

Chapter 5

Agricultural System

The previous chapters have shown a lot of microstructures in the farming sector. Farmers and the other actors in the agricultural chain place themselves in hierarchies in which they dominate in some areas and are dominated in others. On various markets, they trade not only commodities but also labels, occupations and residences. Furthermore, they try to collaborate both in established and in new settings.

Generally, these hierarchical, market and cooperative dynamics apply to both Zambian pastoralists and Swiss Alpine farmers. Nevertheless, in reality, very few parallels exist between these two groups; their agricultural systems differ in almost every respect, also in socioeconomic terms. It is therefore worthwhile to look at agricultural systems as a whole. How do hierarchies, markets and cooperation add up to a real-life context?

Every system can be perceived from various angles, and this multitude will be addressed in this chapter. For example, a system can be perceived from a producer's or from a consumer's perspective, as presented in the following sections. Finally, the chapter will conclude with an 'objective', scientific perspective on agricultural systems.

5.1 Producer Perspectives

Philosophers, particularly if coming from a Marxist tradition, repeatedly emphasized that our social existence determines our consciousness. Thus, it will be useful to begin with a reflection on the social existence of farmers. What distinguishes traditions in farming from traditions in non-agricultural backgrounds? And how do the actual situations in current farming systems shift?

Affected parties usually have a different perception than parties not affected by a system. Thus, Sect. 5.1.2 will deal with empirical studies concerned with the self-understanding of farmers.

5.1.1 *The Changing Environments of Farmers*

We are coming from a past in which almost all humans were farmers. In northern countries, the 19th and 20th centuries were the time that reduced this vast majority to a tiny minority. In southern countries, this process started in the 20th century and is still ongoing.

This simple notion implies that farmers are usually the people in the region who do something similar to what their parents did, and in many cases they do not have to leave the region. As a logical consequence, farmers are more conservative and thus more reluctant toward change than non-farmers. This assumption has been confirmed for seven European countries (Baur et al. 2016), for Korea (Kyong-Dong 2003) and for the USA (Tickamyer 1983). It likely is true for almost every other region in the world.

Societal changes happen, regardless of farmers' resistance toward change. Some of these changes occur far away from most farmers' reality (such as changing attitudes toward homosexuality), but in other cases, the changes occur right on the farmer's doorstep. Such changes can be placed in four broad categories: agribusiness, consumers' demand, commodification and digitalization. Changes in agribusiness and changes among consumers are the two with the broadest validity. Both categories have been mentioned in a different context in previous chapters.

In agribusiness, for example, it has been mentioned that vertical integration, as a matter of hierarchy, increasingly restricts the decisions farmers can make, for example by dictating a lot of production parameters. However, vertical integration is not the only factor restricting farmers' choices. The concentration in the agribusiness sector has a similar effect. Market concentration has been taking place in most sectors of agribusiness, albeit to varying degrees. The degree of concentration in the pesticide business, tractor business and grain trading has always been high and is still growing. In the pesticide and tractor businesses, we still talk about six major market players each; the four largest grain traders cover by now over 90% of the market. This concentration leaves farmers with fewer and fewer choices which products to buy and to which buyer to sell.

The growing market share of hybrid seeds is another case in point subsumed under 'constrained choices' by Hendrickson and James (2005). For a long period, farmers had to make the choice whether to buy seed or to use part of their harvest as seed, which would generate slightly lower yields but save costs. The larger the share of seeds in hybrid varieties, the lower is this degree of freedom because hybrid seeds do not produce fertile seeds. In addition, a growing number of states also have implemented regulations forcing farmers to even pay fees to breeders if they use their own harvest's seeds. All of these developments may be justifiable in respect to innovation empowerment. However, none of them strengthens the farmer's leeway, and none will increase the pleasure of being a farmer.

Consumers' demand for sustainable practices, as discussed in the previous chapter, is a completely different driving force but may have a similar effect. Although conscious consumers can mostly be found in rich countries, their demand also covers the

demand for bananas, coffee and other products that have to be grown in the global south. If farmers have the option to subscribe to labels that allow them to charge higher prices for their goods, the labels usually include additional restrictions: The animals have to be kept in special ways, the application of pesticides is only possible under certain conditions or not at all, or grassland has to be kept uncut until a certain date. The same applies to a growing number of agri-environmental schemes offered by governments mostly in Europe and North America. In some cases, production practices (e.g. keeping cattle outdoors in Switzerland) enable both a higher price through a label and additional public payments. The farmers will always happily accept the money. However, how are they affected by all the additional restrictions?

Burton and Wilson (2006) suppose that the restrictions change farmers' self-perception from productivism toward post-productivism. Although the paradigm of multifunctionality, describing that agricultural activities have all sorts of side-effects shaping society in many ways, has been around for some time, this paradigm may start to slowly alter the self-image of producers. Empirical studies that tested this hypothesis will be presented in the next subsection. Beforehand, the third and fourth categories of changes will briefly be touched. These types of changes are less universal but may considerably shape the development in some agrarian systems. Commodification and digitalization are very different drivers, but their impact should not be underestimated.

Commodification is a development that describes the increasing treatment of the inputs and outputs of agriculture as commodities. In the socioeconomic system of hierarchies, markets and cooperation, it could also be viewed as a development from cooperation to the market. Most scholars concerned with commodification in agriculture consider land as the most illustrative example, particularly in Africa (Bernstein 2007). De Janvry and LeVeen (1986) have been among the first to describe the integration of farming in the institutions of national and international markets, including the market for land.

Whereas the process of commodification can already fully be evaluated, it is certainly too early to fully judge the effects that digital technologies will have on agriculture. Only a few more or less speculative remarks can be made: It is unlikely that new technologies will narrow down the decisions farmers can make. To the contrary, their options of how to organize production should actually increase. However, intelligent technologies will decreasingly rely on human involvement. The farm manager would have the choice to run an automated farm on which the necessary work would be done without a lot of human involvement. If neighbours make the same decision, the size of the farm may have less and less to do with economies of scale. Drones and robots will not care whether they produce wheat on five farms of 20 ha or on one farm of 100 ha.

5.1.2 Empirical Results About Self-perception

If anything should have become clear over the course of this book, it is the strong heterogeneity of agriculture in different parts of the world. US entrepreneurs and Zambian pastoralists, for example, have very little in common. Under these circumstances, is it justified to say anything about self-perception of farmers? Perhaps self-perception of farmers differs too much within and between the various agricultural systems.

The multifaceted reality of farming systems barely allows finding a single term under which self-perception of today's farmers could be summarized. The best term would probably be 'productivist'. In general, farmers like to consider themselves as producers of food more than anything else.

This self-image applies, for example, to Kenya. As Waithaka et al. (2006) showed, Kenyan farmers, when depicting an 'ideal' farm, start dreaming about milk yields 10 times the actual level, or about corn yields 20 times as high as they are. Feed needs are underestimated, whereas animal density is rather overestimated. Such farms are ideal because they generate maximum food yield with minimum effort. The provision of anything else besides food, under these circumstances, is not really part of the picture. The self-image of being a productivist also applies to Ireland, where Howley et al. (2015) showed that farmers are willing to sacrifice additional income to avoid participating in agri-environmental or forestation schemes compromising their production potential.

However, it is crucial to acknowledge that farmers are as heterogeneous a group as people in most other professions. This heterogeneity is nicely illustrated in a study from the USA where Sulemana and James (2014) involved farmers in discourses about ethics. Farmers were confronted with scenarios such as applying pesticides under windy conditions or disposing pesticide containers without rinsing them. The farmers' attitudes differed widely, allowing the authors to categorize parts of their sample as conservationists, others as productivists.

A recent study from Switzerland (Mann 2018) raised the question of how 'green' even conservationists among farmers are. Farmers who subscribed to a public program on no-tillage and stated in a standardized survey conservation as a very important task for farmers would usually be regarded as being conservationists. However, in conversations with this group, this view was strongly challenged. The sequence below, for example, shows that these farmers, at least in some cases, still prioritize intensive production.

Farmer 3 (F3): Yes, and then I did it like that, and then I also worked outside the farm. Now I have arable production and pigs.

Interviewer (I): Yes, OK.

F3: And, er (...) right, since 03 I'm actually doing no-tillage (.)

I: OK

F3: When it actually was prescribed, due to run-off.

I: The district administration has prescribed it, right?

F3: Yeah, prescribed, they have recommended it, so to say, they actually recommended it.

I: Yes.

F3: And I thought, I would plough. Weed, right, problem, right?

I: Yes.

F3: And it is, of course, with the glyphosate that is, of course, (.) simple, I'm saying, no-tillage.

I: Yes, hmh.

F3: And I am always saying, if the glyphosate, the Roundup, we are actually only saying Roundup, if this goes away, ffff

I: Yes.

F3: Then I am seeing problems in arable production, right?

Although the farmer partly restricts himself of throwing in keywords like “weed” and “problem”, the detailed text analysis in Mann (2018) shows how this farmer, as many others, leaves no doubt that he considers production as the primary objective and that he will need tools like glyphosate to maintain this objective.

Environmental conservation, however, is not the only requirement that can challenge the traditional farming perspective. The growing demand for animal welfare is a similar challenge to the traditional image of farmers as mere food producers. Te Velde et al. (2002) nicely showed how the self-images of farmers diverge from consumer perspectives in that respect. Farmers emphasize animals as a tool for production: Animals are supposed to serve for human nutrition, a process facilitated by farmers, and the farmers have no ethical issues with this view. Meat is and remains a necessary part of our diet. Consumers are much more ready to question the legitimacy of killing animals for nutritional purposes, even though their knowledge about the technicalities behind animal production is weak to non-existent. Subsequent studies (e.g. Franz et al. 2012) confirmed that animal behaviour will hardly become one of the main concerns of farmers, so that a gap between farmers’ and consumers’ perceptions is likely to remain.

The many new and extended activities of farmers, commonly known as farm diversification, are likewise challenging the traditional production-oriented view. Brandth and Haugen (2011) offered qualitative insights into this process. In interviews with Norwegian farming couples who are active in agritourism, they demonstrated how offering shelter, food, drinks and stories to tourists changes the self-understanding of farmers. These farmers fully perceived themselves as farmers but broadened the scope of being a farmer in a multifunctional direction.

Another branch of the literature follows the self-understanding of farmers as businessmen. Legally, managers of family farms are businessmen as much as any other self-employed entrepreneur. A Spanish survey (Gonzales and Benito 2001) showed that the majority of Spanish farmers consider themselves as workers (‘trabajador’) rather than businessmen (‘empresario’). A follow-up study in Finland (Vesala and Vesala 2010) allowed its farming respondents to declare more than one identity. That way, only a quarter of farmers explicitly considered themselves as not being an entrepreneur. This comparison shows not so much the differences between

agricultural reality in Finland and Spain, but more so the complexity of farming life, which can hardly be summarized in a single term.

Following the causalities of a considerable number of suicides among farmers in Australia and other countries, Bryant and Garnham (2015) described farm managers as ‘fallen heroes’. They found a large gap between the romantic agrarian mythology of the ‘Australian battler’ who nurtures the population through hard work, struggle and self-sacrifice and the drought-stricken reality of volatile markets. This gap causes shame and despair ending lethally in some cases.

After all, a ‘self-identity that is open to learning, difference and change’ (Lankester 2012, 233) seems crucial for being prepared for the rapidly changing reality in the 21st century. Although this view generally applies to every professional group, the challenge is particularly large for the group of farmers, who over many centuries enjoyed a rather static perception of their duties in society.

5.2 Population Perspectives

Agricultural production, including agritourism or conservation, will always depend on the level of appreciation by the general population. In a way, farmers are on the safe side: As long as humans exist, they will be a very broad target group for food—nobody will be able to survive without food. Nevertheless, a strong dependence on how non-farmers perceive agriculture remains for various reasons.

The first dependency comes with shared localities for production. In developed countries, farmers have become a small minority, also in rural areas. Particularly for animal production, part of their viability will increasingly depend on which practices are tolerated in their neighbourhoods. On the consumption side, although it is true that consumers always have to eat, they are increasingly free to choose the origin of their food and the production system (integrated, organic, etc.). Finally, consumers are also political actors. A few of them are involved in designing new agricultural policy strategies, and many of them take part in elections where (among many other points) various agricultural policies are offered, of which some will generate more benefit to farmers than others.

It may be important to understand farmers’ self-perception. However, to estimate how agriculture will develop in the future, it is arguably more important to understand the claims, hopes and (mis-)perceptions of the general population.

5.2.1 *The Role as Residents*

The issue of allowing or not allowing local production is only raised in regions in which farmers have become a small minority, and therefore is of minor relevance for most developing countries. For the rest, local residents likewise have few concerns with respect to arable farming or grassland production. The main field of conflict

is animal production. One of the first studies in this field (Mann and Kögl 2003) was motivated by the experience of failed investments in northeast Germany. By that time, the animal density in the sparsely populated region was extremely low, so that politicians managed to attract some investors for large-scale (capacity 10,000 animals) pig fattening stables. However, only nine out of the 18 investments were realized, whereas the rest was prevented by local resistance. A combination of a survey and interviews with local mayors revealed some patterns important for acceptance, which differed considerably between villages with investments and villages without investment.

In villages without investment, the economic argument was the main driving factor. If residents believed a pig stable would generate new jobs and added value for the local economy, they would be in favour of it, but not if they did not believe in this economic effect. This economic concern faded as soon as the stables were built. From this time on, environmental factors became important. People who found the odour of pig farms problematic and who expected water pollution were now the ones against the investment.

Another factor that was crucial for the acceptance of the investment project and surfaced in the study was the social integration of the potential investor. Persons with a network in the village, perhaps by being sponsors of the local fire brigade, had much better chances to succeed with their investment project than foreigners with little relation to the target community. A related finding was validated when Soland et al. (2013) analysed the acceptance of Swiss biogas plants: Information offered to the local population increased trust and perceived benefits while reducing scepticism.

Gerlach and Spiller (2008) could not prove that decisions on new stables in rural areas would be based on negotiations. They considered farmers in a position so weak that the lack of clear legal guidelines would prevent many new investments. Given that the economic effects of animal production goes beyond the locality, their point may be an important one. Whereas radioactive waste depositories are often built without majority support of the local population, a society that wants to produce (or at least eat) meat should be able to define mechanisms that enable the investment in efficient production sites.

5.2.2 The Role as Consumers

It may not have been coincidental that the case of pig production was the starting point for our analysis of consumer attitudes. Many critical aspects—animal welfare, pollution and the health effects of meat consumption—culminate in this subsector. Two more publications on consumer attitudes toward pig production, albeit from rather differing cultures, can help understand the dynamics. de Barcellos et al. (2013) asked Chinese consumers about their demands regarding pig production to generate clusters with relatively homogeneous claims. They finally described three clusters. One cluster of consumers focused on food security, largely neglecting quality aspects.

This was the cluster with the lowest consumption but with the strongest preference for Chinese races. The second cluster was labelled as ‘indifferent’ by the authors. These consumers preferred medium-sized farms (i.e. around 400 animals) and placed the largest emphasis on taste, being the most active consumers of pork. The third cluster favoured large-scale industrial production, preferring lean meat imported from Britain.

Weible et al. (2016) followed a very similar objective when approaching German consumers. However, their methodology included a factor analysis beforehand to identify groups of variables describing relevant attitudinal dimensions. These dimensions consisted in a generally critical approach toward pig production, a critical attitude toward farmers, the acceptance of the existent system and a critical attitude toward other persons’ behaviour. The subsequent cluster analysis resulted in the three groups ‘opponents’, ‘moderates’ and ‘the tolerating’; the opponents, for example, scored high in critical attitudes toward pig production, toward farmers and toward other persons’ attitudes but scored low in acceptance of the current system.

By comparing the two studies, one can certainly draw conclusions regarding different attitudes between German and Chinese consumers. However, the two project teams had differing foci. It is no coincidence that the Chinese questionnaires focused on the aspects of food safety and quality, whereas the German survey focused on animal welfare and the share of meat in people’s diets. Both projects caused massive blind spots in their results due to the limited range of questions. This limitation was probably necessary to prevent huge, time-consuming questionnaires, which nobody would want to fill in. However, it remains central to keep the limitations of such focused research in mind.

Comparative research offers the advantage that the same research design can be applied to different systems, as done in a comparison of internet discourses on agriculture led by German or Swiss non-agricultural citizens (Mann 2015). Although the languages overlapped, the internet message boards and newsrooms were sufficiently separated to make this comparison. Both the quantitative and the qualitative part of the study generated the same result: In Switzerland, the discussions focused on the things that could be improved around agriculture. Participants discussed best practice or weather events affecting agriculture. In Germany, discourses had a different focus. Agriculture was more often than not considered as a dangerous black box. Food not produced by organic farmers was thought likely to be harmful, and agricultural production was viewed as harming the environment and animals. Although Swiss discussants also made critical remarks, they clearly moved *within* the system rather than feeling threatened *by* the system. The different agricultural structures could be one clue to understand the differences. The 20-ha farms in Switzerland may still allow at least indirect ties to farmers, whereas this contact may have vanished for a large majority in Germany, where average farms are three times as large.

Certain attributes, of course, can improve the perception of food quality. Chapter 3 repeatedly mentioned that organic production over a long period has done an excellent job to improve this level of trust. However, observations over time indicated that labels advertising production systems, even including organic production, lose importance

over time, while the roles of local production (Moser et al. 2011) and quality grading (Mann and Erdin 2016) increase.

The issue of local production deserves a bit more attention due to the problem of low production site tolerance by the local population mentioned in the preceding subsection. Among a series of studies indicating a general preference among consumers for food produced in their country, Lobb and Mazzocchi (2007) stand out for the width of their approach. They conducted 2725 face-to-face interviews in five European countries and found preferences for domestic production in each. While trying to decompose the preference for local production among US consumers, Darby et al. (2008) found that production ‘within the state’ was similarly important as production ‘nearby’. All this shows, of course, the contradiction between our two roles as residents and consumers with respect to animal-based food: As consumers, we want it to be produced close to where we live. As residents, however, we do not want animal farms too close to our homes.

5.2.3 *The Role as Citizens*

In addition to being residents and consumers, we are citizens. In this role, we are supposed to develop convictions that influence our voting behaviour. In most cases, it is not a party’s stance on agricultural policy that makes us vote for it. Nevertheless, our political attitudes with respect to agriculture are an important component of the socioeconomic system of agriculture.

It may well be that the role as citizen contradicts the role as consumer. The German ‘Agrarwende’ at the beginning of the 21st century is a case in point. At that time, the share of organic products on the market was still around 2%. Then a member of the Green Party became minister of agriculture and announced strong financial support for organic farmers. A survey (Mann and Mante 2003) showed that this political strategy found broad support, even among conservative voters. Apparently, people who were not willing to spend money for buying organic food still seemed to be willing to spend tax money to promote organic food.

Usually, however, our attitudes toward agricultural policy are well embedded in our general belief system. This was shown by a study on the admission of genetically modified crops in Switzerland (Schlöpfer 2008), in which voting behaviour toward a five-year moratorium of genetically modified crops was explained by survey results. The predictive power of sociodemographic characteristics such as education, age or gender was very weak. Related attitudes did a much better job. Respondents concerned about the freedom of research were consistently against such a moratorium, whereas respondents concerned about the health and environmental effects of genetically modified organisms were in favour.

Mittenzwei et al. (2016) attempted to explain the origin of such attitudes and found support for the hot cognition theory. This theory suggests that our culture, the milieu we come from, shapes our attitudes. Knowledge is then only used to find supportive arguments for this attitude, not to change it. Accordingly, the authors found that the

level of knowledge we have about agriculture does little to alter our attitudes toward agricultural policy. Growing up in a rural area and having farmers among your friends are much stronger predictors of your evaluation of farming policies than your related knowledge.

Results by Aerni et al. (2009) suggested that not only do attitudes influence agricultural policies, but also do agricultural policies influence attitudes. They showed that stakeholders in New Zealand, where farmers operate in a free market, pursued a more innovative approach toward the concept of sustainable agriculture than stakeholders in Switzerland, where the state provides conservative political conditions and where maintaining the status quo has a high priority among stakeholders.

5.3 Varieties of Capitalist Agriculture

After presenting perspectives through the eyes of others, it may now be overdue to return to the diversity approach as presented in Sect. 1.3. Although authors writing about the varieties of capitalism have defined emerging forms of market economies, the analysis of the varieties of capitalist agriculture is still due. What should be the differences in the approach?

The agricultural sector strongly depends on land; furthermore, it is older than the industrial and service sectors and it targets basic needs. Thus, some of the characterizing variables of agriculture will probably be different from those of other sectors. This claim becomes clearer when we apply the five core blocks of variables proposed by Amable (2003) for the farming sector.

One case in point is the wage labour nexus used to characterize varieties of capitalism. In developing and developed countries, family farming is the dominant form of production. This implies that wage-dependent labour has a far lower impact than in other sectors. The organization of financial systems may also have some importance for the organization of farming, but financial services are a sector of their own, distinct from agriculture. The main tools of social policy are primarily of relevance for urban areas (Todaro and Stilkind 1981; Mann 2005), so that the focus of these policy instruments is not appropriate for an understanding of agriculture. Education may be more relevant for agriculture than the indicators mentioned above, but probably less so than for other sectors. Hence, four of the five blocks used by Amable (2003) to characterize the diversity of capitalism are of very limited use for describing the agricultural sector.

From Amable's set of choices, the product-market-regulation variables may be the most relevant ones for the farming sector. The level of protection in agriculture is markedly higher than in the other two sectors (Josling 2000; Morley and Piñeiro 2007; Matsumura 2008). Of 1 Dollar earned, sometimes more than 50 Cents come from tax money, mostly through direct transfers to farmers and market support. This fact, of course, has grave consequences for the entire sector and individual farming strategies.

Agricultural economists widely acknowledge that governments differ greatly in their support of agriculture. Brunstad et al. (1999), for example, recall Norway, Switzerland, Iceland, Japan and Finland as the ‘biggest spenders of OECD’ (p. 541). This finding is regarded either as welfare-destroying misbehaviour (Tyers and Anderson 1988; Hertel and Keeney 2006) or as a conscious strategy or view labelled as multifunctionality (Paarberg et al. 2002; Wüstemann et al. 2008). Multifunctionality emphasizes the importance of environmental amenities provided by farmers in addition to mere food production.

Potter and Tilzey (2005) identified three types of discourses in agriculture: neoliberalism, where most interventions in the sector are viewed as being welfare decreasing; neomercantilism, where national sectors attempt to protect themselves from foreign export interests; and multifunctionality, where public intervention is considered as internalizing the external effects of agriculture. However, Mann (2016) claimed that only neoliberalism and multifunctionality, due to a strong welfare–economic theoretical backbone, would qualify as paradigms.

There is thus a strong normative discourse among agricultural experts about the ‘right’ strategy for their sector. The lessons to be learned from the debate around the diversity of capitalism—complementarities that allow for certain characteristics of a society and not for others—have not yet been learned in the farming sector. It is therefore worthwhile, before closing this book, to leave aside the normative debate and empirically analyse the existing diversity of capitalist agricultural systems. Scholars concerned with empirical work on the diversity of capitalism have generally used cluster analysis to identify similar patterns among countries (Amable 2003; Farkas 2011; Schneider and Paunescu 2012). There is no reason to change this approach when shifting attention from the national to the sectoral level. However, there is a reason to start afresh by identifying appropriate variables for our purpose.

5.3.1 Selection of Variables

As mentioned in the previous section, governmental support plays a significant role in shaping the agricultural sector. In particular, tariffs for food imports and direct transfer payments to farmers are instruments which are still broadly applied to protect domestic production. The producer support estimate (PSE) by the OECD (2016) has been for many years a widely accepted measure used to quantify the support given to the farming sector. Although the PSE is measured in absolute money terms, it becomes more meaningful if set into relation with gross farm revenues. This number, the percentage PSE, describes how many cents of one dollar a farmer owes to the state’s agricultural policy.

In some countries, not only producers but also consumers benefit from generous public policies making food more affordable. Producer and consumer support estimates add up to the total support estimate (Tangermann 2004; OECD 2016). If set into relation with the country’s gross domestic product, the ratio gives a useful impression of what share of national wealth is used to keep farmers and food con-

sumers happy—or, if negative, how the food sector is used to fund other parts of the economy through taxation, for which Ukraine would be an example.

The size of farms also shapes the agricultural system. Although many possible ways exist to statistically measure farm size (Mann et al. 2013), a global comparison is well advised to focus on acreage. It is obvious that an average Chinese farm with 0.7 ha must be organized along different lines than an average Australian farm with 3200 ha. Lowder et al. (2016) provided an excellent overview of the frontiers of knowledge regarding worldwide farm sizes. Admittedly, for some countries with a strongly bifurcated agricultural structure, the information provided by this variable is of only limited use. For example, Russia and South Africa have two coexisting agricultural systems in their countries: big commercial farms and a large number of smallholders (Greenberg 2010; Lerman and Sedik 2013). The average for these cases is therefore of little importance. However, we accepted this weakness in light of the precious information the variable provides in most other cases. Consequently, we kept South Africa and Russia in the sample.

Another indicator would be trade balances. Agriculture in countries where food is the main export item will have a different status than agriculture in countries where it mainly competes with imports. Most self-sufficiency measures compare calories produced with calories consumed (Pinstrup-Andersen 2009). The Food and Agriculture Organization uses also monetary figures. This value may give a more balanced picture of the trade balance because it considers the value of the traded goods, so we used it for our analysis.

Agriculture is a sector with major environmental impacts, accounting for 9% of worldwide greenhouse gas emissions and being the most important emitter of methane and nitrous oxide (Sensi 2016). The resource efficiency of agriculture has become a central concept for scientists (de Wit 1992; Hayashi 2000; Keating et al. 2010; Altieri et al. 2012) and policy makers. As the Food and Agriculture Organization has collected and published estimates on emissions of nitrous oxide and methane per country, it is useful to set these emissions into relation with the agricultural outputs of the countries concerned, as a rough estimator of environmental resource efficiency.

Last but not least, we included food expenditure per head as a clustering variable. Although food expenditure is usually considered as a proxy for food security (Esturk and Oren 2014) or income (Oyekale and Adesanya 2012) in poorer countries, it does not lose its relevance in wealthier regions. The costs borne by households to feed themselves are a good descriptor of the interplay between food prices on the one hand and purchasing power on the other. The amount spent on food also reflects quality components that are difficult to operationalize and many factors from the agri-food chain that are likewise difficult to grasp.

Table 5.1 Variables used for the description of varieties of agriculture

Variable	PSE (%)	TSE (%)	Farm size (ha)	Self-sufficiency (%)	CH ₄	N ₂ O	Expenditure (US\$)
Explanation	Percentage producer support estimate	Percentage total support estimate of gross domestic product	Average farm size in ha	Value agricultural products consumed as percentage of value agricultural products produced	CO ₂ equivalents of methane divided by food production	CO ₂ equivalents of nitrous oxide divided by food production	Food expenditure per head in US\$
Mean	18	0.88	284	139	0.87	0.69	562
Minimum	-7	-3.05	0.7	84	0.06	0.12	245
Maximum	62	4.57	3243	526	1.88	1.30	1117

5.3.2 Processing of Variables

The variables described in the previous subsection are summarized in Table 5.1. The question for which countries these variables should be collected and processed is answered through data availability and conception issues. On the latter issue, most empirical studies restrict themselves to wealthier countries, because the ‘varieties’ otherwise would often just distinguish poorer from wealthier countries, as Solga (2014) explains.

As another distinction from clustering exercises on general economic characteristics, it does not make sense to treat European countries separately. For more than 50 years, the European Union (EU) has enjoyed a common agricultural policy, so that important characteristics are no longer nation specific, particularly not the degree to which agriculture is subsidized. Therefore, the EU was treated as an entity in the analysis.

K-means (Steinhaus 1956; Jain 2010) as the most established algorithm of cluster analysis was used in Stata. The average farm size was eventually transformed into a logarithmic scale to avoid a too-powerful influence on the outcome. After various attempts, we decided that dividing participating countries into three groups would generate the highest explanatory value.

Table 5.2 Results of the cluster analysis

Cluster	PSE (%)	TSE (%)	Farm size (ha)	Self-sufficiency (%)	CH ₄	N ₂ O	Expenditure (US\$)
1	54	1.2	4.7	84	0.41	0.32	832
2	16	1.5	17.3	120	0.81	0.69	535
3	1	-0.2	127.7	200	1.21	0.91	451

5.3.3 Results

The three clusters are summarized in Table 5.2. Cluster 1 is the smallest of the three, containing Japan, South Korea, Norway and Switzerland. As an average, more than every second dollar earned in these countries is politically induced. This public support apparently comes to farmers by way of direct payments, rather than through artificially high food prices, as can be seen from the moderate total support estimate. As this cluster contains Korea and Japan, two countries with average farm sizes of just over one hectare, it is hardly surprising that this cluster has the smallest farm size. It is the only cluster with net food imports. The differences between the three clusters concerning environmental performance are considerable. It is obvious that Cluster 1 with its protective and small-structured approach produces much lower emissions per unit of production than the other clusters. Per capita expenditures on food are considerably higher than in other countries, and Switzerland (with 1100 US\$ per person and year) holds the top place.

On the other end of the global spectrum, Cluster 3 unites countries that are much more directed toward free markets. It contains New Zealand, Australia, Brazil, Chile, Ukraine, Vietnam and South Africa, with average farm sizes of over 100 ha. These countries come closest to free markets of the global community. As an average, they largely abstain from subsidizing either farmers or consumers, although some participants such as Ukraine (total support estimate = -3.05%) are effectively subsidizing food prices instead of increasing them. Fifty per cent of the food output in these countries is exported to other countries. It seems that the price for this expansive strategy is high emissions per unit of food produced.

Cluster 2, the largest cluster, contains Turkey, Russia, Kazakhstan, Israel, Columbia, China, Canada, the USA and the EU. Although food expenditures per capita are considerably lower than for Cluster 1, Cluster 2 is the group with the highest taxation on food products. All other measures are situated between the two other clusters. There seems to be a broad middle course between a strong export strategy with large farms and cheap food at the expense of the environment and a greener strategy based on small farms, generous subsidies and food imports.

5.3.4 Discussion and Conclusion

The clustering on a sectoral level (i.e. within agriculture) revealed some remarkable results, particularly if compared with cluster results on the macro level as obtained, for example, by Amable (2003). The diversity of capitalism becomes even more diverse when broken down on a sectoral level.

An initial finding is that the clusters on the meso level, at least in the case of agriculture, diverge strongly from the results on the macro level. Canada and the USA, for example, share a cluster in both cases, but on a macro level they join Australia, which in the agricultural clustering (on the meso level) is in a different grouping. In the agricultural analysis, Switzerland is in company with Japan and South Korea, whereas the latter two form a cluster of their own in Amable's (2003) macro-level study.

The results reveal a peculiarity of the agricultural clusters. Compared with clusters from macro-level analyses, the sectoral clusters reveal far fewer geographical patterns. Cluster 1, for example, may be shaped on the one hand by the historical experience that self-sufficiency is a worthwhile goal, and on the other hand by climatic and topographic factors making self-sufficiency difficult. However, Norway and South Korea, for example, have almost no commonality beyond that, neither culturally nor geographically.

It is certainly worthwhile to reflect on both the causes and the impact of these differences. Some scholars have already linked different attitudes to different policies. Aerni (2009) showed that citizens in New Zealand consider agriculture in the context of agricultural competitiveness, whereas Swiss citizens watch new technologies with scepticism when it comes to sustainability aspects. This example indicates that different attitudes among voters might cause different varieties of capitalist agriculture; other branches of the literature also named history as a crucial factor. Spoerer (2015) nicely showed how disadvantaged farmers in the EU managed to make the moral case for a welfare policy in favour of the farming sector. In Australia, where agriculture does not have the traditional face but is rather considered as another entrepreneurial activity, this would not have been possible.

The three clusters provide some added value for the intra-agricultural discourse. For example, the common assumption that Japan, Switzerland and Norway are protective in terms of agricultural trade and pursue the model of multifunctional agriculture is much more often put into a context with the EU than with South Korea (e.g. Brunstad et al. 1999). Thus, the exercise of using sectoral variables for clustering reveals some new patterns.

The results on the sectoral level may be slightly less interesting than those on the macro level, where multi-dimensionality is one of the greatest assets. Finally, the three agricultural clusters can be placed on a rather one-dimensional scale. On one end of this scale, we observe an import-dependent agriculture that enjoys ample subsidies and produces high-priced food but has relatively low emissions per output. On the other end of this scale, a strong and export-oriented sector is doing well without state involvement, while causing environmental pollution. Most countries are

between these two extremes, feeding themselves with some support for the farming community. This finding indicates, as a worldwide pattern, that societies are willing to transfer resources to farmers to substitute imports. When enough food is available for the population, the rationale for this transfer is apparently lost. The connection to the level of pollution certainly deserves increased future attention.

Still, the main advantage identified in the ‘varieties of capitalism’ debate certainly also holds for agriculture. The concept teaches us to emphasize complementarities rather than (sometimes artificial) welfare effects. Thus, worldwide agriculture can be seen as a colourful and rich composition of various fruitful systems.

5.4 Concluding Thoughts on Agricultural Systems

Many socioeconomic systems of organizing food production have been described in this book, both on the micro and on the meso level. Their diversity indicates that agricultural systems may have the potential of successful self-regulation. Based on this conclusion, we could interpret the developments of the last years and decades as follows:

- Liberalization processes in many countries could have been the response of unnecessary inefficiencies in government regulations and a move toward more affordable food.
- The demand for blooming meadows, butterflies and the like in many countries has been answered by agri-environmental programs.
- Mistrust about the side-effects of modern production methods has been met both by growing organic markets and by creating trust through community-supported agriculture.
- A perception of unjust resource allocations between northern consumers and southern producers has led to the fair trade movement.

This interpretation is not a claim that we live in the best of all possible agrarian worlds. The sectoral analyses on the micro and meso levels certainly revealed problematic issues for which solutions still need to be found:

- Many people care for animals today. This care is certainly reflected in the lives of cats and dogs, but hardly reflected in the lives of most pigs, chicken and cows. Animal welfare today is neither conceptually fully understood nor realized to a degree that would suffice for a large part of the population.
- Agriculture contributes to 15–20% of climate change, more so through animal production than through crop production, and little is done to reduce this contribution.
- The share of starving people on our planet has been reduced, but the share of obese people is strongly on the rise. Although the joy of overeating may outweigh the ‘cost’ of a belly, it is likely that we are actually moving away from the social optimum in this respect.

This book was extremely brief on these three aspects, simply due to the lack of promising solutions. However, all three issues could be tackled by reducing meat consumption. There is ample room for agricultural (and other) researchers to develop strategies to overcome these and other challenges.

A socioeconomic perspective, however, will certainly help to tackle these and other contemporary problems of agriculture, as it neither neglects the objective scarcities in the system, nor the cultural setting in which interaction and decisions occur.

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