

Agricultural transformations: Their diversity and the challenges they pose



Observatoire des Agricultures du Monde
Comprendre les évolutions structurelles des agricultures
Alimenter le dialogue politique

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Abstract:

In a given area, different forms of farming (from small-scale family farming to large-scale enterprises) contribute and respond differently to global challenges such as food insecurity, employment, poverty, climate change and biodiversity. Rapid structural changes are happening (e.g. in land holding size and tenure, use of hired labour, increasing reliance on finance and market integration) but little is known about their impacts. Ongoing agricultural investments have triggered policy debate on the relevance and effects of different business models, and access to knowledge of these is crucial for all stakeholders to be included in policy dialogue.

Given the variety and complexity of ongoing transformations, policy debate at national and international levels should be supported by novel approaches for assessing and monitoring this phenomenon. This approach should take into account, among others, for the diverse forms of farming systems; the multiple sectors with which they interact at food chain, territorial and global levels; and impacts on ecosystem services spanning environmental, economic and social dimensions.

This paper presents a short review of the literature on agricultural structural change and discusses options to characterize different ongoing patterns of change, not limited to those which took place in developed countries in the second half of the XXth century. It calls a more comprehensive approach to monitor and evaluate these changes in order to improve policies through an assessment of the contributions of different types of farm organizations to sustainable development. In a given territory, and in the relatively long term, transformations can be described at least partly, by the changes in farm types. These structural changes are the result from strategies implemented at farm level to adapt to changing economic and environmental contexts.

Keywords: agricultural transformations, farming system, typology of farms

NB. The opinions expressed in this document are the authors' alone

¹ The authors wish to thank Eric Leonard, Benoit Daviron and Sandrine Fréguin-Gresh for their contributions and comments on an earlier version of this paper.

1 Introduction

Agricultural systems are undergoing multiple and sometimes rapid structural transformations. This is evidenced from the great changes taking place in land tenure systems, the use of hired labour, recourse to off-farm activities, forms of market integration, new forms of enterprises, in every sphere, whether in the developed countries, the transition countries in the former Soviet bloc, or the "emerging" or developing countries. At the global level, but in a very concrete way in areas where production units "produce" output, the different ways in which agriculture is organized (ranging from small-scale family farming to large-scale agricultural enterprises), are confronted by differing market and resource access conditions, deliver different economic, social and environmental services, and face global challenges in different ways. We assume that their contributions differ, depending on the types of structures and contexts in which they evolve and change.

The issue of changes in agricultural structures relates directly to structural changes occurring in the economy. Conversely, structural changes in the economy cannot be addressed without dealing with structural changes in agriculture, mainly because of the now "classic" historical sequence that led to a decline in the share of agriculture to employment and the wealth produced in the developed countries following the industrial and agricultural revolutions in the 18th century in the United Kingdom, and then in the 19th and 20th centuries in Western Europe and the United States. The expression 'agricultural structural transformation' refers to changes in the production structures defined on the basis of the data on developments observed in the combination of different types of capital mobilized in agriculture, namely, capital (land, materials and finance) and labour (family and/or hired) in terms of quantity and quality.² This paper does not deal with changes in the agrifood processing sector, even though we consider that the enormous changes taking place there are major determinants of the transformations taking place in agriculture today, and of the emergence of urban poles.³

After setting out the general framework of the relationships that exist between structural change and economic development, the paper addresses structural changes in the agricultural production sector, emphasizing the key role of agricultural productivity, while stressing the need to renew prospects by redesigning a paradigm that is more appropriate to meet present-day challenges. Lastly, the paper proposes a number of operational ideas to appreciate the diversity of the structural changes in agriculture, and the different forms they can take.

2 Structural change and the role of agriculture in economic development

Since the publication of C. Clark's book in the 1940s, followed by the studies of the developing countries (Johnston and Mellor, 1961; Johnston 1970; Johnson, 1973) and the latest findings summarized by Timmer⁴ (1988, 2009) and by Beyerlee, de Janvry and Sadoulet (2009) in the framework of the "*Agriculture for development*" Report (World Bank, 2007), the contribution of agriculture to economic development has been very prominent in academic studies, regardless of the public policy decisions taken to promote or foster it.

Structural changes in the economy, which thereby define the development process, is both a cause and an effect of economic growth. Changes in the respective parts played by agriculture, industry and services, and in particular a declining share of agriculture in GDP and employment, take place in tandem with the development of other sectors of the economy, urbanization fuelled by rural-to-urban migration, and a demographic transition (Timmer, 2009).

Demographic variables have a critical effect "*on the structural transformation of an economy, particularly on reaching the turning point where the size of the agricultural labour force begins to decline. The time required to reach this point depends on the initial share of agriculture within the total labour force, the rate*

² Such data can also be presented and captured by taking the 'livelihoods' approach, which defines five types of capital: human, physical, natural, social and financial.

³ Both historically and in a contemporary way.

⁴ "*Through rising productivity in the agricultural sector, overall economic growth is stimulated, and this then leads to the relative decline of agriculture in both GDP and in the labor force*" (Timmer 1988).

of growth of the total labour force and the rate of growth of nonfarm employment. Countries with a large initial share of total labour force in agriculture and countries with high growth rates of total labour, will take a long time to reach the turning point” (CEA, 2005, citing Gabre-Madhin and Johnston 1999).

Agriculture's share of GDP and employment is declining in relative terms, but the agricultural sector is continuing to grow in absolute terms (particularly the agricultural and food system taken as a whole) and to generate substantial growth links with the rest of the economy. Structural change therefore presupposes a net transfer of resources from agriculture to other sectors of the economy over the long-term (Staatz, 1994). The Economic Commission for Africa (CEA, 2005, citing Spencer 1995), spoke of the “*strong link between African agriculture and the rest of the economy, with growth multipliers of 1.5–2.7 per cent in Africa,. This means that a \$1 increase in rural income would translate to \$1.50–\$1.70 increase in income for other sectors, mainly through expenditure and consumption links among agriculture and other sectors, leading to growth and job creation in the nonfarm sectors.*”

Economists agree on several of the mechanisms that drive agricultural and economic development. The first is the capacity of agriculture to create employment and produce wealth by increasing agricultural productivity, referring here to the work by Lewis (1954). These relations are then qualified by input-output relations linking the industrial and agricultural sectors through the production of raw materials of use to industry, cheap food for labourers and the labour force in general or for the international markets, and in exchange, developing the capacity of the agricultural sector to serve as an outlet for industrial manufactured goods.

In both cases, relations are mediated by the markets, whose crucial role is stressed on the assumption – so often empirically proven – that they do not function as perfectly in practice as in theory. And contrary to the idea that is sometimes broached, this increase in agricultural productivity does not come about as a result of some spontaneous "trigger" but presupposes an appropriate context and significant public and private investments⁵ over the long term. Without referring to some mechanistic "developmental stages" approach, the question of the gradual nature of increased agricultural productivity has been emphasized by Timmer (2009), who has pointed to the failures caused by political intentions to hasten this process by “cutting corners”.

There is also general agreement in the economic literature on the multiplier effects on the rest of the economy of developing the agricultural sector. When these multiplier effects – which very often exceed 1, or even 2 or 3 – are not achieved, the debate is about the public policy choices that prevent them from being generated.

The classic view of structural changes (Bairoch, 1989; Timmer, 2009) refers to the reduction of the share of agriculture in the main macroeconomic aggregates. These changes were brought about, among other things, by the Industrial Revolution, urbanization and large-scale migration by European populations in the 19th and early 20th centuries. In agriculture, technological development brought about several agricultural revolutions across the years,⁶ replacing labour with capital and with massive recourse to chemical inputs, especially at the end of the 19th century and after the Second World War (Bairoch, 1989). In some instances,⁷ this led to a sharp growth in the productivity of the land and labour, whereas in other situations, less productive forms of production remained in place. Worldwide, the highly uneven distribution of these developed environments generated huge productivity gaps between agricultural systems, which were only slightly offset by the development of the "green revolution" in India and Southeast Asia, in particular (Mazoyer, 2001). Should

⁵ On a global scale, farmers make up the largest sector in numerical and economic terms.

⁶ According to Bairoch (1989), who excludes the Neolithic revolution which "invented agriculture", historians of the agricultural economy seem to identify three agricultural revolutions: the one that began in Britain at the turn of the 18th century, with the elimination of fallow land and its replacement by crop rotation, the beginning of mechanization which took off in the latter half of the 19th century, and lastly the recent revolution combining motorization, genetic improvement and the widespread development of the use of chemicals to intensify agriculture in the wake of the Second World War. Britain is a rather specific case to the 19th century considering its trading policies to import massive volumes of agricultural foodstuffs, which played a part in reducing the share of agriculture in the British economy.

⁷ The situation is substantially different in the countries colonized by 'white' migration (New Zealand, Australia, as well as Argentina), where the combination of available land, forms of land appropriation and systems of extensive farming techniques gave rise to other trajectories that exploited these advantages. However, the transformations now taking place in the Argentine pampas demonstrate the influence of the external players in introducing new technical, economic and social changes in a very short time.

one infer from this that this "model", or this type of trajectory, is therefore universal and non-historical, namely, that this may be the only way for agriculture to develop? Whereas the environment that predominated at the time of its expansion is now undergoing huge changes, and certain resources are being increasingly depleted or uncertain, with new challenges posed by climate change, and to public health etc.

Such path returns to extract a large share of labor in the agricultural sector and that in a time much shorter than the change is fast. However they occurred historically in countries with particular features: a demographic transition in progress or already completed, the existence of other sectors able to absorb the redundant agricultural workers, or the possibility of migrating abroad (European immigration in the 19th and 20th centuries). Today the situation is radically different in many areas, and above all in Africa, because the demographic transition has not yet come about, and the industrial and services sectors are not developing sufficiently rapidly to absorb the labour force, at a time when curbs on international migration are being hardened (Losch et al., 2011). In this part of the world, structural change and increased agricultural productivity in particular, is being rendered even more difficult by market liberalization, which is exposing the farming systems to competition against those in the highly productive countries, north and south. The liberalization of trade has tended to push down agricultural price until quite recently, with the result that farmers have been kept in a poverty trap preventing them from raising the resources needed to invest in improved productivity (Mazoyer and Roudart, 1997). In the long term, and this applies particularly to Africa, the Agrimonde foresight exercise (Paillard et al., 2010, pp. 61 and 62) has revealed real stagnation in land and labour productivity (farmed hectares and food crop production per active farmworker) between 1961 and 2003.

The core issue is therefore the question of the conditions for increasing productivity in the agriculture sector, which is key to developing agriculture, and beyond that to creating the effect of establishing positive linkages with other sectors of the economy.

3 Productivity, the centrepiece of agricultural transformation

Productivity, particularly of labour⁸ is the centrepiece of agricultural transformation, as Timmer (2009) has written: *"The basic cause and effect of the structural transformation is rising productivity of agricultural labor. There are three ways to raise labor productivity in agriculture (and the first two are usually linked):*

- (1) Use new technology to produce more output for a given amount of labor (an agricultural revolution)*
- (2) Let agriculture workers migrate to other occupations, without lowering output, thus sharing the output with fewer rural people (the classic Lewis model of development, leading to an industrial revolution)*
- (3) Through higher prices for agricultural output (make it worth more in real economic terms, which may well be happening in the current economic era, but is a reversal of historical trends – this would be a price revolution based on scarcity rather than surplus)".*

The importance of changes in terms of productivity has greatly influenced public policies for fostering agricultural transformations, and which have been expanded since the 1980s under competitiveness and liberalization policies being implemented in the OECD countries (Paillard et al., 2010). This has created a tendency to expand the size of holdings and increase the number of hectares per active farmworker. In a given territory, the first two ways of increasing productivity can only be understood in terms of the developments taking place in production units as a result of changes in production practices, and between production units as a result of changes in the distribution of resources, capital and incomes, and certainly with impacts on the three pillars of sustainable development. Structural transformations are therefore the result of farm performances and strategies over fairly long (medium-term) periods.

For this view of the transformation dynamics of the agriculture sector, based on a general understanding by reference to averages, ignores the fact that even within the OECD countries, where there has been an increase in the sizes of holdings and in productivity per farmworker, this tendency is accompanied by alternatives, with the persistence of smaller production structures, not based on the agriculture sector alone.

⁸ Productivity per hectare is only important as a means of raising the productivity of labour. *"Output per hectare is important only as a vehicle for raising output per worker"* (Timmer, 1988, page 304).

Empirically observing situations within the context of specific territories, and the differences that can be observed between different territories within the same country, and between different countries, lead to a re-evaluation of the change trajectories in production structures. For in a great many situations, structural change does not follow the model one would expect (Laurent et al., 1999; Van der Ploeg et al., 2009). Furthermore, a great deal of the literature questions the reasons for this economic "aberration" in which production structures continue to exist, and in some cases and above all in the South, even continue to develop, which judged according to economic and financial criteria alone would be doomed to disappear, on the ground that they are not economically viable (World Development, 2010).

For a major proportion of rural households in the South tend to combine a substantial reduction in farming activities with their contribution to incomes formation, through the migration of some members of the household, with a powerful anchorage to the rural locality and to the smallholding, without any permanent departure or significant transfer of resources to the holdings that perform best. "Archipelago" family organizations (Quesnel and del Rey, 2005; Losch et al., 2011) are being established according to multiple-activity models and the multi-localization of household members, being regularly recomposed, while remaining based on a family-run holding which is only able to provide a small part of the resources pooled by all the household members.

In contrast to these dynamics, and following recent tension on the international agricultural raw materials markets in 2007 and 2008, the dynamics of large-scale land acquisition, regardless of the legal form this has taken, are now part of the new version of the contemporary agrarian question (Akram-Lodhi and Kay, 2010; Van der Ploeg, 2008) taking account of the populations and areas involved, and the ensuing social, political, environmental and economic questions (Anseeuw et al. 2012).

Apart from the allocation of land and natural resources alone (particularly irrigation water) these land acquisitions raise numerous issues including the type of technique production model and the process for developing rural lands. For the investors' notices on the prospects for employment, increased production and food security for the host countries, often conceal more modest and uncertain results (Gabas, 2011). More generally, the increase in these dynamics – which camouflages more widespread, but no less important, phenomena in terms of their effects on tenure structures linked to the land investment strategies of the national economic and administrative élites, as in Mali, for example (Burnod et al., 2011)⁹ – raises the question of choosing the type of holding to be favoured to underpin the development of the agri-food sector, between a family-based model and an entrepreneurial model as standard ideals marking out the continuums and meshings of these different forms.

This therefore suggests that there is not only one model, and that particular attention should be devoted to the diversity of the transformations of agricultural structures. This requires us to describe and characterize them, and to acquire the means of monitoring their developments and the ways they are recomposed.

4 The framework for analysing expanded agriculture: towards a new paradigm

Climate and environmental issues, and the persistence of poverty and food insecurity demand an intersectoral approach that takes account of other dimensions, referring in particular to the place and the roles of farmers in societies and in their territories.¹⁰ At this point, it is important to introduce the notion of "territory", since farm holdings use natural resources located in specific territories. We may define "territory" in the following

⁹ While huge allocations of land to Libyan companies have been widely documented, "about 90% of the eight hundred and forty lease applications registered at the Office du Niger were filed by Malian nationals, representing 45% of the 870 000 ha requested by all the investors. The majority of the national farmers requested smaller areas: 80% of the applications were for between one and fifty ha, and 30% fewer than five ha. Individual farmers or farmers' associations wanted to expand their holdings or to settle in the ON zone to farm rice or develop truck farming. Only 3% of the national investors applied for between 500 ha and 100.000 ha. The sum total of these applications was 300.000 ha (more than three quarters of the total hectares applied for by Malian nationals" (Burnod et al., 2011).

¹⁰ "With the rate of large-scale land acquisitions in developing countries growing, the debate over appropriate models of development for ensuring food security has come again to the forefront of international forums" (FAO, 2011a).

manner: *"The territory is an area of land occupied and appropriated by a social group. It may depend on an authority. The notion of territory takes into account both the geographical area limited (or natural limits or political boundaries) and the political, economic, social and cultural societies living there."*

➤ ***Beyond production, the question of the development model***

According to FAO, *"approximately 75% of the food insecure live in rural areas"* (FAO, 2005).¹¹ *"As confirmed in the recent food crisis, in most cases hunger is not the result of insufficient food production but rather a question of unequal conditions for accessing food. Currently, an important number of the world's hungry base their livelihoods on access to land and other natural resources."*¹²

Poverty and food insecurity in rural zones are often short-term matters, in order to meet some emergency situation, but the roots are structural, with solutions that have to do with the structural transformation of the rural economies concerned, whose sustainability has to be gauged in terms of their economic, environmental and social impacts. The development models must be analysed, for as FAO has indicated, *"with the rate of large-scale land acquisitions in developing countries growing, the debate over appropriate models of development for ensuring food security has come again to the forefront of international forums"* (FAO, 2011a).

Agriculture must therefore increasingly take account [and do so publicly, interacting with the rest of society] of resource management at the territorial level, the production of environmental amenities and even managing externalities from other sectors, food security, energy, health care and even social peace. Agricultural issues cannot be addressed by conventional sectoral approaches alone, but must integrate or reintegrate relations with nature, resource and environmental management, and more broadly issues raised socially and politically by society. The question of food security entails many interactions with health (nutrition, physical status, and ultimately with the productivity of labour...), the generation of non-farm incomes in the rural environment, technical innovation for the sustainable management of resources and the environment (water, carbon storage, greenhouse gas emissions...). This broader perspective cannot ignore economic and commercial import policies and with their urban bias, and it is advisable to create synergies between consumers and producers in order to increase the productivity of the latter, and the security of supplies for the former.

➤ ***The multifunctional nature of agriculture***

WDR 2008 recognized these sectoral interdependencies in a comprehensive manner by proposing a reconsideration of *"agriculture for development"*, particularly through the questions of food security and the search for new technical and institutional models to accompany the development of family farming (WDR 2008). Taking these reflections further led Bayerlee et al. (2009) to outline a new paradigm consistently with the conclusions of the collective expertise of IAASTD¹³ (2008) or of the UNDP (2011) particularly on agriculture,¹⁴ energy and transport. Agriculture is therefore recognized simultaneously as an economic activity, a livelihood and the source of environmental goods and services. This shift in perspective clearly raises questions of measuring performance, which would be difficult to restrict purely to measuring the productivity of labour and land, whatever their structural effects.

Consideration of the agronomic and environmental impacts raises substantial conceptual and methodological difficulties, as does an understanding of the non-commercial dimensions of farming, however essential they may be for understanding how certain forms of production persist, which would be doomed if subjected to a purely economic rationale. This is the approach taken by the *World Agriculture Watch* initiative whose objective is to monitor and evaluate transformations and their impacts on food security and natural resources in terms of improving local, national and international public policies. WAW focuses on the transformations of farms and their production systems, but above all on their systems of activities in rural territories characterized mainly by their natural resources in relation to the structural changes taking place in the commodity sectors and markets, which constitute one of the main determinants of these changes.

¹¹ FAO. 2005. *The State of Food Insecurity in the World*, p. 5.

¹² See: *Land access and rural development: new challenges, new opportunities*, 9th Brussels Development Briefing, 2009.

¹³ *International Assessment of Agricultural Knowledge, Science & Technology for Development*

¹⁴ PNUE Coordination Hans Herren.

5 Specific transformations for farms and territories

Developments in agriculture are often presented on the basis of macroeconomic indicators. However they relate to very concrete microeconomic developments in the production units making up the sector: farms and enterprises both upstream and downstream of agricultural production. It is at the level of these units that decisions are taken which, when combined, lead to the development of the whole agricultural sector, including decisions to quit or to pull out of it. And it is also at the level of these units that public policy measures take shape, or do not take shape, which impact on agri-food production.

Present structural developments in the agri-food sector are now greater (the concentration of enterprises in processing and distribution, globalization, concluding contracts with producers, etc.) (McMichael (ed), 1994; McMichael (ed), 1995; Goodman and Watts, 1997; Rastoin and Ghersi, 2010; McCullogh, Pingali et Stamoulis, 2008) directly affect production systems. The following account, however, only deals with production.

The decision-making models used by the managers of these units (farm managers and business executives) are complex and highly variable, which increases the further away they are from the classical model of the firm which would maximize their profits. However, one may work on the assumption that these decisions, particularly if they commit the unit over the medium or long-term, are linked to:

- developments in the physical and socio-economic context, particularly as a result of the public policies being pursued;
- the structural features of these units, and primarily their available or accessible capital assets, but also in the broadest sense of their capacities (including market access) and their "capabilities" in the case of family farms;
- in a given country, these transformations are rarely "homogeneous" at the national level, and they vary from one territory to another (agro-ecological conditions, production systems, market access conditions, the availability of public goods and infrastructure, institutions and governance) with differing consequences.

Lastly, these transformations in the structures of production are also associated with repercussions on agricultural activities (farm practices) in terms of socio-economic and environmental performance, and on natural resources and the social organization of the territories concerned.

With regard to agricultural output in a given territory these transformations correspond to changes in the structural features of the farms. Even though each production unit is specific, in a given territory, it is possible to understand the developments taking place by using typologies and by observing structural developments within these different types, and the changes to the distribution of these types within the territory. Apart from any external factors, for each type of holding, these developments are linked to the accumulated medium-term performance in respect of all the activities (farm and non-farm) undertaken, and the strategies employed.

They lead in particular to questioning the analyses that have been conducted in terms of "production systems" (Cochet, Devienne, 2006) to adopt approaches based on the analysis of the "activity systems" which comprise all the farm and non-farm practices in the territory and outside it, developed by the members of the families, in the case of family-run farms.

6 The diversity of the processes associated with structural transformations in agriculture

The main purpose of World Agriculture Watch it is to monitor and understand the transformations taking place in agricultural production processes in terms of their economic, social and environmental effects and impacts at both the local and the global levels.

A huge diversity of production systems and agrarian situations exist throughout the world (Mazoyer 1999; Dixon et al., 2001; Wolfer, 2011; Koochafkan and Altieri, 2011). This diversity is exhibited by the type of crops grown, the animals raised, the products processed, the technologies, the available know-how and expertise, the social organizations and the institutions established, and the cultural referents mobilized. Today, with globalization, these systems are becoming increasingly related, and the people who live in them are having to address common challenges: climate change, global food security, resource depletion and degradation, the standardization of practices and habits, and so on. This diversity can easily be grasped at the level of particular territory from the typologies it has adapted. A robust framework is needed to conduct analyses and draw comparisons in space and in time, taking account of the different ways of organizing production.

In economics, the debate on this kind of representation has historically focused on the farm size (surface area, head of livestock, *small-scale versus large-scale*, etc.) even though other matters stake out the area for research, such as technology or the types of contracts used. However, the debate based on farm size depends heavily on the context, making it very difficult to draw any comparisons between different types of agrarian systems. Moreover, the debate to characterize different types of production units, as between family farms, agricultural enterprises, agribusinesses, smallholders and so on is based on concepts, approaches and authors that vary from one school of thought to another. Public policies often bring these concepts in play, adapting them to define and implement targeted measures. This gives rise to the highest level of confusion between the cognitive dimension on the one hand (concepts for understanding the actual situation) and the normative dimension, on the other (definitions for transforming these situations via policies).

The structural and institutional ways of organizing agricultural production are also evolving, “often challenging a certain view of agriculture based essentially around the family farm [...]. These developments reveal a new relationship between Capital and Labour which is gradually and increasingly more distinctly, moving away from family-run agriculture” (Cochet 2008). Vervieu and Purseigle (2011) proposed “analysing ways of re-composing European farming systems [...but] the dynamic of the explosion of the agricultural worlds we are trying to understand has to do with the globalization of economies.

“The differing 'institutional forms' one sees in agriculture today very frequently coexist in the same geographical space, weaving numerous relations between them, particularly with respect to labour, competing for access to the same ecosystems and environmental resources, competing on the same markets, and competing for access to government support... In any given region they are therefore stakeholders in one and the same agrarian system” (Cochet 2008).

To define a robust framework for drawing comparisons, making it possible to draw aggregated international comparisons, we therefore propose to use only one main criterion, namely, the type of labour used in the production units. This choice emphasises the direct or indirect consequences of the interplay between a certain number of determinants that seem to be steering agricultural transformations in the North and in the South, of which we can mention the dynamics of large-scale land acquisitions underlying an agricultural enterprise model, the dynamics of certification which, counter-intuitively, bring into play increasingly larger farms, relying on hired labour (Reynolds, 2004; Gomez Tovar, 2005) or the concentration and specialization of farms in France which has led to a change in the direction of corporate forms of farming¹⁵ using hired labour.

In addition to this first criterion, others could also be used to meet the specific features and requirements of characterizing the transformations occurring at the national and territorial levels.

The main structural transformations include changes in the ways of organizing production (developments across time in the numbers and the sizes of different types of production units, in terms of volumes, market shares, labour force, etc.). These changes will be taken into account according to the typology adopted, with and the impacts will be accounted for through the contribution of each type to sustainable development (the

¹⁵ Between 1988 in 2007 corporate farms increased in number by an annual 3.9% on average. The past three decades, between 1988 and 2010 have seen increased recourse to hired labour from outside the family circle, while permanent hired labour rose from 9.9% of AWUs in 1988 to 17% in 2010 (Gambino et al., 2012) while specialization and concentration dynamics have tended to increase the demand for hired labour (see Darpeix (2010) on the PACA region’s fruit and vegetable sector).

economic, environmental and social impacts) at the territorial level, and in the comparative analyses of different territories and commodity sectors (at the global level) which have been chosen especially in order to represent part of the many different situations that exist and to make the global analyses more relevant (see below).

Without attempting to be exhaustive, here are a few of the processes linked to the transformations, to spell out their diversity in more concrete terms, looking beyond the dominant "concentration and specialization" mechanisms. These processes can also operate simultaneously on one and the same farm (intensification versus 'extensification', but also diversification) and can also be combined between different farms - most often within the same territories, or taking different forms in different subsets within a given territory.

➤ **Concentration**

For farms, this phenomenon refers to a concentration of factors of production (land, livestock, equipment, labour...) which are generally accompanied by a decline in the number of farms and an increase in the numbers of large farms and widespread recourse to mechanization, and often to hired labour. These concentration phenomena generally have direct repercussions on resources, with changes in the agrarian structure (increased field sizes, land management, etc.). These farms are generally managed according to the technical models emerging from the Green Revolution, and set in train intensification processes based on chemical inputs and fossil fuel energy sources (Cochet, 2008; Hervieu and Purseigle, 2011).

Strategies for expanding large farms are being implemented increasingly less frequently by purchasing land and with large fixed capital investment. They are based on tenant-farming, leasing, and even share-cropping, and on and on 'reverse tenancy' relations (Binswanger & Rosenzweig, 1984) in which it is the tenant who controls the capital and market access in a dominant position over the landowner.

Upstream and downstream of production, concentration processes may be horizontal (a decline in the number of players at one stage in the process, to the point of establishing a monopoly) or vertical, and may they entail one operator performing several different functions (contractual agreements between producers and one operator form part of this vertical integration process). Downstream, these transformations have been widely documented (see in particular Rastoin, 2008; McCullough, Pingali et Stamoulis, 2007, IAASTD, 2008), as have the consequences of restructuring on market access conditions by small farmers, particularly in their relations with large supermarket chains (Reardon et al., 2003), from the point of view of forms of more inclusive integration (Vorley et al., 2007).

➤ **Dispersion, fragmentation**

In the case of farms, this phenomenon refers to an increase in the number of farms by dividing them into plots, and reducing input availability and use (land, livestock, capital equipment, family labour, etc...) with or without intensification. In some rural areas of sub-Saharan Africa with a high demographic growth rate, and/or where there exist forms of agricultural production managed by large-scale household structures comprising several domestic units (Losch et al., 2011). This occurs against the background of steep demographic growth without the expansion of agriculture and increased land availability, as in the case of the Madagascar Highlands, for example. As with concentration, this phenomenon has direct repercussions on the territories involved: reduced plot size, increased deforestation, farming on fragile land, reducing fallow periods (Lasry et al., 2005).

At the industrial level, this phenomenon is linked to an increase in the number of stakeholders in a particular link, or a set of links. For example, the privatization of the rice processing agro-industries in Mali and Senegal in the 1990s led to the emergence of small artisanal processing units, to the detriment of the agro-industrial sector which virtually disappeared (Bélières and Touré, 1999; Ducrot 2001).

➤ **Diversification/specialization**

These farm and non-farm diversification/specialization processes are widely described in the literature. WDR 2008 considered these processes to be two major ways of bringing about possible developments in the rural world [in addition to the abandonment of agriculture] to enable agriculture to play a part in poverty

reduction. The Rural/Struc study conducted a broad analysis of these phenomena in rural households, stressing the heterogeneous nature of the situations, the combinations of these processes often within one and the same household, and their consequences in terms of whether or not there is a possibility of pulling out of poverty, demonstrating that they cannot be reduced to simple models (Losch et al., 2011). Diversification and specialization can be agricultural and nonagricultural, and take place off the farm (with the migration of one household member). Specialization and diversification can also apply at the territorial level, according to the three sustainable development pillars: (i) economic, in the case of farms specializing in the production of only one commodity, which plays a central part in the agricultural value-added at territorial level, and which therefore determines the existing dynamics, (ii) environmental, with the development of a monoculture, or (iii) social, with agricultural production concentrating labour.

Like diversification, specialization may also be non-agricultural, with urbanization and the reduction in the areas of land devoted to farming, and a decline in the share of agriculture to added-value, or to labour, etc.

➤ **Market integration: autonomy, dependency**

- Food autonomy, nutrition and health

In order to address the risks (the production and marketing of agricultural products) throughout history, farmers have developed strategies to adapt to and resist external shocks. Household food production which - today¹⁶ - is the primary function of agriculture, has disappeared from the more highly specialised systems that now only produce for the market, such that the farmer is also required to procure food on the market. This function is far from having disappeared in very many situations, and even though food security is viewed on multiple levels, we consider that one of the measurements of the performance of production systems is their capacity to guarantee all or part of the subsistence requirements of the family, particularly where monetary incomes are insufficient or where the markets are unable to guarantee levels of food security. Moreover, collective expertise (IAASTD (2008) emphasises intersectoral relations between agricultural production, health and human nutrition: "The capacities of individuals, communities and countries to attain sustainability targets depend on the links that exist between health, nutrition, agriculture and knowledge of agricultural sciences and technologies". This view implies taking a global approach to the performance of production systems, particularly those in which strategies still significantly depend on home-produced food.

- Energy

Energy issues relating to the agriculture sector arise in two areas which are sometimes not grasped simultaneously despite their interactions. The first is the "consumption" of fossil-fuel energy by farming. This energy is consumed directly (fuel for working or heating) or indirectly (to produce inputs). Energy is also an issue that cuts across that of climate change. The energy crisis in the 1970s made people aware of the problem, and in some cases the energy consumption in agriculture was reduced, as in the case of the United States where fossil-fuelled energy per unit of product was halved between 1978 and 2002 (USDA, 2006). The second refers to the production of biofuels or bioenergy. These raise the same problems in terms of the technical production model, and also give rise to the question of competition against products to be used as foodstuffs.

Inputs constitute a major share of farm monetary expenditure. Strategies to reduce costs, and hence achieve greater autonomy, can also respond to challenges in terms of maintaining and renewing fertility, particularly by increasing and making greater use of labour. This refers particularly to ideas about the ways and means of achieving intensification based more on enhancing the biological functioning capacities of soils and ecosystems (see below).

¹⁶ Here we partially agree with the observation made by Benôit Daviron who relativized the "food production" function of agriculture in historical terms (in the sense of primary production, including forestry etc.), which grew in importance after the 19th century by reducing the other non-food production functions - heating, lighting, habitat, travelling, etc. A major part of the current literature deals, albeit not exclusively, with "greening the economy" (UNEP, 2011) mainly by producing biomatter, biofuels and by using the resources of the "Knowledge-Based Bio-Economy" (KBBE) which encompasses a vast range of technologies that are now available or currently being elaborated.

The mobilisation of fossil-fuel energy lies at the heart of the transformations that have occurred in agriculture in the developed countries. But this is now being challenged as a result of increased production costs (the cost of fossil energy) and their effects in terms of greenhouse gas emissions. This refers equally to production, processing and distribution. Initially, WAW will address energy issues only at the production level.

➤ **Intensification/extensification**

In the case of farms, intensification means maximising production in relation to the inputs used (labour, land, capital investment, equipment, intermediate consumption, etc.). It is designed to increase yields by using new technologies, changing practices and investments (adopting innovations). Whereas until recent years intensification was almost exclusively viewed in terms of increased recourse to tradable intermediary consumer goods, new technical systems using biological processes that have been known for a long time, are currently being developed. Agricultural conservation practices (Giller et al., 2011), organic farming, agroecology (Altieri, 1990) and ecological intensification have been marginalised in the past, but today seem more in step with the ecological and environmental challenges that farming systems have to confront (FAO, 2011b).

Extensification means reducing production in terms of the inputs used by adopting new practices; it most frequently refers to reducing yields by reducing input use; this can often be found with changes to the techniques used on farms under the influence of socio-economic factors, or driven by public policies. In Europe, some farms have moved away from intensive dairy farming to meat production, based on valorizing grasslands and rangelands that require less labour and monetary inputs (Dedieu, 1983).

➤ **Breaking up of assets (land, labour, capital) and disaggregation of the family unit**

These are not new processes, but historically form part of the development of agricultural systems. Tenant farming methods (including sharecropping), commissioning service companies to perform agricultural tasks, and hiring non-family labour in different forms (piece-work, hired labour...), financial investment from outside the farming industry, have long been adopted to enable the agricultural sector to function. Today, these processes have been exacerbated by tension regarding raw materials prices, heavy pressure on natural resources (renewable and nonrenewable alike) and the quest for high rates of return on globalised capital (Hervieu and Purseigle, 2011). Paradoxically, where agriculture is based on investments generating deferred returns, and is faced with numerous risks, today we are witnessing a massive increase in investment particularly in land using capital of non-agricultural origin (Anseeuw et al. 2012).

Two specific situations illustrate this explosion. The first, in South Africa, has been the emergence of "macro stakeholders" (commercial banks, agricultural engineering companies and investment funds) which are establishing new production models (Ducastel and Anseeuw, 2011).

The second one is in Argentina in an extreme situation, where an agricultural system is developing around "Pooles de siembras" (Gras and Hernández, 2007) based on a system of leases and subcontracting agreements, involving service companies and working to order, piloted by an investment fund, wishing to reduce fixed investments to a minimum. Agricultural work is therefore outsourced to agricultural work enterprises, which supply hired labourers and the means of production (tractors, etc.) supervised by teams of agricultural engineers. This outsourcing is often accompanied by certain level of mobility depending upon the season and the zone. Lands are leased to tenants who are no longer involved in agricultural production itself, with a fairly reliable assurances governing the lease, and the multi-year returns on the investment.

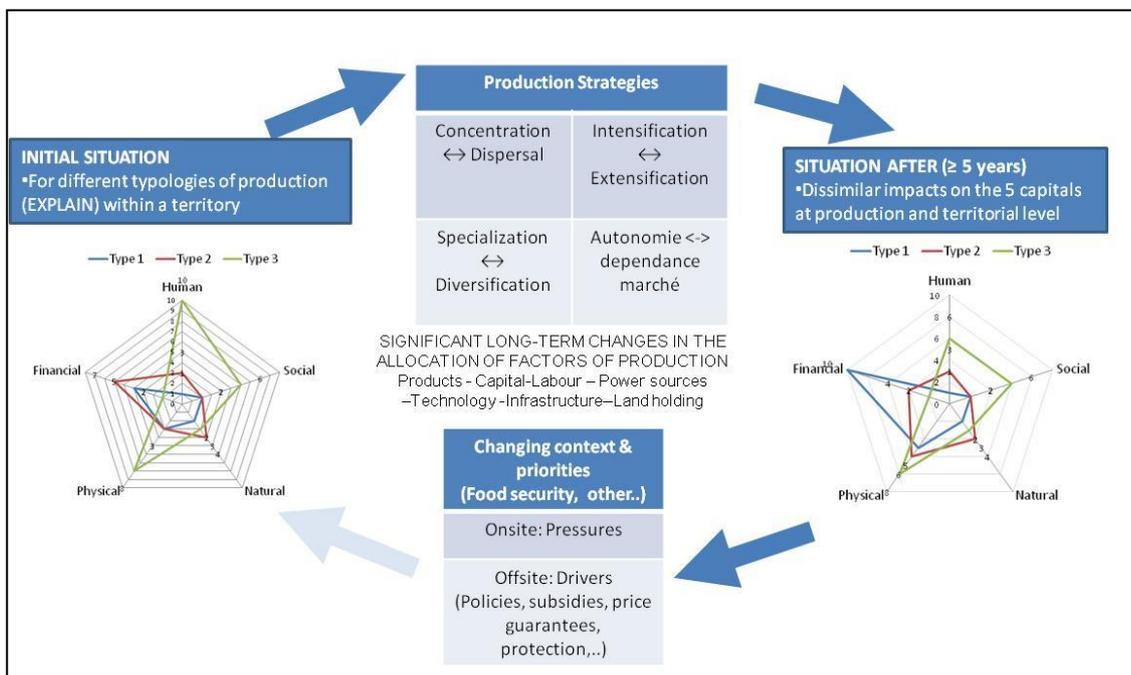
7 WAW: an approach to the monitoring and analysis of agricultural transformations

The WAW approach is based on this analysis of agricultural transformations, hinging around production units, that is to say, farms (in the very broad sense of the term, to include all the activities and consumption functions in the case of family farms) in relation to the other stakeholders and the territory in which they are located (see the diagram below).

The dynamics are the outcomes of strategies implemented by rural households on farms whose features are often complex, because they have been adjusted to developments in their environment (physical, climatic, institutional, economic,...). The economic and institutional components of this environment are often considered to be substantial, and to be the target of public policies being implemented. However, the physical environment is a major element in determining farm strategies (households and enterprises) and the ensuing transformations (Cf. the risk systems identified by FAO (Solaw, 2011)).

If the processes associated with agricultural transformations are often described in studies and empirical materials, it is difficult to take account of the various situations in a homogeneous manner because of a lack of a minimal set of comparatively standardized indicators that make it possible to draw comparisons.

Figure 1 : Schematic representation of the process for farms



The radar diagrams show the structural features of farm types (three main types, aggregated at a level which make it possible to draw comparisons) and the number of farms of each type, and their frequency, developing as the result of strategies implemented on the farms, adjusting to development in the physical and socio-economic environment. This presupposes implementing a model at the territorial level, based on a limited number of production units (farms) to be closely monitored, while being representative of meaningful categories at the territorial level. The capacity of the model to provide meaningful information on public policies depends on it.

Although these processes are often described in surveys and empirical materials, it is still difficult to take account in a homogeneous manner of all the various situations that exist, because there is a lack of a minimal set of relatively standardised indicators making it possible to draw meaningful comparisons. In this paper the indicators are only presented in outline form, but this is a point which should be studied further in the methodological notes currently being drafted under the WAW Initiative.

A table annexed to this paper proposes a number of variables or indicators of the transformations (developments) at farm level.

The more detailed methodology (FAO, 2012) is given in another communication. What has to be done now is to test this methodology and in order to properly conduct the WAW pilot phase; the regions must be chosen which are meaningful in terms of the diversity of the transformation mechanisms currently in progress. If the summary characterization proposed in this paper is tested in different places, will make it possible to identify the characteristics and the determinants of those changes.

Table 1 : A few parameters or indicators of the transformations (developments) occurring as holding level

Structural variables	Intensification ↔ Extensification	Diversification ↔ Specialization	Dispersion ↔ Concentration	Autonomy ↔ Market integration
Labour	Productivity of agricultural labour by unit of inputs: by hectare, capital employed, etc.	Share of active household members employed in agriculture out of the total. Share of household labour out of total agricultural labour force	Number of active workers per farm Total number of workers per farm Unit of input per unit of labour	Family labour/total labour force Share of labour for production under contract Share of labour for household consumption or non-monetary trade
Land	Agricultural yields per surface unit Surface unit per household active worker Income per hectare	Number and kinds of products Share of income from main crop Herfindal - 'Hirschmann index	Farm dimensions by type of land and agricultural labour Distribution of land (Gini index) Share of income from cropping	Land tenure mode Access to common land (rangeland, forests)
Capital Equipement Inputs	Yields per physical unit of capital (livestock, pirogues, etc.) Productivity of capital	Composition and breakdown of capital Practices	Capital per farm and farm laborers Distribution of capital by farm (Gini index)	Dependence on upstream and downstream markets (including contracting) Financial ratios Sources of capital

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