

## Chapter 26

# General Conclusion and New Research Perspectives

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The renewed interest shown in agriculture by the international community and national governments since the 2008 crisis has firmly placed agri-chain approaches at the heart of development issues and debates. *Filières* or agri-chains constitute a framework for regulating relationships between various stakeholders and help generate private investment (Chap. 4). Downstream industries involved in processing, international trading, and distribution have adopted a strategy of investing in tropical agri-chains to secure and diversify their supplies and, at the same time, control the quality of products and the risks to their reputations. Standards, as well as certification and traceability mechanisms, are the tools used in this strategy. Since the limitations and shortcomings of the policies of liberalization are now clear and given the repeated failures of markets (of credit, inputs, etc.), the actors of development believe that supporting agri-chains and promoting public-private institutional arrangements to guarantee the interests of the various stakeholders should once again become priorities. The challenge is to improve the integration of producers into markets and to ensure a better distribution of added value among all the actors on the basis of a common development strategy. The

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strengthening of collective action is one of the cornerstones of this objective (Chap. 6).

The challenges of sustainable development compel us to define new arenas and new forms of action – which are now multiplying through standards and other regulatory instruments – and to come up with innovative practices and novel ways of deriving value. Exploring the links between transformations of tropical agri-chains and sustainable development allows us to conclude this book by listing the lessons learnt about the ability of these agri-chains to act as vectors of development, spaces of regulation, frameworks for innovation, and objects of assessment. A number of new fundamental transformations have begun to take place, such as the emergence of forms of capitalism in the South, new investment strategies in agriculture, and the financialization of this sector. The proliferation of these dynamics calls for further exploration and the identification of research perspectives that can help in this endeavour.

## **26.1 Agri-Chains as Spaces of Regulation of Sustainable Development?**

### ***26.1.1 Agri-Chains and Development Models: Highly Topical Issues***

The historical review of a particular period and a specific type of region in Chap. 3 helps explain how tropical agri-chains were formed and structured, and places the discussion on the role of agri-chains as spaces of regulation for sustainable development in a long historical trajectory. The historical processes of specializing on individual commodities structured the production and marketing by distinct agri-chains. Consequently, agricultural research in the twentieth century too was organized for the most part according to separate commodities. This historical background reflects the political vision of accompanying increases in production in a context of a technological revolution and of the structuring of markets and international trade that went together with the increase in the planet's population from one to seven billion in just two centuries. It shows how agri-chains – a term that encompasses the different concepts of value chains, supply chains, and *filière* – are a particular form of development based on specializations and the division of labour between different operators.

However, agricultural specialization and a sole focus on improving producer incomes are not always sufficient or even desirable given the necessity of a diverse diet and the importance of the sanitary environment for vulnerable populations (Chap. 6).

The current interest in sustainability once again raises the question of the trade-offs between the efficiency of specialization and the ability to manage risk through diversification. These reflections remind us of the importance of

considering – including while undertaking research – alternative forms of support for development and of analyzing how conducive to sustainable development are the different forms of organization. The recent interest that actors of development have shown in reframing agri-chain approaches by incorporating them in new public-private partnerships is proof of the relevance of the issues involved. Furthermore, the growing diversity of strategies for investing in agri-chains and the financialization of agriculture are new factors to consider (Chap. 25). This diversity reflects the changes in international aid and forms of capitalism designed to combine financial returns with social and environmental impacts: philanthropic capitalism, social entrepreneurship, responsible capitalism, corporate foundations, impact investment strategies, etc.

### ***26.1.2 New Forms of Regulation Associated with Agri-Chains***

The proliferation of standards and the mechanisms associated with them is a key factor in the evolving links between agri-chains and sustainable development. As concerns about sustainability have grown, so have the criticisms of the growth of tropical agri-chains because of their negative environmental and social impacts. In response, standards have been used to strengthen the ability of agri-chains to become arenas for action and for regulating behaviour. These standards are defined by different types of actors (NGOs, private actors, States, etc.) and differ widely, both in purpose and in scope: fair trade, organic or ‘reasoned’ agriculture, zero deforestation, sustainability standards, and other commitments made by agro-industries. A number of them are associated with labels that are promoted to and valued by consumers, allowing producers to be better paid for their efforts in some cases. Others are part of social and environmental responsibility (CSR) strategies of individual companies or formalize collective voluntary commitments (zero deforestation approaches, sustainability standards). Their rise is linked to the growing role of civil society in the emergence of new forms of regulation, especially that of NGOs, which are both whistleblowers and partners of multinationals and coalition of actors striving to reorient activities at the agri-chain level and change markets. International organizations such as the World Bank, OECD, and FAO also contribute to this standardization by producing, beyond health and food safety standards, lists of core principles, and guides for adopting responsible practices.<sup>1</sup>

The standards and the way of assessing and ensuring compliance (certification, indicators, thresholds, etc.) with them are established through negotiation by a growing number of categories of stakeholders: companies, NGOs, scientists, governments, and producers. These private voluntary standards are evolving in tandem

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<sup>1</sup>For example, ‘OECD-FAO Guidance for Responsible Agricultural Supply Chains’ (<http://www.oecd.org/daf/inv/investment-policy/rbc-agriculture-supply-chains.htm>, retrieved 9 June 2016).

with public regulations. Some of them complement the action of public authorities by mandating compliance with regulations such as on deforestation (Chap. 22). Sometimes these voluntary standards are made official and compulsory by national governments.<sup>2</sup> In other cases, government standards are less strict. One of the proposals advanced in the book is to combine the implementation of these standards with national mechanisms for payment for environmental services controlled by the States. In all cases, their scope and their consequences remain the subject of much current debate.

### ***26.1.3 The Limits of Regulating Sustainable Development Through Agri-Chains***

This book has explored the effectiveness of the standardization mechanisms put in place in agri-chains in producing regulations for a more sustainable development and has highlighted their limitations. These mechanisms are being promoted as an effective way of including effects of activities – called ‘externalities’ – not previously considered by agri-chain operators in their transactions. In doing so, they themselves generate various unregulated and indirect environmental and social effects. They also displace some problems outside the scope of action of the agri-chains: population migration and increased risk of conflict due to the local attraction of the activities of agro-industries, shifting of deforestation outside monitored areas, etc. Moreover, the very nature of mechanisms used to develop sustainability standards excludes a number of concerns of the local actors from consideration: doubts about some production models, inequality in access to resources, etc. Despite the promotion of participatory and inclusive approaches, asymmetries in the ability to act remain key concerns and complicate the issue of control of agri-chains through standards.

In addition to analyzing mechanisms and proposing improvements, this book examines the limitations of acting via the agri-chains for a more sustainable development. The expansion of markets through long-distance trade and the growth of tropical agri-chains lead to an externalization of the social and environmental effects and costs, which are obscured due to distance between locations of production and consumption. This distance can be geographical, of course, but also strategic and cultural (Princen 1997). By examining the strategies implemented by multinational corporations for the management of sustainable development, Godard and Hommel (2005) show, like Princen, how market competition puts pressure on operators not to internalize all the costs of their activities. These reflections show the limitations of mechanisms intended to expose the environmental and social impacts within agri-chains involved in long-distance trade, whose

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<sup>2</sup>For example, French companies with more than 500 employees are required by law to submit an annual report on their corporate social and environmental responsibility (CSR) activities.

competitiveness is based partly on the fact that some costs are kept hidden. One proposal is to reduce the distance between production and consumption, by reducing asymmetries between producers and the downstream sections of the agri-chains, or through a relocation of marketing channels (Chap. 23). These issues also refer to the debate on the reliance on the market or the State for internalizing externalities and managing public goods, and the necessary linkages between private and public regulation.

## 26.2 Agri-Chains and Territories

Current initiatives for increased social and environmental sustainability in agri-chains will not be sufficient to manage and preserve the commons and environmental public goods and to reduce inequalities between actors. Given the limitations of these initiatives in taking certain social and environmental issues into account, territorial approaches have emerged as a complementary way forward.

### 26.2.1 *Agri-Chains in the Territories and the Management of Local Resources*

The need to ensure not only the sustainability of activities in the agri-chains but also the sustainability of territories that these agri-chains are transforming is being widely debated in this book. Hence, it addresses, first, the role of agri-chains in producing value from territorial resources and as a driver for territorial development (Chaps. 4, 5, and 22) and, second, the strain that agri-chains put on resources (water and land in particular). The territories sometimes become arenas of competition between different agri-chains. Several authors warn against managing a territory's resources exclusively in a manner to benefit the economic interests of agri-chains that are present. On the other hand, Fusillier and Lejars (Box 5.1) show, in a context of sustainable water management and of pronounced scarcity, the importance of involving the actors of agri-chains downstream of production because they play a key role in the health of the economic activities in the territories.

The growth of the circular economy also calls for an examination of the links between the consumption of resources as part of the agri-chains' activities and the management of these resources at the territorial level. Thus, the traditional segmentation into agri-chains and the varying capacity of actors to implement collective regulations and to manage a territory's resources lead to three types of processes (Chap. 16):

- the creation or strengthening of systems of local intra- or inter-farm exchanges of products;

- the emergence of new agri-chains through the creation of new economic relationships between actors;
- the territorial anchoring of agri-chains, with connections between agri-chains taking place through dialogue between actors at the level of a territory.

These distinct processes rely on different tools and methods of analysis, foresight, and support. They differ in their technical dimensions as well as in terms of organization.

### ***26.2.2 The Territory as a Regulatory Space Complementary to the Agri-Chain***

The need to add a territorial dimension to the goal of sustainable development has led to a search for and reflections on the complementarities between territories and agri-chains. As Godard points out (2005, p. 23), it is a matter of ‘articulating common action at the highest possible territorial level to align expectations, set directions and ground rules, and the decentralization of individualizable actions in order to harness the innovation capacities and detailed knowledge of situations that characterize local actors.’ More broadly, the issue concerns the link between the local and the global, between social constructions and local policies, and global regimes. Both territories and agri-chains connect, each in its own way, actors and processes acting at these different scales. To avoid, on the one hand, the reliance on the very local and, on the other, the exclusive control by international mechanisms and a centralizing rationale, this interaction between agri-chain and territory constitutes a crucial space for action. Combining agri-chain approaches with territorial ones helps in taking environmental and social issues into account at a much broader scope.

Given the manifest limitations of market regulation within agri-chains, various authors discuss the role of the State. For example, local professional networks, structured around distinct agri-chains, and national public systems complement each other to ensure a proper monitoring and control of diseases and anticipation of health risks (Box 6.1). The territory, as a link between a framework of public intervention and collective action (Caron 2011), appears as a key regulatory space to manage rural and agricultural land and access to resources, complementary to that of agri-chains, as emphasized in Gaël Giraud’s Foreword. The capacity for regulation and control by local actors, including by local authorities, of trajectories of development depend on how deeply anchored are the agri-chain’s actors (producers and agro-industries) to the territory (Chap. 5). One proposal is to promote territorial projects in order to encourage this anchoring. These projects are based on dialogue and agreements between local communities, agro-industries, and public authorities.

Various territorial development approaches are proposed in this book. They bring together public stakeholders and private-sector actors of the agri-chains in

territorial projects that embed the local into the global. These projects have to be created on the basis of compromises arrived at through a local dialogue and by taking external orientations and regulations into account (Chap. 22). As discussed in Chap. 24 in relation to payments for environmental services, these orientations can be formalized through mechanisms implemented by the State at the national level and by taking the strategies and commitments made at the international level into account. Research should also be undertaken on systems of indicators suitable for monitoring projects in these territories.

## **26.3 Agri-Chains as Spaces of Innovation for Sustainable Development**

### ***26.3.1 The Bioeconomy and New Ways of Producing Value and Using Resources: New Innovation Perspectives***

As presented in the third part of this book, another major source of transformations of agri-chains that pertain to sustainability issues is the explosion of new ways of producing value and uses from biomass, promoted as part of the bioeconomy and a necessary energy transition. A large number of innovations have been adopted for improved material and energy efficiency in tropical agri-chains. Bright new prospects are opening up, due mainly to the circular economy, which uses the concepts of – and knowledge produced by – industrial ecology to propose intersectoral approaches (Chap. 16). Relationships between different agri-chains or with other activities within a territory are multiplying in order to transform and recycle waste and agro-industrial (or urban) effluents into resources for agricultural systems and, in this way, limit the recourse to external inputs. These innovations sometimes even lead to the birth of new – and economically viable – agri-chains for trade in these resources. Even when recycling and the use of by-products of an activity have been going on for a long time, such as between crop cultivation and animal husbandry, gains of efficiency are still possible. Thus, the increasing scarcity of resources is leading today to innovative inter agri-chain connections that mobilize and leverage technical solutions and economic and institutional regulations.

Moreover, bioenergy is now a major component of many agricultural and forestry chains in the South. Energy is no longer a by-product; it has instead become a co-product, whose importance is likely to increase over the next few years. It may even become a product in its own right. Changes and radical breaks with the past in tropical agri-chains thus lead to a remodelling of cropping systems depending on the purpose of production: food or non-food. Green chemistry also helps produce value from multiple products and to propose options for the future, in line with policy adopted to ensure energy and food transitions. Goebel et al. (Chap. 15) show the need to conduct research to better integrate these new uses in the objectives of cropping systems, thus allowing the design of suitable itineraries. However, current

research investment remains low in the field of bioenergy. In the North, as in the South, public policy on bioenergy is still struggling to define clear frameworks for intervention and is thus currently encouraging modes of production which confine bioenergy to a secondary production (Chap. 14).

### ***26.3.2 Embedded and Interlinked Technical, Political, and Organizational Aspects***

Technical choices and innovation cannot be considered in isolation of organizational and institutional factors. It will be a delusion to believe otherwise. Technical and policy choices cannot be made independently; they have to be coordinated. The desire for sustainable development reinforces the need to make technical choices in view of policy objectives that are themselves currently undergoing profound changes and to make new trade-offs and compromises. The exclusive focus on a logic of supply through technical and economic support to agri-chain operators has become outdated. While uninterrupted and reliable supply remains a key objective, even more so in a changing and uncertain context, the methods of achieving this goal are no longer those of the past. Zakhia-Rozis et al. (Chap. 13) propose a global perspective for a research agenda in the field of the biotechnical sciences to confront the challenges of food availability. These authors emphasize the combinations between qualitative and quantitative improvement in production, new relationships between actors within the agri-chains and territories, and a reduction in losses and waste.

The strategic choices to be made in the domain of bioenergy are apt illustrations of the complexity of trade-offs and linkages between technical and political factors, as revealed in the report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (HLPE 2013). Indeed, two equations require resolving:

- that of the energy transition and the opportunity of substituting biomass for fossil fuels;
- that of food security and the possible competition between food and non-food uses of agricultural production, land, and co-products.

This second equation itself involves two underlying trade-offs concerning technical options, explored in Chap. 15:

- between the use of dedicated crops and the use of by-products;
- between possible alternative uses of the land in terms of their agronomic characteristics.

It is interesting to note that innovative technical solutions can reduce the importance of the trade-offs to be made between objectives and between uses,



such as processes that enable a more efficient and complete utilization of the plant. Indeed, this is a key aspect of the bioeconomy.

Throughout the book, we have noted the unavoidable embedding and interlinking of technical and organizational aspects at all stages of the innovation process. The growing concern for sustainability has enriched technical and economic criteria that orient technological trajectories. Thus, Chap. 12 illustrates how the design of innovative processing methods and support for different forms of organization of artisanal or industrial processing require us to consider technical and organizational aspects together, regardless of the objectives (environmental efficiency, job creation, food security, etc.).

## 26.4 New Challenges for Evaluation

Given the urgent issues that have to be resolved and the intellectual and institutional renewal associated with evaluation requirements, assessment mechanisms are increasingly being mobilized to address issues of sustainability. For proof, one has only to look at the emphasis placed on the indicators and monitoring framework associated with the 169 targets that constitute the 17 Sustainable Development Goals of the UN and the global partnership to achieve them formed through a resolution of the UN General Assembly in September 2015. The objectives of sustainable development require a fundamental re-examination of how the performance of agricultural activities is measured. It is no longer enough – as the concept of multifunctionality already pointed out 20 years ago – to evaluate these performances solely in terms of production volumes, an objective that assumed so much importance in the nineteenth and twentieth centuries that it overshadowed all other metrics of performance. Even though job creation; the fight against poverty and food insecurity; social cohesion; resilience of social groups; political stability; mitigation of the effects of climate change; cultivation of biodiversity; prevention of pollution and desertification; etc. are now accepted as necessary and desirable outcomes of agriculture, we are far from being able to measure them reliably. To complicate matters further, the evaluation of these objectives is interlinked. Furthermore, even if they concern a measurable process or have an impact on a global scale (for example, the mitigation of the effects of climate change), these various objectives retain their specificity. Indeed, the structural characteristics of the agricultural sector and the policy objectives assigned to it still differ from one local production area to the next, from one country to its neighbour. The process of evaluation is therefore especially complex and assessments only acquire meaning through specific institutional mechanisms. It requires the linking of criteria, indicators, and standards resulting from, on the one hand, political trade-offs required by the local situation, and, on the other hand, a globally negotiated framework. The challenges of adaptation to and mitigation of the effects of climate change and the measurement of agricultural performance illustrate this tension perfectly.

The evaluation of the performance of agri-chains and of all that happens within them is no exception to these intellectual and operational exigencies. This is especially so since agri-chains are extremely fertile spaces of innovation, and because, with rare exceptions, they connect actors to global and local processes. They are an essential vehicle for impacts at scale, necessary given the challenges faced and the importance policymakers and donor agencies assign to them. The aim is not the widespread dissemination of a locally proven solution – which appears most often doomed to failure given the non-reproducible nature of the context and the resources invested to ensure success – but to design mechanisms for experimentation, learning, and supporting innovation that enable transformations by acting in a complementary manner at several organizational levels.

Different methods of evaluation are presented in this book's fourth part for measuring a wide variety of environmental and social impacts of production systems and agri-chains. They are used to estimate *ex ante* the impacts of different scenarios, to assess *ex post* the outcomes of actions already taken, or to control and orient trajectories in real time through *in itinere* monitoring of systems of indicators (Chap. 20). The choice of criteria and indicators is crucial to being able to make the correct trade-offs. Scientific methods and knowledge provide us with the tools and information to inform and guide these choices, and establish sustainability thresholds. In this regard, life cycle assessments, designed to analyze the impacts all along a supply chain, play a special role. The illustrations presented show how important it is to use new time steps and spatial scales in order to reassess performance, reconsider the design of innovations, and take criteria that could reflect discrepancies into account. To be able to predict the long-term consequences of decisions and actions and take global environmental problems such as climate change into account, we have to consider unusual and unexpected temporal and spatial scales as well as interdependencies within production systems and supply chains. This issue of the scale of evaluation goes hand in hand with that of representation of the system under evaluation and the ability to take inter-system transfers – for example, of pollution – into account. In this sense, the use of methods that combine life cycle assessments undertaken at the scale of the supply chain with more territorial approaches appear to be a promising option. Similarly, to ensure that ecological imperatives do not overshadow the social dimension during the construction of sustainable development indicators at the supply chain level (Feschet and Garrabé 2013), it is important to include this dimension explicitly in assessment methods.

Furthermore, the objectification of the assessment methods remains open to debate (Chap. 19). The criteria and indicators used are based ultimately on political choices, sometimes negotiated, sometimes not. Their choice depends on decision-making processes, the nature of the choices to be made, and assessment mechanisms. It is a matter of finding a balance between normative sustainability (externally defined indicators and thresholds) and systemic or procedural sustainability (negotiations, choices, trade-offs, compromises, negotiated thresholds) (Box 18.1). This raises the questions of how the actors organize themselves to negotiate and revise these criteria and of problems of asymmetry in the ability to implement original mechanisms and produce and use indicators.

The development of tools and indicators should lead to a better assessment of the environmental and social functions fulfilled by agricultural systems and chains, and to identify others and link them to specific practices. Characterizing practices and their effects in this manner opens the way for the necessary regulations by relying on new mechanisms that implement novel types of coordination between actors. Recognition of the services that agriculture provides is an essential step in their promotion and, consequently, the transformations of the agri-chains concerned. It opens up new perspectives, whether to provide remuneration through payments for environmental services, produce or develop standards, or support the organization of new agri-chains (Chap. 16).

## **26.5 Challenges of Knowledge Creation: Research Approaches and Agenda**

Giving thought to the links between transformations of agri-chains and sustainable development strengthens the relevance of research to act at political and technical levels for supporting:

- local, national, and international mechanisms and vehicles at the level of agri-chains and territories in defining and making trade-offs, and the policy frameworks and instruments necessary to implement them;
- the different operators of agri-chains, individually or collectively, in making appropriate technical choices and broadening the range of possibilities.

As this book repeatedly notes, the challenges of sustainable development require us to revisit the design of innovation systems and processes associated with agri-chains. This has major implications for research, which is evolving to meet the diversity of the criteria, actors, and situations to account for, with a growing awareness that research activities in themselves are rarely neutral. It is a matter of changing attitudes and practices, and of reconsidering objects and conceptual categories that form the basis for action. The second and third parts of the book discuss the transformation of practices, research and partnerships mechanisms for innovation, and of research themes. The lessons learnt and the feedback obtained from the different aspects that constitute the development of products presented in this book (varietal improvement, cropping systems, artisanal and industrial processing) inform the reflections on the positioning and modalities for agricultural research and its future agenda.

### ***26.5.1 Contextualizing Knowledge In Order to Innovate Sustainably***

The linkages between the technical and organizational aspects have to be addressed differently depending on particular economic and social contexts, with each agri-chain raising specific issues of sustainable development. For example, the issues of energy transitions and food security are addressed in different ways in different countries, regions, and agri-chains, even if they also make sense at a global scale (Chap. 14).

Developing and evaluating technical options requires an accurate diagnosis of the context. For example, the recourse to selected genetic resources depending on the end uses (Chaps. 11 and 15) helps in designing cropping systems and processing methods differentiated according to political contexts and trade-offs. The relationship between the genotype and the environment must be formed in an integrated manner, not only in the design and choice of crop itineraries and processing methods, but also by linking these choices between them and between different agri-chains present in a same territory, as shown by the seasonal complementarity between sorghum and sugarcane (Chap. 15).

### ***26.5.2 Positioning of and Approaches to Research***

Even though partnerships between the research community and the various actors of agri-chains have existed for a long time, the desire to incorporate sustainability issues has led to a renewal of the manner in which innovation is engineered and partnerships are formed. The emphasis is thus on defining research topics and processes in multi-stakeholder platforms in order to ensure greater relevance of knowledge production and sustainable capacity building (Chaps. 8 and 9). It is no longer a matter of proposing turnkey solutions but rather of supporting agroecological, climatic, energy, health, and urban transitions while taking into account the diversity of production and processing systems (Chap. 12). Participatory approaches rely on several different types of tools: modelling, production of scenarios, etc.

The need to take environmental and social issues into account underscores the importance of designing innovations in conjunction with an assessment of their expected effects and impacts. Trajectories of adaptation of systems are thus constructed and fine-tuned in a series of design and evaluation cycles by embracing a learning perspective (Chap. 10). As Godard and Hubert (2002) point out, these two dimensions often pertain to different scientific skills, thus constituting a significant challenge for the research community.

### 26.5.3 *Integration of Knowledge*

Meeting the ambitions of sustainable development is a major challenge of integration for the research community. Revising our notion of performance, reconciling different scales, understanding better the links between the technical and political aspects, etc. require us to go beyond disciplinary divisions. Given the narrow specializations that dominate the sciences, the integration of knowledge produced by different disciplines on distinct objects remains a major challenge. In such a context, agri-chain approaches are a veritable boon. Designing techniques and their contributions to innovation to accompany transformations of agri-chains requires cross-disciplinary contributions from the biological, technical, and social sciences. Considering the agri-chain in its entirety means combining genetics, agronomy, process engineering, analysis of actor systems and of instruments of regulation, evaluation, etc. As emphasized in this book's Introduction, the agri-chain or *filière* has long been a major arena and object for the integration for targeted research. This agri-chain approach, whose developments this book has presented, has proven its worth from the standpoint of integration of research into innovation processes.

From the perspective of the social sciences, different types of agri-chain analysis have also shown themselves to be important tools for understanding the insertion of actors into economic processes: insertion of producers into markets, quality management, governance of standards and power relationships, distribution of added value, etc. However, other dimensions at the household level – such as women's labour, access to a varied diet, the health environment, exposure to risks, etc. – are not sufficiently taken into consideration, especially from the perspective of food and nutrition security (Chap. 7). Conversely, 'sustainable livelihoods' approaches, which focus on the diversity of household strategies to ensure the livelihoods of families and their ability to access and combine different resources, do deal with these dimensions. But as Scoones (2009) emphasizes, these latter approaches, rooted in the local environment and context, fail to sufficiently take global transformations into account. Combining them with agri-chain analyses, which connect the local to the global, is an interesting way of understanding the processes of change between scales.

Similarly, links are yet to be constructed from the viewpoint of environmental issues between agri-chain analyses, which historically have given short shrift to them, and the very many approaches which focus solely on them: whether from the viewpoint of sustainable management of resources, which has resulted in an extensive literature but with little reference to agri-chains (Bolwig et al. 2010); or that of global environmental changes, with the emergence of sustainability studies (Steffen et al. 2015; Ericksen 2008).

The transformations taking place in production and processing systems in order to ensure a more sustainable development may need to bridge sectoral divides, and therefore divisions by agri-chains specialized each on a single product. The renewed interest in ecological intensification in pursuit of more integrated production systems (agroforestry, integration between crop cultivation and livestock

rearing, etc.) lead us to rethink the connections with downstream segments and markets. The circular economy is also shaking up the modes of organization by agri-chain. Notions of sustainability can also differ and thus call into question our development models depending on particular perspectives (Chaps. 17 and 23).

To combine the above-mentioned approaches even more closely, different avenues are being investigated or need investigating: enrichment of life cycle assessments by incorporating territorial and social considerations; approaches focused on sustainable food systems, whether at the level of territories – localized agrifood systems (LAS) (Muchnik et al. 2007, 2008) and foodsheds (Kloppenborg et al. 1996; Peters et al. 2009) – or at wider scales where global environmental changes and risks become relevant (Ericksen et al. 2010; International Panel of Experts on Sustainable Food Systems 2015). In all these different perspectives, the linkages of processes structured within agri-chains, on the one hand, and territories, on the other, is a major challenge. It is from this that our notions and visions of the role of agriculture in sustainable development will be redefined. It is on this basis and through the interfacing of the communities of scientists, policymakers, and agricultural practitioners that it will be possible to reconcile global and local forms of management of commons and public goods.

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