



A comparison of statistical and participatory clustering of smallholder farming systems – A case study in Northern Ghana



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ABSTRACT

Typologies are often used to understand and capture smallholder farming system heterogeneity, and may be derived using different approaches and methods. This article aims to compare a quantitative, statistical typology based on a survey dataset and multivariate analysis, with a qualitative participatory typology based on informal group sessions and activities with local stakeholders from three communities in Northern Ghana. The statistical typology resulted in six clusters, with farm households categorized on the basis of their structural (resource endowment)- and functional (production objectives/livelihood strategies) characteristics. The participatory typology identified five farm types, based primarily on endowment (farm size, income investment), gender and age-related criteria. While the entire household was adopted as the unit of analysis of the statistical typology, the participatory typology provided a more nuanced differentiation by grouping individual farmers; with possibly several farmer types per household (e.g. 'small' and 'female farmers') as well as 'farm-less' individuals as a result. Other sources of dissimilarity which contributed to limited overlap between the typologies included changes that occurred in the communities between the two data collection efforts and inaccuracies in the data. The underlying causes of the latter seemed to mainly relate to socio-cultural issues that distorted information collection in both typologies; including power and status differences between both the researchers and farmers, as well as the farmers themselves. We conclude that although statistical techniques warrant objectivity and reproducibility in the analysis, the complexity of data collection and representation of the local reality might limit their effectiveness in selection of farms, innovation targeting and out-scaling in R4D projects. In addition, while participatory typologies offer a more contextualized representation of heterogeneity, their accuracy can still be compromised by socio-cultural constraints. Therefore, we recommend making effective use of the advantages offered by each approach by applying them in a complementary manner.

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1. Introduction

In Sub-Saharan Africa, the primary producers of agricultural outputs are smallholder farmers, who account for 80% of all farms in the region (AGRA, 2014). Smallholders are perceived to share

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certain characteristics which differentiate them from larger-scale, profit-driven producers. Such characteristics include: limited access to land, financial capital and inputs, high levels of vulnerability and low market participation (Chamberlin, 2007, 2008). However, far from being homogeneous; like farms everywhere, smallholdings are adapted to the conditions of their biophysical, economic, and socio-institutional environments (Ruthenberg, 1971). In this study, a farming system is defined as the complex of resources that are arranged and managed according to the totality of production and consumption decisions taken by a farm household, including the choice of crops, livestock, on-farm and non/off-farm enterprises (Fresco and Westphal, 1988; Köbrich et al., 2003). The process of

adapting to different macro- and micro-level contexts has resulted in a rich diversity of smallholder farming system configurations at all scales (*i.e.* household, village, region and country) across the African continent (Tittonell et al., 2010; Giller, 2013). This diversity is made manifest spatially (*e.g.* based on resource endowment), temporally (by virtue of their openness, farming systems are dynamic) and in farmer strategies (Ruthenberg, 1971; Mortimore and Adams, 1999).

A practical way of distinguishing patterns in populations of heterogeneous smallholder farming systems is by stratifying farms into subsets or groups according to specific criteria (Andersen et al., 2007; Van den Brand, 2011). Farm typologies attempt to perform such groupings; the term ‘typology’ designating both the science of type delineation and the system of ‘types’ resulting from this procedure (Landais, 1998). The use of typologies has a long tradition in rural sociology (Whatmore et al., 1987) and has attracted the attention of agricultural scientists who create typologies in an attempt to find a meaningful compromise between analysing single farms (no farming system is organized exactly like any other) and assuming broad categories such as smallholders in general.

Farm typologies may be constructed for different purposes; such as to identify diversity and its underlying causes (Gaspar et al., 2008; Tittonell et al., 2005), analyse agricultural trajectories (Iraizoz et al., 2007) or support the development (selection of farms), implementation (targeting and scaling-out of novel technologies or innovations) and monitoring (scaling up of impact assessments) of agricultural development projects (Byerlee et al., 1980; Emtage et al., 2007; Alvarez et al., 2014). Furthermore, farm typologies can focus on different aspects of a farming system; with some looking at differences at field level (Andersen et al., 2007; Carmona et al., 2010; Dossa et al., 2011; Zorom et al., 2013), and others focusing on household-level diversity in resource endowment, for example (Iraizoz et al., 2007; Righi et al., 2011; Tittonell et al., 2010). Finally, different approaches to typology construction can yield different results and this will affect the relevance of the resulting types for all stakeholders involved.

The approach and methodology used to construct a typology is embedded in specific epistemological assumptions which determine the research paradigm (Whatmore et al., 1987). Social scientists and practitioners of participation frequently rely on qualitative evidence, while natural scientists and economists tend to favour ‘hard data’. Meanwhile, governments and donors often leave decisions about research approaches to the technical advisers involved in agricultural research and development (Barahona and Levy, 2007). In response to the need to look beyond the conventional, top-down, transfer-of-technology models for agricultural research and extension of the 1990s, which often failed to achieve the required impact for many smallholders in Africa (Chambers and Jiggins, 1987), recent discourse has focused on the potential and limits of alternative participatory approaches (Jones et al., 2014; Kudadjie et al., 2004; Neef and Neubert, 2011; Van Asten et al., 2009).

The epistemological perspectives in the theoretical debate surrounding the development of farm typologies and their utility has been reviewed by Whatmore (1994) who identified three approaches to farm clustering. The first is the taxonomic or ‘positivist approach’, which defines types based on quantitative data, according to standard scientific protocols with the choice of variables usually determined by the researcher. The second approach is more explanatory and is termed the ‘relational approach’; it challenges the dominant positivist approach with its emphasis on the identification of relations between farmers and their contexts to help explain causal processes. The third is the more interpretive yet similarly unorthodox ‘folk approach’, which incorporates the qualitative, subjective processes (motivations, meaning-making

etc.) behind the patterns of behaviour, relationships and strategies of the participants into the typology. In the latter, the participants themselves usually determine the criteria for grouping of farmers or farm systems. In a similar vein, Maton et al. (2005) discriminate two kinds of farm typologies: those using ‘positivist’ methods based on statistical data (Köbrich et al., 2003) and those using ‘constructivist’ methods based on expert knowledge (Landais, 1998; Girard et al., 2001). Although it is acknowledged that the boundaries between these different frameworks are not rigid, the spectrum of approaches to the study of farm diversity generally has the positivist approach and the folk approach as its extremes (Emtage et al., 2007). The ‘etic-emic’ distinction employed by anthropologists is particularly useful for further differentiating them.

The positivist approach takes as its starting point theories and concepts from outside of the studied setting, regarded as meaningful and appropriate by scientists (‘etic’ perspective) (Lett, 1990). Most farm typologies have been constructed within the positivist framework (Whatmore et al., 1987). Farm diversity is studied using quantitative variables that are believed to have strong relations with the variation in the systems under investigation, and clustering arises from multivariate statistical analysis of these variables (for examples, see Bidogeza et al., 2009; Chavez et al., 2010; Tittonell et al., 2010). Strengths of this top-down approach are its reproducibility and transferability (ease of comparison across scales and contexts) (Kostrowicki, 1977). However, by depending on researcher-defined criteria, important drivers of diversity may be overlooked and the identified categories may lack meaning for farmers themselves (Van Averbek and Mohammed, 2006; Pacini et al., 2014). Obtaining complete quantitative data is often also costly and time-consuming due to the diversity and the complexity of farming systems (Thornton and Herrero, 2001).

In the folk approach, the intent is to discover how members of a system perceive and classify diversity (McKinney, 1969; Sims and Bentley, 2002). Constructs are expressed in terms that are meaningful and appropriate to local perspectives and indigenous knowledge (‘emic’ perspective) (Lett, 1990) and as a result, data collection tends to emphasize participatory methods (for examples, see Adjei-Nsiah et al., 2007; Kong et al., 2014). The main strength of this qualitative, bottom-up approach is the attention paid to situating the typology in the local context, which provides room for unexpected patterns and concepts to emerge (Jones et al., 2014). For example, the criteria of classification used by farmers usually differ in interesting ways from those used by scientists (McKinney, 1969; Nazarea, 2006). One of the weaknesses of the folk approach is that it lacks the authority of the scientific method. Its subjectivity renders it difficult to measure the identified categories and its specificity makes it ill-suited to generalization beyond its local boundaries (Van Averbek and Mohammed, 2006). Research using participatory methods may also be costly in terms of resources and time spent by researchers and stakeholders who take part in the studies (Barahona and Levy, 2007; Neef and Neubert, 2011; Röling et al., 2004).

Notwithstanding the somewhat polarized debate on the value of participation for agricultural research and development (Barahona and Levy, 2007; Jones et al., 2014; Sims and Bentley, 2002), participatory approaches have encountered both successes and failures worldwide (Bentley, 1994; Johnson et al., 2004; Lilja and Dixon, 2008; Scoones and Thompson, 1994; Van Asten et al., 2009). Improving the effectiveness of positivist approaches to typology construction by combining participatory methods in a way that will make research more useful for farmers in their own local context remains a methodological challenge (Kudadjie et al., 2004; Neef and Neubert, 2011). Nevertheless, careful integration of expert and scientific knowledge can potentially lead to a more comprehensive understanding of complex and dynamic farming systems

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