

## Some conceptual issues

Practically oriented professionals seeking guidance about research methodologies are often reluctant to dedicate their attention to the discussion of conceptual issues. Yet, as we have already seen, value chain analysis has been used under so many different approaches and disciplinary backgrounds that a need for a discussion of its fundamentals is warranted. It is expected that readers will find, in the brief presentation that follows, the essential information for understanding what a ‘value chain’ means and how its theoretical principles can be useful for their professional activities.

The timeline presented in Box 1 should help in understanding the value chain concept, as it evolved through time across varied disciplinary fields, areas of application and levels of analytical aggregation. It should also illustrate the fact that, in spite of the differing notions associated with the concept, there is a clear unifying feature in the theoretical basis for value chain analysis: the systems approach.

### CHAINS AS SYSTEMS

According to its classic definition, a system is made up of two different aspects: a set of components and a network of functional relationships, which work together to reach an objective. These components interact through dynamic links that involve the exchange of stimuli, information or other non-specific factors.

From a historical perspective, we can say that the consideration of agrifood chains as systems is a result of the gradual development of methods and approaches to analyze economic sectors. Economists, in particular, have long been concerned with the ways in which individual sectors are organized and perform. Their work in the area of ‘industrial organization’ has offered the theoretical and analytical background that inspired much of the earlier work about value chains.

Industrial organization studies typically viewed a sector, or industry, as a collection of firms producing similar products for similar markets. In these studies, the structure of the industry (number of firms, their market shares, the relative ease of entering and leaving markets, etc.) was related to the conduct of the firms (long-term strategies, pricing policies, investments in research and development, advertising policies, etc.) that, in turn, would define performance, indicated by criteria that include technical efficiency, social welfare and efficiency in resource allocation. Thus, the structure-conduct-performance paradigm offered a reference model for the investigation of economic sectors.

Yet, as these ideas began to influence the analysis of agrifood sectors, it became apparent that their consideration of industries as **horizontal** cross sections of the economy limited the understanding of performance influencing factors associated with the **vertical** relations

**Box 1. The value-chain concept timeline**

Period	Concepts / Paradigms	Major Disciplines			Level of Analysis
		Economics	Business Management	Engineering / Management Science & Operations Research.	
'50s	Input/Output Analysis*	X		X	Macro
	Agribusiness (Harvard)	X	X		Meso
	Industrial Dynamics & Systems Science (MIT)	X	X	X	Macro/Meso/Micro
'60s and '70s	Industrial Organization (S-C-P )	X			Meso (horizontal)
	Subsector Analysis (Commodity Systems Approach)	X			Meso (vertical)
	French 'Filière'	X	X		Meso
'80s	Porter's 'value chain'		X		Initially Micro; later Macro
	Supply Chain Management		X	X	Intra and Inter Organizational
'90s	Agrifood chains; agro-industrial chains; productive chains; etc	X	X	X	Mostly Meso
	Global Commodity Chains	X			Macro
	Transaction cost theory* applied to vertical coordination analysis in agrifood systems	X			Meso
	Policy Analysis Matrix (PAM)	X			Macro
2000s	Value chains (revisited)	X	X	X	Micro and Meso

\* The fundamental concepts of transaction cost theory appeared earlier in literature

established by firms. Clearly, if we were to examine, say, the dairy sector of an economy focusing in one horizontal dimension only - for instance the processing segment - we would not be in a position to identify dairy farm related factors that could be affecting processing and thus be key determinants of sector performance.

The realization of the importance of a vertical dimension in the analysis of agrifood sectors has been attributed to the seminal work of two researchers from the University of Harvard, John Davis and Ray Goldberg, who coined the term **agribusiness** to represent the aggregate of operations that take place between the farm and the consumer<sup>1</sup>. Later, agricultural economists in the United States have developed the general framework that became known as the ‘commodity systems approach’ (CSA), which offered a logical structure to perform agrifood sector analysis, taking into account both the horizontal and vertical dimensions<sup>2</sup>. A parallel development with a similar focus was the *‘filière’* (chain) approach developed by French researchers.

As suggested by its own denomination, CSA is based in the fundamental principles of systems science. The systems approach takes into consideration properties such as interdependency, propagation, feedback and synergy, which are particularly relevant for the analysis of agrifood chains. These four principles provide the reference model we will be using to both the design and application of the methodology presented in this text.

**Interdependency** refers to the fact that the activities performed in a chain (production, processing, distribution, etc.) are related to one another. To operate efficiently and profitably, a chain actor, say a fruit processor, depends on a stable and regular supply of inputs that meet quality criteria and are delivered at an affordable cost. Raw material providers, such as fruit growers, depend on the other hand, on processors to guarantee a regular outlet for their products. Thus, the success of each one of these two actors is very much associated to the fortunes of the other.

**Propagation** exists because there is interdependency among a chain’s components. Any action causing an impact in a particular component of the chain will have effects that propagate backwards and forwards. If, for example, fruit juice consumers require retailers to inform them about the presence of genetically modified organisms (GMO) in their products, then processors and growers will have to adjust their production methods, so as to ensure that this information is readily available. The action in this case, though initiated at the retail level, had its effects propagated throughout the chain until its initial stages were reached. It is interesting to note that the propagation property makes it often difficult to distinguish symptoms from causes, when analyzing an agrifood chain; effects might be separated from their sources, both in time and space along the chain.

**Feedback** is a property associated with the two system elements already discussed. As seen above, actions impacting a chain component will propagate throughout its links. As chain actors adjust to these changes, the propagation principle causes a new round of adjustments, in a process that continuously occurs until some form of equilibrium is reached. As an example,

1 Davis, J. and Goldberg, R. *A Concept of Agribusiness*. Harvard University Press, Boston, 1957.

2 Good overviews of the CSA approach are provided by Holtzman and Staatz (2004)

consider the typical cycles observed in some commodity markets. Eventual price rises at the retail level are propagated back into the chain, ultimately inducing farmers to increase production. As production rises, for a fixed level of demand, the excess supply created will cause prices to fall. Farmers will eventually be aware of the new prices and cut back production, thus starting a new cycle of supply and price adjustments.

**Synergy** is a system characteristic that in essence tells us that the whole is greater than the sum of the parts. In agrifood chains there are frequently opportunities for gains which can not be realized unless all actors work together for mutual benefit. Consider, for example, the case of product traceability. Some markets for internationally traded commodities require that products be fully traced along their chains. This calls for common standards for information gathering and record keeping, product labeling, bar coding and other data processing protocols. It is clear that such complex organizational arrangements are only possible with the adhesion of all chain participants.

The system thinking is clearly present in the original introduction of the idea of a ‘value chain’, attributed to Michael Porter. In the mid 1980s, this author published a book where he proposed the chain paradigm as a construct to relate the activities performed by one organization with its competitive position. Firms, he noted, can be organized into primary activities that include inbound and outbound logistics, operations, marketing and sales, and service. Support activities, also performed by firms, include procurement, technology development, human resource management and infrastructure. It is the systematic arrangement of these activities that creates value and influences the competitive position of the firm.

Porter’s ideas had a large impact on managers and other professionals interested in the area of competitiveness. Since competitiveness is not only a key performance dimension for a firm, but also for their aggregation into sectors, regions or entire economies, soon the value chain terminology found use in the area of sector wide evaluations.

Systems principles are also present in the general thinking of the area of supply chain management (SCM). Originated in the logistics and management science disciplines, SCM is primarily concerned with the way firms organize the flow of inputs and production resources from procurement through product manufacturing and distribution. The processes necessary to accomplish this flow effectively, efficiently and profitably are seen as a system - a chain with nodes that can exist both internally and externally to an organization. (For more information about SCM, refer to: Van der Vorst, J. *et al.* 2007). Planning and executing these processes require managerial coordination of the internal nodes within the organization. Managerial coordination is also required beyond firm borders, often by nurturing cooperative relationships with chain participants external to the organization.

Other uses of the chain concept were promoted by researchers interested in globalization and international trade issues. The vast literature on ‘global commodity chains’ stems from this general interest, although its focus has been mostly in industrial, rather than agrifood products<sup>3</sup>. Additionally, the concept has been associated with policy analysis methodologies and

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3 For a contrast among ‘global commodity chain analysis’ and the ‘*filière*’ approach, see Raikes *et al.*, 2000.

with applications of neo-institutional economics. The list of suggestions for further readings, presented at the end of this text, includes studies that apply these approaches in agrifood chain analysis. None of them departs from the fundamental systems principles, though.

Hence, for the purposes of these guidelines, we use the term value chain to characterize a system composed by different actors, activities and institutions, all functioning interrelatedly, so as to enable the accomplishment of a common goal. Value chain analysis examines such a system and evaluates the extent to which its goals are being accomplished. This need for evaluation draws our attention to a second important conceptual issue: chain performance.

## **CHAIN PERFORMANCE**

We will see later in the methodology presented that one initial concern will be with the characterization of a chain: how is it organized? How does it function? Who are the main actors? What are the institutions and forms of coordination? These are questions that can help us to make statements about what a chain is. In economic terms, these are concerned with the **positive** dimension of value chain analysis.

However, we should be also concerned with what ought to be the chain. How is it faring? Are there problems to be solved, bottlenecks to be removed or strengths to be reinforced? Are their goals being accomplished? For an economist, these are known as **normative** questions. They express judgments about whether an observed situation is desirable or undesirable and thus require the definition of performance criteria.

Performance dimensions for value chain analysis should be clearly associated with its objectives. They can be qualitative or quantitative and might involve the following criteria:

- **Competitiveness, as indicated by the relative market share of a chain in domestic or international markets**

The dairy chain of New Zealand, for example, is considered to perform efficiently because it can competitively and profitably offer its products in international dairy markets. The country is the world's leading dairy exporter, with a global market share of 30 percent in 2004. The same reasoning can be applied to analyses in domestic markets. In a given country, chains can be differently organized in different regions; their relative market shares in domestic markets could then be seen as a performance indicator.

- **Competitiveness of a chain's product against its substitutes**

For products with close substitutes, chain performance might be indicated by the market share of its products vis-à-vis the competing ones. Beef chain analysis, for example, can use relative shares of substitute meats (pork, poultry, fish, etc.) as performance indicators. In developing countries, it is not uncommon that domestic agrifood products face the competition of imports. The relative shares for domestic and foreign products could also be taken as performance measures.

- **Profitability of chain actors**

To be sustainable, competitiveness has to be the consequence of the combined, synergistic action of chain participants. Such actors, in turn, have to be able to cover their costs and receive an acceptable return on their investments. Otherwise, they will not remain in business. Profitability is thus a classical performance indicator. Yet, profitability must be achieved in a sustainable basis. If a chain's competitive position is a result of, say, subsidies or other distortions that artificially generate profits for chain participants, this is a potentially threatening situation in terms of future performance.

- **Food security**

For agrifood chains, the ability to provide enough products to guarantee an adequate supply to meet food needs is an important performance criterion. Related topics are production and price stability, as both affect food security.

- **Technical and operational efficiency**

Efficiency, as indicated by input – output ratios or other productivity measures, such as crop yields, also provide a reference for performance evaluation. Value chain analysis invariably examines efficiency measures within and across the different chain stages.

- **Equity considerations**

How is the value that is added along a chain distributed among chain members? Are there indications of non-competitive behavior by chain actors? Is information freely and evenly flowing among chain actors? The current discussion about the power exercised by supermarkets in fruit and vegetable chains in developing countries is an example of how the equity dimension can become a concern in value chain analysis. The distribution of value among countries that are part of so-called global value chains is also an example of equity concerns in performance measurement.

- **Consumer satisfaction**

Are consumers getting the products demanded, in terms of quantity, quality, timeliness and prices? To the extent that consumer demand should ultimately drive agrifood value chains, consumer preferences and their fulfillment is a relevant dimension for the analysis.

To sum up, we can say that there are a variety of chain performance indicators. Depending on the purpose of the analysis, the recommendation might be for one or more of the discussed criteria. Pragmatically however, the ability of an analyst to appraise the criteria must also be taken into consideration in the selection decision.

The scope of analysis of performance of an agrifood chain undoubtedly comprises, beyond agricultural and livestock production per se, all inputs for these activities (such as animal health inputs, fertilizers, machinery, equipment, etc), plus processing and distribution. Also, it should consider crucial aspects related to the institutional environment under which a chain operates. As we saw, the systemic thinking, implicit in the notion of an agrifood chain, is an



essential tenet of the theoretical framework that should ideally support this type of analysis. The overall performance of a given agrifood chain cannot be merely considered as the sum of the individual performance of its agents. There are gains in terms of coordination, normally revealed in contractual arrangements that are set up according to the conditions of various markets and the institutional environment. These gains should be taken into account in the analysis of the chain coordination, as discussed below.

## CHAIN COORDINATION

Chain coordination should be understood as a process of transmitting information, stimuli and controls to guide the movements of players, so that they are consistent with the strategic objectives of market leaders, which are usually the same as the objectives of the chain as a whole. Coordination can assume a spectrum of modalities that include spot markets, strategic alliances, contractual partnerships and full vertical integration. All of them determine how product flows are regulated in terms of prices, quality, quantity, and delivery specifications, among other aspects.

Full vertical integration exists when one firm has total control among two or more stages of a chain. A tobacco company that also owns and operates tobacco farms would be an example of a vertically integrated operation. Alternatively, this firm could opt for an outgrower scheme, whereby tobacco farmers would be contracted to produce independently, but under closely specified production terms, price determination rules and delivery schedules. Coordination, in this example, would be specified by the contractual provisions. A third alternative would be for the firm to procure tobacco in the market place. Such a modality would characterize a coordination system based in spot markets. Alliances between producers, processors and retailers, not necessarily involving formal contracts, but clearly specifying transaction terms and mutual responsibilities and are another form of coordination that is gaining increased acceptance in agrifood chains.

The choice of coordination strategy by firms in agrifood chains is influenced by many factors, among which the so-called ‘institutional environment’ (also referred to as ‘enabling environment’) is of particular relevance.

The institutional environment in which firms establish relationships may enhance or impair the performance of the chain and its component parts. Institutions are formal rules, informal constraints, and the mechanisms responsible for the effectiveness of these two types of norms (North, 1994). Examples of formal rules include laws in general, the constitution, property rights, commercial and tax legislation in general, food safety legislation in the case of agrifood chains, and warranty and sales pricing policies, among others. Informal constraints are determined by conventions and self-imposed codes of conduct inherent to different cultures. They are also called informal rules and are usually unwritten.<sup>4</sup>

<sup>4</sup> Note that coordination is associated with the concept of governance, which is very much used in the neo-institutional economics literature and in the global commodity chain studies. A difference in focus exists, though, as this use of the terminology is chiefly related to discussions regarding power asymmetry in a chain, especially in distinctions between supplier driven chains and buyer driven chains. For a discussion of governance, see Gereff, G., Humphrey, J. and Sturgeon, T. The Governance of Global Value Chains. *Review of International Political Economy* (2004).

According to Williamson (1985), institutions set the ‘rules of the game’ and attenuate uncertainty. They generally help to make sure the market, society and socio-economic interactions function properly. Thus, institutions are important for the ‘coordination’ of linkages among firms operating in a chain. For example, as a mechanism for improving milk quality and safety, a government can set a combination of formal regulations, incentives and penalties to encourage adoption of cooling tanks. Government agencies will try to enforce adoption by means of penalty charges, combined with incentives, such as special credit terms and price differentiation for quality products.

Informal rules are equally important. Dairy farmers may informally agree with a processing firm on price and quality standards for raw milk. Both sides may respect the agreement because cheating is seen socially as a major non-ethical behavior. Opportunism may not be punished by legal sanctions, but may cause irremediable damage to the agent’s reputation and put him or her out of the market. Thus, formal rules are not always the main instrument for coordination purposes, as relations between companies and growers transcend them and extend to a universe of values relating to tradition, local culture, etc.

Coordination in the chain may be established through contracts, which determine how product flows are regulated in terms of prices, quality, quantity and delivery specifications, among other aspects. Contracts may be formal (written and regulated by law) or informal (guaranteed by informal constraints). While formal contracts may be well-constructed in legal terms, from the standpoint of economic theory they are always imperfect instruments that cannot account for all possible developments in relations between the parties. The presence of contracts, whether formal or informal, reduces the uncertainty involved in economic relationships, but does not eliminate either uncertainty or the risk of opportunistic behavior, which at worst can entail breaches of contracts. Thus the challenge of coordination is how to define and operate mechanisms (economic, regulatory and contractual incentives) that reduce conflicts, contradictions and transaction costs along the entire chain, while at the same time strengthening the incentives for each player to act in accordance with the strategic objectives of the leaders, thereby limiting the cost of overseeing or monitoring the system. Further aspects of contracts in agrifood chains are presented in Annex 2.



## The drivers of chain performance

We have seen that the chain paradigm provides a sound foundation for both positive and normative appraisals of agrifood systems performance. The methodology to be presented later in this publication is based on the premise that performance, as judged by one or more of the criteria we have discussed earlier, is the outcome of the combined impact of several factors that influence the ways in which a chain is organized and operates. These factors are here denominated **performance drivers**. To analyze chain performance, one must identify its main drivers and then assess the extent to which they contribute, positively or negatively, to the observed situation.

For the sake of analytical convenience, performance drivers can be clustered into a number of logical categories, which can be derived from the conceptual framework we have been discussing. Taking into account economic, organizational and technological issues, we will explore in this discussion six major performance drivers<sup>5</sup>. They are:

- The enabling environment
- Technology
- Market structure
- Coordination
- Firm management
- Inputs

While the six drivers above should cover the essential factors influencing performance for most agrifood chains, analysts certainly have the flexibility to adapt them and/or define new drivers, according to their specific needs and circumstances. For most practical purposes, the possibility of breaking down the drivers into their constituting elements should provide the flexibility one needs in order to consider these six categories as a general frame of reference. We will briefly discuss these major drivers next. Methodologies to assess performance drivers in chain analysis will be the subject of a later section in this document.

### • The enabling environment

The ‘enabling environment’ comprises policies, institutions and support services that form the general setting under which enterprises are created and operate. Depending on the way it is arranged, it can either support or harm the performance of an agrifood chain. A chain might be extremely competitive internationally with regard to the quality and costs of its products, for example, but this competitive advantage may be lost if domestic policies restrict market access by mechanisms such as export taxes or costly regulations. On the other hand, competitive

<sup>5</sup> This framework is based on Van Duren *et al* (1993)

disadvantages in cost and quality might be offset by policies that encourage investments in production technologies and / or support the provision of technical services. Understanding the enabling environment is thus crucial in chain analysis. As such, it constitutes the first performance driver in our framework.

The range of elements that constitute an enabling environment is varied. Annex 6 lists a number of issues that are generally considered as central components of a conducive climate for business activities and as such can be used as a source to guide the analysis of this specific performance driver.

- **Technology**

Technologies associated with production, processing and distribution operations in agrifood chains are essential determinants of productivity and costs. Also, technologies can influence agrifood product safety and quality. The ability to access technologies, including the requirements of financial resources, might on the other hand be a potential barrier to competition and thus affect performance in a negative way.

The evaluation of the ‘technology’ driver should take into account such broad issues. It should consider methods, processes, facilities and equipment used in agrifood chain operations, plus the aspects related to research and development (R&D), technology adaptability and technology adoption patterns.

- **Market Structure**

Evaluation of market structure might reveal the existence of competitive markets or of concentrated markets, dominated by oligopolies or monopolies. As noted earlier, there is a strong correlation between market structure and the conduct and performance of firms. In principle, competitive markets provide the incentives for firms to seek the type of intra and inter-organizational efficiencies that favor chain performance. However, the association of performance with the degree of market concentration is not a simple issue for the chain analyst. There is in fact a controversy among economists, in that respect. For some analysts, market concentration allows for economies of scale and investments in state of the art technologies, logistics, governance and other important determinant of firm competitiveness. Large firms would be able to coordinate horizontal and vertical arrangements to set up capital intensive infrastructure. Hence, the evaluation of market structure should not only consider the typical quantitative indicators, such as market concentration ratios or indexes, but also qualitative aspects regarding the existence of barriers to entry or the distribution of power among chain participants.

- **Chain Coordination**

Coordination refers to the harmonization of the physical, financial and information flows and of property right exchanges along a chain. Well functioning coordination facilitates planning and synchronizing such flows and exchanges among a chain’s different echelons, thus promoting organizational efficiencies. These, in turn, should translate into lower systemic costs, better consumer responsiveness and increased overall competitiveness. Coordination is affected

by governments and/or organizations that can play a direct role in establishing or fostering public and private sector strategies and policies of interest to a particular chain. Commodity associations, chambers of commerce and other forms of trader groups, for instance, are known to have been instrumental in the promotion of particular chains in a number of countries. The evaluation of coordination should concentrate on the mechanisms that govern transactions among chain participants and on the effectiveness of such mechanisms in promoting the harmonization earlier referred to.

- **Firm Management**

The ability of individual firms to efficiently allocate resources, respond to consumer needs and adapt to market changes is to a great extent a function of its managerial prowess. Management tools enable firms to control and monitor their production and financial processes, identify process bottlenecks, make decisions under risks, build long-term strategies, explore markets, reduce costs, etc. These tools comprise cost accounting and controls, production planning, inventory control and quality management, to name a few.

While the most important management tools are fairly straightforward and generally well known in business administration, it should not be taken for granted that their widespread adoption is the norm in any given chain. In fact, lack of adoption of even the simplest managerial tools is frequently a barrier to improved efficiency, particular in small and medium scale firms of developing countries. Also, the complexity of some agrifood chains demands a move towards increasingly more sophisticated systems of management and control. The rise of the needs to comply with certification standards for processes and products (ISO, EUREPGAP, etc.) is an example of managerial challenges for which adequate responses are still needed in many areas of the world. Another example is the growing need for firms to adopt standardized enterprise resource planning systems, in order to be able to supply major retailers of agrifood products. An assessment of the extent to which management is affecting chain performance is thus warranted.

- **Inputs**

The availability and costs of the main inputs (land, labour and capital inputs) in the different segments of a chain directly affect its performance. Low cost or high quality inputs can be seen as comparative advantage of an agrifood chain in a country or region. Availability and regularity of supply of critical inputs, such as skilled labour and capital goods for both processing units and farms, should also be evaluated.

As previously mentioned, each performance driver can be sub-divided into sets of constituting elements, which can then be appraised with regard to their contribution to chain performance. For the driver 'technology', for example, three groups of elements could be defined. The first group could comprise indicators of technology diffusion. It is important to identify the key technologies for each echelon of the agrifood chain and the degree of diffusion of these technologies in the respective chain segment. A second group could comprise indicators of public and private support to R&D. In this case, information on public and private resource allocation to R&D, number of R&D organizations, number and types of R&D partnerships, human resources availability, infrastructure availability and number of

patents could be used as performance indicators. A third group could comprise indicators of yields and/or results already reached from the adoption. Annex 5 presents the interview guide utilized in a comprehensive analysis of the Brazilian beef chain (Silva & Batalha, 2000). It illustrates the categories of informations that are typically considered in the analysis of the performance drivers described above.