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Exploring Farming Styles: Analysis of Farm Records in Two Austrian Regions, 1945–1980s*

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I. Introduction

If we were to assess agricultural development in twentieth century Europe, the label 'revolution' comes into mind. In terms of production and productivity growth as well as institutional change, the post-1945 (or, perhaps, post-1939)[1] decades experienced a truly 'agricultural revolution' as part of the agrarian transformation in the past two centuries fostering the industrialisation of

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[1] Tough this paper's focus is on the postwar decades, we regard the wartime years as the initial phase (*Sattelzeit*) of the 'agricultural revolution' in twentieth century Austria, as has been revealed recently by a regional study on Lower Austria: Ernst Langthaler, *Schlachtfelder. Ländliches Wirtschaften im Reichsgau Niederdonau 1938–1945*, 2 vols., habilitation thesis at the University of Vienna, Vienna 2009 (publication scheduled for 2011). For Great Britain a 'state-led agricultural revolution' in the Second World War has been outlined by Brian Short / Charles Watkins / John Martin (eds.), *The Front Line of Freedom. British Farming in the Second World War*, Exeter 2007. For a comparative perspective on both accounts see Ernst Langthaler, *English and Austrian Farming in the Second World War: Revolution or What Else?,* in: Peter Moser / Tony Varley (eds.), Integration through Subordination. Agriculture and the Rural Population in European Industrial Societies, Turnhout 2010 (forthcoming).

society by provision of labour, food and capital.[2] Rural history has recently made progress in studying agricultural development in the twentieth century; however, macro-level approaches prevail due to the international and global scope of these studies.[3] Local and regional studies on this topic are mostly confined to disciplines such as sociology, anthropology and ecology.[4] In this article, we aim to complement the prevailing perspective by a micro-level approach to the postwar 'agricultural revolution', thereby illuminating under-investigated aspects of this 'large issue' in 'small places'.[5] Above all, we focus on the *diversity* of postwar agricultural development, i.e. the various ways farming actors experienced, interpreted and acted upon the natural and societal structures of their rural lifeworlds, thereby reproducing and/or transforming the local, regional and supra-regional agrosystems they were embedded in.[6] If the post-1945 decades, as has been pointed out, 'can be characterized as an agricultural revolution, then farmers were the revolutionaries'[7]. Accordingly, we attempt to 'follow the actors'[8] on their more or less 'revolutionary' pathways through time and space.

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[2] From a political-economic perspective see C. Peter Timmer, *A World Without Agriculture. The Structural Transformation in Historical Perspective,* Washington 2009, 1-12.

[3] See, at the European level, Pedro Lains / Vicente Pinilla (eds.), *Agriculture and Economic Development in Europe Since 1870*, London / New York 2009, and, at the global level, Giovanni Federico, *Feeding the World. An Economic History of Agriculture, 1800-2000*, Princeton / Oxford 2005. See also the twelve-volume book series *Rural History in Europe* being published since 2008 and a reader on rural change in Europe from the 1930s to the 1950s currently edited by Paul Brassley, Leen van Molle and Yves Segers. For a global overview see Ernst Langthaler, *Landwirtschaft vor und in der Globalisierung*, in: Reinhard Sieder / idem (eds.), Globalgeschichte 1800–2010, Wien / Köln / Weimar 2010, 135-169.

[4] We can only give a few 'best practice' examples of recent monographs: From an anthropological perspective see Jane Adams, *The Transformation of Rural Life: Southern Illinois 1890-1990,* Chapel Hill 1994; from a sociological perspective see Christa Müller, *Von der lokalen Ökonomie zum globalisierten Dorf. Bäuerliche Überlebensstrategien zwischen Weltmarktintegration und Regionalisierung*, Frankfurt am Main / New York 1998; from an ecological perspective see Geoff Cunfer, *On the Great Plains. Agriculture and Environment,* Texas 2005; and – as an exception to the rule – from a historical perspective: Joseph L. Anderson, *Industrializing the Corn Belt. Agriculture, Technology, and Environment, 1945-1972*, DeKalb, IL 2009. For a rather journalistic, but nevertheless empirically grounded 'thick description' of a Dutch village in the second half of the twentieth century see Geert Mak, *An Island in Time: The Biography of a Village*, London 2010 (forthcoming).

[5] This micro-historical 'credo' is inspired by Clifford Geertz, *The Interpretation of Cultures: Selected Essays,* London 1973, 22: 'Anthropologists don't study villages (tribes, towns, neighbourhoods …); they study *in* villages.'

[6] As a programmatic outline of our actor-centred approach to rural history see Ernst Langthaler, *Agrarsysteme ohne Akteure? Sozialökonomische und sozialökologische Modelle in der Agrargeschichte*, in: Andreas Dix / idem (eds.), Grüne Revolutionen. Agrarsysteme und Umwelt im 19. und 20. Jahrhundert (Jahrbuch für Geschichte des ländlichen Raumes 3), Innsbruck et al. 2006, 216-238.

[7] Anderson, *Industrializing*, 193.

For actor-centred approaches like this one, the concepts regularly applied by students of agricultural development are of limited value, regardless of a few exceptions.[9] Established approaches evolving from agricultural economics, e.g. the 'induced innovation' model,[10] or rural sociology, e.g. the 'diffusion of innovations' model,[11] tend to conceptualise rural actors in a rather simplistic way: as 'rational' allocators of production factors according to given endowments of land and labour or as 'early' or 'late adopters' of technological innovations. Though factor allocation, adoption of innovations and similar decision-making are central to agricultural development, these models underplay the complexity of farming systems. Therefore, in this article we follow the more holistic approach of *farming styles* which has evolved from actor-network theory[12] as well as the empirically evident diversity of farming.[13] Accordingly, farming styles are internally coherent and externally distinctive 'modes of ordering'[14] of farming systems.[15] They comprise symbolic, social and material elements: at the symbolic level, formal and informal *rules* (instructions, ideals, customs etc.) about how farming is (not) to be done; at the social level, more or less hierarchical *relations* between farming actors and others (members of cooperatives, extension officers, upstream and downstream industries etc.); at the material level, a broad range of *resources* (land, labour, knowledge etc.) applied to agroecosystems. These elements are being interconnected in different ways – even in similar structural settings – through the practice of farming, thereby creating a variety of farming styles as 'socio-technical networks'.[16] In this paper, we focus on the *material* level, i.e. the resources (in orthodox terms: 'production factors') applied

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[8] This principle of actor-network theory is outlined by Bruno Latour, *Reassembling the Social. An Introduction to Actor-Network-Theory,* Oxford 2005, 11 f.

[9] One exception to this rule is: Frank Ellis, *Peasant Economics. Farm Households and Agrarian Development*, 2nd ed., Cambridge 1993, who differentiates varieties of peasant farming with aid of neo-classical concepts.

[10] See Yujiro Hayami / Vernon Ruttan, *Agricultural Development. An International Perspective,* 2nd ed., Baltimore / London 1985.

[11] See Everett M. Rogers, *Diffusion of Innovations*, 5th ed., New York et al. 2003.

[12] See Latour, *Reassembling*, 247-262.

[13] See Jan Douwe van der Ploeg, *Rural Sociology and the New Agrarian Question. A Perspective from the Netherlands*, in: Sociologia Ruralis 33 (1993), 240-260.

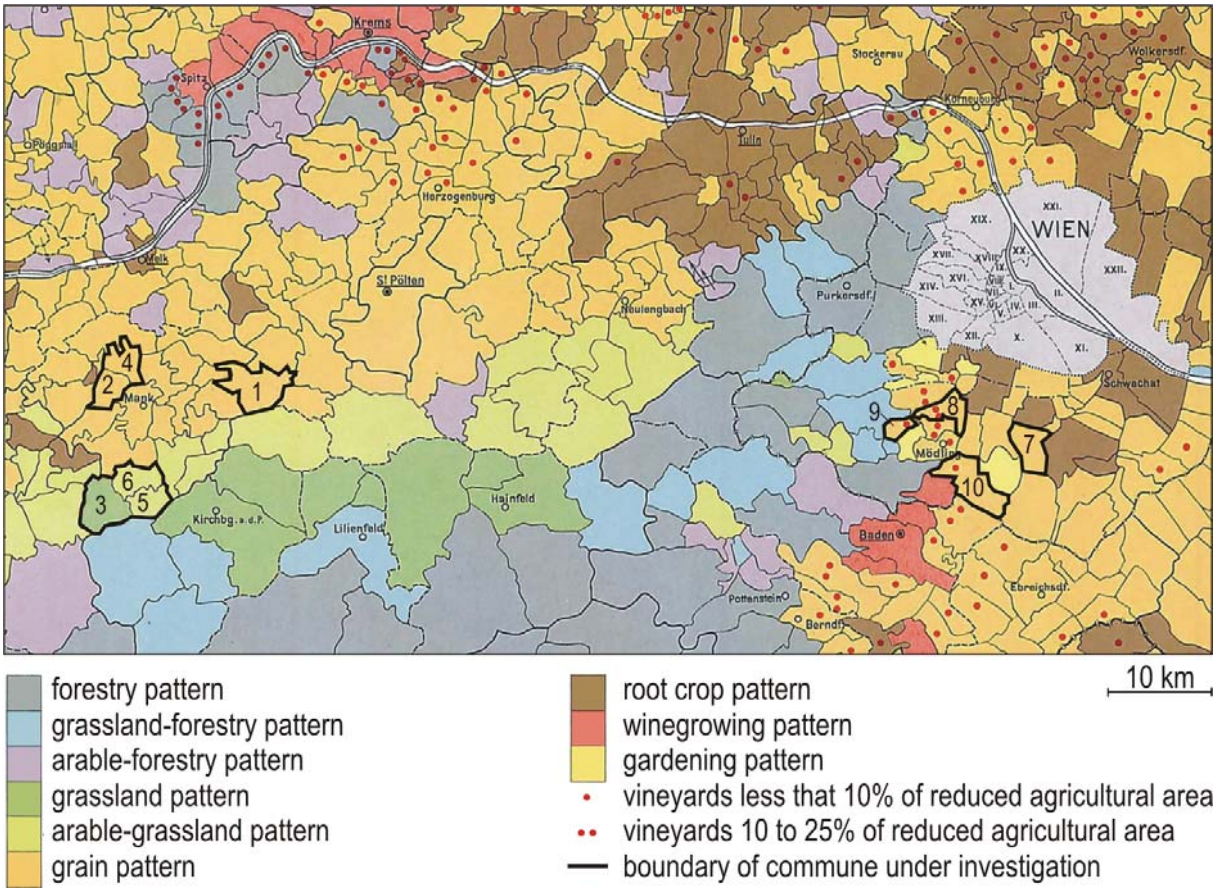
[14] On the distinction between (static) 'order' and (dynamic) 'ordering' see John Law, *Organizing Modernity*, Oxford / Cambridge 1994.

[15] For an introduction to farming systems research see John S. Caldwell, *Farming Systems*, in: Charles J. Arntzen / Ellen M. Ritter (eds.), Encyclopedia of Agricultural Science, vol. 2, San Diego et al. 1994, 129-138.

[16] For a theoretical outline and an empirical application of the farming styles concept see Jan Douwe van der Ploeg, *The Virtual Farmer. Past, Present and Future of the Dutch Peasantry,* Assen 2003, 101-141. For a critical assessment see Frank Vanclay et al., *The Social and Intellectual Construction of Farming Styles: Testing Dutch Ideas in Australian Agriculture*, in: Sociologia Ruralis 46 (2006), 61-82.

to agroecosystems. However, our investigation is closely connected with a parallel study focusing on the symbolic level, i.e. the discourses mediated by the agrarian press.[17] Moreover, both papers are complemented by a subsequent study covering also the social level, e.g. the lifeworlds of interviewees working and living in farming systems in our regions of reference. By integration of the findings of these three investigations, we will finally (re-)construct the complexity of farming styles in our research period and area.[18]

Figure 1: Local patterns of land use in Lower Austria south to the river Danube in 1938



Note: land use data were collected in 1938; the boundaries represent the administrative units in 1951.
Legend for the communes under investigation: Mank region: Bischofstetten (1), Grimmegg (2), Plankenstein (3), Pöllendorf (4), St. Gotthard (5), Texing (6); Mödling region: Achau (7), Brunn am Gebirge (8), Gießhübl (9), Guntramsdorf (10).
Source: own design based on Anton Steden, *Formen der Bodennutzung in Niederösterreich*, in: Erik Arnberger (ed.), Atlas von Niederösterreich (und Wien), Vienna 1952, map 90.

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[17] See Ulrich Schwarz, *Exploring Farming Styles: Analysis of an Austrian Farmers' Journal, 1950s–1980s*, paper to the conference Rural History 2010 in Brighton/GB, September 13-16, 2010, http://www.univie.ac.at/ruralhistory/RH2010_Schwarz.pdf.

[18] For an outline of the research project see Rita Garstenauer / Sophie Kickinger / Ernst Langthaler / Ulrich Schwarz, *Landwirtschaftsstile in Niederösterreich zwischen 1940er und 1980er Jahren – ein Forschungsprojekt*, in: Österreich in Geschichte und Literatur 54 (2010), 86-99.

Our exploration of farming styles in postwar agricultural development is located in Lower Austria, the Austrian province surrounding the capital city of Vienna.[19] We have chosen ten communes in the former judicial districts of Mank and Mödling as research sites out of two reasons: firstly, both regions cover a broad range of agroecosystems, ranging from extensive forestry and grassland farming in Mank to intensive arable farming, gardening and winegrowing in Mödling (Figure 1). The six communes in the district of Mank are situated at the foothills of the Alps and divide into the more mountainous and climatically rough south and the more plane and mild north. The western part of the four communes in the district of Mödling belongs to the Vienna Woods, the eastern part belongs to the Viennese Basin with soils and a climate favouring highly sensitive crops. Secondly, both regions are well documented by 'farm files' (*Hof-* and *Betriebskarten*), i.e. surveys periodically undertaken by the official farmers' organisation of the Nazi state and, later on, the Second Republic of Austria from the 1940s to the 1970s, which were replaced by the electronic farm information system (*LFBIS*) in the 1980s. Our Farming Styles Project Database builds upon the 1944/46, 1952, 1959/60, 1970/71 and 1982/83 surveys.[20] Except for the 1944/46 survey, our dataset differs more or less from the official agricultural censuses with respect to the number of cases by year and region (Table 1): The surpluses of the 1952 and 1959/60 surveys reflect a bulk of smallholdings below two hectares of farmland in the Mödling region not registered in the 1951 and 1960 censuses; we can conclude that these holdings did not conform to the official definition of a 'farm enterprise' (*Betrieb*). The deficits of the 1970/71 and 1982/83 surveys result for the most part from missing files covering a broad range of farm sizes in the Mank region; however, our dataset in total comprises about four fifth of all cases registered in the 1970 and 1980 censuses. This huge body of sources covers a broad range of serial farm and household data, i.e. on location, labour force, family members, land use, crops, livestock, machinery and buildings as well as, in the 1944/46 survey, crop and livestock

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[19] On agricultural development in twentieth century Austria see Ernst Bruckmüller et al., *Geschichte der österreichischen Land- und Forstwirtschaft im 20. Jahrhundert*, vol. 1: Politik, Gesellschaft, Wirtschaft, Vienna 2002; idem et al. (eds.), *Geschichte der österreichischen Land- und Forstwirtschaft im 20. Jahrhundert*, vol. 2: Regionen, Betriebe, Menschen, Vienna 2003.

[20] The originals of the 'farm files' fed into our database are available for the most part at the Provincial Archives of Lower Austria (*Niederösterreichisches Landesarchiv*); in addition, parts of the 1970/71 and 1982/83 surveys are still being stored at the district offices Melk and Baden of the Agricultural Chamber of Lower Austria (*Landwirtschaftskammer Niederösterreich*) and, thanks to the district secretaries' concession, were available for this project. For Mank only the 1944 survey, for Mödling only the 1946 survey is available; therefore, we have merged the 'farm files' of these different, but very similar surveys. Except for the 1952 survey, each 'farm file' encompasses entries referring to two successive years; occasionally, complementary entries (e.g. concerning the farm holder and his or her household) were made in the years after the survey.

yields. All in all, these data reflect the official view of agriculture, shaped by the state's attempt to regulate the sector according to policy goals such as 'food security' in the 1940s and 1950s, 'structural change' in the 1960s and 'rural development' in the 1970s.[21] The historical construction of these sources has to be taken into account for the (re-)construction of farming practices; this applies to the construction of our dataset as well: electronic forms were created according to the original 'farm files', the entries were fed into the database and, finally, the records were interlinked according to the postal address; 'farm files' with identical addresses in different surveys were assumed to belong to the same farming unit.[22] After exclusion of inadequate cases,[23] a total of 3559 farming units or, after record linkage, 1237 units with identical addresses over time entered the dataset of our study.

Table 1: Number of farming units of the project's dataset and the agricultural censuses

	communes in the Mank region		communes in the Mödling region		communes in both regions	
	total units	units < 2 ha	total units	units < 2 ha	total units	units < 2 ha
1944/46 survey dataset	461	71	322	187	783	258
1939 agricultural census	459	–	–	–	–	–
difference	2	–	–	–	–	–
1952 survey dataset	451	57	470	352	921	409
1951 agricultural census	470	61	391	248	861	104
difference	-19	-4	79	104	60	100
1959/60 survey dataset	441	58	447	337	888	395
1960 agricultural census	449	51	321	210	770	261
difference	-8	7	126	127	118	134
1970/71 survey dataset	323	38	221	130	544	168
1970 agricultural census	399	50	229	132	628	182
difference	-76	-12	-8	-2	-84	-14
1982/83 survey dataset	270	12	153	80	423	92
1980 agricultural census	374	28	164	93	538	121
difference	-104	-16	-11	-13	-115	-29

Note: The results of the 1939 agricultural census for the Mödling region were not published because the communes had been incorporated into the province of Vienna. The numbers of cases of the 1970 and 1980 agricultural censuses

[21] See Melanie Kröger, *Die Modernisierung der Landwirtschaft. Eine vergleichende Untersuchung der Agrarpolitik Deutschlands und Österreichs nach 1945*, Berlin 2006, 392.

[22] We found the idea of the 'farmstead' (*Hof*) as a coherent and continuous entity to be inadequate for our special source material, and, moreover, for describing farming practice in general. In order to be as precise as possible, we prefer 'farming unit' to 'farmstead' because some holdings, especially those in the winegrowing areas, only encompass a small parcel of land without any buildings, machines and livestock. Following the concept of farming styles as socio-technical networks, the basis link to identify farming units over time is the farm site (be it a farmstead or simply a plot of land); in unclear cases, we also considered the name(s) of the farm holder(s). On the difficulties of interlinking the farming units over time see section IV of this paper.

[23] These cases comprise farming units with missing data, corporate bodies owning land like communes, companies or associations and large estates which we decided to exclude from our investigation due to our focus on family farming.

in the Mank region have been interpolated due to the consolidation of communes. Due to different minimum levels of farm size (1939 to 1970: 0.5 hectares, except for special cultivation, 1980: 1.0 hectare, except for special cultivation), the figures of the 1980 census are hardly comparable with those of the other censuses.
Source: own calculation based on the authors' Farming Styles Project Database, the 1939 agricultural census of Germany and the 1951, 1960, 1970 and 1980 agricultural censuses of Austria.

In order to provide appropriate answers to our question about the diversity of postwar agricultural development, we have applied a statistical technique for the analysis of the totality of farming units without aggregating them into larger units: *Multiple Correspondence Analysis* (MCA).[24] With aid of MCA, the totality of 3559 farming units (i.e. cases) has been analysed according to a multitude of 76 features (i.e. variables) available in each survey.[25] The analysis positions the cases and values of variables within a multi-dimensional space according to their (dis-)similarities: farming units and features lying in close vicinity are relatively similar to each other; vice versa, a great distance between two farming units indicates relative difference. The first, second, third, fourth and following dimensions of this space indicate differentiating moments of the totality of farming units with decreasing importance. Far from being predetermined by theoretical models, they are explored according to the peculiarities of the empirical dataset – and, thus, have to be identified by interpretation. In short, not the data fit the model, but the *model fits the data.* All in all, MCA provides a powerful tool for the explorative analysis of heterogeneous micro-level data; moreover, it provides a bi-directional interface providing data export for further analyses, e.g. Hierarchical Cluster Analysis (HCA), Social Network Analysis (SNA) or in-depth case studies, and data import of the respective results.

The theoretical and methodological strategy outlined in the introduction guides our exploration as follows: In the second section we explore the ideal-typical directions of the two-dimensional space (re-)constructed by aid of MCA according to the features of the farming units. The third section is devoted to the complex reality of the farming units positioned within this two-dimensional space; by aid of HCA, clusters of farming units deriving from the same survey are compared with regard to (dis-)similarities of their features. In the fourth section the migration pathways of farming units into, out of and between these clusters are mapped by aid of SNA and

[24] See Brigitte Le Roux / Henry Rouhanet, *Geometric Data Analysis. From Correspondence Analysis to Structured Data Analysis*, Dortrecht 2004. MCA has become prominent in the humanities through, among others, the lifestyle studies by Pierre Bourdieu, *Distinction. A Social Critique of the Judgement of Taste,* Cambridge et al. 1984.

[25] MCA processes nominal ('qualitative') data; therefore, metric ('quantitative') data have to be transformed through classification. In addition to the entries in the 'farm files', we have also created new variables. Whereas 'livestock units' and 'labour force units' have been calculated according to contemporary conversion keys, we have calculated 'tractor units' according to contemporary purchase price relations in order to quantify the stock of machinery.

detailed by exemplary cases. In the conclusion we evaluate our findings and their contribution to the overall aim of our research project – the historical exploration of farming styles.

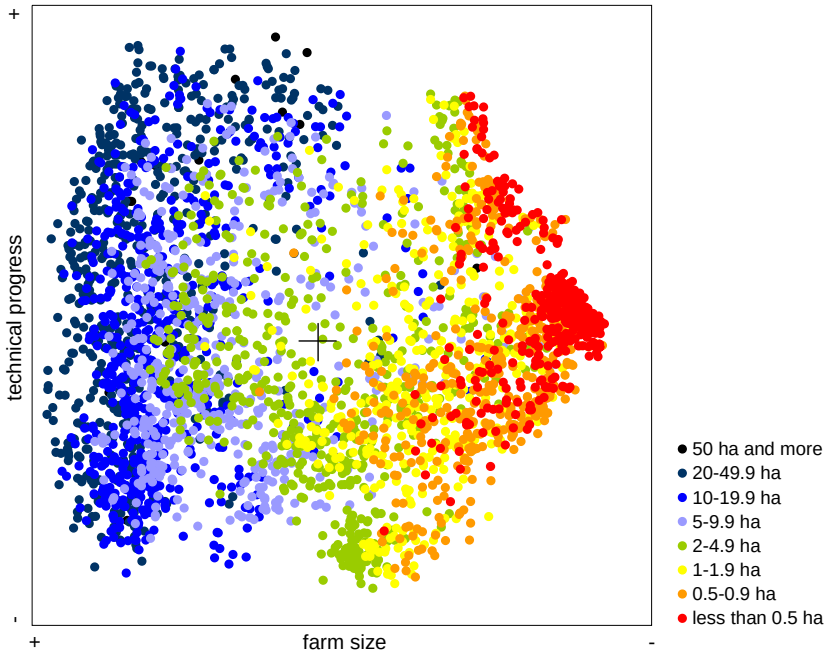
II. The timespace of farming

The analysis of our dataset by aid of MCA shows that the first and second dimensions of the multi-dimensional space explain 53 and 12 percent, together 65 percent, of the modified variance of the scatter plot. For this reason, we confine our analysis to these two most explicatory dimensions, even if investigating further dimensions would broaden and deepen our findings. The two dimensions can be interpreted as two geometrical axes, which describe two distinctive moments of our research subject. The first and most important dimension arranges the farming units basically according to *farm size,* i.e. scale in terms of both cultivated area (Figure 2) and livestock (Figure 3). As size belongs to the crucial features of farming systems,[26] it is not surprising that MCA detects it as being the most distinctive moment. Farmland and livestock are two assets which, though interrelated, represent different ways of measuring the size of a farm.[27] The size of grassland farms in the mountains, mostly oriented towards cattle breeding, is best measured by the number of livestock units due to large amounts of extensively used farmland such as pastures and forests; in contrast, for arable farms in the plains the cultivated area is a better measure of size. However, MCA moves beyond simple categorisations according to either farmland or livestock to combine both measures into a more complex gradient of farm size.

[26] See Caldwell, *Farming Systems*.

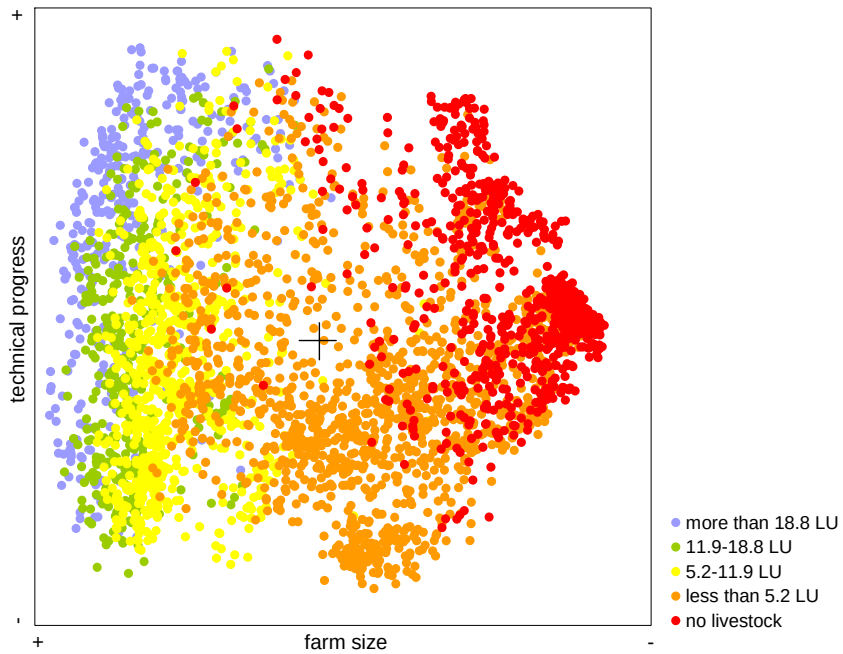
[27] On measuring and other economic aspects of farm size see Robert Eastwood / Michael Lipton / Andrew Newell, *Farm Size*, in: Prabhu Pingali / Robert Evenson (eds.), Handbook of Agricultural Economics, vol. 4, Amsterdam et al. 2010, 3323-3397.

Figure 2: Farming units within the two-dimensional space classified by cultivated area (ha)



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Figure 3: Farming units within the two-dimensional space classified by livestock units (LU)



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Regarding the arrangement of the farming units along the first dimension of the two-dimensional space, it is obvious, that further aspects go along with the farm size gradient. Farms well equipped with cultivated land and livestock are characterised by diversified forms of land use, combining arable land, grassland, forests. The distribution of arable crops does not deviate considerably from the average. The livestock is also mixed, with cattle having the largest amount,

followed by pigs and, more rarely, horses. In contrast, small farms and smallholders are characterised by specialised forms of land use. On the one hand, we can find rural households combining subsistence farming with non-agricultural occupations. On the other hand, specialised cash crop producers such as gardeners, fruit growers and winegrowers enter the scene. Small farms and smallholders usually have little or no livestock, except for some goats, pigs or hens for their own need. As a lot of these farming units are situated in the Mödling region, the existence of a labour market in the nearby urban and industrial areas facilitates the combination of farm and off-farm work. According to the segmentation of the labour market by gender, the cultivation of the small parcels of land is often done by women, while men earn money through off-farm wage work.[28] Moreover, winegrowers show a high business discontinuity which reflects the separation and re-combination of plots of land in case of land transfers between parents and children.[29]

A further aspect of the first dimension which needs to be mentioned is the construction of our dataset. The farm records of the smallholders regularly lack data, above all with regard to workforce, built infrastructure and landed property relations. They have been filled out less completely than the farm records of the large, medium-sized and even small farms. Consequently, we assume that the first dimension – besides farm size – also reflects a hierarchical relation between the farm owners and their legal representation, the Chamber of Agriculture. In contrast to the holders of larger farms, smallholders were not regarded as the Chamber's core clientele and, therefore, were registered less carefully; they were even considered not to be 'real peasants'.[30]

Let us turn to the second dimension of the two-dimensional space reflecting *technical progress*, i.e. the increasing stock of technical (in our case: mechanical) capital in the course of time.[31] Most obvious is the temporal arrangement of the farming units according to the surveys 1944/46 to 1982/83 (Figure 4). As some features of the farming units have not been registered uniformly over the whole period (e.g. the categories of machines), a certain consolidation affects the cases belonging to the same survey. Nevertheless, besides this bias, the chronological

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[28] On the relation between family farming and labour markets from the view of development economics see Ellis, *Peasant Economics*, 123-145.

[29] See Erich Landsteiner / Ernst Langthaler, *Ökotypus Weinbau: Taglöhner- oder Smallholder-Gesellschaft?*, in: Franz Eder et al. (eds.), Wiener Wege der Sozialgeschichte: Themen – Perspektiven – Vermittlungen, Vienna / Cologne / Weimar 1997, 183-224.

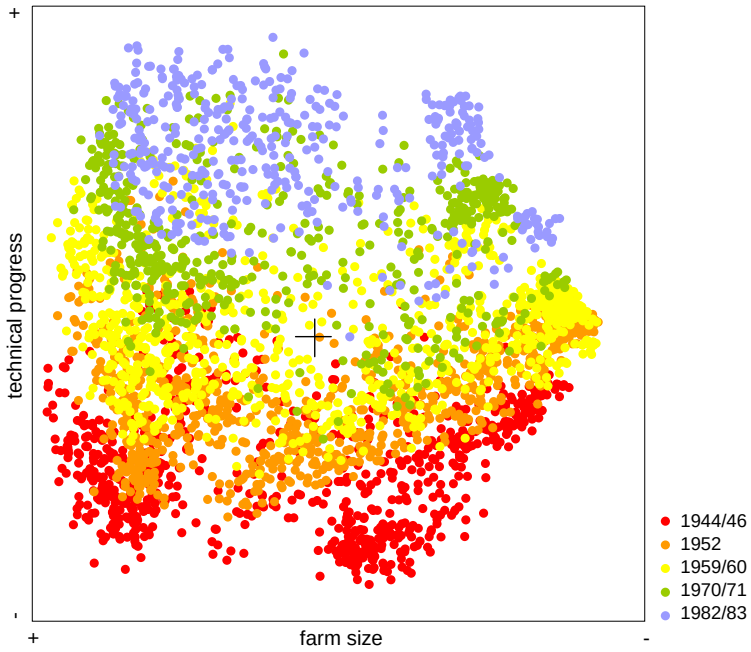
[30] A telling example of this pejorative view is the evaluation of Lower Austrian winegrowers as not being 'real peasants' by a functionary of the official farmers' organization in Nazi Germany in the 1940s. See Langthaler, *Schlachtfelder*, vol. 1, 133.

[31] For an economic assessment see Prabhu Pingali, *Agricultural Mechanizatiom*, in: Robert Evenson / idem (eds.), Handbook of Agricultural Economics, vol. 3, Amsterdam et al. 2007, 2779-2805.

arrangement of the farming units according to the survey periods points to a major development. It is characterised by the accelerated substitution of machine power for human and animal muscle power, the transition from an (via photosynthesis) energy producing to an (via use of fossil fuels) energy consuming metabolic regime, the change from the reproduction of agricultural factors to the consumption of industrial products. In short, this development reflects 'technical progress' which is expressed, in the narrow sense, by absolute and relative increases of the stock of machinery. In particular the diffusion of tractors bears special significance: while in the early years tractors are extremely rare, in the later years one, two or more tractors are usually registered (Figure 5). In a broader sense, technical progress also involves built farm infrastructure such as fodder silos, dung sites and liquid manure pits.

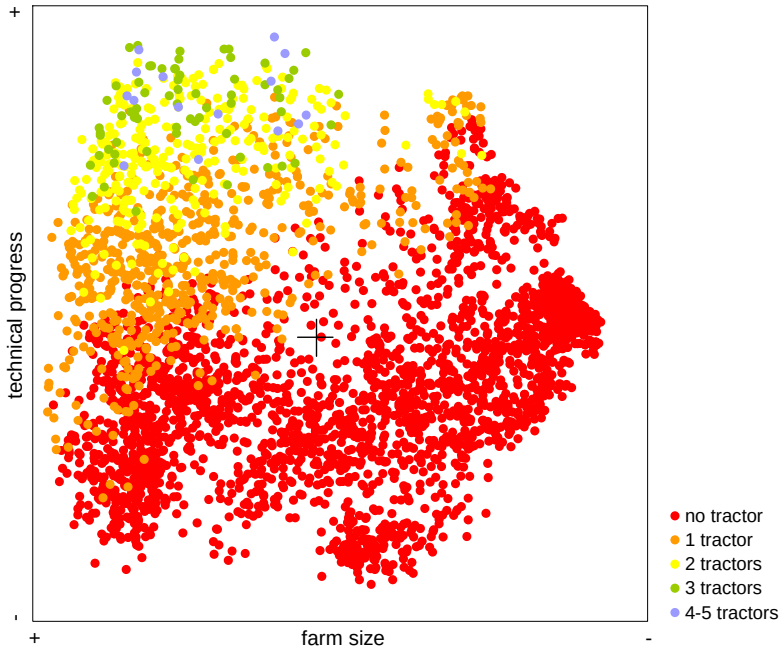
Technical progress does not diffuse equally over time, but in a differentiated way according to certain conditions. Naturally advantageous locations as prevailing in the district of Mödling – i.e. the plain area and a dense network of transport routes – promote mechanisation. Though the natural conditions in the district of Mank are not particularly unfavourable for mechanisation, it is hindered especially at locations lying more than 350 metres above sea level and more than five kilometres away from the next train station. Furthermore, medium-sized to large farming units between 20 and 50 hectares of cultivated area promote mechanisation, therefore indicating economies of scale. Compared to farm size, the proportion of forms of land use is less selective for mechanisation: The adopters of technical innovations include livestock farms with little or no arable land as well as arable farming with few or no livestock; furthermore, we can also find strongly mechanised winegrowing farms in the 1980s. Where mechanisation had not advanced yet, muscle power as the primary source of energy prevails. This is expressed by the importance of draught oxen and, especially in the plain areas, horses as well as permanent and casual family and non-family labourers in addition to the farm owners in the surveys of 1944/46 and 1952. Relatively high livestock numbers in relation to the cultivated land point to the small size of some of these farming units. In this setting mechanisation is mostly confined to mobile motors and equipment for fodder production, which – together with accentuated oats cultivation on the arable land – indicates the importance of draught animals.

Figure 4: Farming units within the two-dimensional space classified by survey period



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Figure 5: Farming units within the two-dimensional space classified by the number of tractors

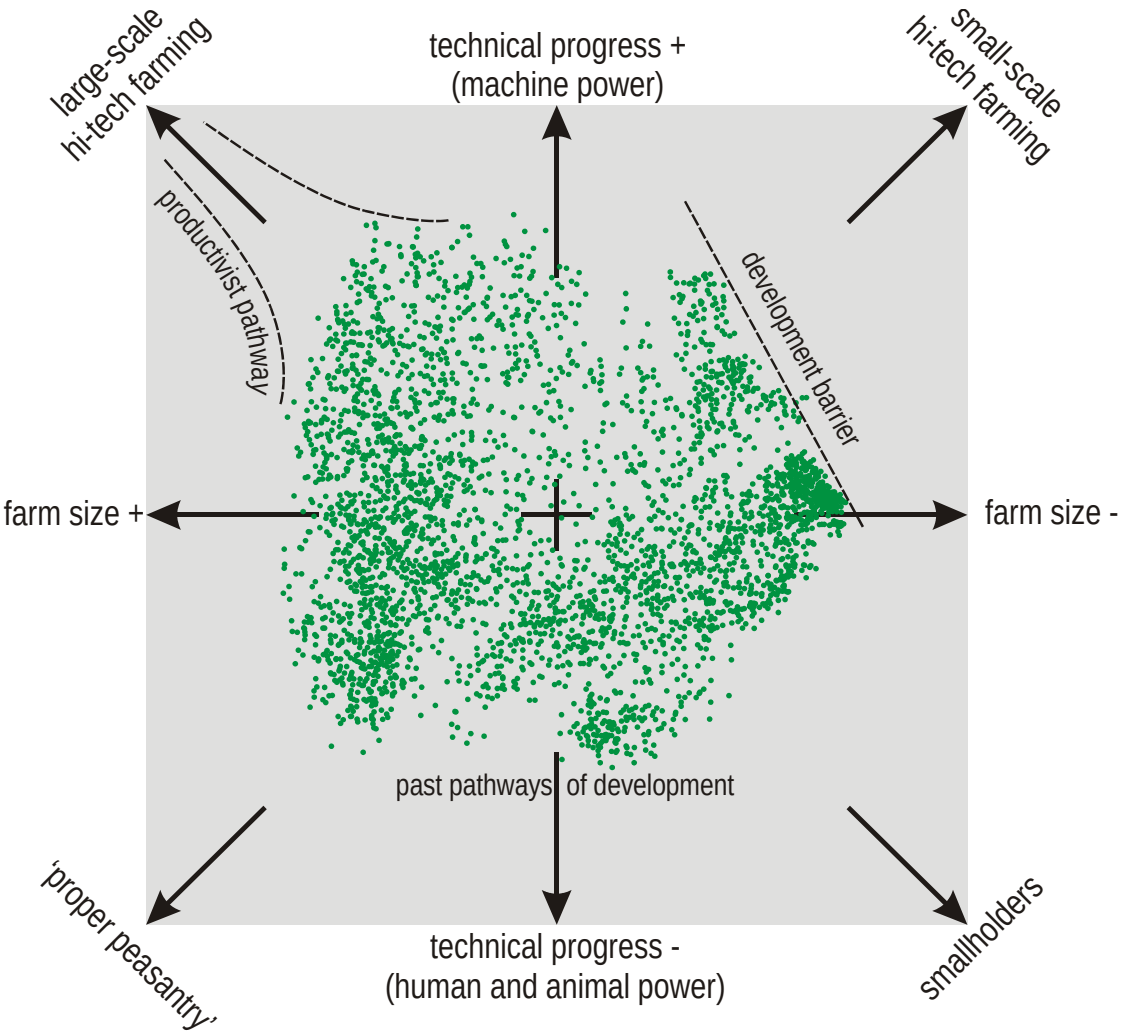


Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Through combination of both dimensions a two-dimensional space emerges, mapping farming systems in the regions of Mank and Mödling from the 1940s to the 1980s (Figure 6). The spatial distribution of farming units also involves temporal aspects. For this reason, we understand the combination of the first and second dimension as *timespace of farming*. Time and space are no

longer considered as separated realms, but as being interwoven in a multidimensional network.[32] The scatter plot illustrating the timespace of farming can be read as a coordinate system with farm size as the horizontal axis and technical progress as the vertical axis. Where the axes intersect, the theoretical position of the 'average farming unit' is located. All farming units obtain their coordinates in this space according to their differences from the average farm size and level of mechanisation over time. Therefore, similar farming units lie close to each other. Dissimilar farming units are located far away from each other. The corners of this space are directed towards ideal types of farming – beyond the reality gathered by our dataset – according to farm size and technical progress.

Figure 6: The timespace of farming in the regions of Mank and Mödling, 1944/46–1982/83



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

[32] See Jon May / Nigel Thrift, *Introduction*, in: idem / idem (eds.), TimeSpace: Geographies of Temporality, London et al. 2001, 1-46, here 5: '[…] the picture that emerges is less that of a singular or uniform social time stretching over a uniform space, than of various (and uneven) networks of time stretching in different and divergent directions across an uneven social field.'

In the lower left corner we meet the 'traditional' mixed farm of the 1940s in the less advantaged locations of the district Mank, well equipped with farmland and cattle – in short, the *'proper peasant'*. The level of mechanisation is low; instead, the production relies on human and animal labour force in the form of draught oxen as well as family and non-family labourers. As arable farming and livestock farming are strongly integrated, land use is diversified. The proportions of the sorts of land use and field crops equal the total average of all years and regions. Vis-à-vis, the upper right corner points to the 'modern' specialised farm in Mödling in the 1980s without any livestock – in short, *small-scale hi-tech farming*. The cultivated area consists predominantly or fully of vineyards in climatically advantageous locations. The labour intensity per unit of cultivated area is above average. Due to the tension between the high level of mechanisation and the small farm size, this vanishing point includes a development barrier, marking the boundary between profitability and unprofitability. Turning to the lower right corner, we find the 'traditional' *smallholder* keeping only small animals (pigs, sheep, goats or hens) for self-supply. Here we can find neither machines, nor farming facilities. This direction also represents a blind alley in agricultural development; therefore we cannot find any farming units moving towards this direction. In contrast, the upper left corner points to a particular agricultural future project: the productivist 'megaproject'[33] of *large-scale hi-tech farming* as debated with regard to the 1968 Mansholt Plan of the EEC.[34] The highly mechanised farm of the 1980s, well-equipped with farmland and cattle, depicts the vanishing point of this direction.

With regard to the distribution of farming units in this two-dimensional space, certain push- and pull-forces become apparent. While the hardly mechanised lower half of the space depicts past paths of development, the increasing mechanisation in the upper half points to future trajectories. Farm size proves to be a limiting factor of technical progress: beyond a certain frontier, small farm scale and the need to mechanise become so contradictory that farming is abandoned. However, the metaphors of 'push' and 'pull' are quite misleading; they underestimate the farming actors' agency vis-à-vis these forces. In order to explore this 'field-of-force'[35] more carefully, we have to 'follow the actors'. Thus, we now shift our attention from the structures of

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[33] On modernist 'megaprojects' see James C. Scott, *Seeing Like A State. How Certain Schemes to Improve the Human Condition Have Failed*, New Haven 1998.

[34] In 1968, Sicco Mansholt, the EEC Commissioner for Agriculture from 1958 to 1972, proposed a plan for fundamental agricultural restructuring, oriented towards farm sizes large enough to provide satisfying farm incomes. Though the original plan was not realised, it fuelled the debate about 'structural change' in and outside the EEC – also in Austria. See Rosemarie Fennell, *The Common Agricultural Policy. Continuity and Change*, Oxford 1997, 207-239.

[35] For the concept of a 'societal field-of-force' see Edward P. Thompson, *Eighteenth Century English Society: Class Struggle Without Class?,* in: Social History 3 (1978), 133-165, here 151.

the timespace of farming to the *practices* of the farming actors navigating within this both structuring and structured framework. Before following their paths over time, we carefully examine their farming styles at a particular time according to the material features captured by our dataset.

III. (Dis-)Similarities of farming style features

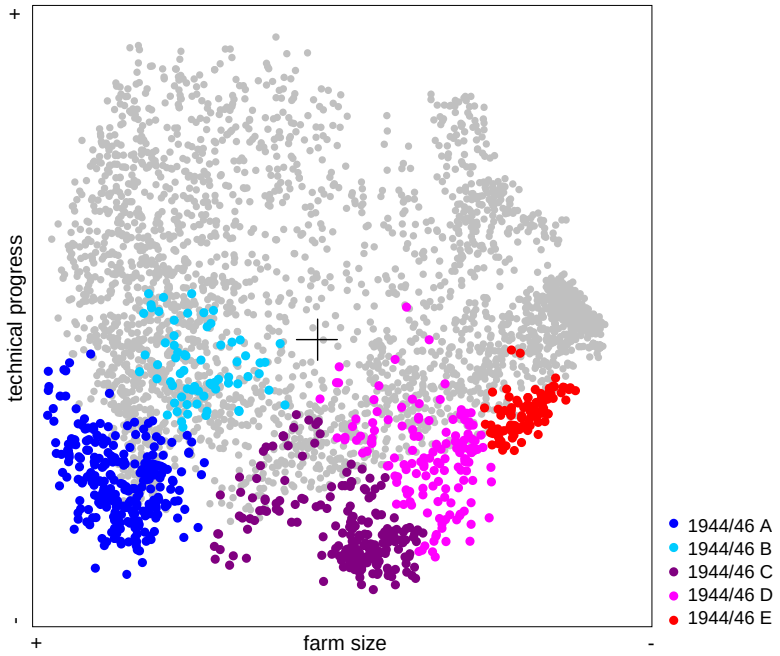
In the scatter plot showing all farming units under scrutiny, we have paid attention to the distribution of single variables such as farmland size, livestock units or stock of machinery. In order to get a grip on all variables simultaneously, we group the cases according to their (dis-)similarities by aid of HCA.[36] As farming styles refer to a particular development pattern,[37] we group the farming units by survey period. We obtain four to five clusters for each period of reference from the 1940s to the 1980s. These clusters are, according to the method, specific for the respective period. However, since they also refer to the same totality, each of the 23 clusters can be compared with any other. In the following passage, this twofold mode of examination is applied for each cluster.

Let us begin with the clusters from the 1944/46 survey (Figure 7). Their position within the scatter plot can be read according to their relation to the dimensions. The first dimension represents a gradient from large to small farm size; the second dimension represents a progressive degree of farm mechanisation over time. Accordingly, we find the clusters from the earliest survey period at the bottom of the scatter plot. However, the farming units of the 1940s differ substantially in mechanisation; therefore, some cases scatter vertically into the top half of the plot.

[36] We apply Ward's HCA. As a measure of similarity, we use the x- and y-coordinates from the scatter plot resulting from MCA, which represent the Euclidian distance between the specific variable profile of any given case and the average variable profile. For the optimal number of clusters, the 'elbow-criterion' is applied.

[37] See Ploeg, *Farmer*, 111.

Figure 7: Clusters of farming units from the 1944/46 survey



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Table 2: Features of the cluster 1944/46 A-E

features	1944/46 A	1944/46 B	1944/46 C	1944/46 D	1944/46 E
cultivated area (ha)					
less than 0.5	no cases	no cases	(--)	--	+
0.5-0.9	no cases	no cases	-	+++	+++
1-1.9	no cases	no cases	+	+++	++
2-4.9	no cases	-	+++	+	--
5-9.9	++	+++	+	--	no cases
10-19.9	+++	++	--	--	no cases
20-49.9	+++	++	no cases	no cases	no cases
50 and more	++	(+++)	no cases	no cases	no cases
livestock (LU)					
none	no cases	no cases	no cases	-	++
less than 5.19	--	o	+++	+++	++
5.19-11.92	+++	+++	-	(--)	no cases
11.93-18.75	+++	-	no cases	no cases	no cases
more than 18.75	+++	no cases	no cases	no cases	no cases
machinery (TU)					
none	(--)	(--)	+++	+++	+++
less than 0.9	+++	+++	--	--	no cases
0.9-2	-	o	no cases	no cases	no cases
2.1-3.4	no cases	-	no cases	no cases	no cases
more than 3.4	no cases	no cases	no cases	no cases	no cases

Note: LU = livestock units, TE = tractor units, -- = actual frequency strongly below average, - = actual frequency below average, o = average actual frequency, + = actual frequency above average, ++(+)(+) = actual frequency strongly above average, (…) = only one case ('outlier'). The 'average' (i.e. the expected frequency) refers to all 23 clusters of the 1944/46, 1952, 1959/60, 1970/71 and 1982/83 surveys.
Source: own calculation (MCA and HCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Cluster 1944/46 A at the outer left margin comprises farming units of rather large size, but relatively low degree of mechanisation. These mixed farms (i.e. farming units including a farmstead) combined grassland with arable farming, but also forestry. Most of them were located in the hilly parts of the Mank district. Regarding the labour force, family farms with considerable proportions of permanently employed servants prevailed. Livestock comprised cattle, pigs and chicken; while the latter two served for subsistence needs, cattle were raised for market purposes. A combination of subsistence and market production can also be observed on the arable land: while bread and fodder grain were being planted in quantities to cover domestic need, one third of the farming units also cultivated cash crops such as oilseed. Nearly all of the farming units in this cluster owned a few machines – mainly basic devices for arable and grassland farming and motors; tractors were the exception. Mostly, the draught force was provided by oxen, less frequently by horses. Compared to the totality of farming units, the most defining feature of this cluster is the employment of wage labourers, in particular permanent servants. This goes along with high numbers of livestock, mainly cattle, but also a small number of sheep and goats. Among the cattle, the presence of oxen and breeding bulls is distinguishing. Furthermore, a higher proportion of arable land and a smaller proportion of grassland, with some of the fields dedicated to cash cropping, is typical for this cluster (Table 2).

Cluster 1944/46 B comprises farming units smaller in size, but better equipped with machinery. Here we can find medium-sized farms specialising in arable farming. The greater part of the arable land was used for grain growing, but nearly 40 percent of the cases also used a smaller proportion of their land to cultivate sugar beet as a particular cash crop. Half of the farming units also cultivated vines – small proportions in relation to the total cultivated land, but considerable patches given the potential yields per hectare of vineyard. At the time, livestock husbandry was required to cover the need for manure, so all farm holders had some cattle, and most of them kept draught horses. Manpower was mostly provided by the farming family, but also combined with seasonal and day labour. Nearly all of these farms were situated in the naturally favourable plain area of the Mödling district, in close vicinity to the capital city of Vienna, and close to a main railway line. Among the farming units registered by the 1944/46 survey, technical progress was most advanced here: the farms were well equipped with machinery (in particular for arable farming), and one fifth of them already owned tractors; additionally, built infrastructure like fodder silos was widespread. Compared to all other clusters over time, the unique features of this cluster are the employment of temporary labourers and several features connected with the dominance of arable farming: a broader variety in sorts of grains and particularly good equipment with the respective machinery. Also draught horses are specific for this cluster. Interestingly, though cattle was not the main line of production for these farms, the

presence of breeding bulls was above average, while livestock units were overall low. To some extent, the cultivation of sugar beets and the leasing of plots of land in addition to owned land are typical for this cluster.

The farming units of cluster 1944/46 C are considerably smaller and characterised by a low degree of mechanisation. Most of them were small properties below five hectares of farmland run by rural craftsmen and labourers. The labour force was based on the owner or the owning couple; rarely, servants or day labourers were employed. The majority of these farming units were situated in the Mank district, particularly in the mountainous communes; however, the regional divide is less clear cut than in the previous clusters. According to this regional bias, the land use pattern shows a dominance of grassland, arable land (if only to a lesser extent), and, in 35 percent of the cases, forests. On the arable land, grain still took the bigger part in many cases, but root and fodder crops gained relative importance. In very few cases, also cash crops were planted. The livestock comprised cattle in all cases, mostly cows; pigs and chicken serving subsistence needs were also common. Since the 1944/46 survey used a simplified form for units below five hectares of farmland, we lack information on draught animals and machinery. Probably, these assets did not exist in most of these cases. Among the units documented by the extended form, we can find only one farming unit equipped with a device for arable farming; moreover, half of them kept draught oxen or horses. Within the totality, this cluster is distinguished by the small size of the farmland, its specific land use pattern of mainly grassland and a more dominant role of root and fodder plants on the small arable patches. In terms of livestock, the prevalence of cows is a unique feature. The most defining feature, however, is the combination of small-scale agriculture and a craft or wage labour.

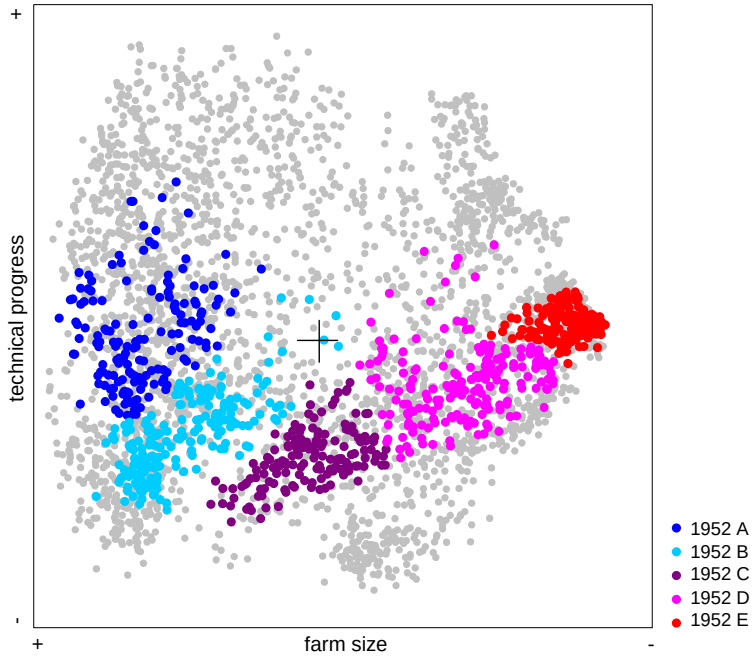
Moving along further to the right, cluster 1944/46 D comprises farming units even smaller in size, but slightly more advanced in technical terms. Similar to cluster 1944/46 C, subsistence farming for family needs was often combined with an engagement in crafts, trade or wage labour. The majority of the farming units belonged to the Mödling district; a few were located in the Mank district. Unlike their counterparts in cluster 1944/46 C, they pursued mixed subsistence agriculture with a focus on arable farming, cultivating a great variety of crops. About 35 percent combined this subsistence farming branch with market-orientated winegrowing. Small livestock prevailed: three quarters of the farming units did not keep any cattle, but poultry, pigs, sheep or goats. The potential manpower was rather strong in relation to the small scale agriculture as a consequence of pluriactivity. Accordingly, wage labourers were scarcely hired. Due to the simplified forms for farming units smaller than five hectares, the machinery is as difficult to judge as in cluster 1944/46 C; however, there is electric infrastructure documented for some cases. The distinguishing features of this cluster in contrast to all others are very small farm

sizes from 0.5 to two hectares, the occurrence of rare crops like corn, vegetables or other cash crops, small livestock and the combination of agriculture and winegrowing.

Cluster 1944/46 E at the outer right margin of the spectrum comprises specialised winegrowers and gardeners with mostly less than one hectare of cultivated land, all of them situated in the district of Mödling. It is due to these cases that we use the terminology 'farming unit' rather than 'farm' or 'farmstead'. Quite often, we find persons pursuing agriculture on their own account, but without the necessity of maintaining a farmstead, machines or draught animals. Even cellar and wine press could be spared, if the harvest was sold to other wine producers. It was typical for this location in the close vicinity of urban product and labour markets to manage a single vineyard not as a full-time occupation, but in combination with wage labour, crafts or trade. Furthermore, a particular gender structure went along with such small scale vineyards. While the large and medium-sized farms usually featured a male head of business (though property was most likely commonly owned), the small vineyards were often owned and managed by women. The domestic name for these winegrowers, *Hauer*, refers to an essential tool for soil working, the hoe. In fact, the technological requirements for small-scale wine growing were low. Since pest control in viticulture had become obligatory in the aftermath of the phyloxera infestation in the late nineteenth and early twentieth centuries, the technological standard of winegrowing had increased.[38] However, in 1946, the *Hauer* of the Mödling region were registered by the simplified forms for smallholdings, therefore no information on machines is available. Judging from the poor machine equipment of similar farming units in the subsequent survey period, it is most likely that they did not own any noteworthy machines or devices. About 40 percent of the farming units included arable land used for planting vegetables and, to some degree, potatoes. Animal husbandry was pursued in dimensions to cover subsistence needs; 60 percent of the holdings kept poultry, sheep or goats and pigs. Family members provided the main source of labour force. The number of potential workers per farming unit was high: we can assume that most of the family members earned their income through wage labour or other activities. Only 5 percent of the units, among them the few commercial gardeners, seem to have depended on agricultural income only. Hired labour was used in few cases, mostly temporarily. The most defining features of cluster 1944/46 E in comparison to all other clusters are the cultivation of vegetables and an acreage of 0.5 to one hectare.

[38] For Lower Austria see Erich Landsteiner, *Wein und Weinbau in Niederösterreich im 19. und 20. Jahrhundert*, master thesis at the University of Vienna, Vienna 1986.

Figure 8: Clusters of farming units from the 1952 survey



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Table 3: Features of the cluster 1952 A-E

features	1952 A	1952 B	1952 C	1952 D	1952 E
cultivated area (ha)					
less than 0.5	no cases	no cases	no cases	+	+++
0.5-0.9	no cases	no cases	-	+++	++
1-1.9	(--)	no cases	++	+++	-
2-4.9	--	+	+++	-	--
5-9.9	+	+++	++	--	no cases
10-19.9	++	+++	-	--	no cases
20-49.9	+++	+	--	--	no cases
50 and more	+++	no cases	no cases	no cases	no cases
livestock (LU)					
none	(--)	(--)	no cases	++	+++
less than 5.19	--	-	+++	++	-
5.19-11.92	++	+++	-	no cases	no cases
11.93-18.75	+++	+++	--	no cases	no cases
more than 18.75	+++	--	no cases	no cases	no cases
machinery (TU)					
none	--	--	+++	+++	+++
less than 0.9	++	+++	--	--	no cases
0.9-2	+++	--	no cases	(--)	no cases
2.1-3.4	+	no cases	no cases	no cases	no cases
more than 3.4	--	no cases	no cases	no cases	no cases

Note: LU = livestock units, TE = tractor units, -- = actual frequency strongly below average, - = actual frequency below average, o = average actual frequency, + = actual frequency above average, ++(+)(+) = actual frequency strongly above average, (…) = only one case ('outlier'). The 'average' (i.e. the expected frequency) refers to all 23 clusters of the 1944/46, 1952, 1959/60, 1970/71 and 1982/83 surveys.
Source: own calculation (MCA and HCA of 3559 farming units) based on the authors' Farming Styles Project Database.

In the following survey period, most clusters are similar to one particular cluster of the 1944/46 survey in respect to the two dimensions defining our scatter plot – farm size and degree of mechanisation (Figure 8). To be clear, the farming units forming an earlier cluster are not necessarily identical with those of a similar cluster of a later survey period. However, as is shown in the next section of this paper, there may be considerable migrations of farming units from one cluster to another similar one.

Cluster 1952 A is situated closer to the left margin than the corresponding cluster 1944/46 B, indicating that the leading group in mechanisation and built infrastructure comprises more large farming units. Cattle breeders from the hilly and lowland areas of the Mank district make a considerable part of this cluster. Accordingly, the highest count of livestock and equipment related to manure preparation are characteristic. What sets this cluster apart from all others is the employment of both family and wage labour, breeding bulls and the cultivation of sugar beets (Table 3).

Like cluster 1944/46 A, cluster 1952 B comprises a number of farming units well equipped with acreage and livestock, but lagging behind in technical equipment, and relying on animal and human labour power. While the majority of the former cluster was medium-sized cattle breeders from the hilly parts of the district of Mank, the farming units of the latter were distributed over both regions. On the fields, grains, root vegetables and fodder prevailed. Compared to cluster 1952 A, in this cluster a slower process of mechanisation is indicated; it was characterised by the combination of motors and dairy machines as well as devices for fodder preparation and transport purposes.

Clusters 1944/46 C and 1952 C are very similar, comprising small scale mountain farming with mainly grassland and smaller acreages of arable land used to cover domestic need, little family labour force and a high degree of part-time farming. Technological equipment was rare. These features are also the most distinctive for this cluster among all.

Cluster 1952 D is also not very distinct from cluster 1944/46 D: small scale tillers and agriculturally active pensioners, labourers, craftspeople and traders with small livestock and poor mechanisation characterise the cluster. Mechanisation had started and a few farming units had already acquired machinery for various purposes. In relation to the totality of clusters, the unique properties are the presence of sheep or goats among the livestock and the cultivation of corn.

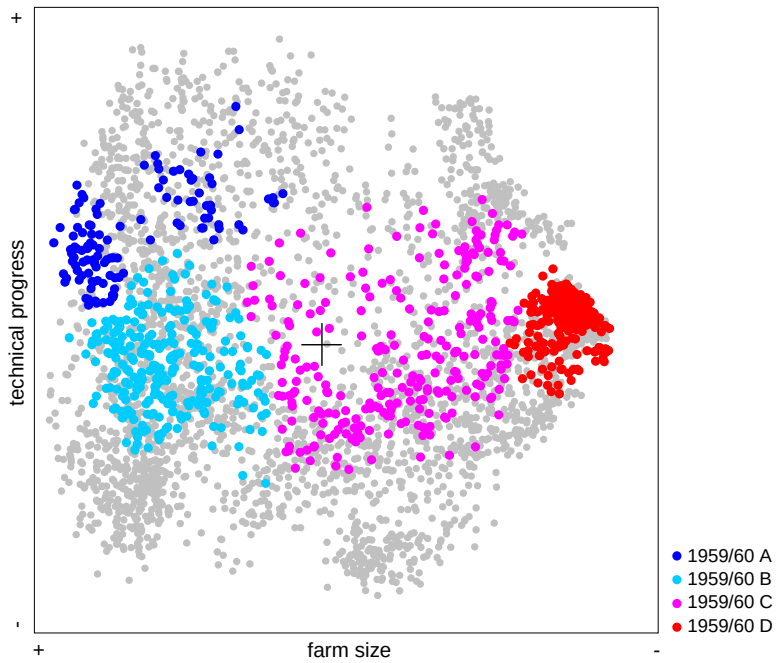
Nor differs cluster 1952 E fundamentally from cluster 1944/46 E. However, arable farming, and with it the cultivation of vegetables, has not been indicated. In 38 percent of the cases, the number of workers per farming unit amounted to no more than two. Due to the minimal capital requirements for this branch of agriculture, taking up the management of a vineyard (and quitting again) was rather uncomplicated. What sets apart this cluster from all other

clusters is the absolute lack of machinery, the lack of electric light in terms of infrastructure, and an above average frequency of married couples without any other labourers running the farming unit.

Cluster 1959/60 A, comprising the then technologically most advanced large and medium-sized farms, is located upwards left-hand in relation to cluster 1952 A (Figure 9). Infrastructure in electricity, tap water and manure treatment facilities were now standard; half of the cases also used fodder silos. Arable farming was practiced by all farming units in this cluster, with grain, fodder and root vegetables on the fields. 74 percent of the farming units cultivated sugar beets as a cash crop. The emphasis on arable farming notwithstanding, only a minority had little or no livestock; most kept cattle with varying aims of production: breeding, feeding or milk-production. The still existing amount of small livestock corresponded to subsistence or complementary market production. Among all clusters over time, the cluster 1959/60 A is distinguished by cultivating sugar beets and keeping beef cattle, by combining family and wage labour and by a high amount of machine capital in diverse branches, with an emphasis on manure management (see Table 4).

Compared to the cluster 1952 B, cluster 1959/60 B has caught up and shares position with the technical vanguard of the previous survey period. The infrastructure for electricity and tap water was available for the vast majority, while one quarter to one third of the farms also had dung sites and liquid manure pits. Machine capital had been purchased in considerable quantities, and more than a quarter of the farming units were already equipped with tractors. Motors made a considerable part of the machine capital, but also machines for arable farming and grass harvest. In particular, motor mowers, machines fit for sloped ground, had become widespread. Furthermore, household machines made a considerable part of the machinery. The composition of the labour force had changed, too: less than 10 percent of the farms employed permanent servants; the larger part of the work was carried out by the farm holders and their families. The regional composition of the cluster has shifted slightly to mountain farmers with an emphasis on grassland. The unique feature of this cluster compared to all others is the high proportion of household machines in overall machine capital. This observation is due to the fact that household technology had arrived at the farms, but the total investment in farm machinery was still relatively low.

Figure 9: Clusters of farming units from the 1959/60 survey



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Table 4: Features of the cluster 1959/60 A-D

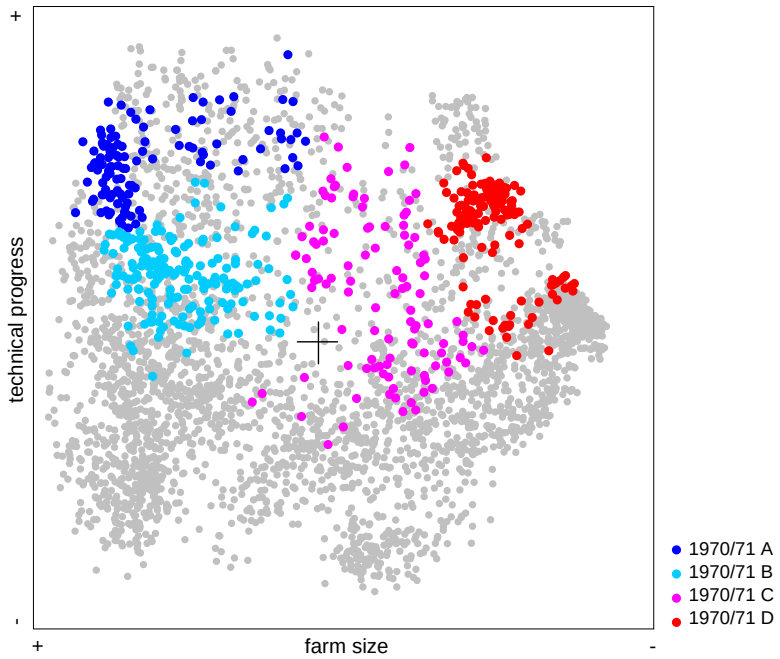
features	1959/60 A	1959/60 B	1959/60 C	1959/60 D
cultivated area (ha)				
less than 0.5	no cases	no cases	-	+++
0.5-0.9	no cases	(--)	++	++
1-1.9	no cases	--	+++	-
2-4.9	(--)	+	++	--
5-9.9	--	+++	-	--
10-19.9	++	+++	--	no cases
20-49.9	+++	-	--	no cases
50 and more	+++	(-)	no cases	no cases
livestock (LU)				
none	--	(--)	o	+++
less than 5.19	--	-	+++	-
5.19-11.92	o	+++	--	no cases
11.93-18.75	+++	++	no cases	no cases
more than 18.75	+++	--	no cases	no cases
machinery (TU)				
none	no cases	--	++	+++
less than 0.9	no cases	+++	-	no cases
0.9-2	+++	+++	--	no cases
2.1-3.4	++++	--	--	no cases
more than 3.4	+++	(--)	no cases	no cases

Note: LU = livestock units, TE = tractor units, -- = actual frequency strongly below average, - = actual frequency below average, o = average actual frequency, + = actual frequency above average, ++(+)(+) = actual frequency strongly above average, (…) = only one case ('outlier'). The 'average' (i.e. the expected frequency) refers to all 23 clusters of the 1944/46, 1952, 1959/60, 1970/71 and 1982/83 surveys.
Source: own calculation (MCA and HCA of 3559 farming units) based on the authors' Farming Styles Project Database.

As the cluster analysis of the 1959/60 survey has suggested only four clusters, comparisons with the clusters of the 1952 survey, especially with C and D, are hardly possible. The cluster 1959/60 C comprises small holdings with mixed land use, focusing both on grassland and on arable farming respectively. Within the scatter plot, this cluster is placed at the centre with a bias to the right. Especially the spread along the vertical axis is remarkable: while the majority of the cases lagged behind in respect of technology, one third had adopted new machinery – mainly equipment for arable farming, transport and pest control. More than one half of the farming units were restricted to the labour force of the owner couple and family members; wage labour was scarcely used. Nearly 60 percent combined part-time farming with other sources of income. This cluster comprises more than average farming units run by single farm holders and their family members. Furthermore, distinguishing features are small farm sizes below two hectares with relatively high proportions of garden land and small proportions of vineyards; furthermore, low numbers in livestock with poultry, pigs and sheep or goats are indicated.

The cluster 1959/60 D comprises the specialised small winegrowers; it is most similar to cluster 1952 E. Arable farming has decreased a bit. No machines are noted in the records. The farming units specialised in commercial gardening have increased in number. Defining features comprise farmland less than 0.5 hectares, high labour intensity and the lack of machinery.

Figure 10: Clusters of farming units from the 1970/71 survey



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Table 5: Features of the cluster 1970/71 A-D

features	1970/71 A	1970/71 B	1970/71 C	1970/71 D
cultivated area (ha)				
less than 0.5	no cases	no cases	(--)	+++
0.5-0.9	no cases	no cases	++	+++
1-1.9	no cases	--	+++	++
2-4.9	no cases	o	++	-
5-9.9	--	+++	+	--
10-19.9	++	+++	--	no cases
20-49.9	+++	o	--	no cases
50 and more	(+++)	no cases	no cases	no cases
livestock (LU)				
none	(--)	--	-	+++
less than 5.19	--	-	+++	-
5.19-11.92	-	+++	--	no cases
11.93-18.75	+	++	no cases	no cases
more than 18.75	++++	o	(--)	no cases
machinery (TU)				
none	no cases	no cases	+	-
less than 0.9	no cases	+	-	+++
0.9-2	-	+++	+	+
2.1-3.4	+++	+++	o	--
more than 3.4	++++	--	--	no cases

Note: LU = livestock units, TE = tractor units, -- = actual frequency strongly below average, - = actual frequency below average, o = average actual frequency, + = actual frequency above average, ++(+)(+) = actual frequency strongly above average, (…) = only one case ('outlier'). The 'average' (i.e. the expected frequency) refers to all 23 clusters of the 1944/46, 1952, 1959/60, 1970/71 and 1982/83 surveys.
Source: own calculation (MCA and HCA of 3559 farming units) based on the authors' Farming Styles Project Database.

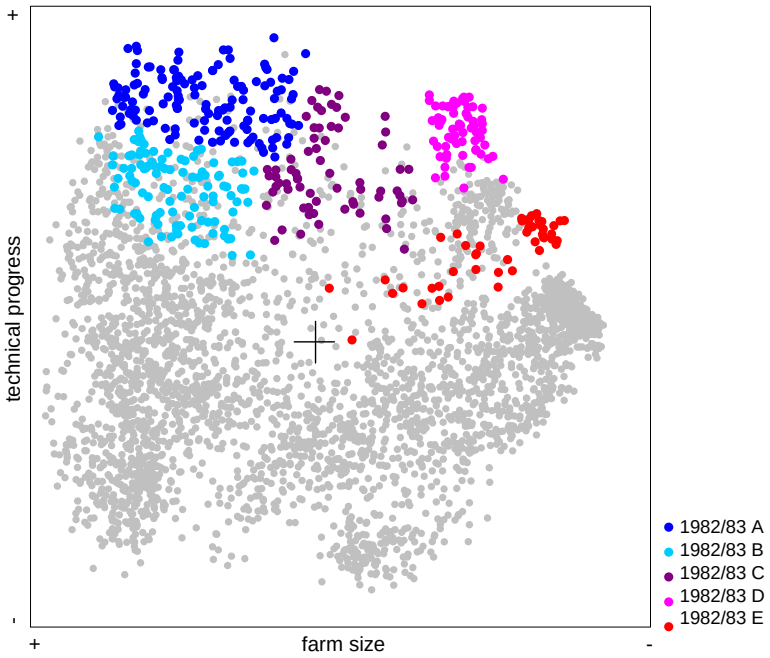
Within cluster 1970/71 A, a tendency towards uniformity can be observed (Figure 10). Most of these large, well-mechanized farm units oriented their production to animal husbandry, with a clear tendency towards fattening. Animals such as draught horses and oxen and breeding bulls are not registered anymore. The cattle counts are the highest among all clusters of this survey. While small livestock was mostly kept in dimensions to fit for subsistence needs, a few farming units had already specialised on pig- or poultry-fattening. On the fields, the ratio between grains, root vegetables and fodder had reached a striking degree of uniformity: the smaller part up to one fifth was used for root vegetables (mainly sugar beet), 10 to 30 percent were used for fodder crops and the rest was dedicated to grains – mainly wheat and barley. This pattern is also reflected in the unique properties of this cluster among all: equipment with green fodder silos, highest counts in livestock and in particular beef cattle and dairy machines indicate the tendency towards intensive animal husbandry; minimal acreages used for rye and the absence of potatoes among the root vegetables indicate the tendency towards uniformity on the fields. Two interesting features also lie above average: the possession of two or more tractors and the lease of farmland. (Z-Rate?) (Table 5)

The cluster 1970/71 B is different from cluster 1970/71 A mainly with respect to mechanisation; in terms of farm size, both clusters share a similar range. More than in any of the previous periods, the peripherally situated grassland farmers from the mountainous part of the Mank district contribute to this cluster. Despite the predominance of grassland with small proportions of forest land, nearly all farms had some arable land used for grains, root crops and fodder plants. Livestock counts are rather high in this cluster, with a clear dominance of cows, indicating an orientation towards milk production. The proportion of beef cattle has also reached a considerable quantity. Like in cluster 1970/71 A, draught animals and breeding bulls were not present on the farms anymore; instead, tractors have become common. Machine capital comprised mainly tractors and motor mowers, but, if only less frequently, also machines for grass harvesting, transport and dairying. Family farms, mostly run by holder couples with the help of their family members, prevailed. The distinctive features of this cluster are relatively high proportions of beef cattle as well as dairy and versatile machines.

The cluster 1970/71 C comprises smaller part-time farming units with mixed land use, irrespective of the predominance of either arable or grassland farming. According to the position of the cluster in the scatter plot, the range of the degrees of mechanisation is much larger than the range of farm sizes. While infrastructure for electricity, water and manure processing was widespread, green fodder silos were rare. Machine capital consisted mainly of versatile machines (tractors and motor mowers); only few farming units had other, specialised machines and devices. While no particular orientation in agricultural production is typical for this cluster, the composition of the labour force is: While most cases operated with married couples and their families, a great share of single holders or couples without additional labourers can be observed. Features above average in this cluster compared to all other are various modes of small-scale agriculture and part-time farming.

Cluster 1970/71 D, comprising specialised winegrowers and some gardeners, shows a clear division between non-mechanised and mechanised farming units. For one quarter of the cases we observe a total lack of machine capital; in contrast, 14 percent even owned tractors. The remaining machine capital of the mechanised winegrowers consisted of devices for pest control, rotary hoes and transport machines. The cluster is distinguished by features characterising this new trend of mechanisation: a high intensity of machine capital per hectare due to the small acreages and high proportions of pest control devices in the overall machine capital.

Figure 11: Clusters of farming units from the 1982/83 survey



Source: own calculation (MCA of 3559 farming units) based on the authors' Farming Styles Project Database.

Table 6: Features of the cluster 1982/83 A-E

features	1982/83 A	1982/83 B	1982/83 C	1982/83 D	1982/83 E
cultivated area (ha)					
less than 0.5	no cases	no cases	no cases	+++	++
0.5-0.9	no cases	no cases	--	+++	++
1-1.9	no cases	--	+	++	+++
2-4.9	--	+	+	++	+
5-9.9	-	++	++	no cases	-
10-19.9	++	++	++	no cases	no cases
20-49.9	+++	++	-	no cases	(--)
50 and more	++++	no cases	no cases	no cases	(+++)
livestock (LU)					
none	--	no cases	++	+++	+++
less than 5.19	--	-	o	--	--
5.19-11.92	-	+++	o	no cases	(--)
11.93-18.75	+	++	no cases	no cases	no cases
more than 18.75	++++	+++	--	no cases	no cases
machinery (TU)					
none	no cases	no cases	--	no cases	+++
less than 0.9	no cases	no cases	-	++	(--)
0.9-2	--	+++	+++	+++	no cases
2.1-3.4	+++	++++	+++	+++	no cases
more than 3.4	++++	+++	+++	(--)	no cases

Note: LU = livestock units, TE = tractor units, -- = actual frequency strongly below average, - = actual frequency below average, o = average actual frequency, + = actual frequency above average, ++(+)(+) = actual frequency strongly above average, (…) = only one case ('outlier'). The 'average' (i.e. the expected frequency) refers to all 23 clusters of the 1944/46, 1952, 1959/60, 1970/71 and 1982/83 surveys.
Source: own calculation (MCA and HCA of 3559 farming units) based on the authors' Farming Styles Project Database.

In the reference period 1982/83 (Figure 11),[39] the cluster A comprising the furthest mechanised farming units is less homogenous in terms of land use and cultivation than cluster A in the previous period. While in 1970/71 intensive mechanisation was characteristic for a particular orientation towards arable farming (however combined with fat stock breeding), in 1982/83 a considerable number of the larger grassland farmers have joined the group of highly mechanized farming units. Labour force was exclusively provided by family members in nearly all of the cases. The number of single farm holders cooperating with family members was relatively high. Similar to the previous period, leasing farmland was a widespread practice. Given the observed distribution of livestock, we recognise a tendency towards high numbers of cattle and specialisation on the other categories in several cases (pig and poultry) or few exceptions (horses, sheep or goats). The unique features of this cluster are high proportions in young cattle (combining fat and breeding stock in this survey), a varied assortment of machines with a high proportion of the machine capital deriving from several tractors and the exclusive presence of the largest farmland sizes with 50 hectares or more (Table 6).

In cluster 1983/82 B, the peripheral grassland farmers of the Mank district predominate. Relatively high amounts of livestock with a high proportion of cows and machinery for dairy farming and manure processing indicated a specialisation in dairy farming. One to two tractors were omnipresent. Small livestock suited to subsistence needs, and, the grassland emphasis notwithstanding, small acreages of arable land with varying types of cultivation were widespread. Family labour and married holder couples were most frequent. 34 percent of the farming units were run part time. The most typical features of this cluster in comparison to all others is a good but not exceptional equipment with machine capital, and machines for transport, manure processing and dairy farming.

Cluster 1982/83 C comprises mainly medium-sized farming units of both the Mank and Mödling districts. No particular pattern of land use could be observed. In fact, land use points to various specialisations on arable and grassland farming as well as forestry – a particular features compared to the other clusters. Similarly, specialisation has been taken place in animal husbandry. The majority of the farming units were moderately mechanised, but also a few cases were exceptionally well equipped with technology. Four out of five cases had one or more tractors. 37 percent of the farm holders gained other than agricultural income.

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[39] Since the data of 1982/83 derive from the electronic farm information system (*LFBIS*) based on the official agricultural census, the survey categories are slightly different in structure compared to the previous surveys carried out by the Chamber of Agriculture. Therefore, the documentation of machinery and livestock is less detailed; for example, no general category for fat stock or beef cattle has been counted.

Cluster 1982/83 D comprising specialised wine producers and gardeners has an emphasis on small farm size: one quarter of the cases featured acreages of farmland between two and five hectares. A considerable part of farmland was leased. The farm units were mechanised, with 56 percent of the cases owning tractors, and 81 percent owning devices for pest control. No single case in this cluster was without machinery. The labour force mainly comprised the holders and their family; the number of potential family labourers was relatively high. 40 percent of the farm holders had an income from off-farm activities or pensions. Only four of the six commercial gardeners within this cluster employed wage labourers permanently. The most defining feature of this cluster is equipment for pest management in various proportions of the total machine capital.

Finally, in the period 1982/83, a cluster E without any structurally similar forerunner emerges. It includes farm units at a range of smallest to medium size, with two exceptions of very large grassland and forest farms with 20 to 50 hectares. More than half of these cases cultivated vines exclusively; the other cases had different emphasis on arable farming, grassland farming and a combination of grassland farming and forestry. Animal husbandry was rarely practised. The potential family labour force was high, but since nearly half of the cases practised pluriactivity, it can be assumed that most of the family members worked outside the farming unit. The common feature of these cases is the lack of machinery; this is also what distinguishes the cluster from all other clusters.

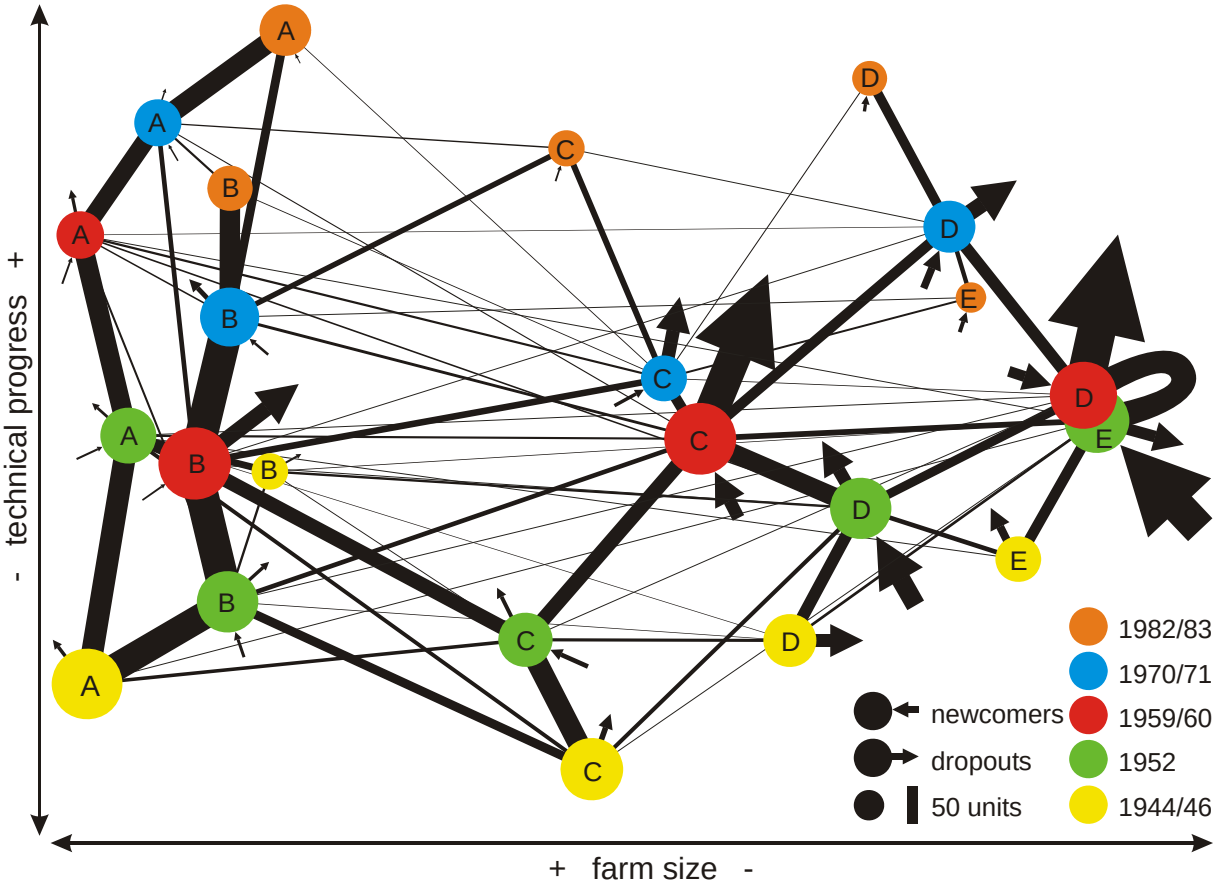
This examination of clusters per research period refers to structural (dis-)similarity due to variations along farm size and mechanisation. From this follows the assumption that similar clusters from different surveys are connected by strong migrations of farming units from one to the other; conversely, dissimilar clusters are assumed to lack any migrations. To what extent these assumptions can be validated by our dataset, is the question the following section aims to answer.

IV. Farming as navigating through a field-of-force

In the previous sections of this paper we have regarded the farming units by year; i.e. each of the 3559 farm records represents one case, regardless of whether it derives from the 1944/46, 1952, 1959/60, 1970/71 or 1982/83 survey. Now farm records originating from different surveys are interlinked according to the postal address of the farming unit, thereby creating 1237 farming units over time. This procedure uncovers that more than three quarters of the interlinked cases are missing in at least one survey. Incomplete cases – i.e. cases represented in less than five surveys – occur due to different reasons: either the farming unit – be it a 'newcomer' or a 'dropout' – did not exist when the respective surveys were carried out due to sale, lease or

conversion between agricultural and non-agricultural use and, thus, had not been registered; or it once was registered but cannot be identified in our dataset, e.g. because the address had changed, contains a mistake or is missing due to loss of files. Be that as it may – at this stage of our project we cannot decide for each case whether the former or the latter reason applies; thus, a rest of uncertainty must be taken into account. However, our findings suggest that the distribution of 'newcomers' and 'dropouts' does not primarily reflect incomplete or wrong data; it refers to a social reality beyond our scientific construction: actors navigating – or 'dancing'[40] – through the timespace of farming.

Figure 12: Development pathways of farming units (in absolute terms)



Note: The clusters are positioned according to the coordinates of their central cases.
Source: own calculation (MCA, HCA and SNA of 3559 farming units) and design based on the authors' Farming Styles Project Database.

[40] For an example of farming as ‚dancing through time' see Ploeg, *Farmer*, 51-100.

Table 7: Development pathways of farming units (in relative terms)

farming systems/styles	number of cases	newcomer-rate	dropout-rate (next survey)	dropout-rate (1982/83 survey)	most frequent path	second frequent path	third frequent path	migration pattern*
	proportion of the number of cases (percent)							
A	259	–	6	28	B (49)	A (39)	C (6)	two-way fork
B	69	–	13	68	A (45)	B (16)	D (16)	multi-way fork
C	202	–	12	67	C (49)	B (20)	D (9)	two-way fork
D	145	–	38	92	D (39)	C (11)	E (8)	multi-way fork
E	108	–	32	87	E (48)	D (19)	A (1)	two-way fork
total 1944/46	783	–	18	61	–	–	–	–
A	162	6	8	32	A (56)	B (28)	C (6)	two-way fork
B	195	7	8	35	B (76)	C (11)	A (5)	one-way street
C	152	14	12	70	C (44)	B (43)	D (1)	two-way fork
D	194	45	30	88	C (44)	D (21)	A (4)	two-way fork
E	218	70	24	86	D (63)	C (12)	A (0)	one-way street
total 1952	921	31	17	64	–	–	–	–
A	117	8	13	21	A (70)	C (9)	B (6)	one-way street
B	271	3	26	36	B (55)	C (11)	A (8)	multi-way fork
C	267	22	57	78	C (18)	D (18)	B (5)	(two-way fork)
D	233	22	75	88	D (23)	C (2)	–	(one-way street)
total 1959/60	888	14	47	60	–	–	–	–
A	115	6	6	6	A (80)	B (9)	C (5)	one-way street
B	180	7	12	12	B (51)	A (22)	C (14)	multi-way fork
C	109	15	56	56	C (25)	E (8)	A, B, D (4)	(two-way fork)
D	140	24	53	53	D (31)	E (14)	C (1)	(two-way fork)
total 1970/71	544	13	30	30	–	–	–	–
A	138	1	–	–	–	–	–	–
B	106	0	–	–	–	–	–	–
C	68	12	–	–	–	–	–	–
D	63	24	–	–	–	–	–	–
E	48	38	–	–	–	–	–	–
total 1982/83	423	10	–	–	–	–	–	–

* Classification: *(…)*: dropout rate (next cluster) more than one half, *one-way street*: share of the sum of the second and third frequent routes in the most frequent route less than one third, *two-way fork*: share of the third in the second frequent route less than one half, *multi-way fork*: clusters not classified as one-way street or two-way fork.
Source: own calculation (MCA, HCA and SNA of 3559 farming units) based on the authors' Farming Styles Project Database.

Interlinking the farming units over time enables us to explore the network of their development paths between 1944/46 and 1982/83 in absolute (Figure 12) and relative terms (Table 7). This micro-level perspective reveals an eye-catching *diversity* of agricultural development. The ways actors navigate through the timespace of farming are not fully predetermined; nor are they completely arbitrary. The spectrum between the extremes of predetermination and arbitrariness can be highlighted from different angles. Firstly, we observe 'newcomers' and 'dropouts' who are unevenly distributed within the timespace of farming. One differentiating moment is technical progress, i.e. the substitution of machine power for human and animal muscle power from the

1940s to the 1980s. Though we have to consider biases in our dataset,[41] two irreversible movements accompanying this substitution process can be observed: the decrease of the rate of 'newcomers' in the 1950s (from 31 to 14 percent) and the steep increase of the rate of 'dropouts' in the 1960s (from 17 to 47 percent). This transition was accentuated according to the prevailing agrosystem: in large and medium-sized farming systems (A and B) it was more moderate – and nearly stopped in the 1970s – than it was in settings characterised by small farms and smallholdings (C/D and D/E); there, one half (1959/60 C, 1970/71 C and 1970/71 D) to three quarters (1959/60 D) of the farming units disappeared within one decade. In our view, this double-exclusion – the bringing up of external as well as internal barriers – reflects the growing importance of 'economies of scale', i.e. advantages of larger farms compared to smaller farms, with regard to the application of farm technology. Most of the machinery used on Lower Austrian farms up to the 1940s could be used efficiently on larger as well as smaller farms. However, the accelerated diffusion of tractors, combine harvesters and other large-scale technical innovations from the 1950s onwards[42] pushed up the limit of economic efficiency – the so-called 'minimum farm size' – step by step.

The socio-technical regime driving the substitution of large-scale machinery for human and animal labour is labelled 'technological treadmill'.[43] Accordingly, in highly industrialised societies 'innovative' farmers respond to political-economic incentives for production increase by substituting (relatively cheap) technology for (relatively expensive) labour, specialising on agricultural branches best suited to the location and enlarging farm size (both in terms of farmland and livestock); falling output prices (due to limited growth of consumer demand) in relation to input prices press the rest of the farming community to follow the 'innovative' path of

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[41] As described above, the 1952 and 1959/60 surveys comprise much more farming units than the contemporary censuses (concerning above all smallholdings in the Mödling region); moreover, in the 1970/71 and 1982/83 surveys a considerable number of farming unit is lacking (concerning above all units of different sizes in the Mank region). Thus, the decrease of the rate of 'newcomers' in the 1950s as well as the steep increase of the rate of 'dropouts' in the 1960s are biased by the construction of our dataset.

[42] See Roman Sandgruber, *Die Landwirtschaft in der Wirtschaft – Menschen, Maschinen, Märkte*, in: Bruckmüller et al., Geschichte, 191-408, here 323-343.

[43] This model and its metaphoric label ('agricultural treadmill') were coined by Willard W. Cochrane, *Farm Prices: Myth and Reality,* Minneapolis 1958, 85-107; idem, *The Development of American Agriculture: A Historical Analysis*, 2nd ed., Minneapolis 1993. For an application to agricultural development in twentieth century (Lower) Austria see Ernst Langthaler, *Die gebremste Tretmühle. Österreichs Agrarmodernisierung im 20. Jahrhundert*, in: Historicum. Zeitschrift für Geschichte (fall 2005), 11-18; Rita Garstenauer, *Ungleiches Wirtschaften. Die Entwicklung der Landwirtschaft in verschiedenen Regionen Niederösterreichs,* in: Peter Melichar / Ernst Langthaler / Stefan Eminger (eds.), Niederösterreich im 20. Jahrhundert, vol. 2: Wirtschaft, Vienna / Cologne / Weimar 2008, 219-260, here 219-226.

capital intensification, specialisation and concentration in order to maintain incomes, therefore opening the 'price scissors' (*Preisschere*); the resulting vicious circle of hi-tech investments, overproduction and underpay forces all farmers – even the 'laggards' – to choose between the alternative strategies of *growing* (i.e. further intensification, specialisation and concentration) and *giving way*.[44] In short, farmers who have stepped onto the 'technological treadmill' must keep pedalling in order to avoid falling off. Using this model as a heuristic device, we see the double-exclusion of 'incomers' and 'dropouts' from the 1950s onwards reflecting a divide within the farming community: large and medium-sized farmers rather tried to keep pedalling, i.e. taking heavy debts by investing in large-scale technology and expanding the farm enterprise; small farmers and smallholders rather fell off, i.e. they tended to lease out, sell or convert the farmland to non-agricultural uses. This divide was driven not only by the 'invisible hand' of market forces; moreover, the 'visible hand' of the by state strongly regulated agriculture via agricultural policy (price support, investment credits, farmland consolidation, extension services, retirement schemes etc.).[45] A dictum of the contemporary agrarian discourse puts it in a nutshell: *Wachsen oder Weichen* ('growing or giving way').[46]

As we have seen above, technical progress as a differentiating moment of the distribution of 'newcomers' and 'dropouts' interconnects with farm size; however, we regard farm size in combination with land use intensity also as a differentiating moment on its own. The rates of 'newcomers' and 'dropouts' were significantly lower where large and medium-sized farms with mixed arable and grassland prevailed (A and B); they were significantly higher where small farms and smallholdings using primarily vineyards or gardens appeared more frequently (C/D and D/E). This observation is supported by recent research revealing the correlation of the dominant patterns of land transfer and the prevailing agrosystems in Lower Austria: in arable and grassland farming regions landed property remained undivided more frequently than in winegrowing and gardening regions, where – besides the transfer of the majority of the farmland as a whole – small parcels were often separated and recombined (e.g. as a subsistence basis for the retiring holders or non-inheriting offspring for a certain period).[47] Thus, the idea of the 'farmstead' (*Hof*) as a

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[44] For a critical discussion of the 'treadmill' model see Ken A. Ingersent / A. J. Rayner, *Agricultural Policy in Western Europe and the United States*, Cheltenham, UK / Northampton, USA 1999, 171 f. The main aspects of the 'productivist transition' – intensification, specialisation and concentration – are detailed in Brian Ilbery / Ian Bowler, *From agricultural productivism to post-productivism*, in: Brian Ilbery (ed.), The Geography of Rural Change, London 1998, 57-84.

[45] See Kröger, *Modernisierung*, 266-314; Ernst Hanisch, *Die Politik und die Landwirtschaft*, in: Bruckmüller et al., Geschichte, 15-189, here 154-164.

[46] See Hermann Priebe, *Die subventionierte Unvernunft. Landwirtschaft und Naturhaushalt,* Berlin 1985, 86.

[47] For local and regional studies dealing with, among others, land tenure in Lower Austria see Landsteiner / Langthaler, *Ökotypus Weinbau*; Ernst Langthaler, *Agrarwende in den Bergen: eine Region in den niederösterreichischen Voralpen*

coherent and continuous entity – which gained hegemony in conservative land tenure policies in the late nineteenth and early twentieth centuries in general and in the Nazi 'blood and soil' ideology in particular – had more response in the former areas; in the latter regions it clashed with the custom of strong land mobility.[48] Our data clearly reflect the strong connection between agrosystem and farm (dis-)continuity.

Secondly, after having explored the flows into and out of the farming community, we now shift our attention to those actors who kept farming from one survey to the next. The migration network between the clusters of farming units in the years of the surveys (i.e. features of time-specific farming styles) contradicts any textbook notion of unilinear agricultural development; even from this aggregated view, there was always and everywhere a *multitude* of options. However, the diversity of the actors' strategies varied according to the structural settings of time and place. From 1944/46 to 1952, the relation between the preferred route and the second and third frequent routes was rather balanced; the migration patterns resemble 'forks' with two (1944/46 A, C and E) or three continuing pathways (1944/46 B and D). In the period between 1952 and 1959/60 this relation considerably lost balance, especially at the large-scale and small-scale margins of the timespace of farming, where 'one-way streets' emerged (1952 B and E); the migration patterns of the other clusters resemble a 'two-way fork'. In the 1960s this imbalance got even stronger; in addition to the 'one-way streets' continuing at the outer margins an enormous exodus of small farmers and smallholders encompassing one half to three quarters of all units occurred (1959/60 C and D). All in all, these imbalanced migration patterns were prolonged in the 1970s – except for the small-scale farming sphere where in addition to the most frequent route an alternative path emerged (1970/71 D).

(1880-2000), in: Bruckmüller et al. (eds.), Geschichte, 563-650; idem, *Agrarwende in der Ebene: eine Region im niederösterreichischen Flach- und Hügelland (1880-2000)*, in: ibidem, 651-740; idem / Franz Sinabell, *Abschied von der „Agricultur"? Agrarkulturen in Niederösterreich 1850-2000*, in: Manfred Wagner (ed.), Niederösterreich. Eine Kulturgeschichte von 1861 bis 2000, vol. 3, Vienna 2006, 23-61; Garstenauer, *Wirtschaften*. For a survey on the inheritance of landed property in Austria in the 1920s see Karl Schmidt, *Die Vererbung des ländlichen Grundbesitzes in der Nachkriegszeit in Österreich*, in: Max Sering / Constantin von Dietze (eds.), Die Vererbung des ländlichen Grundbesitzes in der Nachkriegszeit, vol. 2: Nachbarländer, Munich / Leipzig 1930, 1-107.

[48] For case studies on Nazi land tenure policy in Lower Austria see Ernst Langthaler, *From Capitalism to 'Neo-Feudalism'? Property Relations, Land Markets and the Nazi State in Austrian Rural Society, 1938-1945*, in: Rosa Congost / Rui Santos (eds.), The Social Embeddedness of Property Rights to Land in Europe, Turnhout 2010 (forthcoming); idem, *Wer ist (k)ein „Bauer"? Inklusion und Exklusion durch Erbhofgerichtsverfahren (1938-1945)*, in: Rita Garstenauer / Erich Landsteiner / idem (eds.), Land-Arbeit. Arbeitsbeziehungen in ländlichen Gesellschaften Europas (17.-20. Jahrhundert) (Jahrbuch für Geschichte des ländlichen Raumes 5), Innsbruck / Vienna / Bozen 2010, 255-280.

From the 1950s onwards, the pathways of the farming units at the outer margins of the timespace of farming were more and more channelled. This is most obvious in the domain of larger farm sizes where we can observe two migration channels: the 'channel A' and, though less unidirectional, the 'channel B'. Vis-à-vis, the 'channel E/D' encompassing farming units of smaller size emerged. Strikingly, these more or less unidirectional paths followed different directions: whereas the bulk of farming units in the clusters A and B migrated straight upward, those belonging to the clusters E/D moved diagonally towards the upper-left corner. According to the 'technological treadmill' model, these peculiarities of the migration patterns reflect different solutions to one and the same problem: how to keep pedalling to avoid falling off. The larger arable, grassland and mixed farms were pressed to substitute machinery for human and animal muscle power. In some way the pressure for mechanisation also affected small-scale winegrowers and gardeners; but additionally they had to enlarge farm size in order to avoid falling below the margin of economic efficiency. For the former faction of the farming community surviving on the 'technological treadmill' first and foremost meant enlarging the stock of technical capital; their farm size was already well suited for large-scale mechanisation. However, the latter faction faced the double-challenge of expanding the endowments of both machinery and farmland; they scratched along an invisible 'development barrier' marking the boundary between 'growing' (*Wachsen*) and 'giving way' (*Weichen*). The 'one-way streets' at the outer margins indicate a certain degree of *path dependency*: If farm holders had already linked their own project of farm development to the productivist 'megaproject' of the expert system,[49] they were pressed to follow the path of hi-tech farming. Due to material (e.g. over-indebtedness), social (e.g. control within the community of 'progressive farmers') and symbolic restrictions (e.g. hegemonic discourses in farmers' journals),[50] they were unable to alter the rules of the productivist game they were engaged in.

However, we must not overestimate the restrictiveness of the 'technological treadmill'; besides the mainstreams of farm development alternative paths emerged. This is obvious in the central domains of the timespace of farming where we cannot find any 'one-way street'; here two or more different paths were chosen by the actors in one and the same cluster. Let us take as an example the C clusters of the 1952, 1959/60 and 1970/71 surveys: from here different pathways towards large-scale, medium-sized or small-scale farming were chosen by a considerable number of farm holders. In contrast to the restrictions of path dependency at the outer margins, the diversity of pathways in the central domains of the timespace of farming points to a certain

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[49] See Ploeg, *Farmer*, 229-269.

[50] See Schwarz, *Exploring*.

degree of *path autonomy*. Two sources of autonomy were of utmost importance here: on the one hand, the medium-sized farms, especially those in cluster C, were not dependent on output markets as much as the farms in the outer left and right clusters: beyond the sharp differences in farm size as well as land and livestock use, the farms in the clusters A and D/E were similarly engaged in commercial cash crop production – wheat, sugar beet, oilseeds, milk and meat on the one side, wine and vegetables on the other side. The farms in between these extremes were focused much more on food crop production for human and animal needs. On the other hand, the medium-sized farms were not dependent on markets for technical inputs as much as the heavily mechanised large-scale (in absolute terms) and small-scale farms in 1982/83 (in relative terms). Though they had relations to input and output markets, they reproduced considerable parts of their means of production themselves, e.g. by relying on family labourers and draught animals fed by self-produced fodder. Limited dependencies vis-à-vis both input and output markets were sources of relative farming autonomy; furthermore, the family farm as the dominant mode of ordering considerably decreased transaction costs, especially the costs of the supervision of the labour force, therefore suspending technical scale economics to a certain degree.[51] However, medium-scale family farming involved not only relative autonomy vis-à-vis external forces, but also dependency from a particular internal force, sometimes referred to as 'self-exploitation', according to hierarchies of gender and age.[52]

According to the farming styles approach, these features fit to the *'peasant mode of farming'* (in contrast to the 'entrepreneurial' and 'corporate modes of farming'):[53]

> 'Central to the peasant condition, then, is the *struggle for autonomy* that takes place in *a context characterized by dependency relations, marginalization and deprivation*. It aims at and materializes as the *creation and development of a self-controlled and self-managed resource base*, which in turn allows for *those forms of co-production of man and living nature* that *interact with the market, allow for survival and for further prospects and feed back into and strengthen the resource base, improve the process of co-production, enlarge autonomy* and, thus, *reduce dependency*. Depending upon the particularities of the prevailing socio-economic conjuncture, both survival and the development of one's own resource base might be *strengthened through engagement in other non-agrarian activities*. Finally, *patterns of cooperation* are present which regulate and strengthen these interrelations [emphases in the original].'[54]

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[51] On the 'family farm theory' in agricultural economics see Eastwood / Lipton / Newell, *Farm Size*, 3336-3343.

[52] This ambivalence was stressed in the context of the debate on the 'agrarian question' from the late nineteenth century onwards by Karl Kautsky, *Die Agrarfrage. Eine Übersicht über die Tendenzen der modernen Landwirtschaft und die Agrarpolitik der Sozialdemokratie,* Stuttgart 1899, 106-116.

[53] See Jan Douwe van der Ploeg, *The New Peasantries. Struggles for Autonomy and Sustainability in an Era of Empire and Globalization*, London / Sterling, VA 2008, 1-5; idem, *The Peasantries of the Twenty-First Century: the Commoditisation Debate Revisited*, in: Journal of Peasant Studies 37 (2010), 1-30.

[54] Ploeg, *Peasantries*, 23.

Several aspects of this ideal-type can be observed in a broad range of the farming style features we have (re-)constructed from our data; however, the medium-sized, diversified and relatively capital extensive farms positioned in between the extremes of large- and small-scale commercial farming conform best to the 'peasant condition'.

Table 8: Development pathways taken by five or more farming units

pathway	number of cases	pathway	number of cases	pathway	number of cases
– E D – –	81	– – – – E	15	A A B – –	7
A A A A A	47	– – – D D	13	A A A – –	7
D – – – –	44	A – – – –	13	– – E C – –	6
A B B B B	41	C C B B B	12	– D C D –	6
– E – – –	36	C B B B B	11	C D – – –	6
E – – – –	29	A B B B C	11	A A B B B	6
– – D – –	28	– – – D –	11	C D C – –	6
– D – – –	26	– – – – D	10	C C – – –	6
– – C – –	26	E E D D –	10	A A B A A	6
C C C – –	25	C C C C –	9	– C C – –	5
– D D – –	21	– E D D D	9	– D C C –	5
D D C – –	20	– – – C –	9	– – C D D	5
A B B B A	19	A B B A A	9	D C C – –	5
A B B – –	19	C B B – –	9	– – C C –	5
– D C – –	18	– E D D –	9	E E – – –	5
E E D – –	18	A A B B A	7	E D D – –	5
C – – – –	18	– C – – –	7	B – – – –	5
D D – – –	17	– – D D –	7	D D D – –	5
C C B – –	17	B A A A A	7	C B C – –	5

Note: The pathway label describes the order of clusters in 1944/46, 1952, 1959/60, 1970/71 and 1982/83. '–' means that the farming unit could not be identified in the respective survey.
Source: own calculation (1237 farming units over time) based on the authors' Farming Styles Project Database.

The 'peasant mode of farming' represents a counteracting force to the socio-technical regime of the 'technological treadmill'; it opens up a 'third path' beyond the alternative of *Wachsen oder Weichen* ('growing or giving way'). The relations between these modes of ordering make up a field-of-force both *structuring* and *structured by* actors navigating through the timespace of farming. The following third angle we explore farm development paths from focuses on the actors' practical navigations within the (both enabling and limiting) structural environment. A simple, but meaningful indicator for the actors' agency vis-à-vis the field-of-force is represented by the diversity of pathways: the 1237 farming units we can identify over time took not less than 317 different pathways between the surveys of 1944/46 and 1982/83. Among the totality, 28 paths or 9 percent were taken by ten or more units, 29 paths or 9 percent by five to nine units, 37 paths or 12 percent by three to four units, 44 paths or 14 percent by two unit and 179 paths or 57 percent by only one unit (Table 8). The most frequent pathway, – E D – – (81 cases), as well as the third frequent pathway, D – – – – (44 cases), indicate the enormous farm discontinuity in the setting of small-scale farming in the 1950s; they also may indicate problems with identifying farming units over time in our data. The second frequent pathway, A A A A A (47 cases), as well as the fourth

frequent pathway, A B B B B (41 cases), represent two vertical channels leading large and medium-sized farms straight ahead towards large-scale hi-tech farming. The fifth to ninth frequent pathways once more reflect the (re-)constructed discontinuity of small farms and smallholdings. The last pathway of the top ten, C C C – – (25 cases), represents a middle – perhaps a *peasant-like* – course between the extremes of continuity on the one side and discontinuity on the other side, which ended with the abandonment of farming in the 'structural change' of the 1960s.

In this article we cannot comment on each of the 317 pathways; we would rather like to exemplify what seems to us to be the most striking feature: the *diversity* of navigation practices arising from similar structural settings. Let us take as an example the cluster 1944/46 C located at a central position within the spectrum of the farming units of the same survey (Table 9). The peculiarities of this group indicate *peasant-like* farming styles: small to medium farm size, diversity of land and livestock use, reliance on family labour, dominance of oxen as draught animals, combination of farm and off-farm income etc. – in short, a high degree of self-reproduced means of production (including family members with sideline occupations)[55]. Starting from here, 29 pathways representing 67 percent of the totality of farming units sooner or later culminated in the abandonment of farming, the so-called 'death of the peasantry'; six paths representing 5 percent led to cluster 1982/83 A; nine paths representing 17 percent led to cluster 1982/83 B; ten paths representing 9 percent led to cluster 1982/83 C; two paths representing 2 percent led to cluster 1982/83 D; finally, four path representing 2 percent led to cluster 1982/83 E. In short, not less than 60 different development paths covering the whole range of the clusters of the 1982/83 survey emanated from the cluster 1944/46 C. Nearly three quarters of the initial farming units were caught in the 'technological treadmill', following the route of *Wachsen oder Weichen* ('growing or giving way'); the majority of them sooner or later dropped out, a small minority linked their farm projects to the 'megaproject' of large-scale hi-tech farming. However, most of the remaining farming units approached intermediate positions between the poles of large-scale and small-scale commercial farming according to the 'peasant condition', therefore indicating the *style-specific* nature of farm development. How actors experience, interpret and act upon socio-technical regimes such as the 'technological treadmill' depends on their habituated mode of ordering – their *style of farming*.[56] Our case suggests that succeeding generations of farm holders partly change, but also partly continue farming styles over decades. All in all, the multitude of pathways

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[55] See Rita Garstenauer, *Family Labour and Sideline Occupation in Two Austrian Agrosystems: St. Johann/Pongau (Salzburg) and Oberwart (Burgenland) in the Early 1970s*, in: Erich Landsteiner / Ernst Langthaler (eds.), Agrosystems and Labour Relations in European Rural Societies (Middle Ages–Twentieth Century), Turnhout 2010, 179-206 (forthcoming).

[56] See Ploeg, *Farmer*, 210 f.

emerging from similar starting points reflects the – limited, but considerable – leeway of the (both structured and structuring) practice of farming; in short, there is always and everywhere *more than one* option.

Table 9: Development pathways emanating from the cluster 1944/46 C

pathway	number of cases	pathway	number of cases	pathway	number of cases
dropouts:	*134*	C B B C –	1	C C B C B	1
C C C – –	25	C B C D –	1		
C – – – –	18	C C C B –	1	*1982/83 C:*	*17*
C C B – –	17	C C D – –	1	C C B B C	3
C B B – –	9	C D D – –	1	C C B C C	3
C C C C –	9	C E C – –	1	C C C C C	3
C C – – –	6			C B B B C	2
C D – – –	6	*1982/83 A:*	*9*	C A A C C	1
C D C – –	6	C A A A A	4	C A B B C	1
C B C – –	5	C – A A A	1	C B C B C	1
C C B B –	4	C – C B A	1	C C – B C	1
C A B C –	3	C B B A A	1	C C C B C	1
C C B C –	3	C B B B A	1	C D C B C	1
C – C – –	2	C B C A A	1		
C A B – –	2			*1982/83 D:*	*3*
C A B B –	2	*1982/83 B:*	*33*	C D C D D	2
C B – – –	2	C C B B B	12	C A D D D	1
C B C C –	2	C B B B B	11		
C D C C –	2	C C C B B	3	*1982/83 E:*	*4*
C – – B –	1	C C C C B	2	C B B C E	1
C – B C –	1	C – B B B	1	C B C C E	1
C A – – –	1	C A – B B	1	C C C C E	1
C A A – –	1	C A B B B	1	C D C D E	1
C B B B –	1	C B C B B	1		

Note: The pathway label describes the order of clusters in 1944/46, 1952, 1959/60, 1970/71 and 1982/83. '–' means that the farming unit could not be identified in the respective survey.
Source: own calculation (1237 farming units over time) based on the authors' Farming Styles Project Database.

V. Conclusion

This article follows a micro-level approach to the postwar 'agricultural revolution' in order to explore the diversity of agricultural development, i.e. the various ways farming actors experienced, interpreted and acted upon their natural and societal environments. For this actor-centred view, the concept of farming styles has been adopted. In this paper, we focus on the material level, i.e. the natural and societal resources used on the farm. The exploration has proceeded in three steps: First, by aid of MCA of farm records in two Austrian regions from the 1940s to the 1980s, farm size and technical progress have been detected as most important differentiating moments in the multi-dimensional timespace of farming. Second, after having identified clusters of farming units per survey period by aid of HCA, the (dis-)similarities of material features of farming styles have been examined. Third, the migration patterns of farming units between the clusters, analysed by

aid of SNA, have revealed a multitude of pathways of farm development: Beyond the alternative of 'growing or giving way' as an effect of the dependency on the socio-technical regime of the 'technological treadmill', a 'third path' of relative autonomy according to the 'peasant mode of farming' has been pointed out. As shown by exemplary cases, the multitude of pathways emerging from similar starting points has revealed the – limited, but considerable – leeway of the (both structured and structuring) practice of farming.

The answers this article has provided to our initial research question raises a new question: We now have a clearer notion about the diversity of pathways farming actors followed through the timespace of farming over half a century; but: what *determines* these navigations? From our findings, the notion of farming as a field-of-force seems to be crucial for answering this question. We have identified the postwar 'megaproject' of state-led productivism as major force impacting on the ways farm holders managed their farms. However, the mechanistic metaphor of 'pull' and 'push forces' would be misleading, because it underestimates the actor's *agency* as suggested by the notion of the 'peasant mode of farming'. The quest for a fuller understanding of the actors' practices within the field-of-force of farming calls for in-depth case studies of farming units and the 'things', 'people' and 'ideas' connected to them over time. This is what we are going to do in the coming stage of our research project. Via exemplary cases, the material features of farming styles explored in this paper shall be linked to the symbolic features explored in another paper[57] and, furthermore, complemented by social features. 'Thick descriptions'[58] of personal and familial cases shall be tied back to the agrosystemic and discursive spaces explored in the preceding turn of our research project, therefore (re-)constructing farming styles in a complex manner.

[57] See Schwarz, *Exploring*.

[58] See Geertz, *Interpretation*.