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Understanding farm trajectories for better targeting of agricultural technologies

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INTRODUCTION

Farming needs to provide working opportunities for 330 million future workers in sub-Saharan Africa (SSA), given the few opportunities in the manufacturing and service sectors which develop slowly (Losh, 2012). To be attractive for young people, farms need to achieve sufficient land and labour productivity while coping with adverse socio-economic conditions. Previous studies have shown a strong link between farm resource endowment (land, labour and livestock) and farm productivity (e.g. Senthilkumar et al., 2012). However, further insight into the drivers of change and the impacts of these drivers on farm dynamics can help to better target agricultural interventions and to address specific farming constraints and opportunities.

MATERIALS AND METHODS

The study was conducted in the cotton zone around Koutiala in southern Mali where mixed crop-livestock farmers depend strongly on income and inputs from the cotton sector. We established a typology based on farm resource endowment using Ascendant Hierarchical Clustering (AHC) on survey data from 30 farms of three villages around Koutiala in 1994. Those 30 farms were monitored from 1994 to 2010 on an annual basis. A simple decision tree using 4 discriminating factors allowed us to classify farms in a type over time. Two main periods (1994-2004 and 2004-2009) characterized by a favourable and a declining trend in the cotton sector respectively were distinguished. For these periods, farm trajectories for each individual farm were recorded, and the average input use intensity, labour and land use efficiency were calculated for each farm type.

RESULTS AND DISCUSSION

A)

	Type 4	Type 3	Type 2	Type 1
	small farms	medium farms	large farms	large farms with big herds
number of farms	5	15	7	3
Resource endowment				
land (ha)	**4** *(2)*	**9** *(2)*	**16** *(4)*	**20** *(6)*
labour	**3** *(1)*	**6** *(2)*	**14** *(4)*	**14** *(5)*
livestock (TLU)	**1** *(1)*	**7** *(3)*	**12** *(5)*	**53** *(24)*
equipment	**1** *(1)*	**4** *(1)*	**5** *(1)*	**7** *(1)*
land productivity (kg.ha-1)				
cotton	**754** *(296)*	**912** *(223)*	**944** *(216)*	**1051** *(309)*
maize	**1298** *(933)*	**1888** *(497)*	**2081** *(514)*	**2427** *(749)*
sorghum	**650** *(254)*	**907** *(130)*	**871** *(130)*	**1107** *(241)*
millet	**524** *(285)*	**697** *(156)*	**668** *(117)*	**884** *(285)*
labour productivity (kg.active-1)	.		.	
cotton	**234** *(109)*	**490** *(202)*	**285** *(105)*	**427** *(199)*
all cereals	**626** *(215)*	**852** *(165)*	**567** *(117)*	**682** *(134)*

B)

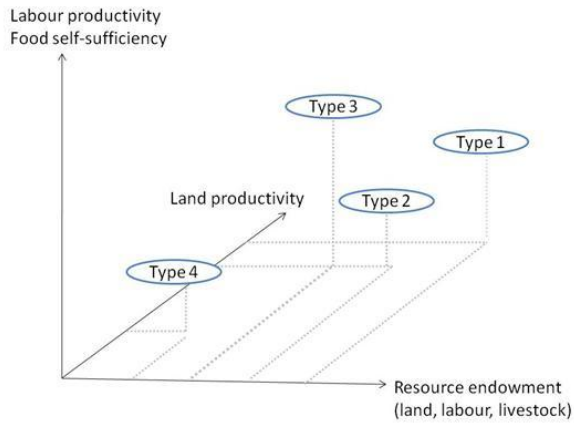

Figure 1: Average resource endowment, land and labour productivity for four farm types in southern Mali for 1994-2010 (left, with standard deviations in brackets) and a conceptual representation in a three-dimensional space (right).

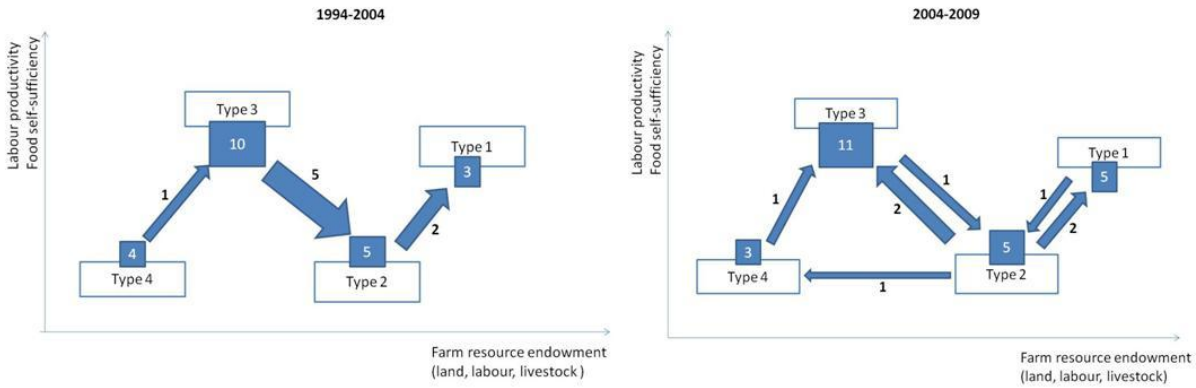

Figure 2: Farm trajectories in a favorable context for cotton production (1994-2004, left) and during the CMDT collapse (2004-2009, right). The numbers in frames and arrows indicate the number of farms considered.

Four farm types differentiated by resource endowment achieved different resource use efficiency: Farm type 1, 2, and 3 (high

resource endowment) obtained higher land productivity than Farm type 4 (low resource endowment) as a result of higher use intensity of organic and mineral fertilizer. Farm type 1 and 3 obtained higher labour productivity than Farm type 2 and 4, because they are better equipped (higher numbers of draft tools and oxen per active). Though type 2 farms had a high resource endowment, their labour productivity was low and such households were food insecure every three years and thus unattractive to retain the youth . Land productivity has shown high inter-annual variability for each farm type (Figure 1) and we didn't find any increasing or decreasing trend for any farm type. Labour productivity kept on decreasing for all types, due to stagnating yields and increasing number of actives.

Due to natural demography, farms of type 3 are expected to evolve to type 2 farms. However, our analysis of trajectories showed no increase in the number of type 2 farms, which is explained by migration out of agriculture and out of the area. There seems to be no poverty trap for type 4, because two farms moved from type 4 to type 3.

For type 4 and 2 farms, it is important to increase equipment assets to ensure timely farm operations, thus enable improved labour productivity. This will help those farms 'stepping up' to higher levels of productivity rather than just 'hanging in' (Dorward et al., 2009) and thus make them more attractive for coming generations with low employment opportunities in other sectors. As type 3 farms achieve high grain surpluses, they could easily engage with market oriented cereal production, while type 1 farms could intensify milk production. As land is becoming limiting and land productivity did not improve over the last two decades, there is now a strong need for intensification.

REFERENCES

Dorward, A., S. Anderson, Y. Nava, J. Pattison, R. Paz, J. Rushton, and E. Sanchez Vera. 2009. Hanging In, Stepping up and Stepping Out: Livelihood Aspirations and Strategies of the Poor. Dev. Pr. 19(2): 240–247.

Losh, B. 2012. Crisis prevention in sub-Saharan Africa - Agriculture: the key to the employment challenge. CIRAD Perspective (19).

Senthilkumar, K., P.S. Bindraban, N. de Ridder, T.M. Thiyagarajan, and K.E. Giller. 2012. Impact of policies designed to enhance efficiency of water and nutrients on farm households varying in resource endowments in south India. Njas - Wagening. J. Life Sci. 59(1–2): 41–52.