

Comparison of statistical and participatory clustering of smallholder farming systems

A case study in northern Ghana



Oscar Dong, one of the farmers involved in testing Africa RISING technologies in northern Ghana. Mother trials have been established on his land and he has helped to manage the crops. He also has his own baby trials.

Photo credit: Charlie Pye-Smith/Africa RISING

Key messages

- Different techniques are available to deal with the heterogeneity of farmers; we compared a quantitative statistical typology based on a survey dataset and multivariate analysis, and a qualitative participatory typology based on informal group sessions and interviews with local stakeholders.
- Both statistical and participatory typology approaches identified farm types based on farm size and endowment, but overlap was limited due to differences in set-up, sampling and data collection methods.
- The participatory typology included additional groups of female and “farmless” farmers, who are important in the communities, but were not included in the survey for the statistical typology.
- Both typology approaches face biases related to socio-cultural issues that distorted information collection, including gender, power and status differences.
- The two typology approaches analyzed here were complementary in their results. Both are useful to handle farm heterogeneity and are relevant and effective in research-for-development (R4D) projects. The dynamic nature of farms and households should be addressed more explicitly.

The issue

A practical way of dealing with smallholder heterogeneity is to stratify farming systems into subsets or groups according to specific criteria. Farm typologies attempt to perform such groupings. The purposes can be: to analyze agricultural trajectories in selection farms, to target and scale-out innovations, and to scale-up impact assessment of projects. Statistical methods are based on quantitative data, according to standard scientific protocols with the choice of variables usually determined by the researcher who attempts to make the results “objective” and reproducible and transferable.






Participatory typologies incorporate the qualitative/subjective processes (motivations, meaning-making etc.) behind the patterns of behavior, relationships and strategies of the participants into the typology. The participants usually determine the criteria for grouping and the attention paid to the local context and it is rooted in local reality. The challenge is to find an effective and efficient method of grouping of farms to contribute to the selected typology purpose. Therefore, we compared a survey-based, statistical typology and a participatory typology method in the Northern Region of Ghana.

Findings

The statistical typology resulted in six clusters, with farmers categorized on the basis of resource endowment, production orientation, and land-use among other factors. The participatory typology identified five main farmer types, of which three were based on farm size and endowment, while the two other types comprised female and “farmless” farmers, who are important in the communities, but not included in the statistical typology.

The overlap between the two typologies was limited due to differences in the grouping approach and units of analysis, inaccuracies in the data, changes that occurred between the two data collection efforts, misidentification of survey farm households for classification in the participatory typology, and deletion of farms as outliers during statistical analysis. The underlying causes of these shortcomings were mostly related to socio-cultural issues that distorted information collection; including gender, power and status difference.

Table 1: The main characteristics of the five farm types determined using participatory methods, symbols made by participants

Type	Symbol	Main characteristics
A		<i>Pukparkara</i> ('Big farmers, men'): HRE (large farm size), market-orientation
B		<i>Pukparsagsa</i> ('Medium farmers, men'): MRE (medium farm size), variable production orientation
C		<i>Pukparbihi</i> ('Small farmers, men'): LRE (small farm size), subsistence orientation
D		<i>Pagba pubihi</i> ('Small farmers, women & children'): LRE/ SRC (small farm size), market orientation
E		<i>Suhukpion</i> ('Farm-less, men'): work on other farms as hired labour

(HRE: High resource endowed; MRE: Medium resource endowed; LRE: Low resource endowed; SRC: Severely resource constrained).

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 and of 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.

For both statistical and participatory typology approaches, the dynamic nature of farms and households, with changes that can occur either gradually or as discrete events, should be addressed more explicitly to remain relevant and effective in research-for-development projects.

Recommendations

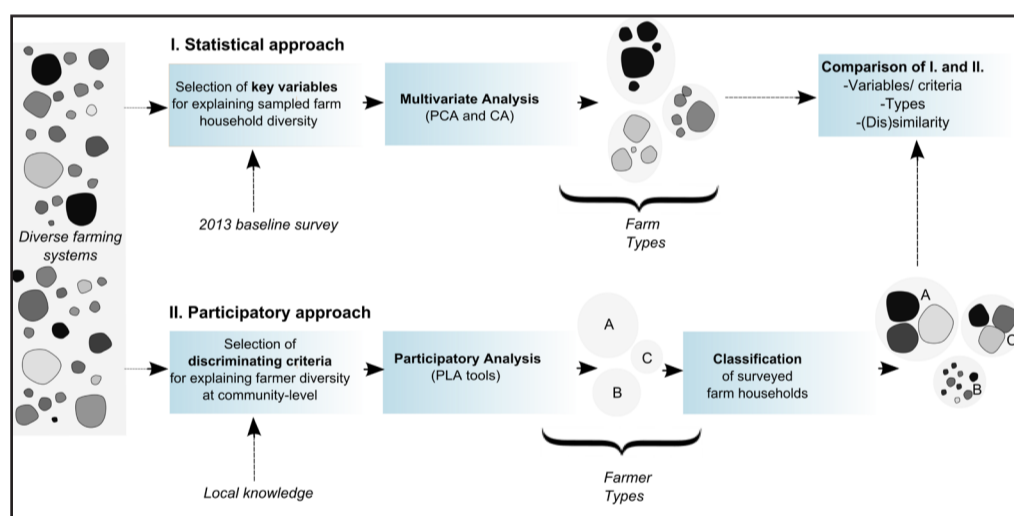
- Application of a combination of quantitative statistical qualitative participatory methods are recommended for farm and household grouping and clustering to reach a systematic, contextual and locally grounded differentiation in farm and household types.

- Ample attention for the local socio-cultural patterns and constraints is needed to create awareness of the influence on the results of typologies. This concerns both quantitative and qualitative methods.
- More research and application of type-related dynamics of farms and households is needed. This can contribute to understanding of technology adoption and likely development pathways.

Methodology

The Africa RISING survey for the Northern Region captured information from 80 farm households across the three case study communities. Although the sample size was rather small, it revealed the diversity in local farming systems. From the pool of farm household-level information, twelve variables describing household, labor, land use, livestock, food security and income dimensions were used. Two multivariate statistical techniques were employed sequentially: Principal Component Analysis (PCA) to reduce the dataset into non-correlated principal components and two-step cluster analysis for partitioning the PCA output into clusters (hierarchical, agglomerative clustering followed by non-hierarchical, partitioning).

Figure 1: Framework of the statistical and participatory approaches to typology construction



*(PCA: Principal component analysis; CA: Cluster analysis; PLA: Participatory Learning and Action)



The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation and impact assessment.

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