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ABSTRACT

Rural Kenyan households have different aspirations and income portfolio strategies, including agricultural intensification and income diversification. This article reports on a study that interviewed 624 households to explore rural aspirations and derive lessons for agricultural technology development and transfer. Though few households specialised in farming, many households self-identified as farmers and aspired to increase their agricultural income. Despite the prevalence of agricultural aspirations, few aspired for their children to have a future in farming. Combining aspirations with potential to invest, the article provides suggestions for targeting agricultural interventions. We need to start listening better to those people we call “farmers” to develop and offer innovations that meet their realities.

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Introduction

Rural households in sub-Saharan Africa (SSA) are among the poorest and most food-insecure people in the world. A large part of African agricultural production originates from smallholder farmers and rapid population growth calls for increased food production (Ricker-Gilbert, Jumbe, and Chamberlin 2014). Accordingly, improving the agricultural performance of African farmers has been proposed as a potential win-win intervention to solve the dual problems of poverty and hunger (Dercon et al. 2009). Many African governments and international development agencies therefore focus on improving the welfare of smallholders. The literature identifies two pathways, often overlapping, for rural households to escape from poverty: (i) intensification through the adoption of agricultural technologies; and (ii) diversification into non-farm activities. We briefly outline the arguments for each pathway in the next paragraphs.

Agricultural intensification is based on the premise that agricultural technologies offer considerable promise to improve yields in rural Africa (Dzanku, Jirstrom, and Marstorp 2015). Moreover, since 2008 the jump in world food prices has made farming more profitable for those with sufficient agricultural land using modern inputs (Jayne, Chamberlin, and Headey 2014). However, achieving agricultural intensification in SSA has proved challenging, as evidenced by continued low levels of technology adoption and persistent yield gaps (Tittonell and Giller 2013). An important research question is therefore why agricultural innovations are under-adopted. A long-standing and extensive body of research has identified various determinants of agricultural technology adoption (e.g. Feder, Just, and Zilberman 1985; Foster and Rosenzweig 2010): farm size, risk preference, human capital, labour availability, credit constraints, land tenure, access to input and output markets, information asymmetries, or a combination of the above. It is therefore surprising that Glover, Sumberg, and Andersson (2016) conclude that there is still little coherent understanding of technological change in smallholder African agriculture. This is not to say that the agricultural research community has

not contributed to smallholder welfare in Africa. Indeed, many studies cite high economic returns on investments in agricultural research on a national or global level (e.g. Renkow and Byerlee 2010).

Gone should be the days when rural populations were assumed to be simply farmers, as diversification is the norm (Barrett, Reardon, and Webb 2001, 315). Diversification can be defined as a process by which households construct a diverse portfolio of income-generating activities to improve their living standards (Ellis 1998). Many farmers work part-time outside agriculture, while others aim to step completely out of agriculture by migrating to cities or specialising in non-farm activities (Dorward et al. 2009). Indeed, rural households have diverse livelihood strategies and long-term aspirations and agricultural innovations need to be compatible with this diverse activity portfolio (Sumberg 2005). These dynamics should be taken into account when targeting technological innovations and rural development efforts.

At the same time, doubts have been raised about the potential of rain-fed agriculture as a pathway from poverty. Over 80% of farms in SSA are now under two hectares (ha) in size (Lowder, Skoet, and Singh 2014). Whether large or small farms are more productive is a continuing debate. It is true that small farms can produce very high yields per hectare and may be more efficient than many larger farms, but the absolute value of outputs will always tend to be small on a small farm. On small farms in the semi-arid and dry sub-humid tropics of Africa and Asia, best-practice agricultural technologies, despite resulting in large percentage increases in yield and profitability, did not provide enough income per household to lift smallholders above the poverty line (Harris and Orr 2014). Moreover, without attention to sustained agricultural productivity growth, small farms in Africa can become increasingly unviable economic units (Jayne, Mather, and Mghenyi 2010). Collier and Dercon (2014) even argued that it might be time to think more seriously about larger-scale agricultural development and migration out of agriculture by poor households. The future role of smallholder agricultural producers in global food production is thus highly uncertain (Herrero et al. 2014). In the meantime, however, there is a large and increasing rural population with limited attractive alternatives to farming (Jayne, Chamberlin, and Headey 2014). The question is, therefore, in what ways agricultural research for development (AR4D) efforts can be reshaped to better target the needs of rural households in Africa.

Against this background, this explorative study focuses on the often overlooked aspect of household aspirations to understand better the potential for technology adoption to improve agricultural performance. Sumberg (2005) indicated that often too little attention is paid to the fact that successful adoption is dependent on people and their aspirations. We build upon research by Verkaart et al. (2017) who found that the agricultural performance of households diversifying away from farming was lower than that of so-called “full-time farmers”. Though some people may just have better farming skills, additional factors may underlie this divergence in agricultural performance. As resources are scarce and the need to reduce poverty and increase food production urgent, observed differences in livelihood strategies of smallholders and associated differences in agricultural performance lead to pertinent questions:

- (1) To what extent are rural households “really” farmers – and do many of the households that we tend to call farmers actually consider themselves to be farmers?
- (2) What are household livelihood aspirations and are there differences based on income portfolio, self-perception, or opportunities such as agro-ecological potential or proximity to markets?
- (3) How can we better understand the complex rural livelihood decision environment in order to improve targeting of interventions towards the most appropriate households and support their needs more effectively?

Materials and methods

For comparison we selected two contrasting districts from eastern Kenya: Embu and Kitui. Rainfall varies from 900 to 1,800 mm according to altitude and is bimodal across both districts, allowing two cropping seasons per year (Jaetzold et al. 2006). Maize is the most widely cultivated crop in

both study areas. Embu district is sub-humid, with fertile soils, relatively high population density, and good market access. At higher altitudes, farmers grow coffee, tea and macadamia, while at lower altitudes *miraa* (khat) is the main cash crop. Livestock consists primarily of high-grade dairy cattle and both input and output market access is good. By contrast, Kitui district has poorer market access and is semi-arid, with lower and more variable rainfall. Our study was conducted in central Kitui, which lies on a plateau at about 1,100 metres altitude and receives between 750 and 1,150 mm rainfall (Jaetzold et al. 2006). Livestock consists largely of goats and zebu cattle.

Our data were collected using a structured household survey conducted in 2013 and a follow-up survey in 2015. Forty-one villages were purposively selected and our findings are therefore not necessarily representative at district level. In total, 684 households were randomly selected from lists compiled by village elders. Data were collected through a structured questionnaire designed to capture the chief sources of household income, the profitability of the main farm enterprises, and whether or not farm households used a range of new technologies. Income sources represent net income as they take into account input and hired labour costs for crop production and livestock rearing, while households were specifically asked to report net off-farm income. We did not measure net returns to specific agricultural technologies, but net returns from agriculture (excluding the cost of family labour) at the household level. To aid recall, interviews were timed at the end of the main rainy season (September–October 2013), when information was collected on farm production in both the main rainy season and the previous season (May–June 2013). In 2015, we re-interviewed 624 households from 2013, giving an attrition rate of 9%. This follow-up survey focused on gaining a better understanding of household livelihood aspirations and strategies using closed- and open-ended questions.

Most descriptives are based on the 2013 data. We therefore only explicitly indicate where information is derived from the 2015 sample. To facilitate the interpretation of our monetary data we converted amounts captured in Kenya shillings (KES) to US\$ in Purchasing Power Parity (PPP) values. This was done using 2013 conversion rates for household final consumption expenditure extrapolated from the 2011 International Comparison Program (ICP) benchmark year. Based on this, we use the international poverty line of US dollars (US\$ PPP) 1.25 per day per capita at constant 2005 prices. To inflate the international poverty line to 2013 prices, we computed its equivalent in 2005 KES using 2005 PPP conversion rates. The KES poverty line in 2005 prices was inflated to 2013 prices using the Kenyan national consumer price index. Conversion of the 2013 KES poverty line to 2013 US\$ PPP prices translated into an international poverty line of US\$1.49 per day per capita in 2013.

To answer the first research question we compared income-based livelihood clusters with a household's self-ascribed livelihood status. We used cluster analysis to assign households to livelihood clusters based on the share of on-farm, farm labour, and non-farm income sources earned in 2013. This resulted in four clusters: full-time farmer, mixed income, farm-worker and non-farm (see Verkaart et al. 2017 for details). We then assessed a household's self-ascribed livelihood status by asking respondents: "Out of the words below, which do you think best describes your household?", with the following categories to choose from: farm household, business household, wage earners, or other. The answers were coded to distinguish between farmer- and non-farmer households. We use the answers to compare self-selection into the farmer household category with the clusters based on actual income sources earned. We present various descriptives for both the clusters and self-ascribed status to characterise and compare the various groups. Analysis of variance (ANOVA) was performed to compare mean descriptive values across the livelihood clusters. Tests were adjusted using the Bonferroni method to correct for possible spurious inference due to making multiple comparisons between group means and proportions.

To answer the second research question, we asked three open-ended questions on household livelihood aspirations. First, we asked: "Think about your life right now. What would you like to do more or less of in terms of your income-generating activities?" Second, to obtain a better idea of the feasibility of this aspiration we asked: "What concrete steps have you taken towards achieving the above changes?" Third, we wanted to assess any differences between current and future aspirations

and asked: “*What would you like your children’s life to look like in the future?*” We compared household aspirations for the two groups described in the previous paragraph (income-based clusters and self-ascribed status). In addition, we disaggregated the analysis between the two districts to compare findings for a district with good agro-ecological potential and market access (Embu) with a district with lower agro-ecological potential and market access (Kitui).

In the discussion, we try to answer the third and final research question by providing targeting suggestions for AR4D interventions based on our findings. We apply the framework developed by Dorward et al. (2009) to describe how household aspirations in various contexts can inform technology development and transfer interventions. We also provide examples of technologies we see as suitable for households as well as suggestions to improve targeting of interventions.

Results

To what extent are rural households “really” farmers based on their income portfolio?

Table 1 shows the contribution of various on- and off-farm income sources to the household income portfolio. We distinguished three sources of on-farm income (crop sales, value of own crop consumption, and livestock income) and four sources of off-farm income (non-farm wage labour, farm labour, self-employment/trade, and transfers, such as remittances and pensions). Data are presented for the full sample and for the four livelihood clusters. Livelihoods in the study areas were quite diversified, with half of the income coming from either farm or off-farm activities. Most households (32%) belonged to the mixed income and non-farm (30%) clusters. Full-time farmers (24%) were a minority. Part-time farming is the norm for more than three-quarters of the households. Farm worker households constituted the smallest (10%) cluster. The full-time farmer and non-farm household clusters were the most specialised, with an average 88% or 84% of income from farm and off-farm activities, respectively. For all clusters, crop activities contributed more to income than livestock activities, though livestock is evidently also an important asset. Mixed farmers were less market-oriented than full-time farmers, with around half the share of income from crop sales. In fact, with increasing off-farm income, marketed shares reduce and farming becomes a source of food rather than income.

Do households that we tend to call farmers actually consider themselves to be farmers?

Table 2 provides a further disaggregation of the livelihood clusters across various household groupings. Though full-time farmers were a minority based on actual income composition, almost three-quarters of households self-identified as being a farmer household in 2015. The large majority of full-time farmer and mixed income households ascribed themselves to the farmer household category, but even among farm worker and non-farm households over 60% self-identified as farmer households. Though farm workers might be expected to identify as farmers (albeit not always on their own farm), this is a surprising result for non-farm households considering that they earned on average only 15% of their income from farming in 2013. However, they are generating a

Table 1. Income by source and livelihood cluster.

| | Total sample (<i>n</i> = 624) | Full-time farmer (<i>n</i> = 165) | Mixed income (<i>n</i> = 201) | Farm worker (<i>n</i> = 66) | Non-farm (<i>n</i> = 192) |
|---------------------------|-----------------------------------|---------------------------------------|-----------------------------------|---------------------------------|-------------------------------|
| Farm income share (%) | 49.0 | 88.4 | 53.2 | 36.0 | 15.3 |
| Crop sales (%) | 17.4 | 37.6 | 15.8 | 12.0 | 3.7 |
| Value own consumption (%) | 19.7 | 27.9 | 24.2 | 17.6 | 8.6 |
| Livestock income (%) | 11.9 | 23.0 | 13.3 | 6.3 | 3.0 |
| Off-farm income (%) | 51.0 | 11.6 | 46.8 | 64.0 | 84.7 |
| Farm wage labour (%) | 8.7 | 4.8 | 2.7 | 57.0 | 1.7 |
| Non-farm wage labour (%) | 25.0 | 3.3 | 22.3 | 2.8 | 54.0 |
| Self-employment/trade (%) | 8.8 | 1.0 | 10.2 | 1.8 | 16.5 |
| Transfers (%) | 8.5 | 2.5 | 11.6 | 2.4 | 12.5 |

Table 2. Self-identification and location (district) across livelihood clusters.

| | Total sample (n = 624) | Full-time farmer (n = 165) | Mixed income (n = 201) | Farm worker (n = 66) | Non-farm (n = 192) |
|-----------------------------|---------------------------|-------------------------------|---------------------------|-------------------------|-----------------------|
| Total sample – clusters (%) | 100 | 26.4 | 32.2 | 10.6 | 30.8 |
| Self-described farmer (%) | 74.0 | 88.5 | 75.6 | 66.7 | 62.5 |
| Kitui (%) | 50.5 | 31.5 | 52.2 | 47.0 | 66.1 |
| Embu (%) | 49.5 | 68.5 | 47.8 | 53.0 | 33.9 |

considerable amount of food for consumption from their farming activities, which could drive identification into the farmer category. There were significant differences between districts in terms of income sources. The share of full-time farmers in Embu (68%) was considerably higher than in Kitui (32%). By contrast, two-thirds of the non-farm households lived in Kitui. Mixed income and farm worker households were almost equally divided across the two districts.

Descriptives presented in Table 3 show that there are considerable differences between clusters in both demographics and welfare characteristics. For example, full-time farmers are older than non-farm households, whereas the latter are better educated. There are no significant differences in terms of household size. Non-farm households are relatively wealthier, with significantly higher incomes, lower poverty rates, and more assets than the other clusters. Interestingly, land ownership does not differ significantly. This may be caused by the larger share of non-farm households in Kitui where landholdings are larger. An alternative explanation could be that non-farm households did not

Table 3. characteristics of income-based and self-ascribed livelihood clusters and districts.

| | Total sample (n = 624) | Livelihood cluster | | | | Self-perception | | Location | |
|-----------------------------------|---------------------------|-------------------------------|---------------------------|-------------------------|-----------------------|---------------------|---------------------|---------------------|--------------------|
| | | Full-time farmer (n = 165) | Mixed income (n = 201) | Farm worker (n = 66) | Non-farm (n = 192) | Farmer household | | District | |
| | | | | | | No | Yes | Kitui | Embu |
| <i>Demographics and wealth</i> | | | | | | | | | |
| Household size (no.) | 4.77 | 4.69 _a | 4.67 _a | 4.74 _a | 4.94 _a | 4.78 _a | 4.76 _a | 5.27 _a | 4.25 _b |
| Age household head (years) | 50.46 | 54.12 _a | 50.53 _{a,b} | 49.11 _{a,b} | 47.69 _b | 48.01 _a | 51.31 _b | 49.45 _a | 51.48 _a |
| Education head (years) | 7.56 | 6.87 _a | 7.66 _{a,b} | 6.26 _a | 8.51 _b | 7.71 _a | 7.51 _a | 7.87 _a | 7.25 _a |
| Household income (US\$ PPP) | 4,816 | 4,383 _a | 4,129 _a | 1,999 _b | 6,875 _c | 5,264 _a | 4,658 _a | 4,768 _a | 4,864 _a |
| Income per capita (US\$ PPP) | 1,197 | 1,071 _a | 1,092 _a | 490 _b | 1,660 _c | 1,329 _a | 1,151 _a | 1,064 _a | 1,334 _b |
| Poverty < US\$1.49 PPP (yes = 1) | .40 | .45 _a | .38 _a | .76 _b | .24 _c | .38 _a | .40 _a | .44 _a | .35 _b |
| Current asset value (US\$ PPP) | 1,816 | 1,434 _a | 1,724 _{a,b} | 680 _a | 2,630 _b | 2,484 _a | 1,582 _b | 2,002 _a | 1,626 _a |
| Land owned (ha) | .95 | 1.01 _a | 1.00 _a | .59 _a | .97 _a | .98 _a | .94 _a | 1.19 _a | .71 _b |
| Tropical livestock units (no.) | 1.74 | 1.99 _a | 1.95 _a | .87 _b | 1.62 _{a,b} | 1.63 _a | 1.78 _a | 2.08 _a | 1.40 _b |
| <i>Farm returns and input use</i> | | | | | | | | | |
| Returns to land (income/ha) | 3,798 | 6,100 _a | 4,079 _b | 2,021 _{b,c} | 2,137 _c | 2,797 _a | 4,149 _b | 2,370 _a | 5,254 _b |
| Returns needed (US\$/ha PPP) | 6,023 | 4,588 _a | 5,656 _a | 9,624 _b | 6,418 _{a,b} | 6,812 _a | 5,747 _a | 5,804 _a | 6,246 _a |
| Returns gap (US\$ PPP) | -2,222 | 1,512 _a | -1,574 _b | -7,609 _c | -4,281 _c | -4,020 _a | -1,594 _b | -3,434 _a | -987 _b |
| Farm family labour (person days) | 177.7 | 206.6 _a | 191.2 _a | 124.4 _b | 157.0 _b | 148.5 _a | 187.9 _b | 13.9 _a | 23.1 _b |
| Farm hired labour (person days) | 43.4 | 48.2 _{a,b} | 33.9 _{a,b} | 11.9 _a | 60.2 _b | 50.1 _a | 41.1 _a | 194.5 _a | 160.5 _b |
| Chemical fertiliser (kg/ha) | 106 | 159 _a | 90 _b | 69 _b | 89 _b | 62 _a | 121 _b | 47.9 _a | 38.9 _a |

Notes: Values in the same row and sub-table not sharing the same subscript are significantly different at $p < 0.05$ in the two-sided test of equality for column means. Tests assume equal variances.

step out of farming altogether but added non-farm activities to their income portfolio. Farm workers are clearly the most disadvantaged group. They have by far the lowest incomes and 74% are living below the poverty line. Differences between self-ascribed farmer and other households are less pronounced, with farmer households having older heads and fewer assets. Despite larger land sizes, households in Kitui earned less income per capita. This is partly related to the larger household sizes in the district as total income does not differ significantly.

Table 3 also provides information on farm returns, accounting for relevant crop and livestock input costs and use. In addition, we computed the returns from farming needed to raise a particular household above the poverty line given family size and cultivated land.¹ By deducting returns needed from actual returns we gain an idea of the ability to generate sufficient returns from agriculture to move above the poverty line. The analysis shows that full-time farmers have the highest actual returns while they require lower returns to stay out of poverty given their household size and land holdings. Accordingly, they are the only category with a positive gap, that is, their agricultural income alone takes them above the per capita poverty line. Full-time farmers and mixed income households utilise more family labour, while non-farm households are more reliant on hired labour. Farm workers have the largest gap of all groups and show limited use of both hired and family labour. Chemical fertiliser use is considerably higher among full-time farmers, indicating that they are more intensified. Similar to full-time farmers, self-ascribed farmer households use more chemicals and use more family labour for farming. Returns to farming are also higher for self-ascribed farmer households, translating into a smaller gap than that for households not describing themselves as farmers. This suggests that households identifying as farmers may be more inclined to invest in agricultural activities, even though these are not always the most important income sources.

Farm returns to land and labour in Embu are considerably higher than in Kitui. This is probably a result of the difference in agro-ecological potential between the two districts. The greater use of chemical fertiliser in Embu also indicates a more intensified agricultural system compared with Kitui. Finally, there is also a higher proportion of full-time farmers in Embu who realise higher returns per hectare. This suggests that the larger share of full-time farmers in Embu is supported by higher returns, whereas rural households in Kitui may be forced out of farming into off-farm activities to support their families. However, it could also indicate that households in Kitui have better opportunities for off-farm employment and thus choose not to focus on farming.

There is significant heterogeneity among the different groups of households based on their income portfolio and potential. Furthermore, there is a clear inconsistency between their self-perception and their actual income portfolio. However, it is impossible to judge, from the current income portfolios, what the reasons are for the less intensive and lower performance in farming. Lower ability to invest or lack of skills could be one explanation, but it could also reflect a choice by the household to focus more on off-farm opportunities and thereby lower their level of inputs (cash and labour) into farming. To shed light on this question, we utilised aspiration-based questions to understand household interest in farming which could be one determinant of the effort they put into their farming activities.

What are household livelihood aspirations and are there differences based on self-perception or opportunities such as agro-ecological potential or proximity to markets?

Table 4 provides an overview of livelihood aspirations to increase farm and/or off-farm income. This is based on open questions with respondents' answers categorised and coded as farm or off-farm. In line with their self-identification, the majority of households (64%) aspire to increase their farm income. Farm aspirations include irrigation, purchasing land, expanding cash and horticultural crops, planting (fruit) trees, as well as expanding or starting dairy and poultry farming. Examples of answers include: *"I would like to commercialise crop farming by buying a water pump and get a big tank to enable irrigation"*, *"Intensify our farming activities through planting mango trees as an enterprise"*, *"Advance crop farming by shifting from manual to intensive farming equipment, like greenhouses."*

Table 4. Livelihood aspirations and steps taken to accomplish them by various household groupings.

| | | Aspiration | | Steps taken | |
|--------------------|------------------|-------------------|-----------------------|-------------------|--------------------|
| | | Farm (yes = 1) | Off-farm (yes = 1) | Farm (yes = 1) | Off-farm (yes = 1) |
| Total sample | | .64 | .41 | .37 | .20 |
| Livelihood cluster | Full-time farmer | .65 _a | .31 _a | .36 _a | .13 _a |
| | Mixed income | .69 _a | .39 _{a,b} | .42 _a | .21 _{a,b} |
| | Farm worker | .56 _a | .47 _{a,b} | .24 _a | .18 _{a,b} |
| | Non-farm | .60 _a | .48 _b | .39 _a | .26 _b |
| Farmer household | No | .47 _a | .57 _a | .27 _a | .30 _a |
| | Yes | .70 _b | .35 _b | .41 _b | .17 _b |
| District | Kitui | .64 _a | .49 _a | .47 _a | .27 _a |
| | Embu | .63 _a | .32 _b | .28 _b | .13 _b |

Notes: Values in the same column and sub-table not sharing the same subscript are significantly different at $p < .05$ in the two-sided test of equality for column means. Tests assume equal variances. Households can aspire to increase only farm or off-farm, increase both or increase neither income source. Accordingly, the percentages presented in the table can overlap and need not add up to 100%.

Considerably fewer households (31%) aspire to increase their off-farm income. Off-farm aspirations comprised advancing current, or starting new businesses, including shops, salons, transportation, and rental houses. Examples of respondent aspirations include: *"Starting a hardware business and m-pesa shop in the locality because there is a vacuum"*,² *"I would like to invest more in business, such as a shop, expand my butchery and buy a motorcycle for transport business"*, *"Starting a boutique and shoe selling business."*

The more common aspiration to increase farm income was also reflected in the percentage of households that had taken steps towards that increase (37% in farming and 20% for off-farm incomes). Aspirations to increase farm income did not differ significantly between livelihood clusters. However, non-farm households more often aspire to increase their off-farm income compared to full-time farmers. Similarly, non-farm households more often took steps to increase their off-farm income. Self-ascribed farmer households were more likely to aspire to increases in their farm income and less likely to aspire to increases in off-farm income. This confirms the assumption that there is a link between self-perception and aspirations/steps taken by households, which needs to be further explored. In Embu, households were less likely to have taken steps to accomplish their aspirations. Comparing aspirations between districts shows no differences for farm aspirations, whereas more households in Kitui aspire to increase off-farm income.

Finally, we asked households to describe how they would see the future for their children (Table 5). This was again an open question whereby we coded answer categories that are not mutually exclusive. Our aim here was to get more insights into longer term aspirations by further detaching answers from the respondents' immediate needs and short-term plans. Besides general comments that parents wished their children to have a good life we could distinguish the following aspiration categories: farming, business, non-farm wage labour, and education. The business and wage labour categories, and to some extent education, can be interpreted as parents hoping for a non-farm career for their children. Common aspirations include: *"I would like them to become educated people with good jobs"* and *"Live healthy, get education, have good jobs and own businesses."* Only 6% of households across all groups aspired for their children to have a future in farming. Usually this was combined with off-farm aspirations, for instance: *"Having good jobs and also being professional farmers."* Only nine respondents (1.5%) wished their children to focus exclusively on farming (not depicted in the table). These respondents wanted their children to engage in intensive farming, for example, wishing they would become *"prominent farmers with dairy cattle and large-scale poultry and fruit farming"*. Three respondents even explicitly hoped that their children would *"not be farmers"*. In sum, most households aspire to increase their current farm income, yet they hope for a different future for their children.

Table 5. Future aspirations for children by various household groupings.

| | Livelihood cluster | | | | | Self-perception | | Location | |
|-----------------------|-----------------------------------|--|-----------------------------------|---------------------------------|-------------------------------|---------------------|------------------|------------------|------------------|
| | Total sample (<i>n</i> = 624) | Full-time farmer (<i>n</i> = 165) | Mixed income (<i>n</i> = 201) | Farm worker (<i>n</i> = 66) | Non-farm (<i>n</i> = 192) | Farmer household | | District | |
| | | | | | | No | Yes | Kitui | Embu |
| Farming (yes = 1) | .06 | .07 _a | .08 _a | .03 _a | .08 _a | .06 _a | .06 _a | .07 _a | .05 _a |
| Business (yes = 1) | .23 | .25 _a | .23 _a | .22 _a | .21 _a | .18 _a | .24 _a | .24 _a | .21 _a |
| Wage labour (yes = 1) | .57 | .58 _a | .65 _a | .60 _a | .51 _a | .57 _a | .57 _a | .56 _a | .59 _a |
| Education (yes = 1) | .53 | .54 _a | .55 _a | .56 _a | .48 _a | .53 _a | .53 _a | .54 _a | .52 _a |

Note: Values in the same column and sub-table not sharing the same subscript are significantly different at $p < .05$ in the two-sided test of equality for column means. Tests assume equal variances. Households can aspire to increase only farm or off-farm, increase both or increase neither income source. Accordingly, the percentages presented in the table can overlap and need not add up to 100%.

Discussion

How can we better understand the complex rural livelihood decision environment in order to improve targeting of interventions towards the most appropriate households and support their needs more effectively? In order to answer this question we build on the framework of livelihood aspirations and strategies of the poor developed by Dorward et al. (2009). Their analysis is built on the proposition that people want to maintain and/or advance their current welfare and that they attempt to do this by expanding existing activities and/or moving into new activities. From this they identify three broad types of rural livelihood strategies for farming households: (1) “Hanging in”, where households engage in agricultural activities to maintain their current livelihood, often in the face of adverse socio-economic circumstances and few or no other options to improve their situation; (2) “Stepping up”, where investments are made to improve agricultural returns to improve livelihoods; and (3) “Stepping out”, where accumulated assets are used to move into non-agricultural activities with higher or more stable returns. This may, but need not, involve cessation of all farming activities. This group could even be subdivided into a fourth category – “stepping out while staying put” whereby people stay on the land while concentrating on off-farm opportunities. In this case it may be that the land is perceived as a long-term safety net in case of job loss, business failure, or for retirement, or it could be that they identify culturally as “farmers” and do not want to give that up. This situation has implications for the development of rural areas as it hinders the consolidation of land which would enable the “stepping up” group to expand and grow their business.

Dorward et al. (2009) also identify situations where these strategies are likely to be more or less important, distinguishing between poor and less-poor households as well as high- and low-potential contexts. We adapted their approach by explicitly differentiating between on- and off-farm household aspirations and poor and less poor households (see Table 6). We recognise that the poverty line is somewhat arbitrary, and use it for illustrative purposes only. This differentiation on the basis of the total household income has been chosen to account for differences in investment potential. Poorer households will have less disposable income to make investments in farming or other businesses. We believe that taking household aspirations into account will improve the likelihood of response to or uptake of innovations, as households will look for opportunities that support their aspirations. We envisage that less-poor households with aspirations in agriculture will aim to step up as they can afford to invest, while “hanging in” is often the only option for poor households. Less-poor households with off-farm aspirations are likely to step out by migrating or starting local businesses, whereas poorer households are likely to hang in while engaging in farm labour or small local business activities such as roadside kiosks. Obviously, differentiating by livelihood strategy is only the first step when targeting rural households, though it is an important and often overlooked one. For agricultural interventions, the second step will have to account for the agro-ecological

Table 6. Implications for AR4D interventions of investment potential and household aspiration.

| | Aspiration | | | | | |
|--|--------------------------------|------------------------------|---|---------------------------------|---------------------------|--|
| | Likely pathway | Agriculture (% of sample) | | Likely pathway | Off-farm (% of sample) | |
| | | AR4D role | Characteristics of potential technologies | | AR4D role | Characteristics of potential technologies |
| Higher potential to invest (less poor / >US\$1.49) | Stepping up | High 40% | High yielding, input and capital intensive, marketable | Stepping out | Very low 23% | Business incubation for agricultural enterprises |
| Lower potential to invest (very poor / <US\$1.49) | Hanging in/ slowly stepping up | High 24% | Lower risk, labour intensive, moderate/ low capital intensive | Hanging in/ slowly stepping out | Low 18% | Low input/labour demands and low risk |
| Total | | 64% | | | 41% | |

potential of the region in question. However, we believe that there are technologies and options available for almost all regions. Moreover, this aspect of targeting is well established while the first step of accounting for aspirations has often been neglected.

Based on the likely livelihood strategies, Table 6 provides an overview of the households that can be targeted effectively by agricultural interventions. First, agricultural interventions are obviously relevant for households that aspire to intensify their agricultural portfolio; this is 64% of the sample. While this is the majority, it may appear surprisingly low for some people as the sample represents rural households that all engage in farming activities. Of the 41% that aspire to increase off-farm activities, only households with both on- and off-farm aspirations (9% not shown in the table) would be additional obvious targets.

Households aspiring to increase their agricultural income should be the main target group of agricultural interventions, as they are more likely to be interested in innovations and respond to incentives. Having said that, provision of attractive incentives for agriculture could persuade other households to re-assess their priorities. Characteristics of suitable technologies will differ by agro-ecological context and a household's potential to invest. Households that have the ambition to make their farm an enterprise and have some capital to invest can be served by catering to their needs. For example, less poor households may have the capacity to invest in options such as irrigation facilities, more expensive livestock breeds for dairy production, or on-farm processing facilities. Yet, the poorer segment of the population with ambitions in agriculture is less likely to have funds to invest in farming and thus need a different set of technologies. One avenue could be more labour-intensive options that reduce their downside risk while gradually improving their revenues. In this category, we would see agronomic management options such as agroforestry, deep tillage, small ruminants, poultry or zebu cattle. For the poorest, social protection programmes or cash transfers may be required to keep households from falling back and enable them to start stepping up.

Some households aim to step completely out of agriculture by migrating to cities or specialising into non-farm rural activities (Dorward et al. 2009). At first glance, these households should not be the primary target group for agricultural interventions. To assist this group, one has to carefully assess the goals they pursue with their agricultural portfolio. There are two very different options. First, they might invest in agriculture in order to generate revenue to invest in their off-farm endeavours. Second, they might use farming as a safety net and produce purely for home consumption with limited sales. In the first case they will require technologies that are easily marketable, and may require investments in inputs but possibly less labour, for example, modern hybrid varieties that might need pesticides or fertiliser to reach their high yield potential. In the second case, the household is likely to be unwilling to invest in farming (neither cash nor labour) and will demand technologies that provide stable outputs in low input regimes such as medium yielding, pest and disease tolerant non-hybrid (replantable) varieties. It is critically important to carefully consider this group

from a societal point of view. If, as elaborated above, this group is not willing or able to fully step out and enable the “stepping up” group to accumulate land, the rural transformation process as envisioned in the combination of “stepping up” and “stepping out” will likely not work. The population remaining in the rural areas will then be trapped on small land parcels and remain vulnerable to shocks and poverty. Therefore, enabling this group to pursue their aspiration to step out could have secondary effects for the “stepping up” group to enable the rural transformation.

Targeting agricultural interventions should be differentiated by household aspirations as well as on agro-ecological grounds. However, it may be very difficult to identify households and their preferred pathways as many rural households will identify themselves as farmers, especially when agricultural researchers are asking. Prospects of free inputs, training and other, more nebulous, project-related benefits may incentivise households to overstate the importance of agriculture. Indeed, in our exercise more households identified as farmers than expected based on their income portfolio. This may have been influenced by expectations of future support for respondents who are identified as farmers. Another explanation for the high share of self-identified farmer households may be related to culture and social norms in communities where farming is seen as a way of life. Finally, the off-farm activities that households engage in are diverse and farming could still be an important contributor to household income. Furthermore, across all groups farming contributes to home consumption needs and therefore food security, which has to be carefully considered.

Rural households do have aspirations but their livelihood strategies are based on current circumstances and qualifications. For example, aspirations were often related to “continuing” or “expanding” current activities, such as renting in land, investing in the current business, and so on. It may be that a stepping-up livelihood strategy is deemed less risky and more feasible than stepping out of farming. Though many respondents self-identified as farming households, very few aspired to a future for their children in farming. Respondents thus seem to be aware that stepping out may not be possible for them due to educational and other barriers. Indeed, it is less likely for a middle-aged person to make the transition out of agriculture, while it may be possible for their children. The difference in livelihood strategies for respondents, which is most often stepping up, and their children, which is almost exclusively stepping out, is likely to be a product of both household aspirations and realities. This reflects long-term trajectories whereby parents see their stepping up as eventually enabling their children to step out.

Conclusions

Our findings highlight the importance of carefully distinguishing between different types of rural households. This distinction must go beyond farming and non-farming households, by further accounting for differences within income portfolios but also aspirations. Avoiding the trap of calling all households with farm activity “farmers” and assuming they have no other interests, may increase the match between demands and technology development. Considering non-farm aspirations in rural contexts is clearly important; they may influence household perceptions of the relative value of agricultural innovations and hence their choice to adopt – or not.

Very few parents hope for a future in farming for their children. This is in stark contrast to their personal aspirations and investment plans, which mostly involve expansion or intensification of farming. This finding raises several pertinent questions that should be explored in future research. For example, what is the implication for agricultural innovations now and in the future? If most households foresee their children stepping out, does this mean that they are focused on short-term investments with quick wins? Though all poor households are probably looking for quick wins, this may mean that even wealthier households might not have the long-term horizons needed to consider investments in practices with delayed benefits such as agroforestry or soil fertility management.

There are also implications for changes in land use patterns, currently characterised by high levels of land fragmentation in densely populated areas. If households increasingly step out of farming, would this reverse the trend and enable consolidation of land for the next generation, for

example, through people selling or renting out their land? Or is the cultural attachment to land too strong and will agricultural areas become increasingly fragmented into smaller plots unable to produce excess food for sale to feed a burgeoning population? Are safety nets sufficiently developed to enable households to leave their farms, or is land still perceived as a necessary insurance or for retirement? Where are the opportunities outside farming to support increasing numbers of people leaving agriculture?

Finally, what are the implications for agricultural research and global development goals? How realistic is a win-win strategy of ending hunger and poverty by improving the productivity of the poor through agricultural innovations? Could it be better to tailor agricultural technologies to less-poor full-time farmer households with potential for more efficient larger scale production? But what about food security of the poorest with limited alternatives?

These complicated questions are largely derived from people's answers to two simple questions: What are your current investment plans? And, what would you like your children's life to look like in the future? This article is meant to start a discussion around the complicated issues raised by our simple questions. We do not claim to understand this complex system fully or that these are the right questions to answer. However, we do hope that raising these issues will broaden peoples' understanding of rural realities. Specifically, we hope that the agricultural research for development sector will more actively consider the implications of rural household diversity and aspirations for research and interventions. We therefore urge the field to listen better to those people we call "farmers" in order to offer solutions that meet their aspirations and realities.

Notes

1. Harris and Orr (2014) returns in \$/ha/year needed are: $(\$1.49 * \text{family size} * 365) / \text{cultivated area}$.
2. M-Pesa is the Kenyan mobile money platform.

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