Social and Technological Transformation of Farming Systems:

Diverging and Converging Pathways

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Workshop 2.3: Well-being in rural areas: how is it affected by different farming systems?

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The lifestyle in most rural areas has changed profoundly during the last decades. Global trends such as globalisation, increased mobility, and global communication networks have brought economic, social, cultural and environmental changes to rural areas. Still, agriculture, even if substantially changing, continues to represent the primary land use in rural areas, and it continues to have extensive influence on rural social ties, community life functioning, and local cultures, landscapes, and environments. With a variety of agricultural systems resulting from the current transformations, some fundamental questions are arising related to the well-being of rural citizens. Local agriculture undeniably influences not only the well-being of farmers but also, to a different extent, residents and temporary visitors, as well as the well-being of the community as a whole. In the research literature, the interconnections between local agriculture and human well-being remain largely unexplored. What impact has the agricultural modernization had on rural well-being? How has the current reconstituted rural population, with fewer people engaged in agricultural production, interacted with local agriculture? Are there different impacts of local agriculture on various population groups? How do the social interactions like people-agriculture, farmers-consumers, and farmers-farmers vary across different agricultural systems? Is farmers' well-being in harmony with the well-being of others? Is human well-being in rural areas compatible with environmental well-being? What are the priorities of rural residents? These are only a few questions that remain largely unanswered. The importance of understanding these interconnections is increasing with the many, often rapid, changes currently occurring in agriculture that in several situations can be hardly reversed. The concept of well-being has attracted much attention recently due to the challenge of redefining progress and moving beyond the gross domestic product as the primary indicator of social progress. On the one hand, there is still an ongoing discussion among researchers about the definition and the dimensions of well-being. On the other hand well-being was already recognised as a broad and dynamic concept going beyond a purely economic issue that encompasses various specialties and requires a multidisciplinary dialogue to advance its measurement. It is recognised as an essential element in sustainable development; thus, there is a growing amount of research focused on developing approaches to assess the interconnections between human well-being and the environment. In a rural context, a linkage between farming systems and human well-being is a necessary contribution to the current research debates. The workshop aim was to open a discussion about the following issues interconnecting different farming systems, including their outputs like goods and services, with the well-being of rural actors: theoretical and conceptual frameworks, future research challenges, approaches, and descriptive and experimental methods. By rural actors, we mean primarily farmers, residents, the local community, and other citizens who in certain modes interact with rural spaces. Well-being, in this case, can have a variety of meanings: life satisfaction, life quality, eudaimonic well-being, household well-being, community well-being, society well-being, objective well-being, subjective well-being, and so on. Moreover, different well-being dimensions are relevant to the discussion. The scale of the focus was the local one when considering agriculture and the community. Nevertheless, the discussion was also allowed to evolve naturally to more global perspectives.

Economies of scope: context of agriculture, smallholder farmers and sustainability

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Abstract: Tracing the evolution of theory and practice of '*economies of scale'* during the last three centuries of industrial revolution, the paper shows the irony of adopting *economies of scale* time and again only to face greater economic recession, market failures, climate changes, food crisis and growing unsustainability of our ecosystem. The article analyses the significance of '*economies of scope'* in the context of: (a) basis of efficiency in agriculture versus industry; (b) operational dynamics of scope and scale across sectors in agriculture; and (c) organisational design and institutional architecture with the logic of scope. Further, through empirical evidence from smallholder farmers and farmer producer organisations from across India, the paper highlights that '*economies of scope*' in agriculture is not only more efficient for nutritious food production, wellbeing in farmers and their communities, and local climate healing but also for the sustainability of agricultural ecosystems and the overall socio-economic environment. Based on the analysis and empirical observations from action research during the last eight years, the article explores three areas: (i) the science of economies of scope in agriculture; (ii) optimal organisational design in the light of economies of scope; and (iii) optimal institutional architecture for a stable relationship between producer organisations and markets.

Key Words: Economies of scope, economies of scale, climate healing agriculture, open systems, smallholder farmers, organisational design, institutional architecture and sustainability

Introduction

In the last three hundred years of industrial revolution, the theory and practice of '*economies of scale'* has snowballed. Scale has been the basis of efficiency and growth in industrial production. Accordingly the industrial enterprises and their shareholders in the secondary and tertiary economic activities across the globe have grown and prospered. More often than not, the governments across geographies have tried to resolve the problems of inefficiency in industry and economy through scale and technology. Such has been the quest for scale under the aegis of globalisation.

In the context of increasing mainstreaming of the ideas of '*economies of scale'* in agricultural production and its associated features across the value chain in agriculture; this paper explores whether this mainstream thought and action lead to sustainability of agriculture, and wellbeing of small farmers and retail consumers of agricultural produce. Empirical evidence from a transitional economy like India from the domain of agricultural production, the enterprises of smallholder farmers and the purchase preferences of retail consumers seems to suggest otherwise.

In light of the above, this paper analyses the relevance and significance of '*economies of scope*' in the context of agriculture and smallholder farmers from the perspectives of efficiency, wellbeing of rural communities and sustainability. The comparative analysis of industry and agriculture for respective efficiency will be on three key dimensions: (a) the basis of efficiency; (b) dynamics of scale and scope in industry and agriculture; and (c) organisational design and institutional architecture to fit the logic of scope.

In this paper, wellbeing of rural areas refers to the efficiency of smallholder farms, nutritional security of farmer families, increase in net income to smallholder farmers, local ecological balance and overall sustainability of the local ecosystem including the agricultural system, farmer organisation, institutional architecture and environment at a district level.

Economies of scale: evolution of practice & theory

'Economies of scope' has been a powerful idea for achieving operational efficiency across the commercial and industrial enterprises. Over the years, the logic of economies of scale has also impacted agricultural production globally. The revolution of agriculture probably occurred in the Middle East about ten millennia ago and developed independently in other parts of the world. People lived in small communities and cultivated for their own consumption. To avert the risks of famines and floods, people tried to grow more than required for consumption and stored them for potential natural calamities. However, the nature of agriculture remained small, ecosystem specific and largely self-sufficient especially in geographies like the Indian sub-continent in the temperate zone with abundant flora and fauna.

With the development of science and technology came the Industrial Revolution in the eighteenth century. This second revolution of mankind has indeed greatly impacted the lives of human beings. It has not only transformed the nature and quality of human life but has also transformed the first revolution of agriculture and our ecosystems as a whole. From an open production system in agriculture, the industrial revolution adopted the closed production system by way of factory production. Factories were owned by the rich and wealthy individuals, with operational efficiency becoming the major concern of factory managers as would be desired by the owners of these factories. Unlike in an open system, many of the variables of production could be controlled in a closed factory production system and hence the efficiency of operations improved in such systems.

Since the factors of production could be controlled, there was scope for individual owners and their managers to better manage the variables and hence be more efficient. Increase in scale of production led to lowering costs and hence was a natural logic for greater efficiency. Greater efficiency in production attracted more entrepreneurs to invest in the factory system of large scale production. Scale lowers the cost of production (Dobrev & Carrol, 2003) and helps in several ways such as: (a) purchase and use of specialised manufacturing equipment; (b) savings from operational expansion and quicker pay back of investments in production facilities and capacity expansion; (c) promotes in-depth employee specialisation based on an intricate division of labour;
(d) extracts value from experiential learning and the benefits of high frequency with which the same tasks are carried out; and (e) reduces per unit overhead cost. Scale also facilitates the gaining of a substantial market share in a competitive market. This helps large scale firms to force customers and suppliers to become price takers as well as to review their own strategies in light of their dependency on the local firm. Scale also serves as a strong barrier to entry.

These obvious advantages of scale in industrial production have caught the imagination of the economists from the time of Adam Smith in the 1770s; from the beginning of the industrial revolution. While the idea of '*economies of scale'* has been the mainstay of discussion and research among the economists since this time, the idea of '*economies of scope'* has appeared intermittently within the history of economic thoughts. In his book "*Wealth of Nations*", Adam Smith (1776) discusses the notion of *economies of scope* in the light of how division of labour is limited by the extent of the market for a product or service. He observed that a person needs to engage in multiple activities because the product or service that a person offers is limited to the nearby smaller market and cannot be sold in far off and larger markets. In other words, scope limits growth and for one to extend his product or service to far off larger markets, he has to specialise in a particular product or service. In the context of industrial culture and production economics, Adam Smith and the other leading economists were indeed right and, rightly so, they buried the idea of *economies of scope*.

As the industrial enterprises grew with the growth in industrial production and trade, several social, cultural and environmental issues emerged. Marx (1927) described the problems of value appropriate to labour by the owners of the enterprise and the alienation of man from his life and culture due to over mechanisation and industrialisation. Joseph Schumpeter (1942), on the other hand argued that capitalistic model of production led to creative destruction and loss of value for the society; which may therefore ultimately collapse from its own internal contradiction and weight. However, the idea of *economies of scale* as propounded by Smith and others, along with the industrialists who had a great appetite for growth, kept the idea of scale to grow. That the division of labour is limited to the extent of the market, as proposed by Smith, was reiterated by Stigler (1951).

With markets becoming more competitive for industrial products during the first 200 years of the industrial revolution, the idea of *economies of scope* re-emerged in the1970s. Panzar and Willig (1977) brought it back to the discourse of economic thinking by arguing for *economies of scope* in multi-output production. David Teece (1980) extended this idea by his empirical observations of scope for diversification to multi-output from single input, especially in the petroleum industry in the USA. *Economies of scope* in business and product diversification were seen as ways to open new avenues of growth in highly competitive industries and markets. The ideas of scale and scope were however applied essentially to industrial production systems, at secondary level production.

To the broader arguments of Marx on capitalism, North (1984) argued instead that the core problems of both capitalism and communism lay in *specialisation* and *division of labour*. Further, explaining the limitations of transaction cost analysis, North(1984) argued that the *economies of scale* built on the basis of specialisation and division of labour, that was supposed to reduce the transaction costs, neglected to recognise the significant increase (nearly 50%) in indirect transaction costs.

Despite the observations on the limitations of industrialisation and mass scale production, the clear benefit of greater efficiency of production through scale led to the formation of large enterprises. In the United States of America, firms followed a three pronged investment strategy (to invest in production, the managerial pool, and distribution) to grow ahead of the

European firms (Chandler, 1990). Europe and Japan soon caught on to this strategy for growth.

With a larger scale of production, supply often overtook demand. This would occur because scale based production is a step function due to indivisibility of production technologies. With greater competition, the local markets in these industrial economies saturated gradually and hence the surplus production had to be exported out to other markets. Hence, the logical step to scale was expansion of markets through geographic expansion; which led to the globalisation of business. From the 1880s international trade and business grew uninterrupted till around the 1920s. War & economic recession in the 1920s favoured state intervention in the economy. Keynes (1936) argued for a welfare state through his book *"General Theory of Employment, Interest and Money*". These arguments supported the government investment in large scale state owned enterprises between the 1930s and 1970s.

Despite the argument for smaller production and implementation of the New Economic Policy under Lenin in the USSR by Kondratiev (1921), Stalin followed large scale production through the large state run enterprises. Many of the European countries including the United Kingdom, Germany and France also promoted several large state owned enterprises in the 19th century. Following the global trend, countries like China and India promoted large scale state owned enterprises after they became independent in the 1950s.

To facilitate global trade and business arising out of the surplus production and recession in the western industrial economies during the inter-war period (1919-1939) the Bretton Woods Conference (July, 1944) chaired by Keynes proposed the formation of international agencies: the World Bank; International Monetary Fund (IMF); and International Trade Organisation. The basis for these global institutions fitted the idea of managing scale through global expansion of markets. While the World Bank and International Monetary Fund were approved by the 44 Allied Nations that attended the conference, the International Trade Organisation was approved only as a milder version as the General Agreement on Tariffs and Trade (GATT).

However, expansion of markets in the developing countries by the large enterprises from the western countries was stalled during 1950-1970 by the protective mechanisms imposed by countries like India and China (the former colonies of the western countries) which became independent after the Second World War (Jones, 1996; Nayak 2008). As a result, the large enterprises from the western countries could not offload their surplus production in developing countries, resulting in greater competition within and among the industrial economies. Moving on from scale, the source of competitive advantage became technological innovations. As a result of market saturation and very high competition based on technological innovations, many of the large enterprises, especially the state owned enterprises, became unviable. This led to the beginning of privatisation of state owned enterprises in the western countries.

Despite international political manoeuvering for global expansion of markets, the industrial economies could not balance their production capacity with the expanded global markets. Observing the problems of scale in industrial production (its negative impacts across the countries), a wave of thought emerged in the1970s. Schumacher (1973) argued for appropriate technology that could be small and hence sustainable. Scholars working on multinational corporations that operated on scale and the trends of global trade and investments had also begun to perceive the dangers of the large corporations. Vernon (1971,

1977) argued that the large corporation through their scale of operations could undermine the sovereignty of other small countries and societies.

However, as global trade and business picked up in the 1970s (Jones, 1996; Nayak, 2008), the industry magnates, policy makers and international agents of trade and commerce pushed forward the idea of large scale operations. The excitement of growth and prosperity through large scale production, although only for a few in the industrial economy, was blissfully ignored by the scholars and academia in terms of any deeper analysis. In addition, by the 1990s, with the maturing of practices and theories of private property rights, commercialization, the control of innovations in product and process technologies, and the coercive opening up of global markets, the market competition intensified globally. To cope up with the intense competition a wave of strategic mergers and acquisitions in the USA and Europe began in 1998. Accordingly, countries across the world had begun to relax the clause to restrict monopolies in order to protect the private corporations of their respective countries, as it otherwise threatened the business and employment of key stakeholders of their respective national polity.

The scholarship in management science since the 1990s had more observations and ammunition to argue for specialisation at the firm level to be competitive in global markets. Prahalad and Hamel (1990) argued for focusing on core competence and Porter (1991) argued for strategically managing the external forces to keep the barometer of profits of the business entities. True to their allegiance to the idea of corporate growth and private wealth creation, the management scholars took great pride in spreading these ideas of economies of scale in the classrooms of business schools where the future managers of corporations were to be found. Chandler (1990) observed that enterprises across America, Britain and Germany had pursued scale to expand their business. Multinational enterprises, that were perceived to be the engines of growth (Jones, 1996) by some business historians, were being deemed as leviathans of the global society by another set of business historians (Chandler & Mazlish, 1995). The explosive growth of Indian multinational enterprises during 1991-2010, in the post liberalisation, privatisation and globalisation period, has largely been an outcome of the manoeuvering capacity of the owners of large enterprises over the various political, industry, social and knowledge networks (Nayak, 2011).

Finally, in 1995, fifty years after its inception, GATT finally became the World Trade Organisation with a remit to regulate international trade and business. The World Bank, IMF, and WTO systematically argued for liberalisation, privatisation and globalisation in the developing countries and even in the erstwhile USSR. Since the 1990s, there has been a great momentum in the expansion of global trade and business. Subsequent intensive global competition has led to large scale mergers and acquisitions across industries and across the globe, furthering the idea of economies of scale.

During these three centuries, industrial economies have faced several business cycles, economic slowdowns and recessions, battles over currencies, economic war, political war and alarming climate changes. Ironically, there is an attempt to resolve the problems of one business cycle by applying more of the ideas of *economies of scale*. It appears that economies and industries are locked into scale and specialisation for survival. Whether the outcomes of the policies based on scale and specialisation led to the global economy moving from bad to worse over these business cycles is yet to be analysed and recognised. The summary of the

evolution and spread of the idea of economies of scale, with some brief interjections by the ideas of *economies of scope*, to the mainstream discourse of economics during the last three centuries is shown in Figure 1.

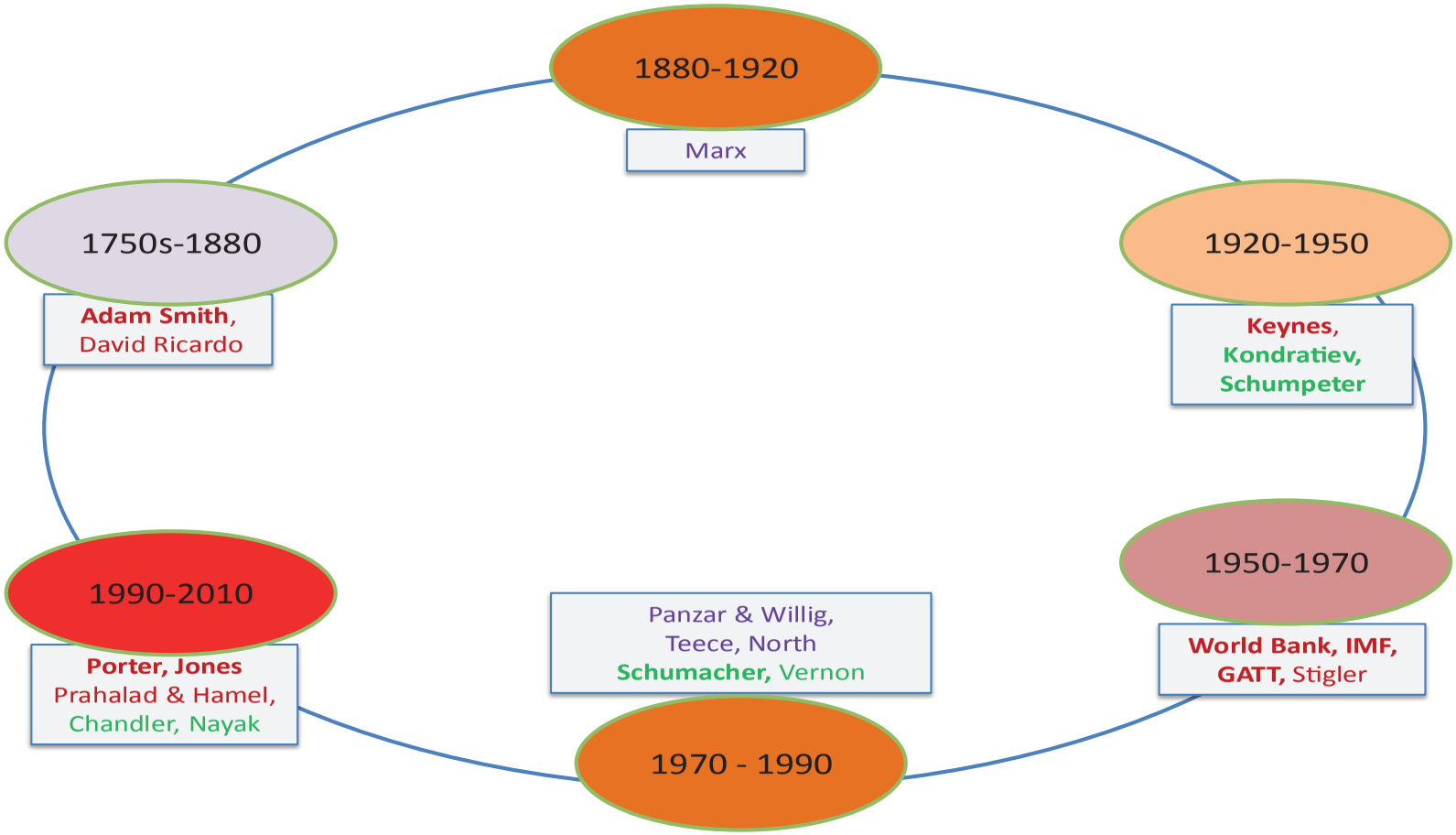

Figure 1. Evolution of *economies of scale* under the aegis of the Industrial Revolution 1700s-2000s

Basis of efficiency in agriculture versus industry

It is increasingly being pointed out that sustainability of agriculture will depend on the systematic and scientific management of soil, seed, moisture, diversity in farms and local ecology. More than the external industrial inputs of fertilisers, chemicals and pesticides, healthy soil management is considered to be the key to high yield and sustainable production (Howard, 1943, 2013). Soil health is linked to the overall management of other dimensions of moisture management, seed, cropping pattern, and integration of agriculture with livestock and forestry. All these improve the micro ecosystem that enhances the condition for better plant protection and better agriculture (Collette et al., 2011; Rupela, 2011).

Scientific experiments in the recent years in India also prove the above points (Gopalakrishnan et al., 2012; Pannerselvam, 2013). A large number of research studies across India also lead to the same conclusion that productivity and efficiency in agriculture lies in sustainable agriculture practices (Shiva, 1993; Alvares, 2009; Nayak, 2012; CRIDA 2012; Nayak, 2014).

International research and studies across the world by different agencies are also building up the argument that agriculture has to adopt sustainable methods by following the basic principles of bringing back life to the soil through integrated agroecological, agricultural practices (IAASTD 2009; Third World Network, 2012; UNCTAD 2013). Several research reports from across the world indeed argue for small scale diversified and integrated methods of agriculture. These studies essentially suggest that it would be logically flawed if '*economies of scale'* were applied in agricultural ecosystems unlike the logic of scale in industrial production.

The core contextual difference between agriculture and industry is in the nature of the production system. On the one hand, high bio-diversity in the life systems, deep interconnections and high levels of interdependence characterise the open system of agricultural production. On the other hand single product specialization and sequential, linear and uni-directional relationships are the characteristics of a closed industrial production system.

Contrary to the basis of efficiency in a closed system, the basis of efficiency in an open system is the high degree of interdependence and cooperation. The high frequency of interactions and high degree of relationships among the various actors and actants are the sources of efficiency in production. The network of relationships is often dense and complex in nature. Bio-diversity is the essence of life in such networks. In other words, *economies of scope* seem to provide a coherent logic of agricultural ecosystems and the basis of efficiency and sustainability in agriculture.

Characteristics of owners in agriculture versus industry

It is also important to understand the characteristics of the owners of production in agriculture and industry. On the one hand, over 80% of the owners of production in agriculture are the smallholder farmers. Their resource base in terms of assets, capital, technology, information, modern equipment and associated skills is rather weak. Their capabilities lie more in indigenous knowledge and techniques of production and most of their resources are in the form of common resources. On the other hand, the owners of industrial production have comparatively greater asset, capital and technology bases that are governed by private property rights. Given the different levels of factors of productions and the principles that govern them, the mechanism to achieve efficiency could be quite different for these two

diverse groups of producers. Further, while the purpose of an investor/owner in an industrial production system is to rotate capital to generate greater return on capital invested, over 80% of the owners involved in agriculture are into subsistence agriculture with a purpose of ensuring food and nutritional security for their families.

Operational dynamics of scale and scope across sectors in agriculture

In the first stage of evolution of an economy (e.g. agriculture) the primary sector is typically the main driver. In the second stage of evolution the secondary or manufacturing sector, including the value adding activities of agricultural produce, drives the economy. As the economy matures the tertiary or service sector, which includes retailing of food products, drives the economy.

As the value chain of primary, secondary and tertiary economic activities of agriculture evolves and matures, the point of gravity moves from the community of farmers to the secondary level processing factory. For some period of time, the processing factory becomes the centre of gravity in the value chain that balances both the farming community and the retail outlets/chains (intermediate market place). As the retail outlet/chain grows larger, develops a good hold over the final consumers, and grows in its size of business, it becomes the centre of control for the other actors of the value chain. The direction of control over time gradually shifts from the farmer to the marketer and finally the direction of control of what is to be produced and at what price is reversed.

As the focus of control shifts to the manufacturer / food processor, who is preoccupied with the efficiency of the capital employed in the factory, the processor will naturally adopt *economies of scale.* In return the manufacturer / factory processing unit will promote production of a single crop (say baby corn) that his factory specialises in processing and packaging. In the subsequent stage the tertiary economic agent, the owner of a large retail chain or a large exporter of processed food, may emerge to be the centre of gravity or the point of control in the value chain. The primary concern of this tertiary actor, efficiency of capital employed for marketing, will be best with economies of scale.

Accordingly, the demand and price mechanism for the single product (say baby corn) at both the secondary level and tertiary level of this value chain tends to alter the cropping pattern of the farming community and make them largely a baby corn producing community. Figure 2 represents the different stages of an economy and the associated centre of gravity and how the direction of control shifts; transforming the cropping pattern at the farmers' level and reduction in choice of products at the final consumer level.

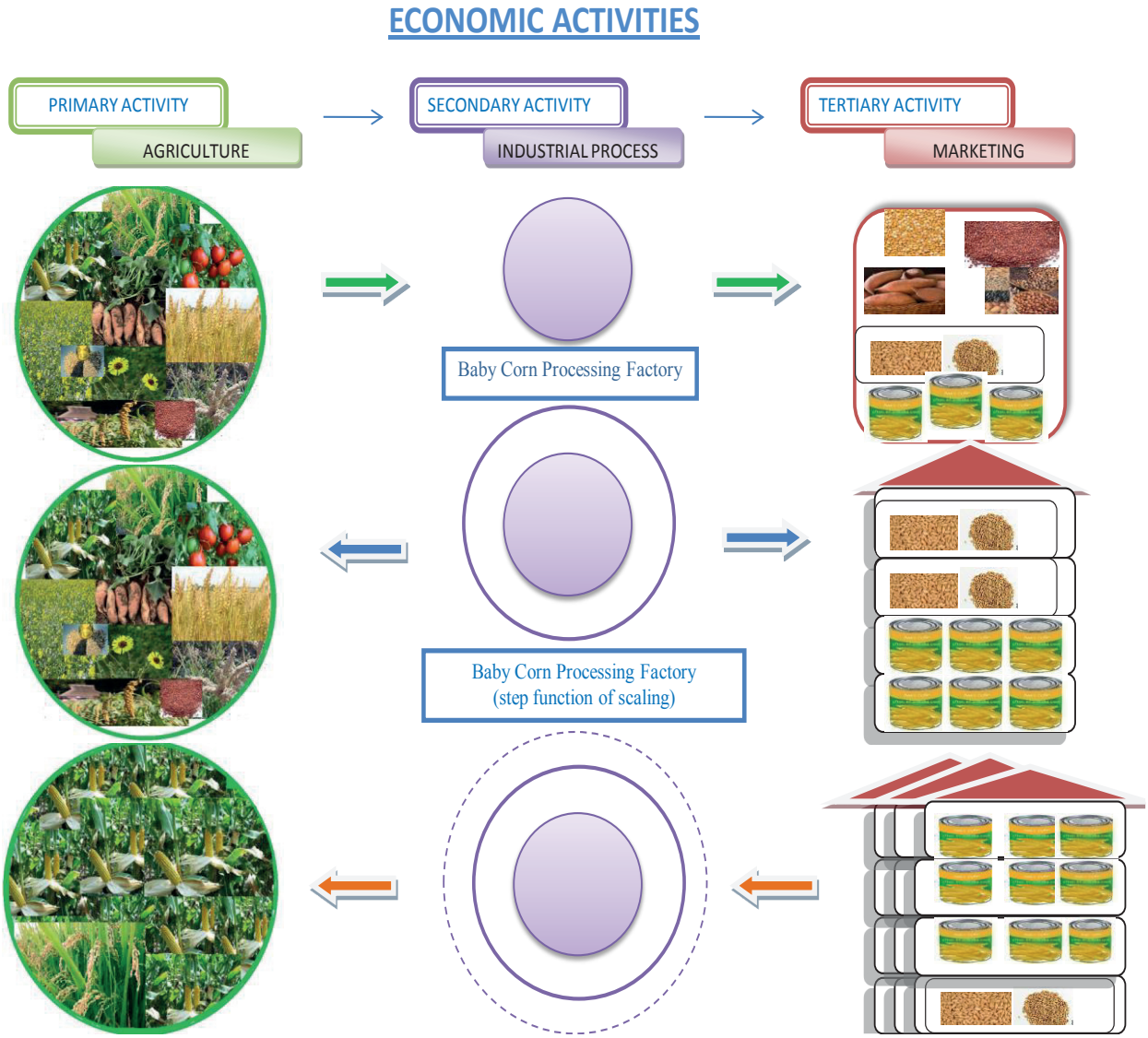

Figure 2. Direction and Point of Control at different stages of evolution of a Value Chain

The scale of operation of an individual enterprise in the value chain appears to determine the power of control. Among the three actors in the value chain, the capacity to engage in large scale operations is available to either the owner of the food processing unit or the owner of the large retail chain/processed food exporter. Given the limited resource base, it is unlikely that the smallholder farmers become the centre of gravity in the evolved value chain under the industrial product-market economy. Hence the smallholder farmer is bound by the demands of the secondary and tertiary sectors that are driven by the logic of mono-cropping or *economies of scale.* The tensions across these three sectors arise out of multiple perspectives: moral; technical; and systems. Table 1 provides the details of the three perspectives under different stages of economic activity.

Table 1. Moral, technical & systems' perspective at different levels of economic activity

Perspective	Primary Economic Activity	Secondary Economic Activity	Tertiary Economic Activity
Moral Perspective: Primary Stakeholders	Smallholder farmers. Rural youth. Rural resource poor.	Industrialists. Investors in manufacturing. Technical professionals.	Banks & financiers. Large wholesalers. Distributors & retail chains. MBAs/professionals. Neo classical economists.
Technical Perspective: Efficiency Criterion	Economies of Scope (*Nutritional Efficiency*)	Economies of Scale (*Production efficiency*)	Economies of Scale (*Operational Efficiency*)
Systems' Perspective: Institutional Architecture & their relationship	Interconnections. Interdependence. Higher frequency of interactions. Bio-diverse and networked relationship. Greater depth of relationships that not only facilitate efficiency but sustainability.	Relationships are more linear as in a chain. Relationships are contractual in nature. Institutional architecture is a top-down design. Chain, contractual, arms' length relationship is preoccupied with achieving efficiency.	Relationships are more linear in design. Relationships are contractual with institutional buyers and need to be contractual as well as personal with retail buyers. Institutional architecture is a top-down design.

Organisational design & institutional architecture with logic of scope

Depending on the logic of efficiency adopted, whether scope or scale, the associated organisation design variables - size, technology, ownership and management - would vary. The deep seated logic, language and values will be different for each of these paradigms (Nayak, 2014). The institutional architecture could vary from being top-down under scale economies to bottom-up under scope economies. Further, under scope economies, there would be optimal lower and upper limits to the institutional architecture unlike the borderless view under scale economies. Empirical observations however suggest the policies and practices on the ground do not seem to observe these differences. The performance of farmers and farmer producer organisations that do not distinguish these differences also show varying performance. Like in industrial production, the institutional architecture for agriculture is top-down. Policies and programmes flow down from the central and state governments to the farmers. These programmes are also controlled from the top making the local institutions

very weak. There is very little research on whether there exists an optimal lower limit and upper limit for institutional architecture for agricultural systems to be sustainable.

Observations and empirical evidence across India

Performance of smallholder farmers adopting scale versus scope

India has had a rich bio-diversity and highly productive low cost integrated agriculture systems, as applicable to local soil and agro climatic conditions and over many millennia of agriculture in India. However, over the last two hundred years, the low cost producer oriented agriculture has been converted to the high cost market oriented plantation and mono crop system (*conventional – green revolution*). The usage of industrially produced fertilisers, chemicals and pesticides has gradually transformed the characteristics of agriculture during the past 5 decades across India.

Smallholder farmers adopting precision agriculture adopting mono-cultures with large external industrial inputs are becoming unviable across India. Farmers in Punjab, where external input intensive agriculture was undertaken through a green revolution about 40 years ago, today have an average debt of about 42,000 INR as compared to the national average of 20,000 INR. In one of the so called 'agriculturally better off' districts (Balasore) in Odisha, 30% of over 4000 farmers are making losses across the six major crops from cereals, pulses, and oil seeds and nearly 50% of the farmers are financially unviable in their farm production practices (Nayak, 2013).

The realisation of the negative impacts of industrial inputs in agriculture, pesticide residues in food, (especially with respect to small holder producer communities), has led to a resurgence of various low cost smallholder farmer and consumer friendly alternatives, replacing the high risk and cost (including environmental and human) of external input based agriculture. Some of the major variants of sustainable practices and concepts have been agro ecology, sustainable food systems, ecological agriculture, sustainable agriculture, integrated agriculture, low external input sustainable agriculture, organic farming, natural farming, natueco farming, bio-dynamic farming, permaculture, zero budget farming, indigenous micro-organism based farming, effective micro-organism based farming, etc. Farmers adopting any of the above sustainable practices using the principle of economies of scope in agriculture that is multiple cropping patterns and integrated agriculture are found across India to be much more productive (Nayak, 2014).

Performance of farmer producer organisations adopting scale versus scope

Empirical evidence on the performances of different forms of farmer producer organisations across India show that most of these are unviable. Interestingly, most of these organisations including the better known dairy cooperatives in India, are either designed or have the intent to be modelled around the designs of an industrial organisation; that is on the principles of *economies of scale* (Nayak, 2014). In summary, the performance of the producer organisations on different sustainable performance indicators: (a) social capital formation; (b) financial capital formation; (c) capability enhancement of the producers; (d) external networks with markets and financial institutions; and (e) engagement of producer organisation with diverse needs of the community, have been low.

Among the dairy cooperatives based on single input of milk, a sector that has received much technical and financial support during approximately the last 40 years, the above performance indicators have begun to decline. For instance, the average income for dairy farmers across different dairy cooperatives is around Rs. 2500 per month. The trends from AMUL, the largest and most well known dairy cooperative, are indeed revealing. Empirical evidence on dairy based farmers suggest that a farmer family can be viable with five or more milking cattle. However, currently about 73% of 3.2 million farmer members of AMUL have less than five cattle. Despite, 85% of every rupee earned by GCMMF (marketing wing of AMUL) being given back to the members, the average net income earned by the members is only INR 3405 per month.

On the contrary, the performance of a few farmer producer organisations that have stayed small but operated on multiple scope have provided more value to the farmer members. AMALSAD, a primary agricultural cooperative society in Gujurat is one such example. The membership of this cooperative has been around 3000 from a cluster of 17 villages. Its annual turnover is about INR 420 million. Since its beginning (1941) its engagement has been determined by the needs of its members; whether they be micro-credit, retail supplies, farm inputs, marketing of surplus produce of different crops, etc. Today, it also runs a hospital and petrol pump to meet the needs of its community. The average monthly income of its members is around INR 12,000 per month and the net income will be over INR 7000 per month. Action research on establishing sustainable community enterprise systems through the experiment of Nava Jyoti PC (www.navajyoti.org) shows that there can be significant performance improvements on all the sustainable indicators by following the sustainable design principles.

Summary and Future Research

The discussion on the ideas of scope and scale, the key pillars of two major revolutions of human history i.e. agriculture and the industrial revolution, is indeed a discussion of the ongoing battle between these two revolutions which is unnecessary, uncreative and disastrous. The idea of *economies of scope* and its *science* with regard to agricultural ecosystems has not been sufficiently explored by scholarship and hence the policy on agriculture across the world has gone against nature and poses serious challenges to our sustainability.

The science of interconnectedness and interdependence of sunlight, moisture, air, soil, plant/crop bio-diversity, micro-organisms, livestock and seeds seems to hold the key to efficient, sustainable production at the primary food production level and overall wellbeing of agricultural communities. In other words, '*economies of scope'* and '*systems thinking'* rather than '*economies of scale'* and '*linear thinking*' better explain the dynamics of production in nature.

Empirical evidence on performance of integrated agricultural practices at the farmer level and the performance of farmer producer organisations in terms of total benefit to the small producers across India strongly supports the logic of ***economies of scope*** for greater efficiency, overall sustainability of agro-ecological systems and wellbeing of rural agricultural communities.

In the above context; firstly, serious research and scholarship on the *science of economies of scop*e in agro-ecological systems is now required to sensibly guide the policy on agriculture

across the world before we further undermine and destroy our food production and ecosystem; and secondly, there is a huge research need and opportunity to determine optimal farmer organisational design on specific design variables i.e. size, technology, governance and ownership with reference to scope; and thirdly, research on optimal institutional architecture to ensure stable relationships among these farmer producer organisations is rather crucial to ensure sustainable global food production and supply system.

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Resource endowment and the greater good: balancing labour between family and individual fields on Beninese farms

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Abstract: In Sub-Saharan Africa, most farms are family farms. In these family farms the workforce may include a husband, his wife or wives, his children, his brothers, and in-laws if brothers or sons are married. The literature provides evidence that 2 types of fields can coexist within family farms: family fields and individual fields, resulting in complex farm management systems. The objective of this study was to investigate the diversity in management systems and their interaction with the production system, as the first step towards suggestions for improving farmer livelihoods**.** A functional farm typology was developed for two case-study villages in Benin; Zonmon in the southern part and Pelebina in the north-western part. Differences between farm types were related to the amount of resources and to resource allocation between family fields and individual fields, as well as between major landscape units i.e. uplands and wetlands. In both villages, individual fields emerged mostly in better-endowed farms. Granting individual fields may be a reward that only better-endowed farms can afford and a strategy to enhance commitment to family fields. The emergence of individual fields may also reflect differences between the objectives of the farm head and the objectives of the family's individuals. Differences in objectives are more likely to appear in better-endowed farms for which opportunities are diverse. Tipping of the balance from family fields to individual fields was more visible in Zonmon, where family fields on better-endowed farms were either small compared to large female-run individual fields or remained large but were served by hired labour.

Keywords: Farm typology, Sub-Saharan family farms, resource endowment, resource-allocation strategies, gender-based labour

Introduction

In Sub-Saharan Africa, most farms are family farms. In these family farms, the workforce may include a husband, his wife or wives, his children, his brothers, and in-laws if brothers or sons are married. The literature provides evidence that 2 types of fields can coexist within family farms: family fields and individual fields (Guirkinger et al., 2015; Kanzianga & Wahhaj, 2013). In family fields, the whole family works as a team and the farm head decides on crops, management sequences and profit distribution among the family farm members. Individual fields are granted by the farm head to a family member for individual use and profit. The interactions between the farm management system and the production system add complexity, as does the presence of different landscape units. In wetland agricultural systems, family fields

and individual fields may be located in uplands or in wetlands or both. They can either be dedicated to food production or to cash production.

In this study we address resource division between men, women, boys and girls as one of the factors defining farm resource use strategies. Understanding the diversity in strategies is expected to help generating and identifying meaningful field and farm level options to improve farmer livelihoods (Tittonell et al., 2005; Cortez-Arriola et al., 2015). Targeting such interventions, however, has thus far not considered resource division among members of family farms.

The objective of this study was to investigate the diversity in management systems and their interaction with production systems, as the first step towards suggestions for improving farmer livelihoods and well-being. We assumed well-being was related to freedom of initiative (the right of using resources to pursue an objective) and to profit distribution among family members. We distinguished family well-being from individual well-being.

Material and methods

Case study villages

We selected two case-study villages in Benin; Zonmon in the southern part and Pelebina in the north-western part. The choice of the villages was subsequent to a rapid regional assessment from south to north in Benin. It was driven by contrasting agro-ecological and socio-economic conditions.

In Zonmon, the rainfall distribution is bimodal. The average yearly rainfall varies from 1100 to 1200 mm. The village territory includes a lowland with mixed flooding regime and 3 permanent streams. The main ethnic groups are Mahi and transhumant Fula. The major food crop is maize and the major cash crops are groundnut and rice.

In Pelebina, the rainfall distribution is unimodal. The average yearly rainfall reaches 1300 mm. The village territory includes 21 lowlands of which 7 allow for irrigating market gardening during the dry season. The main ethnic groups are Yom and sedentary Fula. The major food crop is *noudosse* yam and the major cash crop is cotton.

Farm survey

The number of farms in each village was determined by drawing social maps with help from local authorities. A random sample of 51 out of 134 (38%) farms from Zonmon and 50 out of 146 (34%) farms from Pelebina were surveyed.

Semi-structured interviews with farm heads were used to gather information on the family structure and labour availability as well as to identify the management units on farms and locate sets of fields associated to each management unit. In the end, a total of 100 farmers (51 farm heads and 49 individuals) in Zonmon and 143 farmers (50 farm heads and 93 individuals) in Pelebina were interviewed. Each management unit (the farm head management unit or individual management units) were interviewed on three occasions in Zonmon: once during the long rainy season of 2012, once during the short rainy season of 2012 and once during the dry season of 2013; and on two occasions in Pelebina: once during the rainy season of 2012 and once during the dry season of 2012-2013.

The different fields of each farm were mapped using a GPS. Information collected on a field-by-field basis included: land use, production orientation i.e. food production or cash production, cash spent on chemical inputs in the local currency (FCFA), cash spent on hiring workforce in the local currency (FCFA) and major landscape unit i.e. uplands or wetlands. Fields suitable for dry-season rice or dry-season market gardening were classified as belonging to wetlands. These fields could therefore be located in inland valley bottoms, inland valley fringes or nearby streams (in Zonmon only).

Farm income was not estimated because it requires collecting a large amount of accurate quantitative data. Farm ranking in relation to their resource endowment will refer to some of its drivers (e.g. land and labour assets) and consequences (e.g. cash available to purchase chemical inputs and to hire labour).

Farm typology

A functional farm typology was developed for each village. Types were identified by combining PCA and Ward's minimum variance clustering. Data were normalised and standardised. We started with 43 candidate variables in Zonmon and 48 candidate variables in Pelebina (Table 1). A first PCA was performed to select a subset of variables based on their quality of representation in a two-dimensional space and simplify the overall analysis. Variables for which the sum of the squared loadings on the two first principal components was larger than 0.5 were included in a second PCA. Patterns revealed by the second PCA could be interpreted in a two-dimensional space. PC1 and PC2 together explained 67% of the original variance in Zonmon and 63% of the original variance in Pelebina. Farm scores on PC1 and PC2 were finally used in the hierarchical cluster analysis. The choice of the number of types was driven by a jump in dissimilarity and our interpretability of types. Supplementary variables were used for detailed characterisation of each farm type. Given the skewness of the data, the non-parametric Kruskal Wallis test was used to test for differences among farm types. When significant differences were found, Dunn tests were performed using Bonferroni as p-value adjustment method and a probability of <0.05.

Results

Functional farm typologies

Differences among farm types were related to the amount of resources and to resource-allocation between family fields and individual fields, as well as between major landscape units i.e. uplands and wetlands. We identified 3 farm types in Zonmon (Figure 1). Type 1 farms were small households with both a small number of family members working in the farm and a small number of family members supported by the farm. Family members worked together in all fields under the farm head's supervision i.e. there was only one management unit in the farm. Type 3 farms were large households with both a large number of family members working in the farm and a large number of family members supported by the farm. In Type 3 farms, 1 to 3 individual management units were found. Female individuals tended large upland fields and hired external workforce. Women also handled wetland fields but all in all farm activities were focused on uplands. In Type 3 farms, female individuals contributed substantially to food production as well as to cash production. Type 2 farms were similar in size to Type 3 farms. The farm head managed large rice fields in wetlands with high levels of chemical inputs and external labour inputs. Food production was mostly ensured by the farm head. In these farms, 1 to 2 individual management units were encountered, managed by females. Located in uplands and/or in wetlands, the fields were mainly used for cash crops.

Table 1. Candidate variables to be included in the PCA

Zonmon (43 variables)	**Pelebina** (48 variables)
Age of the farm head; number of family workers; number of dependants	Age of the farm head; number of family workers; number of dependants
Number of management units	Number of management units
Area owned in uplands (ha); area owned in wetlands (ha); livestock (TLU)	Area owned in uplands (ha); area owned in wetlands (ha); livestock (TLU)
Area borrowed in uplands (ha); area borrowed in wetlands (ha)	Area borrowed in uplands (ha); area borrowed in wetlands (ha)
Family fields in uplands (ha); individual fields in uplands (ha); family fields in wetlands (ha); individual fields in wetlands (ha)	Family fields in uplands (ha); individual fields in uplands (ha); family fields in wetlands (ha); individual fields in wetlands (ha)
Food crops in family fields in uplands (ha); food crops in individual fields in uplands (ha); food crops in family fields in wetlands (ha); food crops in individual fields in wetlands (ha); cash crops in family fields in uplands (ha); cash crops in individual fields in uplands (ha); cash crops in family fields in wetlands (ha); cash crops in individual fields in wetlands (ha)	Food crops in family fields in uplands (ha); food crops in individual fields in uplands (ha); food crops in family fields in wetlands (ha); food crops in individual fields in wetlands (ha); cash crops in family fields in uplands (ha); cash crops in individual fields in uplands (ha); cash crops in family fields in wetlands (ha); cash crops in individual fields in wetlands (ha)
Maize (ha); rainy-season rice (ha); dry-season rice (ha); cassava (ha); sweet potato (ha); groundnut (ha); cowpea (ha); bambara nut (ha); geocarpa groundnut (ha); soya (ha); dry-season market gardening (ha); rainy-season market gardening (ha); oil palm trees (ha); fallow (ha)	*Noudosse* yam sown in 2012 (ha); *noudosse* yam sown in 2013 (ha); *assina* yam sown in 2012 (ha); *assina* yam sown in 2013 (ha); cassava transplanted in 2011 (ha); cassava transplanted in 2012 (ha); maize (ha); sorghum (ha); millet (ha); rice (ha); groundnut (ha); cowpea (ha); bambara nut (ha); soya (ha); cotton (ha); dry-season market gardening (ha); rainy-season market gardening (ha); groves (ha); fallow (ha)
Chemical inputs in family fields in uplands (FCFA); chemical inputs in individual fields in uplands (FCFA); chemical inputs in family fields in wetlands (FCFA); chemical inputs in individual fields in wetlands (FCFA)	Chemical inputs in family fields in uplands (FCFA); chemical inputs in individual fields in uplands (FCFA); chemical inputs in family fields in wetlands (FCFA); chemical inputs in individual fields in wetlands (FCFA)
Hired workforce in family fields in uplands (FCFA); hired workforce in individual fields in uplands (FCFA); hired workforce in family fields in wetlands (FCFA); hired workforce in individual fields in wetlands (FCFA)	Hired workforce in family fields in uplands (FCFA); hired workforce in individual fields in uplands (FCFA); hired workforce in family fields in wetlands (FCFA); hired workforce in individual fields in wetlands (FCFA)

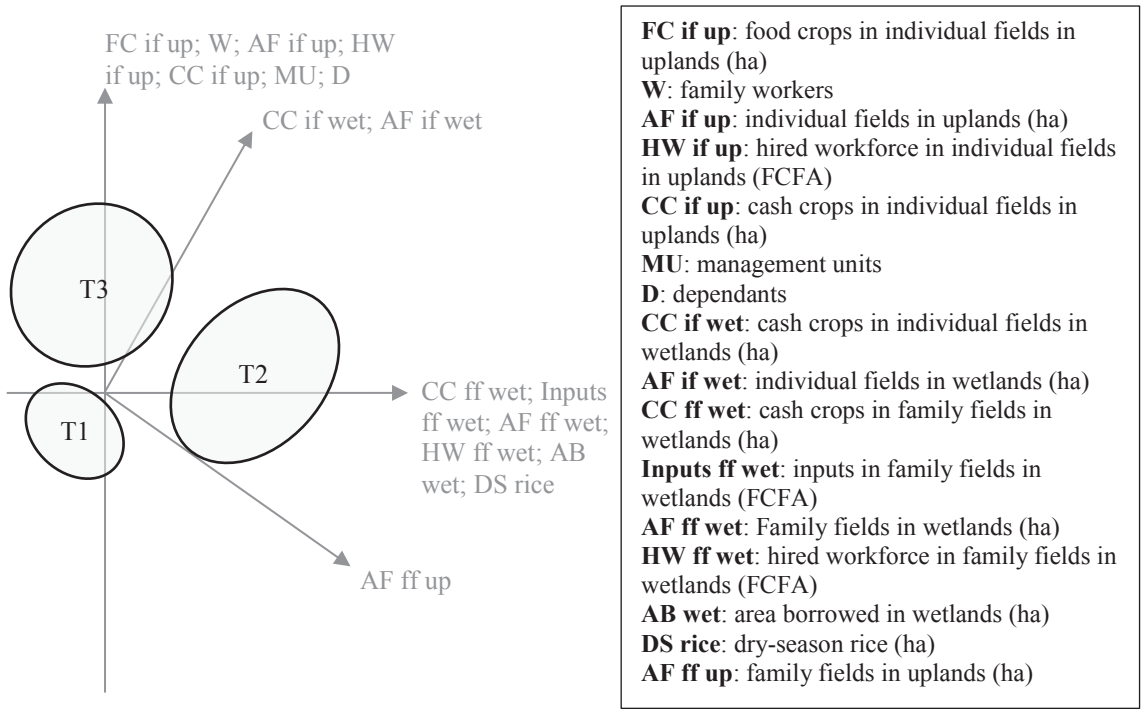

Figure 1. Schematic representation of the functional farm typology in Zonmon. Gradients for variables are symbolized by arrows. Farm types are symbolized by ellipses.

We identified 5 farm types in Pelebina (Figure 2). Type 2 farms were small households with both a small number of family members working in the farm and a small number of family members supported by the farm. Family members worked together in all fields under the farm head's supervision i.e. there was only one management unit in the farm. Type 4 farms were medium size households. Food production in upland family fields included large *assina* yam fields compared to other farms. The number of management units and the area farmed in individual fields were intermediate compared to other farms. Individuals who were granted fields mainly grew cash crops in uplands. Type 1 farms were medium size households. The number of family members supported by the farm was similar to Type 4 farms. The number of family members working in the farm, however, was larger than in Type 4 farms. The number of management units and the area farmed in individual fields were larger than in Type 4 farms. Individuals who were granted fields mainly grew cash crops in uplands. Type 3 farms were medium size households. The number of family members supported by the farm was similar to Type 4 farms and Type 1 farms. The number of family members working in the farm was similar to Type 1 farms. In Type 3 farms, the number of management units was similar to Type 4 farms. The area farmed in individual fields was, however, larger than in Type 4 farms and similar to Type 1 farms. Individuals who were granted fields mainly grew cash crops. Cash crops grown by individuals included cotton in uplands and off-season market gardening in wetlands. Chemical inputs were used moderately and allocated to both upland family fields and upland individual fields. Type 5 farms were large households. The number of family members supported by the farm was larger than in other farms. The number of family members working in the farm was large and similar to Type 1 and Type 3 farms. The area under cash crops in upland family fields was larger than in all other farms. Indeed, in Type 5 farms, most farm heads managed large cotton fields. In Type 5 farms, the number of management units was large and similar to Type 1 farms. Individuals who were granted fields mainly grew cash

crops in uplands. Chemical inputs were used in larger amounts than in other farms and allocated to upland family fields.

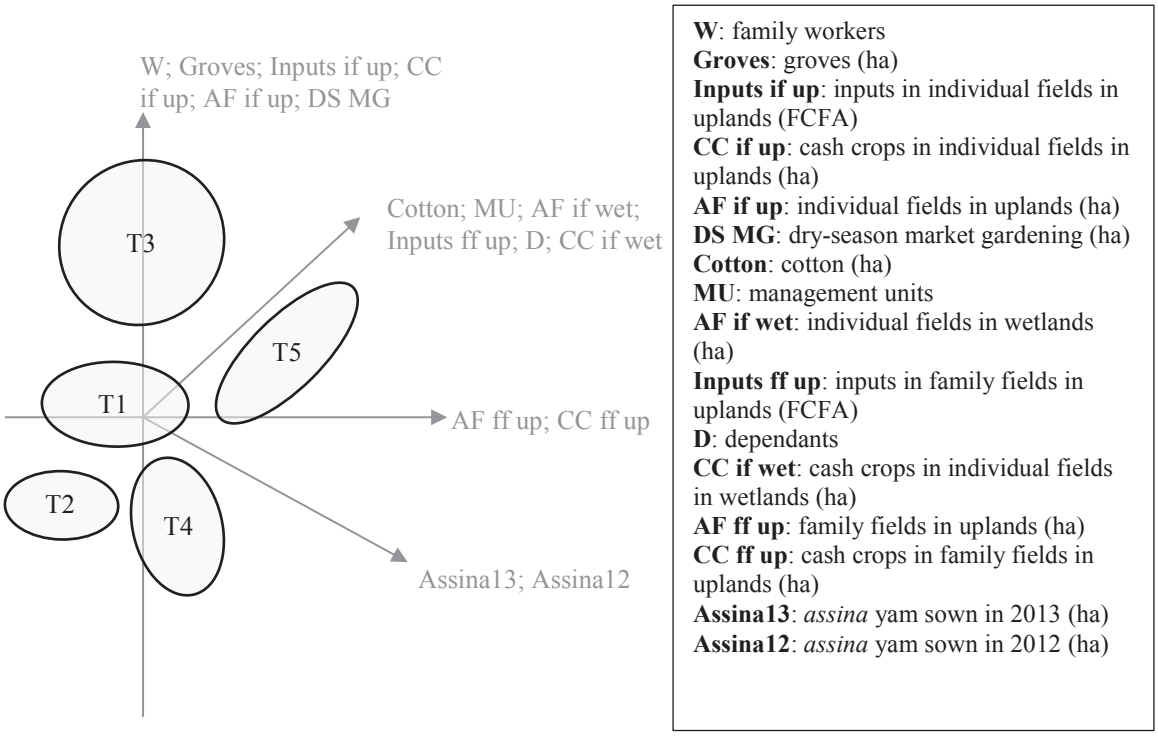

Figure 2. Schematic representation of the functional farm typology in Pelebina. Gradients for variables are symbolized by arrows. Farm types are symbolized by ellipses.

Differences in resource endowment between farm types

In Zonmon, Type 1 farms represented the worse-endowed farms (Table 2). Type 1 farms owned less land in both uplands and wetlands and mobilised less family labour. Their expenditure on hired workforce was small. Type 3 farms represented moderately-endowed farms in Zonmon (Table 2). Type 3 farms were as well-endowed as the best-endowed Type 2 farms in terms of family labour and land in uplands but had less land in wetlands and less cash available for hiring workforce. Type 2 represented the best-endowed farms in Zonmon (Table 2).

Table 2. Differences in resource endowment among farm types for Zonmon. Different letters indicate differences among farm types at the 5% level. Resource endowment increases from Type 1 to Type 2.

	Resource endowment ----------> +		
	Type 1	**Type 3**	**Type 2**
Area owned in uplands (ha)	a	b	b
Area owned in wetlands (ha)	a	ab	b
Number of family workers	a	b	b
Hired workforce (FCFA)	a	ab	b

In Pelebina, Type 2 represented the worse-endowed farms (Table 3). Type 2 farms owned the least area of land in uplands and had least family labour. Type 4 farms were better endowed than Type 2 farms but less endowed than Type 1, Type 3 and Type 5 farms (Table 3). In terms of land in uplands, Type 4 farms were better endowed than Type 2 farms, as well-endowed as Type 1 and Type 3 farms but less endowed than Type 5 farms. The number of family workers was intermediate between Type 2 and Type 1, Type 3 and Type 5 farms. Type 1 and Type 3 farms represented moderately-endowed farms in Pelebina (Table 3). Type 1 and Type 3 farms were similarly endowed in terms of land in uplands and family labour. Type 5 farms represented the best-endowed farms in Pelebina (Table 3). They owned more land in uplands compared to other farms. Type 5 farms were as well-endowed as Type 1 and Type 3 farms in terms of family labour.

Table 3. Differences in resource endowment among farm types for Pelebina. Different letters indicate differences among farm types at the 5% level. Resource endowment increases from Type 2 to Type 5.

	Resource endowment ----------> +				
	Type 2	**Type 4**	**Type 1**	**Type 3**	**Type 5**
Area owned in uplands (ha)	a	ab	ab	ab	b
Number of family workers	a	ab	b	b	b
Chemical inputs (FCFA)	a	ab	abc	bc	c

Gender-based division of labour in individual fields

The composition of the management system on farms differed between the case-study villages. In Zonmon, the majority of individual fields were granted to female individuals (Table 4). The area farmed in female individual fields accounted for 98.8% of the area farmed in individual fields. The number of female individual management units was small in Type 1 farms, intermediate in Type 2 farms and large in Type 3 farms. The area farmed in female individual fields was small in Type 1 farms and large in Type 2 and Type 3 farms. In Pelebina, individual fields were granted to both female and male individuals (Table 5). The area farmed in female individual fields accounted for 54.3% of the area farmed in individual fields. The area granted to female individuals did not vary among farm types (0.22 ha on average with a standard deviation of 0.34; 0.03 being the median). The number of male individual management units as well as the area granted to male individuals was small in Type 2 farms, intermediate in Type 4 farms and large in Type 1, Type 3 and Type 5 farms.

Table 4. Differences in gender-based division of labour in individual fields among farm types for Zonmon. Different letters indicate differences among farm types at the 5% level.

	Type 1		Type 3		Type 2	
Household distribution (#)	31		12		7	
Household distribution (%)	62		24		14	
Female individual management units	0	a	2	b	1	ab
Male individual management units	0		0		0	
Female individual fields (ha)	0.00	a	1.04	b	0.70	b
Male individual fields (ha)	0.00		0.00		0.00	

Table 5. Differences in gender-based division of labour in individual fields among farm types for Pelebina. Different letters indicate differences among farm types at the 5% level.

	Type2		Type4		Type1		Type3		Type5	
Household distribution (#)	17		6		14		4		6	
Household distribution (%)	34		12		28		8		12	
Female individual management units	0		1		1		1		1	
Male individual management units	0	a	0	ab	2	b	2	b	1	b
Female individual fields (ha)	0.00		0.12		0.07		0.62		0.02	
Male individual fields (ha)	0.00	a	0.00	ab	0.15	b	0.17	b	0.17	b

Discussion

Resource endowment and labour division

Individual fields emerged mostly in better-endowed farms (Table 6 and Table 7). In the worse-endowed farms i.e. in Type 1 farms for Zonmon and Type 5 farms for Pelebina, family members worked together in family fields i.e. there was only a family management unit in the farm. In the wealthier farms i.e. Type 2 and Type 3 farms for Zonmon and Type 4, Type 1, Type 3 and Type 5 farms for Pelebina, at least 1 individual management unit emerged which added to the family management unit.

Table 6. Differences in labour division between family fields and individual fields among farm types for Zonmon. Different letters indicate differences among farm types at the 5% level.

	Resource endowment ----------> +		
	Type 1	**Type 3**	**Type 2**
Number of management units	a	b	ab
Individual fields (ha)	a	b	b
Ratio of the area farmed in individual fields to the total area farmed	a	b	ab

Table 7. Differences in labour division between family fields and individual fields among farm types for Pelebina. Different letters indicate differences among farm types at the 5% level.

	Resource endowment ----------> +				
	Type 2	**Type 4**	**Type 1**	**Type 3**	**Type 5**
Number of management units	a	ab	b	ab	b
Individual fields (ha)	a	ab	b	b	ab
Ratio of the area farmed in individual fields to the total area farmed	a	ab	b	b	ab

Individual fields emerged mostly in farms better-endowed with family labour. High correlations (data not shown) suggested that the size of the workforce was a key determinant in the emergence of individual fields within farms. Our finding is supported by Guirkinger and Platteau (2014) who argued that contrary to individual production on individual fields, collective

production on family fields is plagued by free-riding, which increases with the size of the workforce. Individual fields allow workers to be rewarded in proportion to their labour (in terms of working hours and efficiency) contrary to family fields on which it would be socially and operationally not likely (Guirkinger et al., 2015). Guirkinger and Platteau (2015, 2014) and Guirkinger et al. (2015) indicated that the awarding of individual fields within family farms is a strategy to avoid potential conflicts among family members and therefore to enhance commitment to family fields.

For our samples of farms, 40% of the total area owned was left under fallow in Zonmon and 53% of the total area owned was left under fallow in Pelebina: land availability was not a constraint in our case-study villages. In the context of abundant land, labour may constrain agricultural production (Leonardo et al., 2015). Since individual fields imply labour division between family fields and individual fields, it is likely a reward that only farms better-endowed with family labour can afford.

Another explanation for the emergence of individual fields in the better-endowed farms is that it reflects differences between the objectives of the farm head and the objectives of the family's individuals (Guirkinger et al., 2015). Such differences in objectives are more likely to appear in better-endowed farms for which opportunities are diverse (Foster & Rosenzweig, 2002).

The coexistence of family fields and individual fields reflects the interdependence of the workers; otherwise the farm would split into new smaller farms (Guirkinger & Platteau, 2015). Family fields have advantages and may allow: economies of scale and savings associated with the financing of farm public goods (Foster & Rosenzweig, 2002); risk dilution (Chayanov, 1991); or completing farming operations in a timely manner. In farms where family fields and individual fields coexist, the farm head still benefits from the labour of family members on family fields. In return, the farm head has to satisfy part of the needs of these family members. Provided farms are endowed enough, combining family fields and individual fields may be a strategy for the farm head to secure livelihood well-being, in terms of fair remuneration for work and freedom of initiative, for all farm members. In worse-endowed farms, granting individual fields may be to the advantage of an individual but to the detriment of the family as a whole.

Tipping of the balance from family fields to individual fields was more visible in Zonmon, where family fields on better-endowed farms were either small compared to large female-run individual fields (for Type 3 farms) or remained large but were served by hired labour (for Type 2 farms). Different patterns of family fields and individual fields were the result of a farm level rationale. Our research suggests that not only cooperation and conflict (Caretta & Börjeson, 2015; Doss, 2013; Himmelweit et al., 2013) but also resource endowment and, in particular, labour endowment at the farm level shape the sharing of resources and profit within farms. In a context of abundant land, the implementation of labour-saving technologies may be to the advantage of agricultural production in family fields (by at least increasing labour productivity) as well as in individual fields (by freeing up working time in family fields). It may positively influence the individual access to resources in the worse-endowed farms and overall contribute to improving farmer livelihoods.

We did not investigate the inputs of individual family workers on family fields and individual fields, land and labour productivity on family fields and individual fields or profit distribution among members of family farms in relation to the involvement on family fields. Further

research is needed to map practices and their success in terms of fair economic well-being for family workers.

Identifying the diversity in resource division patterns between family fields and individual fields: a framework for the gender-oriented literature?

Resource division among family workers are mostly analysed through the lens of gender-based division of resources in the literature. Research focused in particular on how gender-based differences in access to resources affected differences in land productivity between male and female. Here, we investigate the link between observed patterns in resource division among family workers and gender-based differences in access to resources within farms. We question the choice of the unit of analysis in the gender-oriented literature.

Some studies compare male-headed farms and female-headed farms (Peterman et al., 2011; Vargas Hill & Vigneri, 2014; Croppenstedt et al., 2013; Alene et al., 2008; Gilbert et al., 2002; Tiruneh et al., 2001). These studies aggregate data from fields managed by the farm head (male or female family fields) and fields managed by individuals (male and/or female individual fields) in cases where the latter exist (Table 8). Other studies compare male fields and female fields (Oseni et al., 2015; Slavchevska, 2015; Aguilar et al., 2015; Kilic et al., 2015; Vargas Hill and Vigneri, 2014; Kinkingninhoun-Mêdagbé et al., 2010; Goldstein & Udry, 2008; Oladeebo & Fajuyigbe, 2007; Akresh, 2005; Quisumbing et al., 2001; Udry, 1996; Saito, 1994). Male fields correspond to male family fields or male individual fields (Table 8). Similarly, female fields correspond to female family fields or female individual fields (Table 8). The combination of type of farm and type of field (the matrix in Table 8), however, is overlooked in all studies we found. Hence information on the role of family fields and individual fields in the family's livelihood is missing.

Table 8. Combination of type of farm and type of field

	Male-headed farms		**Female-headed farms**	
Male field	Male family field	Male individual field	Male individual field	
Female field	Female individual field		Female family field	Female individual field

Enabling women's access to resources is often recommended in the gender-oriented literature (Oseni et al., 2015; Slavchevska, 2015; Aguilar et al., 2015; Karamba & Winters, 2015; Doss et al., 2015; Kilic et al., 2015; Vargas Hill and Vigneri, 2014; Croppenstedt et al., 2013; Kinkingninhoun-Mêdagbé et al., 2010; Goldstein & Udry, 2008; Alene et al., 2008; Gilbert et al., 2002; Quisumbing et al., 2001; Udry, 1996; Saito, 1994), at least as a lever to decrease the gender-based differences in land productivity (Oseni et al., 2015; Slavchevska, 2015; Aguilar et al., 2015; Kilic et al., 2015).

In our sample, female-headed farms were present in Zonmon only. They all corresponded to widows and belonged to Type 1 farms i.e. the worse-endowed farms. Individual fields did not exist within these farms. Female-headed farms accounted for 23% of Type 1 farms and 14% of the whole sample. In sub-Saharan Africa, 74% of family farms are male-headed farms (FAO,

2011). Typology studies have revealed links between farm resource endowment and farm land productivity (Falconnier et al., 2015; Senthilkumar et al., 2012). We question the relevance of targeting female-headed farms to decrease the gender resource endowment-based differences in land productivity. Instead, we recommend addressing the worse-endowed farms (which includes female-headed farms) to decrease farm resource endowment-based differences in land productivity.

Our results indicated that differences in access to resources (family labour, agro-chemical inputs and hired labour) among family workers were the result of a farm level rationale. This farm level rationale appears to succeed in at least maintaining cohesion among family workers. In Zonmon, individuals, including women, had a larger access to resources in better-endowed farms (Table 4). In Type 3 farms in Zonmon, women had even access to more land than the farm head probably due to a lack of cash to hire labour on family fields and to the polygamous status of the farm which may increase the probability of conflicts occurring among family members (Guirkinger & Platteau, 2014). Not granting individual fields in the worse-endowed farms may be for the greater good of family members, whether they are men, women, boys or girls. In Pelebina, female and male individuals had an equivalent access to land. Male individuals in better-endowed farms had a larger access to resources compared to worse-endowed farms but no difference was found with female individuals (Table 5).

Finally, reasoning in terms of male and female land productivity, whether at a field or at a farm level, does not provide information on individual economic well-being as profit, in particular from family fields, can be distributed among members of the same family farm. Guirkinger and Platteau (2015) show that as land scarcity increases, the effect of the free-riding problem on family fields outweighs the effect of the size of the workforce available on family fields i.e. a farm split into autonomous branch farms is more profitable than a farm in which family fields and individual fields coexist. In other words, individual fields would tend to disappear as land constraints exceed a certain threshold. We suggest that, at least in a context of abundant land, distinguishing land productivity in male family fields, female family fields, male individual fields and female individual fields may provide better indicators for profit distribution among family members and therefore for analysis of resource allocation efficiency within farms.

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Quality of work of vegetable growers, in conventional and agroecological systems in the Walloon Region (Belgium)

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Abstract: The present study explores the quality of work of vegetable growers for the fresh markets, in a diversity of conventional and agroecological systems. In the literature we identified nine *dimensions* determining the quality of work: autonomy and control level; income and social benefits; work (in)security; political experience at work; time at work; job intrinsic benefits; job painfulness; health; safety; and competence. The production of vegetables in the Walloon Region (Belgium) may be categorised into four main types, ranging from market gardeners on a few hectares to cereal farmers who include some vegetables in their crop rotation. Each type was studied in both agroecological and conventional agriculture. We conducted 41 semi-directed interviews with vegetable producers. In addition to the evaluation of the nine dimensions, production and commercialisation systems, professional path, history, orientation to work and perception of the future were addressed. The first five dimensions appeared to be very central in order to understand, in our specific context, what distinguishes the different types of production from each other. In the present paper and for each group of producers, we will focus on these five dimensions from a qualitative point of view in order to illustrate our general conclusions to the study on the quality of work. Each group of producers is confronted with the necessary trade-offs between the various dimensions. For each dimension indeed, the quality of work is not systematically better for producers in agroecological agriculture. This appears particularly true for market gardeners on small areas.

Keywords: Quality of work, agroecology, vegetable, market gardening, work insecurity, producers' autonomy, time at work, recognition

Introduction

Europe has been facing a significant socio-economic and environmental crisis since 2008. In this context, the question of whether 'green jobs' could be a trail to develop more and better jobs is a great concern for governments. In agriculture, some scientists and associations defend the view that organic and/or agroecological agriculture could simultaneously offer better jobs and avoid some negative externalities on environment, compared to conventional agriculture (Gliessman, 2007; Maynard & Green, 2006; Ollivier & Guyomard, 2013; Timmermann & Félix, 2015)

Nevertheless, concerning vegetable production, the quality of work in agroecological systems remains quite unexplored. Many articles on the subject focus on organic agriculture or are more normative than based on empirical studies (Gliessman, 2007; Timmermann & Félix, 2015). The present study explores the quality of work of vegetable growers in the Walloon Region (Belgium) in a diversity of farming orientations (agroecological or conventional) and farming models.

We identified four main models for producing vegetables in the Walloon Region, from market gardeners on a few hectares to cereal farmers who include some vegetables in their crop rotation. They are referred to as: market gardeners on a small area (MSA), mechanised market

gardeners (MMG), highly mechanised market gardeners (VMM) and vegetable growers in field crops (VFC). Each of these four models of production was examined and studied in both agroecological and conventional agriculture.

The goal of this study is to answer the following two questions, in our specific context: (1) to what extent do agroecological types of production systems offer (or not) better jobs than conventional types?; and (2) more generally, to what extent are the types of production systems different in terms of quality of work?

No definition on the quality of work has so far been unanimously accepted. To address our research question, we looked at the sociological, economic and agronomic literature. We identified nine *dimensions* determining the quality of work: autonomy and control level; income and social benefits; work (in)security; political experience at work; time at work; job intrinsic benefits; job painfulness; health; safety; and competence. The first five dimensions appeared to be very central to understand, in the specific context of the Walloon Region, what distinguishes the different types of production from each other (See next Section). In the following sections we use the term *well-being* to refer to the state of being happy resulting from the satisfaction of a whole series of needs as regards physical and moral health.

We conducted 41 semi-directed interviews with vegetable producers. In addition to the evaluation of the dimensions, production and commercialisation systems, professional path, history, orientation to work and perception of the future were addressed (See Methodology).

Our results are structured in two parts. Firstly, we briefly present the production and commercialisation systems as well as the main socio-cultural characteristics of each type of production systems. Secondly, we show particularities and trade-offs, relatively to the first five studied dimensions, which impact the quality of work of each group of vegetable growers, both in agroecological and in conventional systems.

A theoretical framework at the crossroads of sociology, economy and agronomy

Our theoretical framework is mainly based on sociological as well as economic literature on the subject (Dahl et al., 2009; Méda & Vendramin, 2013). Then we crossed this literature with the agronomic literature reviewing a total of 38 articles and two books (Béguin et al., 2011; Dufour & Herault-Fournier, 2010; Fiorelli et al., 2010; Galt, 2013; Guthman, 2004; Shreck et al., 2006; Timmermann & Félix, 2015). We also looked at a study commissioned by the European Parliament (Muñoz de Bustillo et al., 2009), and, finally, at some publications which specifically study the case of self-employed workers (Baudelot et al., 2003; Bessière & Gollac, 2015; Gollac & Serge Volkoff, 2000).

We identified in the literature examined nine dimensions that determine the quality of work. In this article we present five of these dimensions with a qualitative approach in order to illustrate our main conclusions on the quality of work. We briefly specify them here and provide their interpretation within the context of producers:

(1) *income and social benefits*

For self-employed workers income depends on profit or corresponds to salaries paid by the company. Social benefits are diverse: premiums, personal and health insurance or even productive capital. In this paper we will mainly develop producers' perception with

	respect to their income and standard of living. Productive capital is, by definition, increasing from MSA to VFC types of production systems.
(2) *work (in)security*	This is the well-being loss coming from an uncertainty as to one's ability to keep one's job
(3) *time at work*	This one takes into account all working hours (production, commercialisation, administrative tasks).
(4) *autonomy and control level*	A producer's degree of freedom can be limited by climate, State, markets or even previous technical choices.
(5) *political experience at work*	This one assesses (1) to what extent producers feel considered as equal to other individuals (authorities, customers, neighbours, State, Union, etc.) and (2) to what extent they consider influencing decision-making concerning them. In this study, we will essentially develop the first item which rather differentiates the various groups of producers from each other. This dimension has been initially developed in the case of workers (Ferreras, 2007).

Methodology

We conducted 41 semi-directed interviews with vegetable producers. The types of production were initially chosen as strategic clusters,[1] that is a group of people who developed the same behaviour when facing a specific situation. These groups were established so as to respect the principle of complex triangulation[2]. Triangulation imposes crossing data collected during the interviews. Complex triangulation suggests varying informers according to their relationship to the issue the interviewer is dealing with. The objective is to include the heterogeneity of opinions as an element of the analysis. Interviews were stopped for a particular type of production when the last interviews did not bring any new information (Olivier de Sardan, 2008). The interviews were structured with a guide and conducted according to the requirements set by Kaufmann (Kaufmann, 2011) and Blanchet and Gotman (Blanchet & Gotman, 2007). In addition to the evaluation of the nine dimensions, production and commercialisation systems, professional path, history, orientation to work and perception of the future were addressed.

The producers were selected, first because (1) they are considered as key players in their type of production by the experts in vegetable production in the Walloon Region, then because (2) they have special features that distinguish them from the other producers of their group. As no consensual definition of an agroecological system is available, we assigned a producer *a posteriori* to the agroecological orientation when he/she met two conditions: compliance with the organic farming regulations (alternative regulation as *Nature & Progrès* or conventional regulation) and embeddedness in the socio-economic principles of agroecology, as defined in

[1] Strategic clusters is a translation of the French concept of 'groupes stratégiques', introduced by Olivier de Sardan (2008, 81). The word 'strategic' does not refer to the power of actors. Strategic cluster is an empirical notion. Clusters have to be modified along with the field survey in order to stay relevant with the evolution of the studied problematic.

[2] Complex triangulation is a translation of the French concept 'triangulation complexe', a concept introduced by Olivier de Sardan (2008, 80).

Dumont et al. (2016). In this article and from a socio-economic point of view agroecology is considered as a Weberian *ideal-type* described with thirteen principles. The following principles have been evaluated for the present study: environmental equity, social equity, financial independence, market access and autonomy, sustainability and adaptability, partnership between producers and consumers, geographic proximity, rural development and preservation of the rural fabric, shared organisation, joint implementation of the various principles in actual practice.

The final step was to consider each producer as agroecological when he was in organic agriculture and when he included at least eight agroecology socio-economic principles in his work. For each model of production we found several producers we could consider as agroecological, except for VFC. Few organic VFC producers give priority to agroecological issues and all of them use conventional practices for some of their fields. Consequently we could not consider anyone as agroecological.

Nine types of production systems in vegetable farming for the fresh market

Context of the Walloon Region and number of producers interviewed

Vegetable farming is little developed in Walloon Region and little supervised by research centres. Producers are fewer than 300. Most of them are agroecological MSA producers with little experience. Farms are managed by one producer or by a family. In general, there is little sharing between producers and between farms, except for some commercial activities.
We interviewed a total of 41 producers (Table1).

Table 1. Number of producers interviewed

Type of production	Agroecological	Organic	Conventional
MSA	10	0	4
MMG	5	0	4
VMM	2	2	6
VFC	0	5	3
Total	17	7	17

As a producer could only be considered as agroecological *a posteriori*, some of them should have been excluded from the agroecological category and considered only as organic. The more mechanised and larger the production system is, the more difficult it appeared to find agroecological producers.

For MSA and MMG groups, all producers could be assigned to agroecological or conventional systems. For organic VMM producers, two of them could not be considered as agroecological; for VFC producers none could be included in the agroecological category. These producers do not give any agroecological priority to at least eight socio-economic principles. Moreover, most of them keep some agricultural parcels of land in the conventional type of production.

Production and associated commercial systems

Table 2 briefly presents the main characteristics of each type of production system. These have been established according to technico-economic appraisals of 32 producers out of the 41 interviewed.

Table 2. Main characteristics of the types of production

	Main characteristics			
Type of prod-uction	**Vegetable gross area (hectares)**	**Full-time equivalent by exploitation**	**Level of mechanisation**	**Commercialisation pathways**
MSA	< 2,5	2 – 4	Almost absent to low	*Agroecological :* Vegetable box, community supported agriculture, cooperative *Conventional :* Small farm store
MMG	2,5 – 10	*Agroecological :* 7 – 10 *Conventional :* 2 – 6	Low	*Agroecological :* Farm store and markets *Conventional :* Farm store and retailer
VMG	12 – 38	*Agroecological :* 5 – 15 *Conventional :* 5 – 10	Important	*Agroecological :* Farm store and market *Conventional and organic :* Supermarket, wholesaler or, more recently, farm store
VFC	*Biological :* > 25 *Conventional :* > 18	*Biological :* 3 – 5 *Conventional :* 1 – 4	Very important	*Organic :* Supermarket, wholesaler, processing company *Conventional :* Auction, processing company

Main socio-cultural and personal characteristics

The following personal and socio-cultural characteristics are presented for each group of producers (Tables 3.1 and 3.2): age; agricultural family origin; education; professional experience other than production; and agricultural field experience. These characteristics appear crucial to understand the analysis on the quality of work.

Table 3.1. Main socio-cultural and personal characteristics

Type of prod-uction	Orientation	Total number of producers	Number of producers from an agricultural family	Number of producers by age range [years]				
				[20, 30]	[30, 40]	[40, 50]	[50, 60]	[60, 70]
MSA	Agroeco.	10	1		3	5	1	1
	Conv.	4	3	2		2		
MMG	Agroeco.	5	2		1	4		1
	Conv.	4	4	1	1	1	1	
VMG	Agroeco.	2	1			1	1	
	Organic	2	2			1		1
	Conv.	6	6			1	3	2
VFC	Organic	5	4			3	1	1
	Conv.	3	3			1	1	1

MSA and MMG producers include younger producers than in other groups. Agroecological producers, especially in MSA and MMG systems, come less frequently from an agricultural family than from conventional ones.

Table 3.2. Main socio-cultural and personal characteristics

Type of prod.	Orient-ation	Total number of prod-ucers	Number of producers with education after college	Number of producers with other professional experience	Number of producers with field experience [years]				
					[3-5]	[5-10]	[10-20]	[20-30]	[30-40]
MSA	Agroeco.	10	7	8	4	1	3	1	1
	Conv.	4	2	3	1	1	2		
MMG	Agroeco.	5	5	4	1	1	1	1	1
	Conv.	4	2	2		2	1		1
VMG	Agroeco.	2	2	2			1	1	
	Organic	2	1	1				1	1
	Conv.	6	2	1				5	1
VFC	Organic	5	3	3			1	2	2
	Conv.	3	2	1		1	1		1

Conventional VMG and MMG producers are two groups in which fewer producers studied after college. With conventional VFC producers, there are also groups in which fewer producers had other job experience. MSA and MMG types of production systems include more producers with less than 10 years' experience. This is due to the recent attractiveness of this type of production.

Quality of work in vegetable farming

The present section shows particularities and trade-offs relating to five main dimensions impacting the quality of work of each group of vegetable growers: level of autonomy and control; income and social benefits; work (in)security; time; and political experience at work. For each model of production we developed the situation for agroecological and conventional groups of producers. According to its own importance each dimension is more or less developed concerning the well-being at work of each group of producers. For VMG and VFC producers, we briefly summarise the situation of organic producers relative to the situation of groups of the same model but with other orientations.

Market gardeners on small areas (MSA)

Agroecological agriculture

Most agroecological MSA producers have chosen to work in this type of production system because it corresponds to their social and ecological values. For the same reason, they have chosen to commercialise their products through short food channels only and have less links with conventional markets. It is considered as a guarantee of their autonomy and viability. Having a highly diversified agriculture, based as little as possible on fossil fuel and chemical inputs is important to them. They consider the human factor as central in this system mainly because possibilities of mechanisation are extremely limited, their products are directly sold to consumers, areas are small and leave room for other producers. They have an expressive orientation to work. This indicates that such a system is a way to exercise a profession that makes sense and is useful to society. Given such initial motivations, they actually feel limited on the following points. At commercialisation level, they need to find a sufficient number of customers but not too far from their farm to be profitable. Moreover, following the supply increase of vegetable boxes that characterised these past few years, many of them had difficulties with creating customer loyalty. Over the years, some of them question the importance of limiting mechanisation in favour of the environment and human well-being. They usually use tools with a lower fuel efficiency (for instance, rototiller instead of tractor) but there is no scientific proof that these tools consume less fuel. A low level of mechanisation sometimes appears more painful for them and their workers. Manual work is particularly hard for producers who do not have any associates or workers. And finally, the majority of agroecological MSA producers feel financially limited. They can only offer precarious employment (seasonal contracts) or work with volunteers. Most of them consider they are not earning enough money and half of them do not have any leeway for increasing their current income.

If agroecological MSA producers appear to suffer more than other groups of producers having similar income[3], it is due to the low level of work security. The investment capacity generated by the system is low. Most of them are unable to invest and hire workers easily. It is a real challenge that they have to overcome due to low levels of personal capital and consequently a limited ability to gain the confidence of the banks. Some of them do not want to borrow money in order to safeguard their autonomy. The vegetable box system to which customers can subscribe was a good way for most of them to generate their own funds. But this target is becoming difficult to reach as competition in the supply of vegetable boxes has increased.

[3] We did not investigate the accounting of producers but they provided us with their profit before tax and their turnover. As accounting obligations for farmers are very light in the Walloon Region, these amounts are still sensitive and are not disclosed in the present study.

They are also faced with three other barriers to reach a good level of profitability. First, most of them had to acquire more land because they do not come from an agricultural family. When they do not own their land some investments are impossible to do. Secondly, the investment aids are only granted for a minimum amount of equipment (such as machinery). They have many investments to make but most of the unitary equipment is not expensive enough to benefit from grants. Thirdly, it is not beneficial for them to get an outside contractor for some production tasks. Moreover contractors prefer not to work for this kind of system due to expensive transition costs for a few hectares. Despite all these difficulties, agroecologial MSA producers take advantage of a high level of autonomy. Except when their lands are rented under precarious contracts, they have a more stable financial situation than other categories of producers, even if this situation is not as good as they would like it to be relative to the other types of production systems.

Agroecological MSA producers work 2000 to 3000 hours per year (2300 on average) for all the tasks linked to the farm (production, commercialisation and administrative tasks). They take between 0 and 5 weeks of holidays per year (2 weeks on average). This is a very attractive situation compared to the other types of production. Nevertheless, because they wish to develop further their social and family life, half of them would like to have more free time.

Agroecological MSA producers feel they benefit from an important support from society. However, most of them consider that this support exists in debates and talks but is still not apparent enough in vegetable prices. The absence of investment aids for their kind of farming, the lack of legal status adapted to part of their situation, and sometimes the lack of appreciation from conventional producers for producers not coming from an agricultural family, reinforces a feeling of lack of recognition.

Conventional agriculture

In conventional agriculture, most MSA producers developed their system because it was the only possibility for them to develop their passion – vegetable farming. Most of them developed an MSA system in parallel to another professional activity because they consider it is quite impossible to live only from their vegetable production. They appreciate in this system a low financial risk as well as a high level of autonomy. But as in the agroecological system, producers struggle at commercial level to find enough customers not too far from their farm. From an economic point of view, they seem to be in a less precarious system than agroecological MSA producers but most of them consider that prices are too low for them to live only from their vegetable production.

Comparative to agroecological MSA producers they benefit from better work security. It is due to their pluriactivity and/or their free and easy access to the family land which they are settled on, as most of them are from an agricultural family. Because of these situations, they take advantage of the following points: less borrowing; contracting work executed by a member of the family; own funds generated by their service company; and access to workers employed thanks to their service company, etc.

If their quality of life is better from an economic point of view it is much more problematic in the social sphere. Producers in this system work more than 2500 hours and more than 4000 hours when they are in pluriactivity. For the latter, time spent at work and the very low

compatibility between their work and their family life is considered an unbearable situation. Moreover they suffer from a very hard pace of work.

Mechanised market gardeners (MMG)

Agroecological agriculture

Agroecological MMG producers choose their production system for much the same reasons as agroecological MSA producers; most of them begun with an MSA system. Nevertheless, they prefer MMG to MSA systems because it is considered more in keeping with the current socio-economic context and less painful.

From an economic point of view, they seem to benefit from more financial flexibility and work security but they do not seem to earn a higher income. Purchase/resale operations appeared necessary to ensure a living in this system. Except for one of them, their turnover is generated by 50 to 85% of purchase/resale operations. These purchases are essentially made from a wholesaler providing vegetable products from VMG and VFC producers. These producers are sometimes criticized - even by MMG producers themselves - for practicing a less agroecological organic agriculture. This is a paradox specific to agroecological MMG producers related to their economic, social and ecological values. But this important level of purchase/resale operations is necessary for the economic viability of their type of production systems. It contributes to generation of a higher investment capacity. This allows them to offer better contracts to their workers (fixed-term or permanent contracts) and sometimes to be more mechanised.

In terms of security of work, they take advantage of the two following points: because they do not sell their products via vegetable boxes, they enjoy a better protection against competition than agroecological MSA producers have had in recent years; and they benefit from satisfying commercial situations such as good places on markets and/or well-situated farm stores.

MMG producers prefer their kind of system as it allows them to work more comfortably during mechanised operations. For instance, they use a tractor instead of a rototiller. This leads to less suffering from vibrations. They can also get a farming contractor more easily. Being more mechanised and working on a larger area also gives them better recognition from conventional producers.

A major constraint in this system is the amount of time spent at work. This is a problem as agroecological MMG producers have strong expectations in terms of compatibility between family and work lives. They work between 2500 and 4500 hours per year (3500 hours on average). It appears that it is due to the time spent on management and supervision of their numerous workers. Both tasks cannot be devolved in this type of production system.

Conventional agriculture

Half of the conventional MMG producers would prefer being a VMG or a VFC producer because they do not appreciate manual tasks. However, they practice MMG production because they do not have enough land but nevertheless want to make a living from agriculture. Moreover, they consider the VMG and VFC systems to be too risky.

From an economic point of view, producers consider that they earn enough money as they are willing to accept a simple life. Nevertheless, they estimate that their income per hour worked is too low.

For the same reason as the agroecological MMG producers the security of work is high in this type of production. Moreover, in this case, most of them inherited all (or a part of) their land.

They work between 2200 and 4300 hours per year. Producers can be divided in two groups. One group works more than 4000 hours per year. They take almost no holidays. Producers from these farms do not claim to suffer from a too intensive schedule. Nevertheless, their situation is considered as hardly compatible with a family life. It is a hard life for their wives who also work full time on the farm store and take care of children and domestic duties. In the second group producers work less than 3000 hours per year. They generate half of their turnover thanks to two or three vegetables. Because of this, they work a lot for these crops and accept that means neglecting some of the other crops when the pace of work is too intensive. This second group does not seem worse off in terms of income.

Very mechanised market gardeners (VMG)

Agroecological agriculture

Agroecological VMG producers chose the highly mechanised type of system for economic reasons. This group includes only two producers and is consequently too small to draw any conclusions on its profitability. Moreover the producers we met were in two very different situations. Both of them appear to benefit from a high security of work. They sell their products only by short food channels that ensure them a secure income. They also benefit from a quasi-monopoly situation as they are the only ones in their region to sell such an important level of vegetables at such a low price (thanks to the high level of mechanisation). The main issue for them is to have a sustainable and easy way to sell important quantities in short channels only.

These producers work between 2800 and 3300 hours per year. None of them really suffers from this situation, although one of them did consider that it should be improved.

Organic and conventional agriculture

Most producers in this type of system inherited all (or a part of) a small cereal farm. They chose to develop vegetable crops with the aim of changing their small cereal farm into a large vegetable farm. They positively lived with this choice except for two of them who would have preferred to work in a VFC system. A high level of mechanisation was evidence for them.

Conventional and organic VMG producers sell their products in long market channels and/or directly to supermarkets (except for one producer). Between 2000 and 2010 some of them switched completely to or developed short channels. It corresponds to a period of low prices and a higher level of competition between supermarkets. Many conventional VMG producers went bankrupt at this time, especially producers focusing on one or a few crops. Today, none of them grow less than three types of vegetable as it is considered too risky.

We identified two groups in terms of well-being at work. A minority used the difficulties of other producers to reach a quasi-monopoly situation on markets. They are proud of the situation they reached. The other part is saddened at the bad sector situation. Generally speaking, conventional VMG producers feel less considered by society. Conventional agriculture,

particularly their highly mechanised system, is sometimes criticised in social debates. They also found many difficulties with transferring their farm to the new generation. Moreover they feel a lack of recognition in diverse confrontational situations. They considered as abusive the increase of standards imposed by supermarkets and their suppliers since the dioxine crisis, a very important health crisis in Belgium. It is seen as a way to evade their responsibility in food security. If there is a health problem the producer, being the last person in the food chain, has to support all responsibilities. They also feel they are not understood and sometimes insulted by inspectors during controls. Finally, very low prices at auction sales strengthen the feeling of lack of recognition for producers who used to sell their products there.

Conventional as well as organic producers work between 2500 and 3700 hours per year. As for agroecological, none of them suffers from this situation. Most of them just never thought about holidays and working less.

Vegetable growers in field crops

Organic and conventional agriculture

All producers in field crops are originating from an agricultural family in grain production. They wanted to continue to produce but with a higher profitability and less dependence from grain prices and agricultural premiums than their parents. Like VMG producers, having the largest possible area and being highly mechanised is considered necessary in order to live from agriculture.

In organic as well as in conventional agriculture, VMG and VFC producers have a more variable turnover than in other groups. This is due to their commercialisation pathways (which are more insecure) and to their greater vulnerability to climatic conditions as they produce less vegetables. In VFC systems, security of work is even more delicate in organic agriculture. Organic producers have to struggle with supermarkets to sell their products while conventional producers are profitable by selling their products via auction only. The former also have fewer opportunities to sub-contract and have to invest more in specific and expensive tools for organic agriculture.

Time at work is very variable, depending on the diversity of vegetables (and other productions) they have. They work between 1800 and 3000 hours and take between 0 weeks and 2.5 months of holidays in conventional and organic agriculture. Except for two organic producers, they do not feel the need to work less. Family and work lives are always interwoven.

Vegetable growers in field crops are quite rare in the Walloon Region and are rather proud of their current position. This feeling is even more important for producers in organic agriculture as they developed new technical skills and new commercialisation pathways with supermarkets when they shifted from conventional to organic. Like conventional VMG producers, who sell their products to supermarkets, they consider as abusive the increased level of standards imposed by supermarkets.

Conclusions

Our analysis shows that we cannot simply consider that agroecological vegetable production systems offer better jobs to producers than conventional ones.

Firstly, for the five dimensions studied on the quality of work, the results show *specificities* and *trade-offs* which impact on the well-being of each group of vegetable growers, both in agroecological and in conventional systems. Depending on the dimension considered, the quality of work is better in one type of production or another. None of the types of production fulfills perfectly all the dimensions. This is due to technical aspects, differences of socio-cultural heritage and work orientation between producers of different types of production systems as well as the socio-economic and political context.

Secondly, implementation of agroecological principles in vegetable systems is diverse. The quality of work is determined differently in the different agroecological systems.

In the Walloon Region context, divergent trends can be observed for MSA and MMG agroecological types of production. Most MSA producers have difficulties achieving a satisfactory situation relative to the different dimensions of quality of work. Most MMG producers achieve a satisfactory situation for the three following dimensions: level of autonomy and control; work security; and political experience at work. While their situation is still delicate relative to their income and the time spent at work.

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"I don't regret that choice, producing less but doing better" – some key lessons learned in the international RETHINK project

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Abstract: Many farmers are very actively exploring alternatives in farm management, production systems, markets and supply chains, often leading to new configurations in resource uses and relations between different actors, both within the sector and at a territorial level. Experimentation with new approaches tends to create tensions with traditional systems and institutions. However, often it leads to lasting improvement in economic success as well as the perceived quality of life and well-being of farm families and the wider rural community. Our observations of reorientation are not surprising as European agriculture and rural areas as a whole are being confronted with enormous challenges and need to accommodate a variety of demands. Many of those pursuing alternative strategies tend to see these challenges and demands as opportunities for products with particular qualities, new services and new functions. A telling example is the necessary transition of industrialised country economies in particular towards resource-efficient and climate-friendly production systems and consumption. The necessary changes can provide completely new opportunities to farmers, up- and downstream businesses and rural areas. The transdisciplinary RETHINK research programme connected the development of agriculture with the wider societal and policy goal of vibrant and prosperous rural areas. In this paper, I will use the 14 case studies of the RETHINK programme as illustrative examples when discussing conflicting goals and potential synergies between farm modernisation and well-being in rural areas. I also put forward some of the main lessons learned with references to a set of research papers that present the comparative analysis.

Keywords: Agriculture, modernisation, resilience, well-being, rural development, progress

Introduction

Towards a more far-reaching shift in orientations

"I don't regret that choice, producing less but doing better". This quote comes from a farmer in one of the 14 case studies carried out in the RETHINK research programme. In this particular case study, a transdisciplinary team from INRA Avignon has been examining transitions towards ecological production in the fruit and vegetable sector of Drôme Valley (Biovallée), France (Lamine et al., 2015). The quote is only one example but it signifies a more far-reaching shift in orientations that we found in almost all case studies. Many farmers are very actively exploring alternatives in farm management, production systems, markets and supply chains, often leading to new configurations in resource uses and relations between different actors, both within the sector and at a territorial level. Experimentation with new approaches tends to create tensions with traditional systems and institutions, but sometimes it leads to lasting improvement in the perceived quality of life and well-being – or indeed, just *"doing better"*.

In today's post-industrialist world, the daunting claims of modernisation are steadily eroded. Analysts emphasise the need for a 'reflexive' and 'reflective' approach to modernisation (Beck et al., 1994; Borne, 2010). The argument is that technological achievements, material prosperity and consumption tend to be over-emphasised while ignoring other quality of life values, equity issues and long-term sustainability.

Jackson (2009) refers to the *"engine of economic growth* [that] *created jobs, avoided recessions and became a ubiquitous yardstick for progress in the 20th century"*. He emphasises that it's key measure 'GDP growth' does not capture many *"vital aspects of national wealth and well-being, such as changes in the quality of health, the extent of education and changes in the quality and quantity of our natural resources."* Even more importantly, Jackson (2009) questions whether economic growth is still a legitimate goal for rich countries, when *"huge disparities in income and well-being persist across the globe and when the global economy is constrained by finite ecological limits"*.

Stiglitz et al. (2009) point out that *"new political narratives are necessary to identify where our societies should go"* and that *"a shift of emphasis from a 'production-oriented' measurement system to one focused on the well-being of current and future generations, i.e. toward broader measures of social progress"* is needed. The same authors distinguish between an assessment of current well-being and an assessment of sustainability: *"Current well-being has to do with both economic resources, such as income, and with non-economic aspects of peoples' lives (what they do and what they can do, how they feel, and the natural environment they live in). Whether these levels of well-being can be sustained over time depends on whether stocks of capital that matter for our lives (natural, physical, human, social) are passed on to future generations."*

The connection with sustainability points to the global scale of the problems we are confronted with: current resource and emission-intensive lifestyles we are used to in rich countries can be neither sustained nor transferred to the world as a whole. A more equitable sharing of resources is therefore inevitable and overdue (Knickel, 2013).[1]

Well-being in agriculture and rural development

The increasing attention paid to well-being and related redefinition of societal progress has implications for agriculture and its changing role in rural areas and society as a whole. Jackson (2009) refers to the *"ability of rural communities to flourish"*.

In the context of this paper, I define well-being as sustainable food production and access to food of good quality; the quality of life of farmers, consumers and society at large; environmental sustainability; and resource use efficiency.

Agriculture, even if substantially changing, continues to represent the primary land use in rural areas, and it continues to have a very significant influence on rural economies, community life, social ties, local cultures, landscapes and environments (EC, 2014; SCAR, 2011). For the discussion in this paper, it is important to note that situations differ enormously and that the particular context matters tremendously. Farming related pollution is not a problem

[1] *Agricultural and rural development challenges are discussed in much detail in the assessments and foresight reports of the Standing Committee on Agricultural Research (SCAR, 2011) and the background documents on CAP reform by the European Commission (2011, 2014b).*

everywhere and sometimes the capital intensity in farming is still very low. Lifestyle farming is becoming more important in some regions, but not everywhere.

Empirical basis and structure of this paper

This paper is based on data and insights gained from the transdisciplinary RETHINK research programme 'Rethinking the links between farm modernisation, rural development and resilience in a world of increasing demands and finite resources'. The European Commission and funding bodies in 14 countries supported the project under the umbrella of FP7 and the RURAGRI ERA-NET programme.[2] RETHINK was carried out at a time of potentially profound change - when the agricultural sector must finally respond to increasing resource scarcity and distributional demands, and when economies, production systems and lifestyles must be transformed. In the project we tried to connect the development of agriculture with the wider societal and policy goal of vibrant and prosperous rural areas.

RETHINK used a holistic approach encompassing measures of productivity, value-added, income generation, natural resource use effectiveness, resilience, maintenance of ecosystem services, provision of public goods and, not least, well-being in rural areas. The conceptual and analytical frameworks applied build on the results obtained in a large number of EU-funded research projects: MULTAGRI and TOPMARD emphasised the multifunctionality of rural areas and the central role of farming in the provision of public goods (Cairol et al., 2009; Bryden et al., 2011). In our analysis, farming is conceptualised as being part of a set of systems spanning several spatial scales and including agro-ecological, economic and political-social domains. Within such a complex system, farm sustainability can only be achieved through adaptability and change. The analysis explicitly recognises the complexity of challenges, the diversity in situations and the multidimensionality of strategies and ways forward.

In the paper, I use the 14 case studies of the RETHINK programme as illustrative examples when discussing conflicting goals and potential synergies between farm modernisation and well-being in rural areas. The examples focus on alternatives in farm management, production systems, markets and supply chains. They illustrate different ideas about progress, modernity and modernisation. In the discussion, I emphasise that we can shape change in positive ways. When doing that I refer to some of the comparative analyses.[3] I conclude the paper with implications for future policy and research, emphasising the important role of social capital and of more holistic, inclusive approaches in a more balanced development.

Key insights obtained in the 14 case studies

Table 1 provides for each of the 14 cases a brief characterisation of the way that practitioners define agricultural and rural development in new ways. The information provided is just indicative of the key findings in the case study reports.[4]

[2] For more information, all case study reports, a policy brief, etc. see www.rethink-net.eu.

[3] A set of papers with the comparative analysis will be published in the coming months.

[4] All case study reports, short profiles and case study posters can be downloaded at: http://www.rethink-net.eu/case-studies.html

Table 1. Key insights obtained in the 14 case studies related to the redefinition of modernisation

	Case study	How practitioners (re)define agricultural and rural development	Key resilience and prosperity outcomes
AT	Organic farming and resilience	Farmers in the Austrian case focus on economies of scope and niche markets. They search for new business models, and pursue ideas that allow them to use their skills and knowledge in creative ways. Farmers take responsibility for the economic destiny of their farms, which sets them apart from those that feel powerless in the face of global markets and resentfully dependent on direct payments. While the business might grow from 'micro' to 'small', they do not aim for further growth or mass production. They are more likely to network with others and search for social innovations and novel cooperation models, e.g. with chefs in restaurants or hotels that emphasise the uniqueness of the region.	Reflective rethinking, questioning both tradition and modernity, seeking to go beyond both, while preserving those elements that serve their purpose are key features in the case study. Farmers follow a territorial understanding of their activities, seeking cooperation with others in the region.
BE	New forms of governance in landscape development	Land used for agriculture is the only qualitative open space left and maintaining the quality of this open space is a priority for the quality of life in the area. The governance mechanism adopted allows farmers to be managers of high quality open spaces without compromising their incomes. With shared efforts, the farmers, companies and inhabitants collaborate in the development of 'their' landscape.	The voluntary cooperation of farmers, companies and inhabitants in this case is a key success factor.
CH	Sub-urban food production systems in a Swiss agglomeration	Most initiatives examined in the case study represent alternative systems or models of food production, paying stronger attention to social, human and community development processes. Relationship building with consumers and networks, participation and space for knowledge sharing are key. Capacity building for productive cooperation among farmers and processors is a key success factor as well as knowledge and experience sharing and mutual learning.	Social value creation and awareness among consumers concerning local agriculture, farming, farm household realities and territorial development.

	Case study	How practitioners (re)define agricultural and rural development	Key resilience and prosperity outcomes
DE	Opportunities for creating an eco-economy	'Rethinking' the modernisation of farms and rural areas in this case refers to valorising renewable resources in ways that are adapted to regional conditions. New forms of governance and new actor network constellations play a vital role. On-farm bio-energy activities and bio-energy villages aim at establishing smaller-scale distributed systems. Key determinants are the kinds of technology, the investment capital needed and suitable forms of governance for managing cross-sectoral linkages. Key actors prove to be capable of recognising regional potentials, and they are open for novel approaches to securing the future of 'their' region.	Bio-energy activities foster diversity at the level of farms, the agricultural sector and the regional economy. Local farmers and other rural actors aim at opening up a future perspective for their region. Pilot programmes were found to be important catalysts.
DK	Landscape strategy making and agriculture	For several decades, agricultural modernisation in Denmark has meant concentration, specialisation and industrialisation of agriculture. Production has as a result largely been concentrated on few, large farms that are increasingly separated from rural communities. The importance of non-agricultural residential, recreational and ecological functions is increasing in importance in territorial decision-making. Collaborative strategic decision-making and planning on a local scale can contribute to communities that are more resilient and counteract the decoupling of agricultural businesses from the landscape.	Local actors perceive learning as social capital building. Through a collaborative landscape strategy-making process farmers can learn to adapt to new knowledge about the functionality of landscapes as well as reshape their internal relationships.
ES	Innovation and social learning in organic vegetable production in the Region of Murcia	The Camposeven producer association is based on cooperation, trust and transparency, and on prioritising quality over quantity. These pillars have allowed adapting to a complex and highly competitive market context. Camposeven is known for its good practices and for pioneering organic farming systems. The collaboration with other companies and the research group GESPLAN of the Technical University of Madrid aims at developing professional practice, connecting knowledge and action through joint projects. The case study stresses the value of experiential knowledge and joint learning.	Governance, knowledge and learning are perceived as tools for increasing prosperity and resilience. Camposeven members have become more autonomous, experimenting on their farms, sharing ideas and providing mutual assistance.

	Case study	How practitioners (re)define agricultural and rural development	Key resilience and prosperity outcomes
FR	Transitions towards ecological production	The ability to combine long-term vision and short-term opportunism are strongly developed in the Drôme Valley. Stakeholders from farming, marketing, processing and retailing sectors, advisory services, public policies and civil society have a collaborative attitude and a long experience of multi-actor projects to foster the territorial agri-food system. Prosperity and resilience are both associated with diversity and diversification in products, in marketing channels and in sometimes in production modes (organic, conventional, geographic indications etc.). Direct links to consumers and sometimes to school canteens are seen as rewarding by farmers.	Younger farmers connect prosperity much more than their predecessors with quality of life and well-being. Autonomy in their daily work and in their relationship to the market, coherence with their values and their personal 'project' are important.
IE	Farmer adoption of a new nutrient management technology	Ireland is the largest beef exporter in Europe and the 10th largest dairy export nation in the world. Approximately, 90% of beef output and 85% of dairy output are exported and there is a plan to increase milk production by another 50%. Achieving this expansion without compromising environmental quality poses a significant policy challenge. Efficient farm and field level management of nutrients has consistently been found to be an optimal strategy in the management of environmental risk from agricultural production.	Optimal use of expensive fertiliser has the potential to deliver a double dividend of reduced nutrient loss to the wider aquatic ecosystem while maxi-mising economic returns thereby making farms more resilient to external shocks as well as regulation that is more stringent.
IL	Rural innovation in global fluctuation: The Arava region case study	The Arava case demonstrates the ambivalent correlations between farm modernisation, regional resilience and rural development. A decade ago, the Arava farmers thrived economically. However, over the past few years they have experienced a growing crisis as most farms grow pepper (capsicum) and world market prices collapsed. Overall, the region produces about 60% of the total Israeli export of fresh vegetables - mainly to Europe, Russia and the US - with minor distribution in the local market. The recent crisis has placed a strong demand for finding either "the next pepper" or new economic directions altogether. One idea is to approach pharmaceutical and biotechnology companies that use certain kinds of plants that the region is especially suitable for growing and establish completely new regionally based supply chains.	Arava R&D looks for new ways to commercialise the region's unique knowledge in farming, to adopt new types of agricultural activity, to support new local entrepreneurships, and to bring in new investors that may help scale up the region's business activities. The aim is to create new partnerships that contribute to value-added generation and employment in the region.

	Case study	How practitioners (re)define agricultural and rural development	Key resilience and prosperity outcomes
IT	Extensive pig production systems	The Cinta Senese breed represents Tuscan traditional farming, and its products are perfectly integrated into the regional gastronomic tradition. Unlike in intensive indoor farming, pigs are reared in open agricultural and/or forestland. Extensive and outdoor systems are also common in other European countries like Spain, Portugal, UK, France and Hungary. Successful initiatives for high quality pork products require an effective cooperation of all actors along supply chains, in this case pig farmers, breeders, fatteners, feeding companies, slaughterhouses, processors, advisors, butchers, multiple retailers and restaurants. Direct marketing, organised groups of consumers, agri-tourism farms and clear rules for the preservation of the typical landscape play a central role.	Quality of life in rural areas is linked to a social life characterised by networks, shared norms and expectations that facilitate the ability to get things done collectively, and a sense of belonging. Multifunctional agriculture is perceived as the backbone of agriculture in Tuscany.
LT	Resilient farming systems and market differentiation	Nearly three-quarters (2010) of Lithuanian farms larger than one hectare are semi-subsistence farms with an economic output of less than €4,000 per year. Among small farms, a flexible use and re-use of resources, and strategies that are based on the available local social and natural resources prevail. Farmers' markets that promote the consumption of local products are becoming more and more popular. One of the reasons why farmers are only to a limited extent engaged in farm-based processing and direct marketing is the lack of technological, marketing and communication knowledge.	Food markets in Lithuania are becoming more differentiated and a fast growing number of consumers give priority to healthy, authentic and environment friendly produced food.
LV	Small farm development strategies	Small farms, which compose up to 90% of all farms in Latvia, are facing various long-term political, market and socio-demographic pressures, and their number is constantly declining. Diverse practices of small farmers ensure not only their own existence and development but, in their own interest, also aim at contributing to viable rural communities. Small-scale farming is seen as an alternative form of modern sustainable agriculture. Diversity opens up varied paths for modernisation, especially if contemporary societal needs and demands like a sustainable provision of food, the maintenance of rural livelihoods and environmental conservation and sustainable growth are considered.	The case study illustrates the multi-faceted and long-term character of prosperity, where farmer, farm, community and territory are interconnected. Farmers interpret prosperity in terms of family well-being, a sufficient level of income, the freedom to organise one’s life and work, the reproduction of natural resources and the contribution to community well-being.

	Case study	How practitioners (re)define agricultural and rural development	Key resilience and prosperity outcomes
SE	Peri-urban agricultural transformations in Gothenburg	The transformation of and contemporary conditions for farming in a peri-urban area is an increasingly important issue. Gothenburg provides an illustration of the transformation from a rural agricultural landscape with mixed farming systems including livestock and arable production of food for the nearby urban market into a peri-urban landscape with strong imprints of urbanisation. Agriculture has to accommodate leisure demands and facilities for the urban population. The demand for land for housing increases pressures on farmers. A counteracting force is the municipality strategy of fostering sustainable livelihoods that includes agricultural activities for local food production and cultural landscapes.	The importance of different types of ecosystem services demanded in particular in peri-urban areas has changed from mainly provisioning services to mainly cultural services.
TR	Resilience and competitiveness of small ruminant farms in Isparta	The small ruminant sector is traditionally and socio-economically important for most of the western Mediterranean region in Turkey. Goat and sheep production is based on extensive grazing and the shepherds are generally the herd owners. Farms still use traditional methods, and the family workforce is the dominant resource. Most of the farmers have taken over from their families and they have been involved in farming since they were children. Recently however they do not want their children to take over their businesses, and young people tend to find jobs in urban areas.	The use of new technologies is expected to reduce workloads and increase the welfare level of families and their involvement in social life. Farms that use milking machines have a higher productivity with better milk quality, more leisure time and a higher family income.

Source: own compilation based on RETHINK case study reports (see: http://www.rethink-net.eu/)

Discussion: alternatives in farm management, production systems, markets and supply chains

Most of the 14 case studies feature incremental, socially embedded and localised forms of development. Almost all are different from the conventional capital-intensive and technology-driven model of agricultural modernisation that predominates in policy and in the formalised agricultural knowledge system. In all cases a more integrative systems perspective can be recognised that focuses on interrelationships and on interrelated change dynamics.

Progress, modernity and modernisation

The idea of progress implies that advances in technology, science, and social organisation inevitably produce an improvement in societal conditions. The discernible assumption is that a society can raise its quality of life and foster economic development through the application of science and technology. The role of the 'expert' is to help overcome hindrances that slow progress.

Modernisation in this sense is perceived to contribute to 'progress'. The modernisation of European farming in the 20th century freed up a significant proportion of the workforce and eliminated drudgery. It was also connected with major increases in productivity, leading to the satisfaction of European food demand and, at times, sizable surplus production. On the negative side of the specialisation, intensification and scale enlargement of agriculture are monotonous production landscapes, a disproportionate use of natural resources (in particular fossil fuels), an increase in emissions and a standardisation of food qualities. At another level, we can see a concentration of farming in lowland plains and or regions with better access to (imported) feed, fertilisers or markets, and a marginalisation of other, normally less favoured areas.

Our observations of reorientation and change are not surprising as European agriculture and rural areas as a whole are being confronted with enormous challenges and need to accommodate a variety of demands (IAASTD, 2009; SCAR, 2011; EC, 2011; Knickel, 2013). Many of those pursuing alternative strategies tend to see these challenges and demands as opportunities for products with particular qualities, new services and new functions (Knickel et al., 2004). A telling example is the German case study that focuses on the necessary transition of industrialised country economies towards resource-efficient and climate-friendly production and consumption systems.

Interrelations between agricultural change, rural development and resilience

The last decades have – in spite of the particular support provided to less favoured areas – seen a very substantial polarisation of agricultural structures in Europe. Given the increasing demands for a more balanced regional development, both the intensification of agriculture in favourable areas and the simultaneous desertification of marginal areas are problematic.

How then can a different pattern of change contribute to a more balanced development and well-being in rural areas? Cairol et al. (2009) emphasised the multifunctionality of rural areas and the role of farming in the provision of public goods. The findings of this research have been confirmed in a major IEEP study on the provision of public goods through agriculture (Cooper et al., 2009). Olsson et al. (2011) showed that biological diversity is crucial for both rural viability and agricultural activities. The transformation of public goods in the rural economy was the focus of research led by Bryden et al. (2011). Von Münchhausen et al. (2010) and Milone and Ventura (2010) emphasised the central role of social capital and of less tangible factors in the dynamics of rural areas. From these different studies, it seems clear that rural prosperity is not just a question of economic performance, and that it is not only connected with agricultural production.

Agriculture in particular is characterised by close links between social and ecological systems. Technological change has therefore, probably more than in any other sector, major repercussions on the organisation of production, the natural environment and, in the long term, farm and rural structures. The introduction of tractors and of mineral fertiliser has both led to far-reaching changes in production systems and agricultural structures. Mineral fertiliser led to major increases in the productivity of land while increasing greenhouse gas emissions and the dependency from fossil fuels. Both the low cost of fossil fuels and the labour demand in other non-agricultural sectors have decreased a lot in the past years – maybe changing the game again.

Change can be shaped in positive ways!

Factors that will influence the further development of European agriculture and of rural areas include likely demographic changes, the further evolution of food systems and of urban-rural relations, anticipated trends and perspectives in biotechnology, biomass energy and bio-based products, and issues revolving around resource depletion. The concepts of multiple modernities (Fourie, 2012) and resilience pathways (Wilson, 2013) can help to explore alternative futures. For example, the bio-based economy has been suggested as a smart way to overcome resource constraints and to make production systems more sustainable. There is of course also the risk that the related structural changes might aggravate the concentration of power in up- and downstream industries and increase dependencies.

New opportunities can easily be missed if not planned and implemented in beneficial ways. Peter et al. (2015) emphasise that the necessary transition towards climate-friendly production systems can provide completely new opportunities to farmers and rural areas – if shaped accordingly. The authors contrast the high flying bioeconomy concept with the vision – and reality! – of an eco-economy that might be characterised by the principles of a steady-state economy, new multi-actor networks, and embeddedness and value capture at local and regional level thus providing new income sources and jobs at farm-level and within rural areas (Marsden et al., 2011; Knickel, 2013).

Conclusions

Implications for policy

Policy can have a major influence on agricultural structures and production patterns. An example is the increasing capital-intensity of farming that has at least partly been supported through policy, for example agricultural investment support. An unintended side effect is that it has made many farmers more vulnerable. Indebtedness and dependencies from banks and agro-industry are very high in countries where agriculture is perceived as particularly 'modern' (Knickel, 1994). Many farms have become highly path-dependent because of the large amounts of money invested in particular lines of production, production systems and technologies, and the resulting narrowing of management options. Adaptive capacity, the efficiency of the use of natural resources and favourable higher-level system combinations such as between low-intensity farming systems and landscape amenity, in contrast, appear very much undervalued.

Agricultural and rural development frameworks need to be more flexible leaving more space for very different structural, natural, social, cultural and economic conditions. The disparities between countries with different backgrounds and traditions are an example. Some countries like the Netherlands, Belgium or Denmark have for a long time had very high levels of agricultural investment. Other countries like Lithuania and Latvia and most eastern European member states lack investments. Present EU support is trying to rebuild earlier structures based on the assumption that private ownership is going to take care of everything. The problem is that policy instruments that proved effective in the old EU member states might not provide the kind of support needed in these very different situations (Dwyer et al., 2012; Davidova et al., 2013) and in consideration of future challenges (Knickel, 2013).

Currently, there is a lack of more appropriate, future-oriented development frameworks. Traditional and local knowledge tends to be undervalued in current innovation systems and policies. Inappropriate policy instruments sometimes diminish the role of local knowledge. Von

Münchhausen et al. (2010) and Koopmans et al. (2016) argue that new forms of governance and collaboration are needed in order to face the multiple crises to production, consumption and sustainability. I like to add that these new networks should be understood as learning vehicles towards more sustainable production systems and consumption. Brunori et al. (2013) rightly argue that the goal of sustainable agriculture implies a systemic change: learning and innovation networks can develop innovative patterns of production by generating new knowledge. Innovation partnerships and development networks must be motivated by a common cause and need to involve practitioners on a par with researchers.

The challenge for administrations is to find ways to enable motivated individuals and civil society action. Focus should be on supporting future-oriented investments that maximise added value *within* agriculture and rural areas. Rediscovering the value and potential of smaller-scale structures and boosting collaborative innovations is in many areas an important part of that. Administrations need to level the playing field where capital-intensive sectors dominate. Many grassroots initiatives have relevant experiences. The main challenge for the formal knowledge and innovation system comprising education, research and advisory services is to be open-minded and responsive.

Future research challenges: shaping (agricultural) development

RETHINK emphasises the need for more holistic and more inclusive development concepts. Each case examined can be seen as an expression of innovative development trajectories, highlighting potential synergies between farm modernisation and sustainable rural development.

In the last years, we can actually see new relationships evolving among state, business, civil society and the individual. The more recent agricultural, rural and research policies encourage institutions and networks that are able to combine different types of knowledge and experience, and learn. Šūmane et al. (2016) emphasise that these new networks tend to be more effective in shaping future development. Other attributes favouring a positive development are responsive governance structures, and flexibility in decision-making processes and problem-solving (Koopmans et al., 2016).

Future research needs to focus on more effective support mechanisms for alternative modernisation trajectories and resilience pathways. Issues like the role of agency and of enabling institutional structures, the factors that encourage the creation of synergies in agricultural and rural development, are to be explored. Local capacities for transdisciplinary research need to be strengthened to support local-level decision-making in public and private sectors. In an ideal situation, the agricultural knowledge and innovation system is well connected with local knowledge and farmers networks (Röling & Jiggins, 1998; Moreddu & Poppe, 2013; Šūmane et al., 2016).

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Comparing sustainable rural well-being in United States and United Kingdom contexts

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Abstract: This paper proposes that a baseline analytical framework approach is a necessary starting position and point of reference for developing default customised indicators of sustainable agriculture and rural well-being. Rural well-being addresses multiple issues including social/cultural, economic and environmental contexts. Sustainable Agriculture practices are increasing as Industrial Agriculture becomes less acceptable. Rural women, minorities, and the elderly have been the most significantly impacted by these changes. The United States (US) and the United Kingdom (UK) have taken positions on these transformative rural issues discussed herein. For these reasons we propose a set of fundamental indicators of rural well-being in the context of evolving agriculture and rural communities' sustainability. We will also discuss a sampling of evolving models of exemplar sustainable agriculture and rural community partnerships from the United States and the United Kingdom. The United States Department of Agriculture is "committed to helping improve the economy and quality of life in rural America" primarily through loans and subsidies (USDA, 2015). The Sustainable Agriculture Research and Education (SARE) organisation is dedicated to supporting sustainable agriculture and sustainable rural communities. The SARE vision is "*an enduring American agriculture of the highest quality that is profitable, protects the nation's land and water and is a force for a rewarding way of life for farmers and ranchers whose quality products and operations sustain their communities and society*". (SARE, 2016). The United Kingdom government and non-government agencies have taken a more holistic approach to rural well-being in their efforts to achieve a more balanced social-economic-environmental state of rural well-being. The UK interpretation of Community Supported Agriculture (CSA) is a tested example of this sustainable approach to fostering rural well-being (Saltmarsh et al., 2011). To conclude, common generic indicators will be identified in selected models from the US and UK contexts, which can potentially produce positive impacts, supportive of sustainable agriculture, rural community resilience and rural well-being.

Keywords: Indicators, rural well-being, sustainable agriculture, resilience, United Kingdom, United States.

Introduction

This paper compares and contrasts approaches to models of rural well-being in the United Kingdom and United States. Issues including social/cultural norms, economics and environment will be addressed. Sustainability indicators of rural well-being will be drawn and substantiated from this review and dialogue.

Rural well-being is impacted by location and is gender-specific. We define well-being in this paper as achieving a sustainable balance of social, economic, and environmental resilience. Contextually speaking the United Kingdom (UK) and United States (US) geographic contexts include a diverse range of terrains and climate including coastal landscapes, rolling hills,

forests, rocky uplands and mountains. Rural well-being is significantly impacted by location. Proximity of rural locations to urban areas has a strong positive or negative influence on degree of well-being in rural areas of the UK and US. For example, urban development is fuelled by increases in population. Population increase often requires urban development and expansion out into rural areas (Smith, 2015).

The spread of urban growth out into rural areas significantly impacts women, individuals and families, and minorities living below poverty level, for example, due to increased employment opportunities on the one hand and increased costs of living on the other. Rural locations typically bear the brunt of social/economic impacts due to economic fluctuation. In comparison, urban areas are generally more resilient and less negatively impacted by economic fluctuations (USDA, 2015). Rural women, minorities, and the elderly are the most significant sector of the population impacted by these issues. Local and regional environmental factors range from seasonal weather (snow, rainfall and drought) to soil contamination, deforestation and flooding. Statistics show that women, minorities, and elderly rural dwellers are especially impacted by these natural occurrences (UN Inter-Agency Task Force on Rural Women, 2012).

Historical perspective on the agri-environment schemes in the US

In the early 20th Century agriculture in the US was beginning to transform from small rural farms to Industrial Agriculture. In the early 1920s farmers saw several opportunities for increasing their production. New technology and crop varieties were reducing the time and costs-per-acre of farming, which provided a great incentive for agricultural expansion. This expansion was also necessary to pay for expensive, newly developed equipment (such as listers and ploughs), that was often purchased on credit, and to offset low crop prices after World War I (National Drought Mitigation Centre, 2016).

In October 1929 the stock market collapsed leaving farmers with significant debt and fewer buyers for the products of their hard labour. Following the1929 stock market crash the Great Depression began in 1930 and continued through the decade until shortly before World War II. During the 1930s The Dust Bowl covered the entire west and mid-western Plains. The Dust Bowl drought of the 1930s was one of the worst environmental disasters of the twentieth century anywhere in the world. Three million people left their farms on the Great Plains during the drought and half a million migrated to other states, almost all to the West (Cook et al., 2009). The Dust Bowl was caused by deficient rainfall, high temperatures and high winds in combination with the predominant farming system. Additional insect infestations and dust storms further complicated this crisis. The agriculture depression contributed to the Great Depression's bank closures, business losses, increased unemployment, and other physical and emotional hardships (National Drought Mitigation Centre, 2016).

During the 1930s' decade the combined occurrences of the 1929 stock market crash, the Great Depression, and the Dust Bowl had a significant impact on rural well-being and rural communities across the United States. Many once thriving rural communities were lost forever. During the 1930s catastrophic environmental damage occurred, large numbers of farmers and their families had to sell their farms at historically low prices, resulting in homelessness for many. The devastating impacts of these events were felt throughout the country. Rural communities played a key role in supporting agriculture in the 1930s and continue to support sustainable agriculture in the 21st century e.g. by providing local services including venues for

sale of agriculture products. Rural communities are impacted strongly by environment and by agricultural productivity, be it positively or negatively.

The agri-environmental movement in the US commenced with the Agricultural Adjustment Act of 1933 and the Soil Conservation Act of 1935. In the US the first Farm Bill, the 1933 Agricultural Adjustment Act (PL 73-10), addressed environmental issues of significant relevance to agriculture in America during the Great Depression. Two years after the 1933 Agricultural Adjustment Act was implemented the Federal Government also passed the Soil Conservation Act of 1935 (PL 74-46), which established the Soil Conservation Service and made funding available for farmers who embraced soil conservation practices. (Cain, Zachery, and Stephen Lovejoy, 2004). The legacy of these two Agriculture Acts lives on today as the foundational principles of agri-environmental farming.

Agri-environment schemes in the UK

Since the late 1980s within Europe it has been recognised that support for production-oriented agriculture is insufficient to maintain biodiversity and rural well-being in many areas. Consequently, there has been growing support for measures that encourage the maintenance of a resilient and bio-diverse environment, which will maintain ecosystem services. These measures are applied on a voluntary basis by farmers who wish to enhance biodiversity on their farm and contribute to wider societal wishes for positive environmental enhancement that could be achieved through farming and rural development.

The measures include: intensification of farming, low intensity grazing systems, integrated systems management and organic farming, preservation of hedgerows, ditches and woodlands and conservation of high value habitats and their associated biodiversity. The application of these measures can lead to very significant benefits to the environment and to sustainable rural livelihoods. (Pagella et al., 2013) Agri-enviromental schemes have been applied with a considerable degree of variation and flexibility within different EU countries. The UK is no exception, with significant variations occurring between England, Scotland, Wales and Northern Ireland. However, there has been little formal monitoring and evaluation of the effectiveness of agri-environmental schemes until recently (Dwyer et al., 2005). This review anticipated the increasing importance of agri-environmental measures as part of the revised CAP reforms between 2014 and 2020 that are discussed below.

Indicators for sustainable agriculture and sustainable rural livelihoods

In the US the term ‘sustainable agriculture’ is broadly defined. There is significant evidence of sustainable agriculture practices (also referred to as ‘alternative agriculture’) dating back to the mid-19th century. There are many variations and permutations of sustainable agriculture. Many of these ‘sustainable’ agriculture approaches exhibit similar common principles and practices that can provide indicators of sustainable agriculture and rural livelihoods. The United States National Sustainable Agriculture Coalition states that sustainable agriculture “*as legally defined in US Code Title 7, Section 3103 refers to an integrated system of plant and animal production practices having a site-specific application that will over the long term satisfy human food and fibre needs*”. These site-specific applications include:

- Enhancing environmental quality and the natural resource base upon which the agricultural economy depends;
- Making the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
- Sustaining the economic viability of farm operations;
- Enhancing the quality of life for farmers and rural community societies as a whole. (National Sustainable Agriculture Coalition, 2016.)

The basic goals of sustainable agriculture as practised in the United States include achieving and sustaining environmental health, economic profitability, and social and economic equity (sometimes referred to as the 'three legs' of the sustainability 'stool'). Sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, stewardship of both natural and human resources is of prime importance. Stewardship involves taking care of the land, supporting sustainable economies, and preserving/enhancing natural resources, community resilience and health of the environment.

Another characteristic of agricultural sustainability is the systems approach, which in its broadest sense is based on establishing direct, seamless connections from local farms to rural communities in a manner respectful of surrounding environmental contexts and the enhancement of ecological integrity. A systems approach is based on the ecosystems model as a foundational principle of sustainable agriculture and the interconnections between farming and other aspects of our environment. Sustainable agriculture is fundamentally a process. All participants in the system, including communities, farmers, labourers, policy makers, researchers, retailers, and consumers must adhere to the systems approach for this sustainable systems process to succeed.

Van Cauwenbergh et al. (2007) observe that sustainable agriculture lacks a generic framework. They emphasise "*in agriculture, unlike forestry, remarkably few efforts have been made to develop a generic, conceptual framework of principles, criteria and indicators (PC&I) of sustainable agriculture*". SARD Agenda 21, Chapter 14, Section 14.2. proposes that "*major adjustments are needed in agricultural, environmental and macroeconomic policy, at both national and international levels, in developed as well as developing countries, to create the conditions for sustainable agriculture and rural development*".

The major objective of Section 14.2 was and still is to "*increase food production in a sustainable way and enhance food security"*. In order to accomplish these goals indicators of positive or negative outcomes will be required. Agenda 21 emphatically states "*this will involve education initiatives, utilisation of economic incentives and the development of appropriate and new technologies, employment and income generation to alleviate poverty, and natural resource management and environmental protection"* (Johnson, 1993).

Table 1. Examples of United States sustainable agriculture goals *(USAID, 2014)*

Sustainable agriculture goals broadly encompass: ✓ Improving soil quality while reducing erosion, salinization and other forms of degradation to achieve greater resilience to drought, better fertiliser efficiency and reduced greenhouse gas emissions; ✓ Minimising the use of pesticides and herbicides by applying practices including integrated pest management, crop rotation and crop diversification; ✓ Employing environmental management systems to ensure proper treatment of solid waste, manure and waste-water; ✓ Ensuring the safe storage, application and disposal of agricultural chemicals; ✓ Maintaining habitats to support wildlife and conserve biodiversity.

Sustainable agriculture needs to be economically viable and sustainable to survive and prosper. Economic success depends on informed sustainable agriculture management. Sustainable education can change attitudes and outcomes of farm operators and the consumers of agricultural produce in supporting sustainability of agriculture and rural communities. One way to change attitudes is to facilitate dissemination of sustainable agriculture information by making available understandable, applicable and usable sustainable agriculture principles, criteria and indicators supporting sustainable agriculture and rural communities. These principles, criteria and indicators could also facilitate identification and documentation of the appropriate pedagogical approaches for delivering such information.

An assessment of a wide range of indicators of sustainable agriculture and, by implication, rural community sustainability makes the case that there are generally two sets of sustainability indicators i.e. micro sustainability indicators and macro sustainability indicators. Micro indicators are site-specific and targeted at local and regional-scale agriculture (Jackson et al., 2000). Macro indicators are intended to be nationally or internationally applicable (Dariush Hayati et al., 2011). We believe that by focusing on sustainable agriculture macro principles, criteria and indicators development at the international level we can produce the most impact through influencing and supporting development of more effective default baseline micro indicators at the regional and local level.

In support of this effort, the Food and Agriculture Organisation of the United Nations, provides this disclaimer for their publication titled “SAFA Indicators“, clarifying that “*the SAFA default indicators are applicable at the macro level – meaning to all enterprise sizes and types, and in all contexts. However, default indicators of such a universally applicable tool can only contain the frame for the rating scale. SAFA provides such indicators for users who do not necessarily have the knowledge to develop indicators themselves without the risk of lowering the bar of the assessment”* (FAO, 2013). We propose a set of macro-level indicators of sustainable agriculture as a *default baseline* and a method of providing knowledge for users of sustainable agriculture indicators. These macro-level indicators are discussed in more detail

below. The objective is that developing and testing principles, concepts and theories of pedagogy supporting sustainability in agriculture and rural communities will provide opportunity to empower users with the skills to develop their own indicators of rural sustainability in general and rural well-being in particular**.**

Moving from a productionist to a more systemic perspective in farming systems and a concern for sustainability has led to the formulation of more and more complex frameworks for the analysis of the sustainability of agricultural and rural livelihood systems. Sustainability, as defined in Agenda 21, has ecological, social and economic objectives and recognises the importance of understanding the nature of multifunctionality within farming systems. Many authors concerned with developing frameworks for the assessment of sustainability have explored the great variety of contexts in which they might be applied and have moved from earlier, relatively uncomplicated, frameworks with limited numbers of individual indicators, to indicator groups (EU, 2001; Bell & Morse, 2008).

Rao and Rogers (2006) explore a systems approach to assessing agriculture in order to integrate the multi-dimensional goals of sustainable agricultural development and identify how sustainable agriculture can underpin sustainable livelihoods. They adopt a definition of sustainable agriculture based on one provided by Tilman et al. (2002): "*Sustainable agriculture is defined as a practice that meets current and long-term needs for food, fibre, and other related needs of society while maximising net benefits through conservation of resources to maintain other ecosystem services and functions, and long-term human development."* (Rao & Rogers, 2006, p. 441).

In order to identify how to achieve an integrated approach that can accommodate the multiple dimensions of environmental, social and economic aspects of sustainable agriculture, Rao and Rogers first review three existing categories of assessment frameworks namely: environmental assessments; agro-ecosystems assessments; and sustainable rural livelihoods assessment, with a view to analysing the weaknesses and drawing on the strengths of each approach. Not surprisingly they find a lack of social and economic indicators in the environmental assessment approach, which limits the usefulness of these assessments in terms of sustainable agriculture. The focus within an agri-ecosystems' approach on farm level activity raises the issue of an approach to assessing sustainable agriculture that is scalable, with appropriate indicators for different levels, whether they be global, national, regional, local or farm. This highlights one of the challenges of developing a systems based framework, which is identifying where the borders and boundaries reside (Bossel, 2001; Reed et al., 2005). In looking at sustainable rural livelihood indicators Rao and Rogers draw on Chambers and Conway (1991) for a clarification of the term 'sustainable livelihood'. *"A livelihood comprises capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with the recovery from stress and shocks, maintain and enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the long and short term."* (Rao & Rogers, 2006 p. 445)

The sustainable rural livelihoods approach as presented by Rao and Rogers is underpinned by the five capitals' model that has emerged over a period of time from the work of environmental economist Herman Daly. The breadth of the five capitals (natural, manufactured, human, social and financial) attempts to address the multi-dimensional nature

of sustainability by assessing increases and decreases within each capital. This approach was also widely used by the British Aid Agency, DfiD, for many years for analysis and as a constructive framework for developing country farming systems and rural livelihoods. Perhaps its main weakness is the lack of acknowledgement of the importance of power and governance at local and regional levels, which SAFA (above) recognised.

The five capitals model is scalable and capable of providing an initial qualitative assessment. As with any systemic approach the relationships between the elements of the model are of key importance and those relationships can be viewed in contrasting ways as demonstrated in Figure 1. This highlights the difference of perceiving the other four capitals as being ultimately dependent on natural capital.

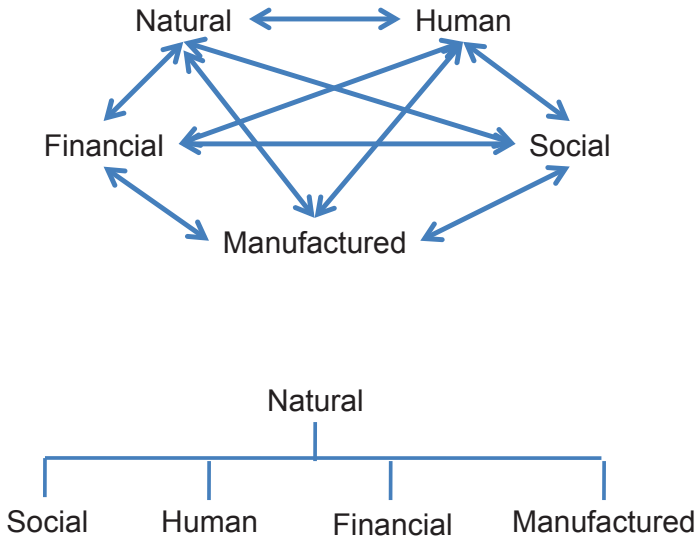

Figure 1. Examples of alternative links between the five capitals

The process of developing a more comprehensive framework that is both quantitative and qualitative and that draws on aspects of environmental assessment and agri-ecological assessment, requires attributing measurable values to the various capitals and identifying the movement in value between the capitals. This process results in a considerably more complex, in-depth analysis.

Potential mainstream developments in Europe through the evolution of the Common Agricultural Policy (CAP)

In Europe, following an extensive review over three years, a new agreement has been reached in which farmers are supported by a more integrated set of measures. There is now a new structure for support which should be better targeted, more equitable, greener and with support for rural development. All this combines to enable member states to encourage the development of more sustainable agricultural practices through producer cooperation, better environmental performance through more sensitive production methods, greater equity, and special support for younger farmers and for small and medium sized farms (EU, 2013).

Initiatives outside the mainstream agri-environment schemes

Since the shrinking of direct research funding through the Social and Natural Science Research Councils in the UK, many agricultural and related sciences researchers have looked toward the European Union (EU) for their main source of funding.

For many years, the EU has strongly influenced agricultural research and rural livelihoods through the development of multi-agency and interdisciplinary research. The natural resource based projects and programmes are designed to encourage joint research initiatives across member states, which facilitate research capacity building and exchange visits on emerging themes of interest. Some earlier EU funded research on natural resource management was designed to stimulate social learning among researchers, land managers and agency staff on a catchment scale (e.g. https://sites.google.com/site/slimsociallearningforiwm/home). More recent research programmes have focused on learning and innovation networks with support for sustainable agriculture. For example, the SOLINSA project involved 17 partners across Europe using transdisciplinary approaches based on participatory methods. The partners included 11 research institutions across 8 countries. (see www.solinsa.net and a series of papers in a special issue of the Journal of Agricultural Education and Extension 2015 e.g. Ingram et al., 2015) . All these programmes were based on the premise that more sustainable land management systems could evolve from learning networks between multiple resource users and actors who had different roles to play in the management of natural resources.

At a more local level in the UK, projects have emerged from the EU Rural Development Programme which have supported the establishment of partnerships of farmers, local communities, and environmental and natural resource management agencies in order to develop stronger local communities, improve their quality of life and the health and well-being of their landscape. One such project is the Clun Forest “Land Life and Livelihoods“ project, which has benefited 105 farming families and 334 participants. (Shropshire Hills AONB Partnership, 2007).

There are also examples of projects and initiatives being established outside of any national or EU framework by individuals and community groups. The Denmark Farm Conservation Centre[1] (DFCC), located between the Cambrian Mountains and the Ceredigion coast in West Wales, is an example of an agro-ecology project started by an individual, which has developed into a broader sustainability project and that has both ecological and educational dimensions and is embedded in a strong community network. DFCC is a sixteen hectare holding, it was farmed until 1984 under the system that predominates in the area, which is based on improving grassland by introducing rye-grass (*Lolium perenne*) and maximising growth with the aid of chemical fertilisers. The effect of reducing the plant biodiversity is to also reduce other biodiversity, most noticeably birdlife. DFCC demonstrates how reducing high energy inputs allows diversity to re-establish itself at all levels. Extensive ecological monitoring over the years following a change in management of the DFCC site has shown how allowing an increase in plant diversity leads to a vast increase in invertebrate diversity. This in turn has seen a significant increase in species and total numbers of birds and other vertebrates, compared to the surrounding farmland, which can best be described as a ‘green desert’.

[1] *See: http://www.denmarkfarm.org.uk/about/biodiversity/*

The practical experiences of DFCC have been used as a basis for training courses for landowners who wish to encourage biodiversity on their own holdings. The aim is not for every holding to be fully converted to the low level management system at DFCC, which is based on late summer hay making and late summer and autumn grazing, but for parts of farms to be managed in this way in order to establish wildlife corridors. Since 1987 DFCC has been managed by the Shared Earth Trust and has diversified its activities by providing a range of educational courses on various aspects of sustainable living alongside the ecology courses. The overall aim is to not only influence land owners, whose practice directly impacts on biodiversity, but also to influence consumers generally to understand how their lifestyles indirectly impact on the ecosystems that ultimately sustain life. DFCC is connected to and works in partnership with the local university (particularly in relation to ecology courses) and community organisations such as the local Transition Town Organisation, a community woodland and the Wildlife Trust.

From a five capitals perspective, the ecological surveys provide data for a measurable increase in natural capital on the 16 hectare holding. Through the social capital of its network of community organisations and the increase in human capital through its education programme, DFCC's aim is to increase natural capital on a wider scale. DFCC has developed its manufactured capital by installing a photovoltaic array and a biomass heating system and developing its buildings for training and accommodation, which all contributes to increasing financial capital, with the sole purpose of re-investing in natural and human capital.

Another example that has established itself as a sustainable business outside of any national or regional support framework is the Real Seed Collection Company[2] (RSCC) a commercial horticultural enterprise. Based in Pembrokeshire, South-West Wales, the RSCC is aimed at providing non-hybrid and non-genetically-modified seed to small-scale growers. The inspiration for establishing the Company was the decline in traditional varieties of vegetable seeds and the domination of large seed producers with a focus on a relatively small number of varieties, which are often hybrids designed to produce a single high yielding crop, but which require the purchase of new seed each year. The business model is unusual in that each packet of seed is accompanied by information on how the grower can save seed for the following year, which in effect is reducing the demand for new seed from the RSCC. However it does fulfill the aim of the Company to promote and spread the diversity of varieties, and to re-skill growers in terms of seed collection. In spite of the unusual business model the business has grown steadily since 1997 when the Company was established by two individuals and now has additional employees drawn from the local community. The Company also provides a model of how a commercial operation can apply sustainable principles to reduce its carbon footprint, treat its staff on an equitable basis and influence its customers to adopt sustainable practices.

A cursory view of the Company from a five capitals perspective illustrates how the human, social, manufactured and financial capitals are all used in the broadly increased natural capital by increasing the diversity of non-hybrid seed varieties which have been in decline for several decades. The network of customers and the re-skilling of growers in terms of seed saving are the basis for this increase in natural capital. The focus on the ecological footprint of the company to minimise mechanisation and to provide employment to members of the local

[2] *See: http://www.realseeds.co.uk/about.html*

community results from careful decision making in respect of manufactured capital and the desire to increase local social capital, while maintaining sufficient financial capital to develop the organisation.

Conclusion

The above comments represent very small fragments of a complex and evolving picture surrounding aspects of sustainability among farming and rural communities. In the US, the UK and the rest of Europe, farming communities have access to and are managing very different scales of farms and natural resources. They often have very different perceptions of the nature of sustainability in relation to farming and livelihoods. In the United States the scale of farming varies widely from vast cattle ranches to small farms and a slow growing presence of urban farming in its variety of forms. The US perception of the nature of sustainability in farming and livelihoods is more difficult to gauge, although one indicator is increased interest in organic farming over the last two decades.

At a policy level, there is recognition that some sectors of the farming community (the young, the organic and those who are very sensitive to sustainable environmental management) have been neglected in the past and there is an attempt to rectify this through more sympathetic support measures and payments. Such measures have been considered essential to counter heavily subsidised export strategies by many countries, including the US, that make it difficult for many smaller farmers in the EU to compete in world markets. There is also evidence that individuals can take action outside of policy frameworks and influence practices at local levels without the support of subsidies or incentives.

The study and analysis of sustainability remains a difficult and elusive endeavor and the design of ever more complex analytical tools may or may not help future planning. That said, we offer a default baseline set of indicators of rural livelihood sustainability as illustrated in Table 2. To reiterate, Dariush Hayati et al., (2011) propose that there are generally two sets of sustainability indicators including micro sustainability indicators and macro sustainability indicators. Micro indicators are site-specific and targeted at local and regional-scale agriculture (Jackson, et al., 2000). Macro indicators are intended to be nationally or internationally applicable.

Table 2. Proposed baseline macro-indicators

Indicators	**Source of indicator**
1. Focuses on agriculture as a symbiotic socially, economically and environmentally based system	Community Supported Agriculture (CSA) (UK/US)
2. Optimises health of soils, plants, animals and people.	Organic Agriculture

3. Uses ethics, design principles and locally adopted practices, to achieve equal ecological footprint	Permaculture
4. Enhances resilience, ecological, cultural and social/economic sustainability of farm systems.	Agro-ecology
5. Sustains environmental health, economic profitability and social and economic equity.	National Sustainable Agriculture Coalition
6. Provides suppliers and buyers with prices that reflect the true cost of the entire process of sustaining a regenerative ecological system, including support for the livelihood of primary producers, their families and employees.	Fair trade and supply chain equity (SAFA: Sustainable Assessment of Food and Agriculture, FAO, 2013 p.185.)

We believe that a framework of indicators for sustainable agriculture can only be relevant and influential when located within a broader set of indicators for well-being, sustainable livelihoods and community resilience. Developing a set of baseline macro-level indicators that see sustainable agriculture as part of this broader systemic whole is a foundation for developing and customising micro-level indicators that are adaptable to all micro-level conditions and contexts. Table 2 illustrates a macro-level set of indicators of sustainability in agriculture and livelihoods and well-being. This macro-level set of indicators is not intended to be complete. It is proposed as a flexible and customisable starting point with the intention that the indicators listed will be tested, altered and improved upon. Within research, there is an increasing emphasis on inter and trans-disciplinary thinking and practice and the recognition that all actors and stakeholders have important, participatory roles to play in collective learning for more sustainable rural livelihoods and well-being.

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Is the local agriculture related to the well-being of rural community today? A case from Portugal, Southern Europe

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Abstract: Well-being in rural areas is recognised as one of the primary goals of the European policies aiming at sustainable development. Rural settlements are closely connected with agricultural areas, and thus it can be expected that local agriculture influences numerous aspects of rural life. However, the relations between local farming practices and the well-being of the rural community have to date been scarcely studied. Recent research indicates that especially subjective well-being ought to be the measure of progress and should be the explicit objective of government intervention. The aim of this study is to explore contemporary associations between the perceived qualities of the local agricultural characteristics and the self-reported levels of well-being by rural residents. A quantitative survey was applied to rural residents in two municipalities in Southern Portugal. In these areas different development trajectories in agriculture have been observed during recent years. Results show significant associations between the perceived qualities of local agricultural characteristics and the subjective well-being of respondents. Life satisfaction, happiness and the satisfaction with the municipality as a place to live were the measures of subjective well-being assessed. They were positively correlated with most of the studied perceptions about local food, farming practices, landscape and the environment. These findings highlight the importance of further research on the existing and possible impact of local agricultural practices on the well-being of the rural community, and the need to consider these associations in formulating agricultural and rural development policies.

Keywords: Perception, local qualities, food, landscape, environment, subjective well-being, rural community

Introduction

Rural development

The Common Agricultural Policy aims at the "*sustainability of European rural areas, including the well-being of rural society".* Accordingly, the European Rural Development programmes are designed in such a way as to contribute to the social, economic and environmental well-being of rural areas and the sustainable management of natural resources. However, how specifically the agricultural practices and their outputs are associated with well-being of the rural community in these days is known only approximately, while a detailed knowledge in different territorial contexts is still to be explored.

Local agriculture is a complex multi-factorial activity, likely to have multiple impacts, direct as well as indirect on the well-being of those taking part, and also of those living in a particular locality. According to the Millennium Ecosystem Assessment (2005), the farming systems represent a dominant land use in European rural areas and embody a vital role in the major aspects of rural life such as environment, economy and social relations. From an ecosystem

point of view, agriculture can provide different services linked to human well-being. In that perspective, in recent years, a reconceptualisation of the role of farming within the framework of wider rural development processes is acknowledged. The reconceptualisation must account for, and simultaneously reflect, the substantial heterogeneity of Europe's rural regions, thus allowing for adequate inputs into the processes of policy formulation and implementation. At the same time, it must go beyond previous sectoral approaches, and it is to be 'interdisciplinary and holistic'.

Contemporary changing agriculture and rural community

Looking at agricultural changes over the last decades, the types of interaction between farming systems and the society are becoming more complex and diversified. Apart from food, farms can produce energy crops, or have environmental, cultural and recreational functions. Simultaneously, a trend of agricultural modernisation intensively involving irrigation water, fertilisers and other inputs is forming large-scale specialised farms. The area occupied by these farms is growing in Europe, bringing to rural territories new environmental, social and economic conditions, which are seen as being negative or at least uncertain in the terms of the ability to face future challenges.

Changes are also occurring at the social level. Many rural places have witnessed unprecedented change and transformation to local economies, property and rural politics (Jones et al., 2011). This has led to a dramatic reconstitution of rural populations, with fewer people engaged in agricultural production, but with a new demand for non-production functions of agriculture, such as cultural identity, aesthetics, environmental quality, food quality and recreation (Surová & Pinto-Correia, 2016).

As farming can adopt different development trajectories, the knowledge about agricultural values contributing to the well-being of rural society should be of use for policy formulations and implementation.

Some studies indicate that in those areas where the rural represents well-being and the opportunity to prosper, people are caring for that place and are trying to develop and enrich it further. In other places, where well-being is poor there is a critique, concern and a many-sided struggle to improve the overall condition (van der Ploeg & Roeg, 2003).

Well-being and its influencers

The concept of well-being has evolved over the past decades as research has continued to reveal its multidimensional, dynamic, person-specific and culture-specific nature. Well-being or quality of life is part of a trend that evaluates progress using multiple factors rather than focusing on a limited view of financial or economic health (Preuss & Vemuri, 2004). Recent research indicates that especially the subjective well-being of people ought to be the measure of progress and should be the explicit objective of government intervention (Diener, 2000). What is specific about the concept of subjective well-being is that only the person under investigation can provide information on their evaluations, emotions and psychological functioning. It is people's views that are the subject of interest (OECD, 2011). Subjective well-being refers to people's evaluations of their lives; it encompasses both cognitive judgments of satisfaction and affective appraisals of moods and emotions (Kesebir & Diener, 2008; Pavot & Diener, 1993). Life satisfaction measures how people evaluate their life as a whole rather than their current feelings. It captures a reflective assessment of which life circumstances and

conditions are important for subjective well-being. Often, the happiness is considered to be different from life satisfaction, even if these two measures are highly correlated. While the life satisfaction refers to a cognitive evaluation or judgment of one's life, happiness involves more affective components of subjective well-being (SWB) (Gamble & Garling, 2012).

An influential body of literature considers that the place where an individual is living doesn't matter considerably in an increasingly mobile and virtually communicating society, and that the place is losing its distinctiveness (Friedman, 2007; Wellman, 2001). On the opposite side, other studies are revealing that the location-specific factors have a direct influence on life satisfaction (Brereton et al., 2008). While there are a considerable number of studies dealing with residential satisfaction in urban areas, these kind of studies are less frequent in rural settlements.

Several researchers have been highlighting the influence of local environmental issues on subjective well-being. The multi-way relationships between environment and well-being were summarised by a New Economic Foundation in the UK (NEF, 2005). Here, the environment is understood to be the external physical conditions people live in and experience. Landscape, as an externality of agricultural practices in rural areas, can influence human well-being in manifold ways (Bieling et al., 2014).

To date, examples of studies into issues of well-being in the countryside tend to focus on particular subgroups of the rural population (e.g. farmers) or specific topics, such as stress or mental health, rather than an examination of wider life satisfaction concerns (Mzoughi, 2014). A neighbourhood satisfaction connected to the physical environmental qualities is also a critical component of the life satisfaction (Sirgy et al., 2006). However, this relation needs more attention from research (Kweon et al., 2010). The answer to the question of why people like the place where they live is complex (Fitz et al., 2016). Some studies in urban areas show that the green spaces, such as local parks, appear to promote well-being in many ways. They facilitate outdoor exercise, which has been found to have even more positive mental health benefits than exercise of other kinds (Pretty et al., 2005). They can also have important effects on social capital at the community level through giving people a place to meet and children a place to play (Marmot et al., 2010). The connections between farming types and activities promoting health or social capital are also currently relevant in rural areas.

The aim of this study is to explore contemporary associations between the perceived qualities of the local agricultural characteristics and the self-reported levels of well-being of rural residents. We believe that this kind of information is necessary for better understanding of the current agricultural role in SWB of inhabitants in the countryside, and to help formulate relevant research questions for future studies.

Methods

Survey and data analysis

A survey was applied to a sample of local inhabitants in the two studied rural settlements. Respondents were selected through a stratified random sampling, where the stratum was the age class distribution in the studied municipalities according to the national statistical records. The answers were measured as the levels of agreement with the statements related to the

perceived situation regarding the aspects associated with local agriculture. Specifically, the perception of the food, local farming practices, local landscape and the local environmental issues was assessed.

The characteristics of the food and the local farming practices included seven variables measured on an ordinal scale. The variables were as follows: perceived freedom of choice in the food origin; accessibility to the marketing places selling local farming products; quality of the local farming products; level of the local knowledge maintenance in agricultural practices; the existing possibilities to interact with the local farmers; the perceived local food autonomy; and the frequency of receiving, giving or exchanging the local farming products. The food origin in this study is linked to the food's geographical provenance. The perceived contribution of the local agriculture to one's well-being was measured on a nominal scale with three categories: yes, don't know and no.

The questions about local landscape and environment were assessed as a subjective appreciation of the visual landscape quality, feeling of one's connection to the local landscape, perceived local soil and water quality, and perceived richness of local vegetation, animals and birds.

The preferred farming type occupational tendencies in the resident's locality were assessed using an ordinal scale. Respondents were asked to assess four types of farming differing in their scale and specialisation. The small-scale diversified farming was represented by extensive olive groves, orchards, vineyards and vegetable plots. The second farming system assessed was the small-scale specialised farming. This was represented by production in the greenhouses and the intensive production of aromatic plants. Large-scale diversified farming is, in the region, known as the silvopastoral system, the montado and the pasture areas. The fourth farming system studied was the large-scale specialised farming, demonstrated in the region by the intensive olive groves, corn plantations and irrigated vineyards. Within the scale used for the preference assessment, the value zero indicated a choice for the elimination of a particular farming type from the municipality. The value five indicated a choice for continuation of the specific farming type on the currently occupied area, while the value ten indicated a choice for the agricultural area of the county to be covered exclusively by the particular farming type.

In the last part of the survey, the self-reported levels of subjective well-being (SWB) measures were evaluated. Well-being elicited from individuals through questions about life satisfaction and happiness has been found to have a high scientific standard regarding validity (Pavot & Diener 1993). In the study, direct SWB was measured by self-reported levels of life satisfaction and happiness. The indirect SWB measure included a question about the satisfaction with the municipality as a place to live. The levels of SWB were measured by applying the eleven-point Likert scale.

Study area

The two surveyed rural municipalities (Montemor-o-Novo and Ferreira do Alentejo) are located in the Alentejo region of Southern Portugal. They markedly differ in landscape diversity, land cover dynamics, agricultural type and land management intensity.

The municipality of Montemor-o-Novo is dominated mainly by low-intensity farming systems, in particular, the montado. The montado is a Mediterranean silvopastoral land-use system

dominated by holm oaks (*Quercus rotundifolia*) and cork oaks (*Quercus suber*) covering a broad range of tree stand densities (Pinto-Correia et al., 2011; Godinho et al., 2016). They are recognised for their capacity to deliver a wide number and variety of ecosystem services (Bugalho et al., 2011). In this study area, the management of the montado is mainly focused on livestock production, combined with forest products such as cork and wood for charcoal production.

The county of Montemor-o-Novo also represents a rural area where demand for non-commodity functions such as nature conservation, new and second housing, leisure and recreation, is high. The local landscape quality is recognised, and also the proximity to Lisbon and smaller urban centres such as Évora. In the surroundings of the main municipality town, as well as in the other and smaller localities, the landscape is composed of a unique small-scale mosaic of farm units between 1 and 5 ha, sometimes up to 20 ha. In these complex land use systems, the land cover is dominated by old olive groves, small vegetable plots and fruit orchards, pastures used for sheep grazing, a few plots of vineyards, and dense vegetation galleries along the water lines.

The individual characteristics of the small-scale farmers observed in our study area by Pinto-Correia et al. (2016) reveal a large diversity in profiles. This area is a highly attractive area for newcomers who appreciate the gentle landscape and the proximity to urban facilities (Pinto-Correia et al., 2010), fostering new dynamics in these patches. As a continuation of an old practice, in the town's centre a market where the local food products are sold by the local farmers is open each Saturday morning.

The second case study is the Ferreira do Alentejo municipality. Due to access to an extensive irrigation system from the recently constructed Alqueva dam, the modernised large-scale plantations of olive groves with an intensive agricultural management dominate the landscape in the municipality nowadays. Most of the new olive groves arise in the new irrigation projects of the Alentejo region (INE, 2011). It is also coinciding with the conclusion of the first phase of the irrigation project of the Alqueva and with the decoupling of direct payments from production (Council Regulation (EC) n.º 1782/2003 of 29 September 2003 – CAP reform of 2003, referred to as the Luxembourg Agreement or Fischler Reform).

Data analysis

Data were analysed using the SPSS software v.22. The Spearman's rank-order correlation was run to assess the strength and direction of the relationship between perceived qualities of the local characteristics and self-reported levels of subjective well-being measures.

A descriptive statistics was used to evaluate the preferred occupational changes of the local farming types. Moreover, the independent samples Kruskal-Wallis test was conducted to determine if there were differences in perceived levels of agriculture-related local characteristics between those who answered 'yes' and others. The Kruskal-Wallis H test (sometimes also called the 'one-way ANOVA on ranks') is a rank-based non-parametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable.

Subsequently, for the analysis of differences between the two studied municipalities, the Mann-Whitney U test was used. This test is the alternative test to the independent sample t-

test when data is ordinal. It is a non-parametric test that can be applied to compare two population means that come from the same population, and it is also used to verify whether two population means are equal or not. It is used for similar sample sizes and is used to test the median of two populations.

Finally, the Pearson Chi-Square test was applied to the differences in the perceived contribution of the local agriculture to respondents' well-being between the two localities. This statistical test is appropriate for sets of categorical data to evaluate how likely it is that any observed difference between the sets arose by chance.

Results

206 questionnaires were collected during summer 2015. In Montemor-o-Novo 105 residents and in Ferreira do Alentejo 101 residents participated in the survey. The sample included 107 women and 99 men. The group of respondents included all age classes. The youngest respondent was 18 years old and the oldest was 87 years old.

According to the results from the Spearman's rank-order correlation, there were high positive correlations between several locality characteristics as perceived by respondents and their life satisfaction, happiness and satisfaction with their municipality as a place to live (Table 1). Specifically, the evaluation of abundance in vegetation, animals and birds, of visual landscape, freedom of choice in the food origin, the local knowledge maintenance, and the existing possibilities to interact with local farmers were significantly positively correlated with all three studied well-being measures.

Moreover, the frequency of giving, receiving or exchanging local agricultural products and the perceived contribution of local agriculture to one's well-being were also positively correlated with reported levels of well-being measures.

Regarding the preferred occupational changes of the local farming types, the respondents preferred the highest increase in area with small-scale diversified farming. Large-scale diversified farming achieved the second largest mean rank with a mode value of six which indicated a desire to maintain the existing area of this farming. It was represented mainly by the extensive silvopastoral system, the montado. A similar mean rank was recorded for the small-scale specialised farming, although with a higher mode. Large-scale specialised farming received the lowest ranking level of the assessed farming types. According to the majority of respondents, this kind of agriculture should not spread over its existing occupied area.

Table 1. Spearman's rank correlation between the perceived qualities of local characteristics and self-reported measures of subjective well-being

	Spearman's rank correlation for self-reported levels		
To what extent do you agree with the following statements related to your county?	Life satisfaction	Happiness	Satisfaction with one's county as a place to live
There is a good water and soil quality	-0.072	-0.012	0.212**
There is an abundance of vegetation, animals and birds	0.205**	0.238**	0.220**
I appreciate the visual aspect of the landscape	0.140*	0.165*	0.337***
I feel connected to the local landscape	0.160*	0.134	0.323***
I can freely choose the origin (locality) of the food I consume	0.157*	0.210**	0.351***
The marketing places selling the local farming products are accessible to me	0.153*	0.080	0.310***
The local agricultural products have a good quality	0.116	0.136	0.338***
The local knowledge and skills in farming practices are maintained	0.194**	0.149*	0.296***
There are possibilities to interact with local farmers	0.182**	0.265***	0.314***
I feel that there is a food self-sufficiency when necessary	0.136	0.209**	0.243***
Frequency of receiving, giving or exchanging local agricultural products	0.157*	0.196**	0.173*
Perceived contribution of the local agriculture to one's well-being	0.262***	0.294***	0.378***

Table 2. The preferred development of the four local farming types

	Farming type			
	Small-scale diversified	specialized	Large-scale diversified	specialized
Mean	8.03	7.51	7.67	5.56
Median	8.00	8.00	8.00	6.00
Mode	9	8	6	6
Variance	4.233	3.607	3.861	5.975
Range	10	10	10	10

The perceived contribution of the local agriculture to residents' well-being was assessed through a nominal question with the three following categories: no, don't know and yes. Most of the respondents (51.5%) stated that the local agriculture contributes to their well-being. Fewer (26.2%) responded that they don't know whether local agriculture contributes to their well-being. A comparable number of respondents (22.3%) thought that the local agriculture didn't contribute to their well-being. Figure 1 shows the relation between the perceived agricultural contribution to residents' well-being and perceived local qualities. The group of respondents who perceived their local agriculture as a contributor to their individual well-being, on average also evaluated the local characteristics as having a better quality. As can be seen from Figure 1, the biggest difference between those who perceived local agriculture as a contributor to their well-being and those who didn't was in their access to the local agricultural products, in perceived freedom of choice in the food origin and the possibility to interact with the local farmers.

The independent samples Kruskal-Wallis test was conducted to determine if there were differences in perceived levels of agriculture-related local characteristics between those who answered 'yes' and others. Results show that perceptions of several local characteristics were statistically different between those reporting the positive influence of local agriculture on their well-being and the others. The subsequent description comprises purely the significant differences observed in both case studies. In both studied localities, the answer 'yes' to the contribution of local agriculture to respondents' well-being was significantly ($p < 0.05$) associated with: higher feeling of freedom to choose the food's locality of origin ($\chi2$ (3) = 5.023 in Montemor-o-Novo and $\chi2$ (3) = 5.820 in Ferreira do Alentejo); higher perceived quality of local products ($\chi2$ (3) = 6.162 and $\chi2$ (3) = 5.340); better possibilities to interact with local farmers ($\chi2$ (3) = 10.239 and $\chi2$ (3) = 5.742); and higher frequency of giving, receiving or exchanging the local products ($\chi2$ (3) = 13.898 and $\chi2$ (3) = 9.284). Moreover, the level of life satisfaction ($\chi2$ (3) = 4.283 and $\chi2$ (3) = 4.779) and the level of satisfaction with the municipality as a place to live ($\chi2$ (3) = 6.951 and $\chi2$ (3) = 5.228) was also higher in this cluster of respondents.

Differences between the two municipalities with distinct predominant farming

Because the nature of the local agriculture in the two studied localities was different, the preferences and the perceived contribution of local agriculture to one's well-being were compared between the localities.

Regarding preferred farming changes in the living municipality, the two groups were not very different. The respondents in both municipalities preferred an increase of the areas with small-scale farming as well as the area with a large-scale non-irrigated agriculture. The mean value for the small-scale and large-scale diversified farming and small-scale specialised farming was 8.3, 7.5 and 7.4 in Montemor-o-Novo and 7.8, 7.9 and 7.6 in Ferreira do Alentejo. According to the Mann-Whitney U test the only significant difference in preferences between the two groups was in a desirable change in the area occupied by large-scale irrigated farming. The group of respondents in Ferreira do Alentejo preferred a slight reduction in the area occupied by large-scale specialised farming (mean value 5.1), while the respondents in Montemor-o-Novo preferred the continuation of the current situation (average value six on scale 1-11).

The differences in the perceived contribution of the local agriculture to the well-being of those interviewed were statistically significant between the two localities. The Pearson Chi-Square

value of the comparison was 20.8 and p-value 0.000. In Montemor-o-Novo, where more diversified agriculture predominates, 67.6% of respondents agreed that the agriculture contributes to their well-being. In Ferreira do Alentejo with predominant large-scale specialised agriculture, it was only 34.7% of those surveyed who thought about the positive impact of local agriculture on their well-being. Those who believed the local agriculture doesn't contribute to their well-being were represented by 11.4% of respondents in Montemor-o-Novo and by 34.7% of respondents in Ferreira do Alentejo. Remaining respondents (21.0% and 30.7%) answered that they don't know whether local agriculture contributes to their well-being or not.

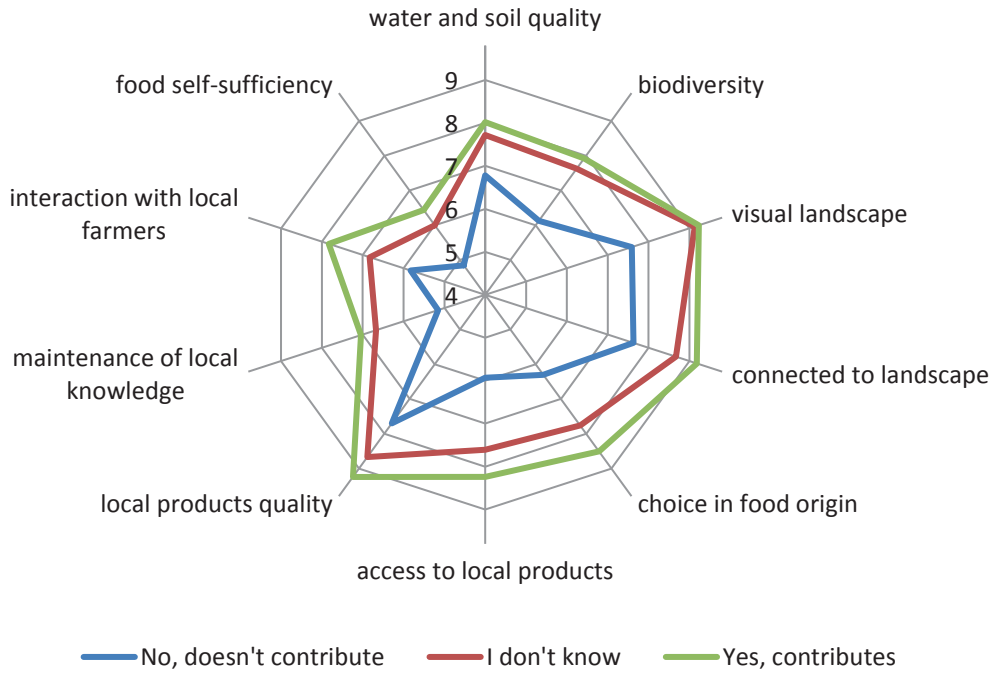

Figure 1. Perceived contribution of local agriculture to individual well-being and perceived qualities of local characteristics.

Discussion

The aim of the paper was to explore the associations between the perceived qualities of local agricultural characteristics and the subjective well-being of rural residents. The quality level of local features in rural areas like environment, landscape, food and social relations are considered to be substantially influenced by the local agricultural practices (e.g. Smith et al., 2012; Westhoek et al., 2013; Wilson & Burton, 2015; Bieling et al., 2014).

As shown in the paper, for residents in Montemor-o-Novo and Ferreira do Alentejo in Southern Portugal, the local food products, agricultural practices, landscape and environment seems to be relevant to their subjective well-being. From the two direct and one indirect measure of subjective well-being assessed in the survey, the satisfaction with one's living place appears to be associated with most of the studied agricultural characteristics.

The local environmental quality, particularly the perceived richness of vegetation, animals and birds seems to relate positively with residents' well-being. The present study also shows a

significant positive correlation between a level of landscape visual appreciation, as well as the level of connection to local landscape and subjective well-being. These findings support previous results of studies connecting landscape and human well-being (Bieling, 2014).

The feeling of freedom of choice in the food origin, the maintenance of local knowledge and skills in agriculture, and the sense of local auto-sufficiency in food are also perceived as qualities positively correlating with well-being of residents. Curiously, the accessibility to local products through marketing centres and the quality of local products is not significantly connected with direct well-being measures in the studied areas. One possible explanation can be that in parallel to marketing centres, an informal exchange of local products between family members, friends and neighbours exists which is not dependent on marketing. Nevertheless, the possibility to interact with local farmers and frequency of receiving, giving or exchanging the local farming products, are significantly positively associated with subjective well-being. This practice can encourage maintenance of the mutually beneficial relationships between rural residents which can be positive for interpersonal trust in rural localities. Trusting social relationships tend to enhance people's subjective well-being (happiness and life satisfaction), and in turn positive feelings of well-being tend to augment cooperation and trust (Tov & Diener, 2009).

The small-scale farming systems could increase in the occupied area according to the rural residents in Montemor-o-Novo and Ferreira do Alentejo. An unchanging continuation of the large-scale extensive farming systems in the studied areas is also desired. This is not surprising as these farming systems are dominant in the region and are embodied by a valuable montado, considered as a multifunctional land use system with important environmental and cultural values for the Alentejo region (e.g. Surová & Pinto-Correia, 2016). Concerning preferences for a large-scale specialised farming, interesting differences between the two localities were observed. Residents in Ferreira do Alentejo, where the large-scale specialised farming has become dominant in recent years, would prefer a diminution of the area occupied by this type of farming. Contrarily, residents in Montemor-o-Novo would not mind if this kind of farming held a slightly larger area in the municipality relative to the current situation. But still, the preferences for small-scale farms are higher.

The preferences for a large-scale specialised farming are not the only perception difference between the two localities. Currently, the proportion of the residents appreciating current local agriculture as a contributor to their well-being is much higher in Montemor-o-Novo than in Ferreira do Alentejo. With this result, a challenging question is arising for research and policy makers related to this changing structure of agriculture and how it affects social well-being, prosperity and sustainability in rural areas (e.g. Smithers & Armstrong 2005; Goldschmidt, 1978).

The present study omits the assessment of relations between the perceived qualities of local agricultural characteristics and subjective well-being of rural residents across different individual socio-economic characteristics, like age, gender and education. This kind of assessment certainly deserves research attention and may be an important lesson for policy and practice. In addition, to put more accurate weight on SWB variance explained by assessed variables, a further statistical analysis would be needed.

Conclusions

What well-being means in contemporary rural areas and what role the local agriculture plays and can play in rural well-being are only a few questions arising in the context of sustainability in rural areas. Certainly the correct answer to the above-mentioned questions will not be the same in all rural localities and will, or should, depend on territorial context and time, involving the social, economic and environmental dimensions.

It is unambiguous that well-being in rural areas is not merely influenced by the agricultural sector alone. Nevertheless, several outputs of local agriculture including environmental quality, landscape, food and social life are significantly associated directly or indirectly with the well-being of rural residents. For policies, it can indicate a necessity to consider local agriculture and its development trajectory as an important issue in rural life quality, even in these days when a smaller proportion of the rural population is engaged in agricultural production. For now, there is a need to assess relationships between farming systems and rural well-being more profoundly across different geographical areas, to gain more robust and generalisable knowledge to enable an improved definition of policies towards a harmony between the sustainability and human well-being.

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Transformation of traditional pastoral livestock systems of Egypt

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Abstract: *Background*: the Northwestern coastal region of Egypt extends about 500 kilometres along the Mediterranean coastline. The pastoral livestock production systems prevail in this area. The zone has witnessed major changes over the last 50 years; demographic growth, urbanisation and degradation of rangelands. More recently, the zone has been faced by drought that has become more frequent*. Objective:* to assess the effect of drought on livestock farming systems and Bedouins' socio-economic vulnerability and to identify the most frequently used adaptive process developed by Bedouins to reduce the negative impact of drought. *Methodology:* a semi-structured questionnaire was used for interviewing 162 randomly selected Bedouins. *Results:* analysis of data showed that drought produces a large number of impacts that affect the Bedouins' economic standard of living. The annual sheep and goat productivity declined by 18.03% and 8.33% respectively. Furthermore, the returns on capital invested in sheep and goat production were significantly reduced by around 47% and 34% respectively. The analyses showed that a significant relationship exists between the Bedouins' socioeconomic characteristics and the encountered challenges ($p < 0.05$). Breeders have developed different adaptive mechanisms against drought conditions such as decreasing flock size, supplementary feeding , changing herd composition ,early marketing of their lambs/kids and migration of family members to urban areas . *Conclusion*: more emphasis should be given to improving livestock productivity and proper utilisation of Bedouins' resources. It is important to take into consideration socio-economic factors that influence small ruminant development programmes to enhance their success.

Keywords: Agro-pastoral system, survey, drought vulnerability and adoption process.

Introduction

The Coastal Zone of Western Desert, Egypt (CZWD) is historically a pastoral zone with the raising of livestock as the main socioeconomic activity. Economic survival of the people of the region depends on management of sheep and goats, beside cultivation of barley and some fruits e.g. olives and figs. There are several million head of sheep and goats, which contribute substantially to the Bedouins' income and nutrition and are used as subsistence and survival reserves in years of drought. The zone has witnessed major changes over the last 50 years; demographic growth, urbanisation, touristic development and agro-ecological diversification. More recently, the zone has faced a long drought period from 1995 to 2011, with low erratic rainfall (< 150 mm). Scarcity of rainfall has affected farming systems and household livelihoods. This study analyses the impacts of this long drought period on the livestock farming systems and the adaptive processes developed by breeders to cope with it, highlighting the socioeconomic factors that affect sheep and goat enterprises' profitability.

Material and Methods

Study design

The primary data were collected from a total of 162 households from June to February 2010 up to August 2011 using a survey based on structured questionnaires. The structured questionnaire contained questions regarding socio-economic characteristics of households, flock management and dynamics, animal productivity, input and output parameters and annual production costs and revenues. Secondary data are based on the Animal Production Research Institute survey which was carried out in 1995 in approximately 240 households. This was a year of average rainfall.

Study area

The study was carried out in the Coastal Zone of the Western Desert of Egypt (CZWD), which extends from Alexandria in the East to the Libyan border in the West. It is classified as an arid zone. Pastoralists and agro-pastoralists are the dominant economic activity.

Data analysis

Microsoft Excel was used to analyse the data. Descriptive statistics such as percentages and frequencies were employed. The profitability of sheep and goat enterprises were evaluated on the basis of returns on capital invested .The general linear model (GLM) in SAS 9.3 (SAS Institute, 2012) was used to evaluate the effect of the different socioeconomic factors on sheep and goat enterprises' profitability.

Results and Discussion

The effects of drought on livestock farming systems and Bedouins' socio-economic vulnerability

Effects of drought on animal feed resources

Grazing months ranged from 3.39 to 4.12 in an average year (Table 1). In the dry year, grazing months ranged between 0.34 and 1.23 months. More seriously, with the poor range conditions, breeders had to provide supplementary feeding during the grazing period (0.55 kg/head on average). Consequently the breeders rely on concentrates for animal feeding all year round, plus available roughages (mainly wheat and barley straw). The unit cost of feeding has been multiplied with the high increase in the prices of the imported concentrates. Digambar (2011) reported that as a result of severe drought there was a direct impact on the growth of palatable grass species and the regeneration of fodder species in pasture.

Table 1. The effects of drought on animal feed resources

Character	Average year	Dry year
Grazing period, month:		
Natural ranges	3.39 -4.12	0.34-1.23
Crop residues	2.28-2.77	0.0
Supplementary feeding, kg		
During grazing on:		
Natural ranges	0.0	0.55
Crop residues	0.49	0.96
Out of grazing	0.91	0.96

Effects of drought on livestock holdings

Bedouins have developed different adaptive mechanisms to reduce the negative impact of drought such as, decreasing flock size, raising more goats and selling their lambs / kids directly after weaning (Table 2). Over the drought period, average flock size has been decreased from 140.7 to 87.23 heads (-38%, Table 2). Most of the breeders limit the sale of animals to cover urgent needs such as the purchase of animal feeds or basic family expenditure. The mature female percentage in the flocks increased from 33.20 to 46.81. Goat percentage in the flocks increased from 13.25 to 29.84%. The proportion of immature males (13.58%) in an average year was about five times higher than that in a dry year (2.77%).

Table 2. Effects of drought on livestock holdings

Character	Average Year	Dry Year
Herd size (heads)	140.7	87.23
Herd composition (%)		
Cattle	2.70	0.0
Sheep	79.23	64.18
Goat	13.25	29.84
Camel	4.82	5.98
Flock age structure (%)		
Mature females	33.20	46.81
Mature males	1.90	1.68
Immature females	21.73	16.66
Immature males	13.58	2.77
Progeny <4 months	29.86	32.08

Effects of drought on animal performance

The effects of drought on the sheep and goats' performance are presented in Table 3. The annual sheep and goat productivity declined by 18.03% and 8.33% respectively. Furthermore, the returns on capital invested in sheep and goat production were significantly reduced by around 47% and 34% respectively. Findings from Abate (2009) showed that the drought and delay of rainfall led to increased mortality of livestock, vulnerability to diseases and physical deterioration due to long distance travel for water and pastures. The study revealed that goat production was more profitable than that of sheep in dry years. According to Ahuya et al. (2005), the profitability of goat production emanates from the fact that goats require less feed and eat agricultural by-products that are of low value, hence the low production costs.

Table 3. Effects of drought on small ruminant performance

Character	Average year	Dry year
Productivity		
Sheep (kg lambs/ewe/year)	25.35 [a]	20.78 [b]
Goat (kg kids/doe/year)	20.66 [a]	18.94 [b]
Return on capital		
Sheep (%)	17.91 [a]	9.39 [b]
Goat (%)	15.73 [a]	10.38 [b]

Means in the same row with different superscript letters differ significantly at p < 0.05

Effects of drought on household source of income

Under dry year conditions, livestock production contributed 71.6% to the household income. The contribution of crop production to household income in dry year is practically zero, while off-farm incomes contribute 25.9%. La Rovere and Aw-Hassan (2005) reported that the country's most vulnerable households are those that depend solely on livestock production.

Table 4. Effects of drought on household source of income

Source of income	Average year	Dry year
Agriculture	2.5	39.4
Livestock (%)	71.6	52.1
Off-farm income	25.9	8.5

The effect of the different socioeconomic factors on sheep and goat enterprises' profitability

Most of farm and household characteristics showed a positive and significant relationship with the profitability of sheep and goat enterprises in the dry year (Table 5). Prokopy et al. (2008) showed that education levels, capital, income, farm size, access to information, positive environmental attitudes, environmental awareness, and utilisation of social networks were positively associated with adoption and use of technology. Sulo et al. (2012) showed that primary occupation, annual income and household size had a positive and significant association with agriculture technologies adoption. On the other hand, results indicate that whatever the differences in characteristics between the farms in the average year they did not seem to cause significant variation in the profitability of sheep and goat enterprises.

Table 5. Factors affecting the profitability of sheep and goat enterprises

Factors	Average year		Dry year	
	Relationship	P	Relationship	P
Farm characteristics:				
Farm size	Positive	P<0.05		NS
Flock size		NS	Positive	P<0.01
Financial incentives		NS	Positive	P<0.01
Extension services		NS	Positive	P<0.05
Marketing distance		NS		NS
Household characteristics:				
Age		NS	Positive	P<0.05
Education level		NS	Positive	P<0.01
Family size		NS	Positive	P<0.05
Off-farm job		NS	Positive	P<0.05

NS=not significant

Conclusions

In dry years the contribution of crop production to household income is practically zero and small ruminants provide the main source of household income. Drought adversely affected sheep and goat productivity and feed expense is a major small ruminant production constraint limiting profitability. This explains why very large farmers have fallen below the poverty line in these years. Bedouins made adjustments to their expenditure to reduce the negative impact of drought. Household budget in an average rainfall year was spent on the purchase of food (36%) followed by clothing (16%), school fees (14%), medical expenses (10%), social activities (7%) and other items (17%). Income in a drought year was spent mostly on the purchase of food (78%). Subsidised feed and government supported animal diets may lead to additional revenue for Bedouins through the activity of fattening lambs/kids. Reducing animal feed cost by enhancing crop by-products' nutritive value is also recommended during drought periods. However, there are many different kinds of agro-industrial by-products available in the region, which is seriously under exploited. Investment in rural education can increase return on labour as well as help diversify income. Using poor quality underground water and drip irrigation systems is considered in drought years.

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