referred to globally dispersed, but linked, production of commodity and frequently the topics of the research are oriented to identify the characteristics of the system considering the influences of some components of global chain.

Based on the above presentation, it is possible to distinguish at least three approaches of interpretation of the value chain. The first is the anglophone perspective of Porter, characterized by managerial point of view of the concept. The second is the anglophone perspective proposed by Gereffi. This perspective was defined to study the globalization processes of the system, but can have useful applications in study of the value chain creations at local level. The last point of view is the francophone concept of value chain named *filiere* and suggested by Malassis. This concept is related to the quantitative approach of analysis based on the accountancy data and finalized to define the local economic multiplier effects of business relations through the measure of the prices and value-added along the chain at a certain point in time. The Malassis' concept of value chain was defined to study the agri-food sector and have so far developed a long tradition into this area of research. For these reasons the *filiere* seems to be a solid starting point of concept as well as a based methodological approach of value chain analysis.

Referring to the specific topics of value chain analysis based on minimum units of observation considered in the different studies of systems, it is possible to define distinct approaches of study: macroeconomic (Davis and Goldberg, 1957; Goldberg, 1968; Malassis, 1979; Gereffi, 1994), microeconomic or a blend of both (Saccomandi, 1986; Porter, 1985; Becattini, 1987). From a microeconomic and local perspective, the concept of agrifood chain described above and proposed by Malassis (1979) seems to be a fruitful approach to study the value created along the agri-food chain in particular, and of every local economic system in general. The key to the reading of this analytical perspective consists in interpreting the agrifood chain as a group of economic entities involved in fulfilling the functions of production, transformation

and distribution of the agrifood product, and which are linked by functional and structural relationships aimed at meeting the food requirements of the demand side. This is not only the real essence of the concept of *filiere* proposed by Malassis, but at the same time represents an analytical proposal of agri-food chain analysis finalized to describe the system under investigation as well as a criterion for highlighting the business relationships that link the activities of the primary sector with those both upstream and downstream.

Even if the idea of *filiere* seems to be a fruitful notion to interpret the concept of value chain, some ambiguities still remain. In particular, based on the evidence that each local agri-food systems are interrelated to each others with some shared steps in common, the dilemma which has often emerged in studies is to establish a unanimously accepted criterion for identifying the perimeter encompassing the agrifood system. In this way it is important to consider the notion of the system proposed in General Systems Theory (GTS) by Von Bertalanffy (1968). According to GTS a system represents a group of entities that interact reciprocally with relationships of a functional and structural nature. By espousing the analytical approach of GTS, the identification of the boundaries of a system can thus be a choice guided by factors which are functional to the research or of a more purely structural nature. This approach circumvents the dilemma above described, insofar the criteria that the researcher use to demarcate the agri-food system must change in function of the objectives of the research. The functionalist approach of Malassis and the notion of the system which emerges from GTS appear to blend beneficially with each other as a useful approach for delimiting the boundaries of any agrifood chain under examination. In this perspective of interpretation of the concept of value chain, the value system represents the result of the value created by the company added to the value created by the activities of all the businesses which make up the system. Each company has a share of participation in the value created, which depends on the value perceived by the final customer and on the characteristics of the system in which the company itself operates, such as the level of competitiveness of the markets, bargaining power in relation to suppliers and customers and relationships and level of integration, as well as the policies implemented in the sector. Moreover the focus is not on the value created by the individual company, but on the integrated system of values created as a whole along the entire chain, which different economic players produce jointly (Peppard and Rylander, 2006), and on the way in which the value is distributed along the chain.

3 Methodological approach

The analysis of the value system in each chain is based on the hypothesis that the chain itself can be conceived as a “group” of companies comparable to an industrial holding company and its subsidiaries, rather than an accidental combination of operators brought together by the market by virtue of their membership of the same production chain. If we accept this perspective, we can also accept the assumption that, in chains, like in groups of companies, it is possible to produce a “consolidated financial statements”. In synthesis, the analysis of the value sharing along the chain and of the food system dynamics is based on the creation of a consolidated financial statement for the chain following various analytical steps aimed at a) chain delimitation and mapping; b) selecting the companies relevant for the value chain analysis; c) analysing the value chain distribution.

3.1. Information and data

The analysis is developed on primary and secondary data. Primary data consist of food chain structure and organisation information and data collected through focus groups and

interviews with stakeholders and chain operators as described in the following paragraph. The secondary data analysed are accounting data of the financial statements of the individual companies selected to represent each chain. All of the companies considered, with the exception of a few indirect suppliers, are located in the Emilia-Romagna region. After a detailed control of the financial statements, it was possible to analyse 208 milk, 98 cereal, 37 tomato chain enterprises, and 137 farms for each year of the period 2003 – 2007. The selected companies thus represent a consistent sample for the entire period in question. The accounting data relating to farms and to some of the financial statements for the industrial phases were acquired from the database of the regional accounting network held by the Agriculture Department. For other types of companies, the financial statements, complete with explanatory notes and directors' reports, were obtained from a specialized data bank – Aida, Bureau Van Dick. For this reason, the companies selected were all joint-stock companies, which are required by law to fill financial statements.

3.2. *Methods*

3.2.1 Chain delimitation and mapping

Chain delimitation means deciding the structure of an agrofood system taking into consideration a number of elements: the product, the components of the agrofood chain and the time frame. The complexity of stages definition from a productive perspective and the multifaceted relationships among chain actors makes the choice over the chain delimitation a crucial task which leads the focus of the research investigation.

The choice made over the present research food chains' delimitation and mapping was carried out with the attempt to highlight the chain's functional productive structure according to the direct experience of the researchers and the chains' opinion leaders interviewed through the focus groups. For each chain, the focus group (FG) involved ten opinion leaders, lasted approximately 3 hours and was coordinated and moderated by the researcher. During the meeting, information of a qualitative nature was collected regarding the key players in each stage of the chains, and the organisational forms, types and intensity of the relationships between them.

With specific reference to the systems examined, this study¹ was conducted on the basis of the structures shown in Figure 1. In this case, each stage shown is (respectively) a direct or indirect supplier of the stages located downstream of it and a customer of those located upstream.

1. The study was conducted within the framework of a research project run by DG Agricoltura from the Emilia-Romagna region, aimed at constructing a system of knowledge for the purpose of governing interventions in the agrifood industry

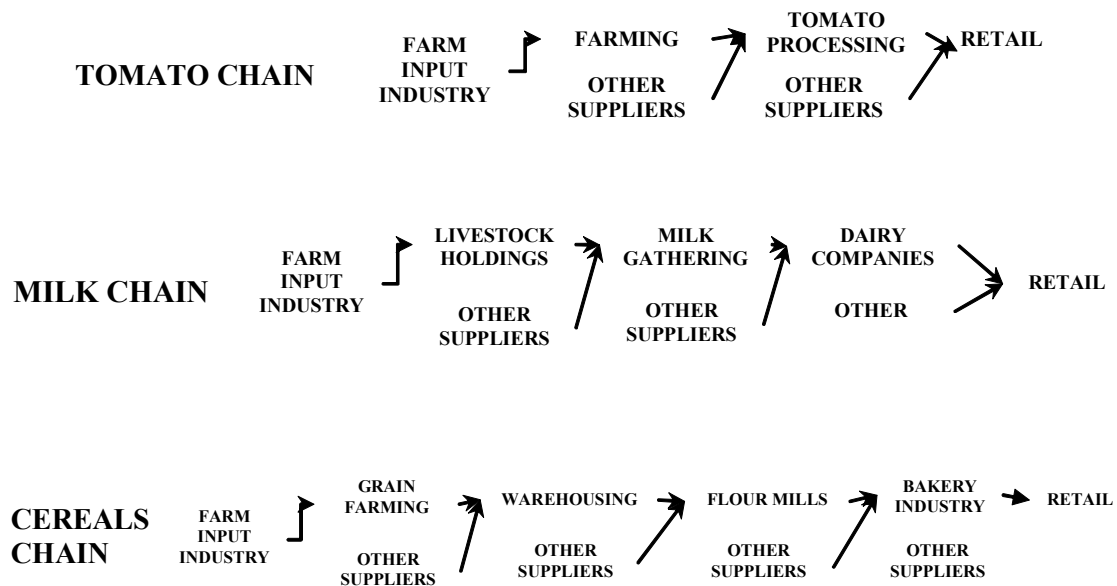


Figure 1. Food chains' value system mapping

3.2.2 Companies' selection

Two selection criteria were adopted: all the companies that make up the chain in question at regional level; the need to obtain a number of observations to enable average group data to be calculated, that is the availability of a five year set of financial statements for all the companies selected. The FG findings supported the sampling plan in relation to the numerical composition of each stage in the chain, in order to ensure the closest possible adherence to reality. The selection of each chain stage was carried out as follows:

- *supply* raw materials and services to farmers for the running and management of their farming activity. This category includes suppliers of fertilisers and phytopharmaceuticals, fuels and agricultural machinery hire.
- *agricultural phase* - consideration was given to all farms which generate at least 40% of their revenues from the sale of agricultural produce.
- *processing phase* - consideration was given to all companies which transform the agricultural produce in question into food products.
- *commercial phase* was broken down into the wholesale and retail trade. The wholesale division encompasses businesses which supply retailers, whereas the retail division encompasses entities set up for the purpose of selling goods to final customers, such as hypermarkets, supermarkets and normal trade.
- the analysis also took account of indirect suppliers of *transport and logistics services* and other business consulting services.

3.2.3 Analysis of the value system

The detailed creation of the chain consolidated financial statement follows the analytical steps described below.

Reclassification and common sizing – A concise income statement was compiled for each company, defined in terms of gross production (GP) and net value added (NVA). To allow comparison with other entities in the same stage a common sizing procedure regarding the financial statement values was carried out as shown below.

Weighting and consolidation – The financial statements, the accompanying directors' reports, and the operators from different chains during the focus group supplied elements which allowed to estimate the dimensions of the functional relationships among chain segments. As previously explained, the income statements of the selected companies provide the starting point for reconstructing the value system. From an operational point of view, having attributed the value of 100 to the total revenues from sales of a stage of the chain (in this study, the sales of farms), the task is to calculate the contribution of the upstream and downstream companies to the total value of sales of the chain as a whole, which become the sum of the costs incurred for the purchase of raw materials and services. The aim is to produce a set of consolidated financial statements, from which it is possible to determine the total income generated by the chain and to see how the total figure is divided between the various operators (Table 1). The parameter chosen for the purposes of analysing the value generated is return on sales (ROS). This indicator, obtained from the ratio of typical operating profit and total amount of sales, highlights the share of revenues that remains once operating costs have been covered.

Table 1. Chains' value creation (example)

	Farm input industry	Farms	Other suppliers	Processing	Other suppliers	Wholesale	Other suppliers	Retail
	Step 1	Step 2		Step 3		Step 4		Step 5
1. REVENUE	26,0	102,6	72,5	211,2	57,0	282,7	36,0	351,1
- SALES	25,4	100,0	70,7	194,4	54,7	269,3	34,6	336,8
2. INTERMEDIATE CONSUMPTION	22,6	25,4	53,2	170,7	34,4	249,1	20,4	303,9
3. GROSS VALUE ADDED	3,5	77,2	19,3	40,4	22,6	33,6	15,6	47,3
DEPRECIATION	0,6	6,2	2,2	10,1	1,8	5,4	1,4	8,3
4. NET VALUE ADDED	2,9	70,9	17,1	30,3	20,8	28,2	14,3	39,0
LABOUR	2,0	48,3	13,5	24,2	18,2	19,3	12,4	30,8
5. OPERATING INCOME	0,8	22,6	3,6	6,1	2,7	8,9	1,9	8,2

The second focus group, carried out in the advanced stages of analysis of the dynamics of value in the chains under examination, marked the first step in validating preliminary results and collecting feedback from operators for the purpose of fine-tuning the analytical procedure and assimilating any observations in interpreting the results obtained.

4 Results

Analysis of the results obtained for the three agrifood chains highlights differences in terms of the creation and distribution of value, as well as in terms of profitability. Firstly, the value created within the various chains varies, being considerable within the milk system but much less significant within the cereals chain. Secondly, the importance of the processing/transformation stage within the three chains is different. In particular, analysis of the way value creation is distributed shows that storage, milling and baking make the most significant contributions within the cereals chain, while value creation is distributed more evenly within the other two chains. Lastly, the analysis of profitability in terms of return on investment reveals two aspects worthy of note. On the one hand, the profitability of similar stages within each value chain differs considerably with, for example, transformation generating 1.1% in the tomato chain, but 7.1% in the cereals chain. On the other, the profitability of individual

stages within the same value chain also differs. Farmers suffer the most of this situation since, in each of the cases analysed, their profitability is below average.

4.1 Description of the sample

Analysis of the three value chains into stages, as described above, identified businesses within the sample that come into contact with each of the three agrifood chains considered. In particular, these businesses are active as service providers (logistics, administration, packaging) to each of the chains. In terms of sample selection (Table 2), focus groups made a key contribution to determining the role and importance of the various players within the value chain, based on the results of both qualitative and quantitative analysis.

Table 2. Statistics of sample companies

		Farm input industry	Farms	Other suppliers	Processing	Other suppliers	Retail
		STAGE 1	STAGE 2		STAGE 3		STAGE 4
Milk							
Enterprises	n.	96	45	24	7	64	18
Sales	Mln €	4,6	0,2	20,7	191,7	23,6	188,7
Assets	Mln €	4,4	1,3	13,5	167,2	14,4	178,8
Tomato							
Enterprises	n.	51	24	42	8	24	18
Sales	Mln €	11,0	0,1	27,8	150,6	20,7	188,7
Assets	Mln €	7,0	1,4	19,0	162,0	13,5	178,8
Cereals							
Enterprises	n.	52	39	24	34	141	18
Sales	Mln €	10,5	0,9	20,7	13,6	25,5	188,7
Assets	Mln €	6,6	1,6	13,5	10,4	16,0	178,8

Note: € sales and assets is the average value for 2003-2007; *n. enterprises* is number of companies for each year; for *Stage 3 other suppliers enterprises* is the number of times that supplier enterprises have been analysed.

4.2 Value of net sales

Considering the tomato chain, the average net retail selling price of packaged products was found to be 3.5 times higher than the cost of the related raw materials. Looking individually at the principal stages within the chain and setting the value of agricultural production (milk at the farm gate) to 100, the value attributable to collection activities was about 20. The value added by transformation activities - processing, packaging, packing and transport - was however much more significant at about 150, with distribution contributing a further 80 or so. There were no particular variations between each of the five years considered, with total value ranging from a minimum of about 320 in 2003 to a maximum of 380 in 2007. Nevertheless, the steady upward trend over the period (Figure 2) is notable.

Turning to the tomato chain, the average net retail selling price of transformed products over the five-year period considered was about 6.7 times higher than the cost of the related raw materials. The value contributed by suppliers and supporting businesses (packaging, business services, transport and logistics) was particularly significant, amounting to about 4 times that identified for agricultural production. The impact of distribution was less significant in this

case. There was little consistency between the years examined, with strong fluctuations in evidence (Figure 2).

Considering the cereals chain, the average net retail selling price was about 12 times higher than the original cost of the cereals concerned. Considering the main stages in the value chain and setting the value of grain at the farm gate to 100, the value added by transformation - storage, milling and baking - was about 700, while almost 400 was generated at the distribution stage. Here too, significant fluctuations were found between years. The scaling back seen in the period 2005-07 followed growth during the three-year period 2003-05 which, apparently, mainly reflected the incidence of the baking stage (Figure 2).

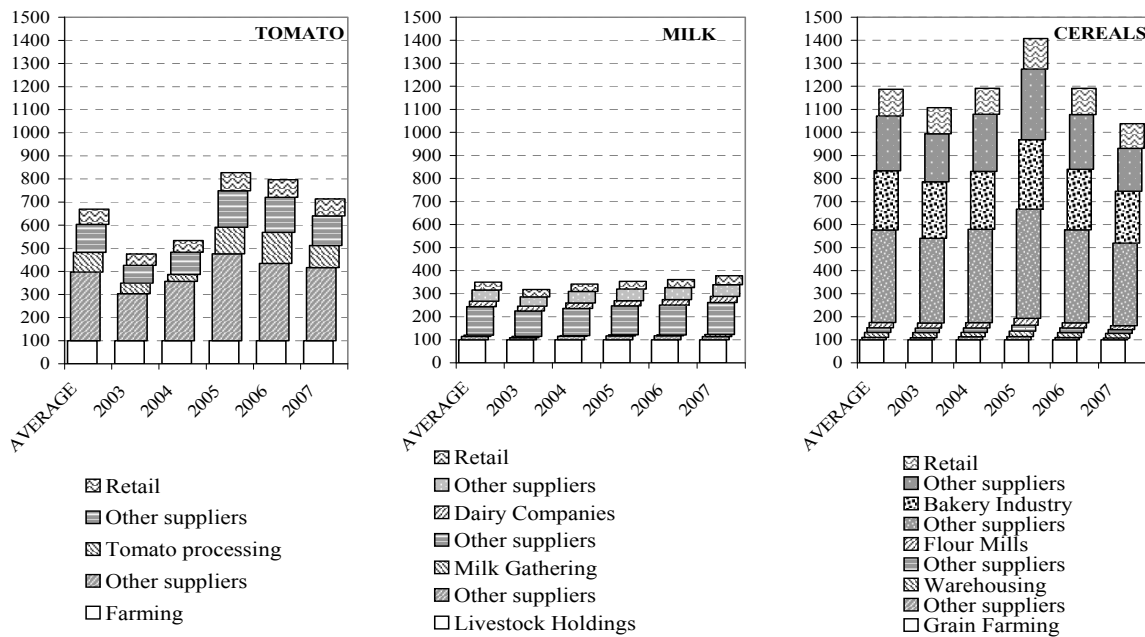


Figure 2 .Value of sales

4.3 Creation of value

Analysis of the value created within the tomato chain - being the sum of the average ROS (returns on sales) during the period 2003-2007 – identified operating profitability of about 12% of the total value created or, as an amount, of 42. Charting the performance of this indicator during the period 2003-2006 shows an inverse relationship between the value created at chain level and operating profitability. In the final year of the analysis, however, a further increase in total value was accompanied by a rise in profitability to 49, or about 13% of the total, after touching a minimum in 2006 (Figure 3).

The average operating margin of the tomato chain was 75, representing about 11% of the value created within the chain. The fluctuations in profitability during the five-year period were significant in a number of cases. As an example, the operating results in 2003 and 2004 were 85 and 54 respectively with, therefore, a reduction in operating margin by more than 7 percentage points in just one year. The results stabilised during the period 2005-2007, with a reduction in the total value of the chain that generated a modest increase in percentage margins (Figure 3).

Lastly, the ratio of operating results to the value of the cereals chain averaged (2003-2007) about 15%, or 179 in terms of absolute profitability. The fluctuations in operating margin were not particularly great during the period. This said, the pyramid shape of the chain's value over the five-year period considered highlights that the best operating profit/total

value ratios were achieved in the start and end years, when the total value of the chain was actually lower (Figure 3).

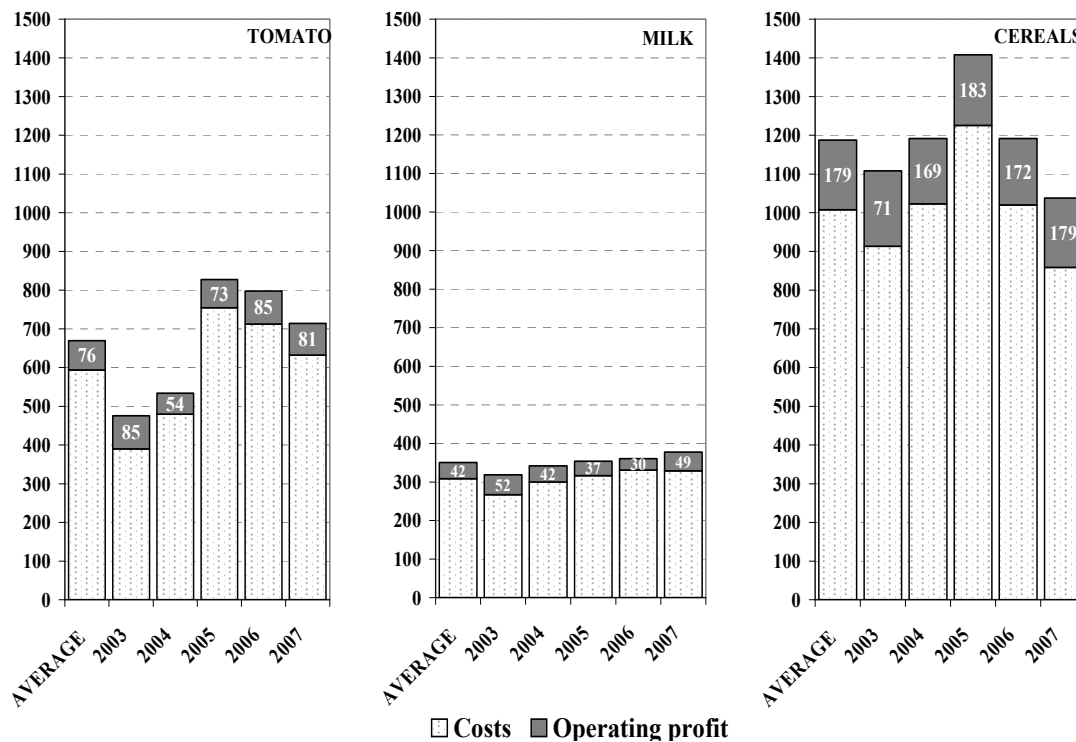


Figure 3. Value creation

4.4 Value distribution analysis

Within the tomato chain, two important aspects emerge from an analysis of the way value is distributed between the various players in the chain. The first of these is the role played by farms and distribution which, on average, keep about 65% of the total net value of the chain. The second is that farms act as the system “stabiliser”, absorbing the majority of any shocks in terms of value generated. Take the period 2003-2006 as an example, when the chain margin fell significantly from 51.6 to 29.6. In this case, more than 60% of the decrease was absorbed by the farms. This ability to absorb the economic fluctuations affecting the chain has a positive stabilising effect for other operators within the chain. The benefit identified above does not however extend to the transformation stage, which contracted significantly in 2005-2006 and actually generated losses in the last of these two years (Figure 4).

Overall within the tomato chain, farms appear better able to retain the margin generated - keeping about 45% of the total. However, the transformation stage (32%) and the distribution stage (just under 22%) also take a significant proportion of the value generated within the chain. In this chain too, the ability of growers to absorb “shocks in the generation of value” was particularly evident throughout the five years covered by the study. The period 2003-2004 provides a clear example: over 95% of the marked reduction in the chain's operating margin (from 85 to 54) was absorbed by the farms (Figure 4).

Lastly, the cereals chain displays characteristics that differ with respect to those of the other two chains discussed. Here, the transformation stage – storage, milling, baking - retains the highest proportion of the margin generated within the chain. In particular, the baking stage

alone earns on average about 50% of the chain's total margin. However, the farms and distribution remain important players, taking about 20% of the total margin each, on average (Figure 4).

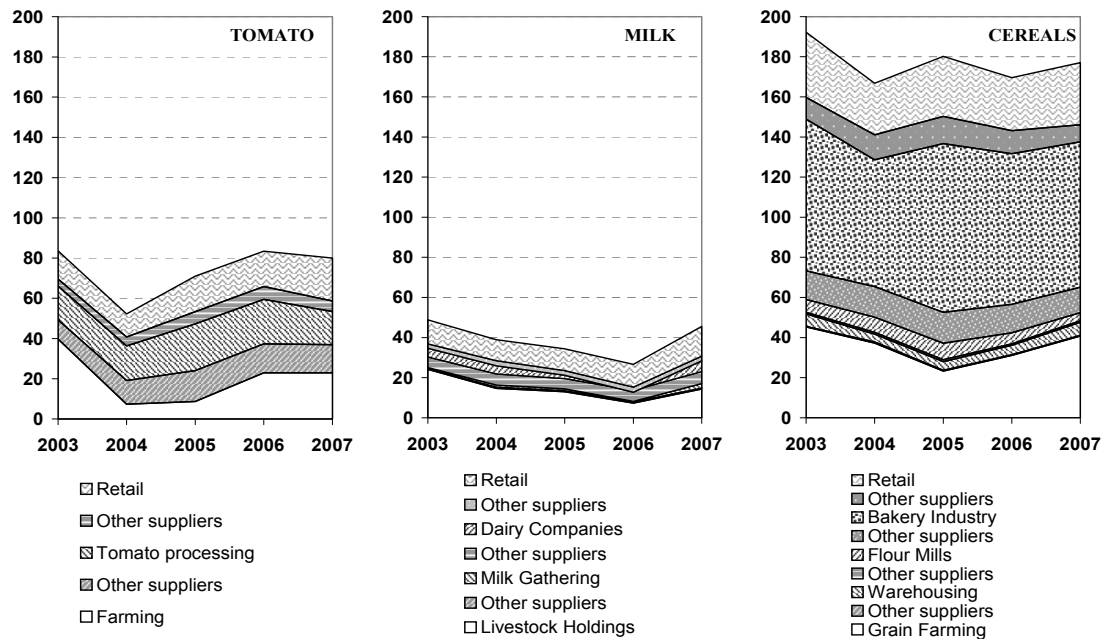


Figure 4. Value sharing

4.5 Profitability

The profitability of capital, measured as the ratio of operating profit to capital invested (ROI), averaged about 4.3% over the five years considered (2003-2007). As the first stage in the chain, the farms' suppliers earn approximately average profits, ranging from 4.1% in the tomato chain to 5.4% in the tomato chain. The situation changes when it comes to the farms themselves, which achieve below average profitability in each of the chains analysed. This is especially true in the cereals chain, where farm profitability is less than 2%. The profitability of the transformation stage (including collection in the tomato chain and storage, milling and baking in the cereals chain) is subject to greater variability, ranging from 1.1% in the tomato chain to 7.1% in the cereals chain. The profitability of the baking stage is notable with an average of more than 12%, while, at the other end of the scale, the ROI deriving from milk collection is less than 1%. Distribution earns roughly average profitability, 4.3%, except in the case of milk where its profitability exceeds 6%. Lastly, with regard to the other suppliers within the agrifood chains considered, the profitability of those serving the tomato and tomato chains is significantly higher than average, while the profitability of those working within the cereals chain is less than 4% of the capital invested (Figure 5).

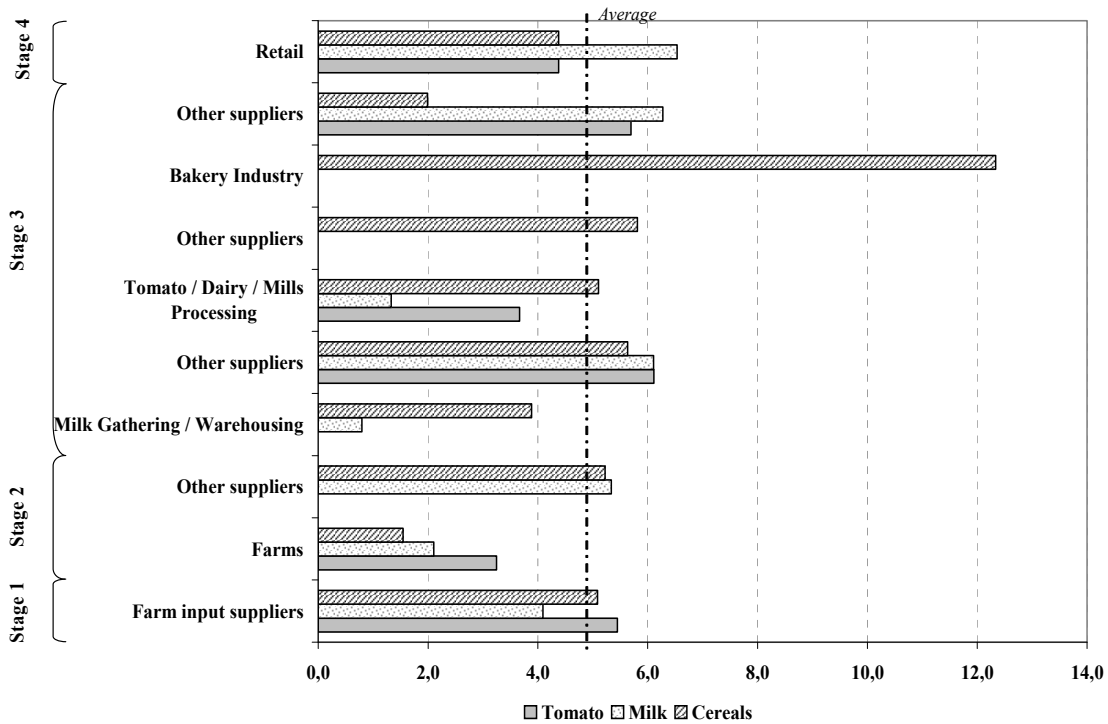


Figure 5. Return on Investment (%)

5 Final remarks

Food chain value distribution and price transparency analysis is attracting increasing attention from both practitioners and researchers. The present paper takes this as starting point to contribute to the discussion whether coordinating supply chain dynamics is a promising approach to attain a sustainable competitive advantage. This paper methodological approach starts from the end point, that is assuming that tens of companies active in different economic sectors, going from agriculture to industry and services, are actually belonging to the same company, totally integrated vertically. This unified economic body can, thus, be compared to an industrial holding company whose total value is to be analysed in order to detect its sharing patterns among companies' subsidiaries, that is chain stages, and dynamics over time. By adopting this innovative and unconventional "backward to forward" perspective, food chains become networks or consortia of firms that are pooling together their capabilities and resources and are primarily concerned with optimizing the common objective, that is overall profit, competitiveness and sustainability.

From this framework, results show that, should each of the three food chains analysed be a single holding company, a) that company would appear competitive thanks to the value created in the processing and distribution company offices to the detriment of the agricultural component, b) the distribution and logistics within the holding company would be contributing to the negative performance of the agricultural component who would then be forced to look for external financing support and European subsidies, and c) the farming component of the company would act as company "stabiliser", absorbing the majority of company's other functions' shocks and economic fluctuations disturbing the company. Should this be one company, it would be inefficient, based on the aim of taking from each other single company's functions or subsidiaries the conditions for achieving performing results, rather than competing effectively with external companies, without understanding

that such managerial approach puts at risk not only the internally rival function or subsidiary, but also the whole company.

Whereas in this metaphoric evocation everybody knows that in the long run the whole holding company becomes vulnerable, in the food chain economic bodies conceive themselves as autonomous and independent without paying adequate attention on the systemic consequences of one-sided and at times hazardous managerial practices. To conclude, food chain should strengthen their perspective of strategic and network alliance along the chain, being aware that external competition, competitiveness and sustainability require tighter chain coalition and partnerships.

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