Extended Abstract
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Paper/Poster Title	**Typology analysis of Egyptian agricultural households reveals increasing income diversification and abandonment of agricultural activities**

Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	***200 words max***

Egyptian agriculture is facing challenges of increasing demand and limited land and water resources. There is a need to improve the effectiveness of policies designed to meet these challenges through the development of insights into the variations in land use decision-making across the farming population.

The objectives of this research are to understand the decision-relevant heterogeneity within farming households in Egypt, determine the characteristics which best describe this heterogeneity, and identify trends in the dynamics of farming household types over recent years and present possible causes.

We performed a typology analysis using continuous and categorical variables which describe the structural and functional characteristics of households from the 2012 and 2018 Egyptian labour market panel surveys. The analysis included data reduction and clustering methods for mixed data to identify household types. By comparing the household types found in both surveys, key transitions were identified.

The results identify household types based on clusters of specialised farming, village farming, diversified income, and landlord households. The main descriptors of variation are the degree of income diversification, cropping intensity, and water use per unit area. A strong trend toward greater income diversification and abandonment of agricultural activities is shown, with implications for future policy-making.

Keywords	Egypt, Farm, Household typology, Mixed data
JEL Code	Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets Q12 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***

Egyptian agriculture is facing challenges of an increasing demand due to a rapidly expanding population, and insufficient water and arable land resources to meet this demand. This has already resulted in decades of dependence on imports of key food staples, and therefore, vulnerability to global food price shocks. Climate change is likely to reduce limited water and land resources further, whilst continued population growth will exacerbate the gap between domestic production and demand. Recent government policy has focused on large projects to

meet this increased demand, with a reduced focus on the livelihoods and economic sustainability of low-income farmers. There is a need to develop insights into variations and define trajectories of change within the farming population to improve the effectiveness of policies designed to meet these challenges. Farm and farmer typology analyses are a useful tool to identify commonalities within farming populations, summarise large groups into representative types, and help in the development and ex-ante analysis of policy options. Previous typology studies of Egyptian agriculture provide an overview of agriculture's role in Egypt but do not trace developments within the sector over recent years or their dependencies on contextual factors.

The objectives of this research are to understand the decision-relevant heterogeneity within farming households in Egypt, determine the characteristics which best describe this heterogeneity, and identify trends in the dynamics of farming household types over recent years and present possible causes.

Methodology	*100 – 250 words*

We performed a typology analysis based on the 2012 and 2018 Egyptian labour market panel surveys. 12 categorical and 31 continuous variables describing farming households were identified and used in the analysis. These included variables to describe the household, the head of the household, and farm and off-farm income and resources. Highly skewed continuous variables were transformed, and highly correlated variables were removed. Subsequently, a factor analysis on mixed data was carried out to determine the variables which contribute the most variation within the dataset. All variables which contributed above 10% to each of the dimensions which satisfied the Kaiser criterion - an eigenvalue above 1 - of the factor analysis were used for the clustering analysis. These variables were clustered using hierarchical clustering on principal components to define the number of clusters. Finally, a cluster analysis of the mixed dataset was carried out to identify the clusters and their characteristics. The evolution of the clusters was determined by tracking the households present in both surveys and determining how their type changed between the two surveys.

Results	*100 – 250 words*

The correlation analysis identified 10 variables which were removed due to being highly correlated with other variables. The factor analysis returned 22 components which satisfied the Kaiser criterion, explaining a cumulative variance of 59%. The variables which contributed the most to the first two components were the degree of income diversification, cropping intensity, water use per unit area, year of survey, and household education level. The appropriate number of clusters was identified as 4.

The household types are **specialised farming**, **village farming**, **diversified income**, and **landlord**. The specialised farming household is dependent on farm income for 62% of their total income, 15% of their crop is high value (compared to an average of 6%), and has the highest water use per unit area. The village farming household has the lowest income per capita, generates 70% of their total income from farming activities, and 60% of which live in a village house (compared to an average of 30%). The diversified income household generates 46% of its income from agricultural activities and has the highest level of education of all households. Finally, the landlord household generates 93% of their total income from off-farm sources and 97% of farm income from land rental.

High levels of land abandonment were identified, with 45% of households with no agricultural activity in 2018 coming from households that had agricultural activity in 2012.

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There was a clear trend towards greater income diversification with 59% of households new to farming in 2018 being part of the **diversified income** household.

Discussion and Conclusion	*100 – 250 words*

A high rate of abandonment of agricultural activities was found here and has been observed in other contexts globally. Previous analyses of Egyptian land use and income diversification support this result. Satellite data shows a loss of cropland in the Nile Delta in 2011 – during the Arab Spring – of 502.21 km^2. Additionally, a typology analysis of Egyptian income diversification shows a reduction of households with some agricultural income from 40% in 2006 to 14% in 2019, further reinforcing this result. The pressures of political instability, adverse climatic conditions, and economic pressures are observed globally as key causes of abandonment of agricultural activities. These pressures are relevant to the Egyptian context and are likely contributors to the high levels of abandonment.

Resource endowment is identified as a key variable to describe the variation within the household population. This is identified in other typology analyses, where natural and human capital is often a key differentiator between farming households. Income diversification, a key descriptor of the variation between household types in this analysis, is also identified as such in previous typology analyses in low-income contexts.

This analysis provides the basis for targeted policy strategies and the development of interventions by identifying farm typologies, the key variables which describe the variation between them, and the evolution of the typologies. Targeted interventions can provide high returns, especially to smallholders. This could help stem the tide of land abandonment and empower smallholder farmers to become profitable enough to continue agricultural activities, whilst increasing resource use efficiency.