RESEARCH TRENDS IN ANIMAL GENETIC RESOURCES IN AFRICA

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ABSTRACT
Under the EU-funded iLINOVA project, a study was undertaken to assess research trends in animal genetic resources (AGR) in Africa with emphasis on the implementation of the FAO's Global Plan of Action (GPA). Specific objectives included determining trends, drivers and direction of research on AGR with respect to funding, participation of local communities and institutional collaborations related to AGR studies in Africa. Methodology involved generating data from publications of FAO Journal of *Animal Genetic Resources* from Africa. From these Journal issues, all research on AGR conducted in Africa were assessed and the following variables were extracted: livestock breed of focus, strategic priority area of the GPA, country and region of Africa where the study was conducted, involvement of local communities, institutions involved, funding source, etc. Data analysis used non-parametric statistics. Results showed that overall, there was a preponderance of studies involving cattle, followed by chickens, goats and sheep. Spread of papers across Strategic Priority Areas (SPA) of the GPA showed that characterization (SPA #1) recorded 64% while SPAs # 2, 3 and 4 recorded much lower patronage. Cross-tabulation of results of livestock across regions in Africa showed that studies in Eastern Africa were dominated by cattle, poultry and small ruminants (in that order), in contrast to West Africa where studies on small ruminants dominated, followed by poultry and cattle. AGR studies from East Africa recorded high proportion of funded research compared to West and Southern Africa. Funding across livestock species showed favourable disposition for small ruminants and poultry. These findings could contribute to R&D efforts in Africa in connection with the implementation of the GPA by considering region-and country-specific research trends for AGRs in Africa.

Keywords: Animal Genetic Resources, Global Plan of Action. Research trends, Africa, iLINOVA

INTRODUCTION
The Global plan of Action (GPA) for Animal Genetic Resources (or the Interlaken Declaration) is an internationally agreed framework for the management, conservation and sustainable utilization of farm animal genetic resources globally (FAO, 2007). The Plan was endorsed by 109 countries, the European community and 42 global organizations. Aims of this global Plan include (a) combating the erosion of animal genetic diversity and (b) using animal genetic resources sustainably. According to FAO (2007), the GPA is divided into four strategic priority areas (SPAs) including characterization, sustainable use and development, conservation, policy, institution and capacity building.

Africa, as a continent, is faced by the constraint and challenge of low capacity in R&D related to long-term genetic improvement programmes (FAO, 2015). In addition, considering the vast livestock resources in Africa, there is the need for pro-poor animal improvement and livestock breeding strategies for the continent (Rege *et al.*, 2011). Since many countries in Africa are signatories to the GPA, it becomes pertinent to address the following questions: (a) What is the overall trend in R&D for AGRs in Africa? (b) Are there region- and country-specific trends with respect to particular AGR, funding for R&D for AGR, role of local communities, breed societies, etc? (c) What is the trend for R&D in AGR before and after Interlaken Declaration? (d) With reference to specific SPAs of the GPA, how are countries and regions of Africa faring with respect to each SPA of the GPA? Are there particular dispositions toward some SPAs? (e) What is the overall trend for SPAs for AGRs? (f) What are the funding patterns of R&D for AGRs across countries and regions of Africa, and across SPAs of the GPA and across breeds, livestock species or AGRs? (g) In particular, what is the trend for SPA_4 (policy, institutions and capacity building for AGR) in Africa?

In the light of these questions, the main objective of our study is to assess the general trend for R&D for AGRs across Africa. Specific objectives include: (a) establishing trends for R&D in AGRs with respect to specific breeds of livestock, countries and regions of Africa: (b) assessing the role of funding agencies for R&D in AGRs across Africa and across the SPAs of the GPA; (c) establishing region- and country-specific trends for R&D for AGRs; (d) establishing a trend for R&D in AGRs pre- and post-Interlaken; (e) assessing the trend for R&D in AGRs with particular reference to SPAs (1, 2, 3 and 4) and possible combinations thereof. Achieving these objectives will contribute towards addressing a comprehensive situation analysis of the *status quo* of R&D for AGR in Africa with respect to the GPA of the FAO. This is also in line with the goals and objectives of the EU-funded iLINOVA project (iLINOVA, 2014) for which Nigeria is a partner.

MATERIALS AND METHODS

Data source: The focus was Animal Genetic Resources Information (AGRI, now called Animal Genetic Resources, AGR), a Journal of the FAO of the UN, now published by Cambridge.org. Issues and contents of the AGR Journal from 1983 to 2015 were reviewed.

Variables extracted: Studies on AGR conducted from Africa were extracted from past issues of the Journal, and the following variables were recorded: volume and issue of the publication, country and region in Africa, study title, year of publication, livestock of focus, breed, breed society (if listed), institution(s) involved, whether *on-station* or *on-farm* study, regional or national coverage, agro-ecology/production systems, target communities, SPAs (1, 2, 3 & 4) of the GPA established through key words, abstract content, or key conclusions, acknowledgements of the funding source(s), involvement of local communities or breed societies, date of the publication (e.g. pre-Interlaken or before 2007 and post-Interlaken or after 2007). These afore-mentioned variables were extracted from a total of 124 papers on AGR studies from Africa. Two datasets were generated and analyzed. These are: (a) whole data of all 124 papers; (b) subset data for the top nine countries that contributed almost 80% of the AGR studies in Africa.

Data analysis: Data analysis was done *via* frequency procedures, cross-tabulations and non-parametric statistics. Overall, the datasets reflected the following summary: (a) Total number of studies from Africa in AGR = 124 papers; (b) Number of countries across Africa where studies were conducted = 26 countries; (c) Livestock covered =13; (d) Regions in Africa where studies were conducted = 4; (e) Years covered by the studies: 1983 to 2015.

RESULTS AND DISCUSSION

Results (Figure 1a) showed that the top six countries in Africa with the highest contributions to AnGR research and development include Ethiopia, Kenya, Nigeria, South Africa, Tanzania and Cameroon (in that order). These countries also have the highest livestock resources in Africa (FAOSTAT, 2013), implying that the superior livestock figures by these countries also translated to a commensurate boost in R&D for AnGRs.

Spread of papers across SPAs of the GPA (Figure 1b) showed that SPA_1 (characterization, inventory, monitoring of trends and associated risks) was top while SPA_4 (policies, institutions and capacity building) received the least patronage. This is may be a worrisome trend because the 4th SPA addresses policies, institutions and capacity building required for enduring systems to harness the advantages of sustainable use and conservation of AnGR for food and agriculture (FAO, 2015). It is of note that some studies combined two or three SPAs (especially SPAs_2 and 3 and sometimes, 2, 3 and 4). A study could combine SPA 4 (policy, institutions and capacity building), via *in situ* or *in vivo* conservation (SPA 3) through sustainable use (SPA 2).

Figure 2a shows the distribution of AGR studies across livestock within regions. In East Africa, R&D on cattle dominated followed poultry and small ruminants. In West Africa, studies on small ruminants dominated, followed by poultry and cattle, while studies from southern Africa showed near equal spread of papers for poultry and small ruminants. The trend for funding of R&D for AnGR is shown in Figure 2b. Across all regions, small ruminants and poultry recorded favourable funding when compared with other livestock.

Livestock R&D across regions in Africa (Figure 3a) showed that for cattle, East Africa dominated, followed by West Africa, while for poultry, East and West Africa were similar in ranking, followed by southern Africa. Small ruminant research showed a preponderance of papers from West Africa, followed by East Africa. Regional rankings (Figure 3b) showed AnGR studies from East Africa dominated (40%), and Southern Africa (13%), with North Africa recording 11%. Reasons for the disparity in regional trends for overall R&D efforts in AnGR across Africa could be attributed to predominant livestock populations, differences in funding, R&D priorities, state of capacities for R&D across different countries and regions.

Funding patterns of R&D for AnGRs (Figure 4a) showed that some 53% and 47% of all studies were funded and not funded respectively, indicating a near equal probability of AnGR studies in Africa being funded or not. Funding patterns however, differed by livestock species and across countries and regions. For instance, funding was more favourable in East Africa when compared to all other regions in Africa. Funding patterns however, differed by livestock species and across countries and regions. Funding across livestock classes (Figure 4b) showed a favourable disposition towards small ruminants and poultry when compared to cattle, pigs, horses and rabbits. Cross-tabulation results showed that cattle and poultry received higher research priorities in East Africa compared to small ruminants and poultry in West Africa, while cattle and poultry received equal rankings in southern Africa.

CONCLUSION

Our study has shown that there are differences across regions of Africa with respect to priorities of AnGR research, funding patterns, type of AGR funding across different livestock categories. There is the need to consider region- and country-specific research trends in AGRs in Africa.

ACKNOWLEDGEMENTS (a) EU funding for iLINOVA under which this study was conducted; (b) DAD-Net (FAO) and Cambridge.org for all Journal articles of ***Animal Genetic Resources Information*** (now ***Animal Genetic Resources***) accessible at: http://www.fao.org/ag/againfo/resources/en/pubs_gen.html.

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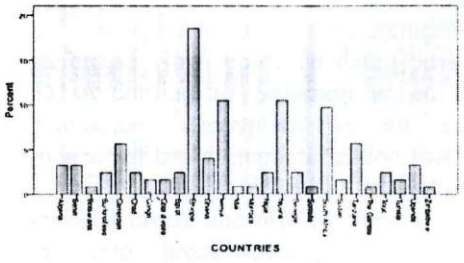
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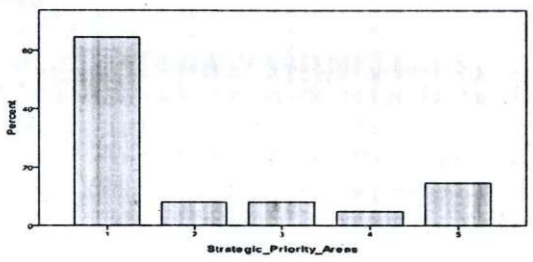
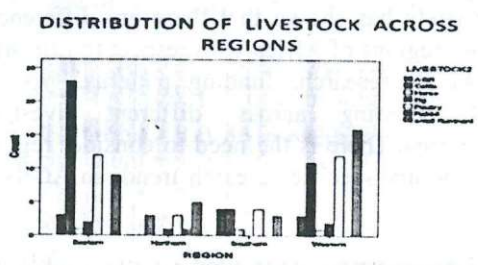


Figure 1a (Left): Spread of AGR studies across countries in Africa
Figure 1b (Right): Spread of AGR studies across SPAs of the Global Plan of Action



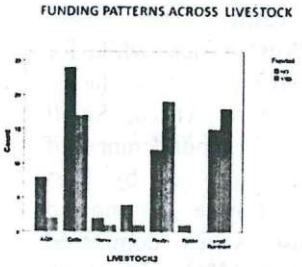
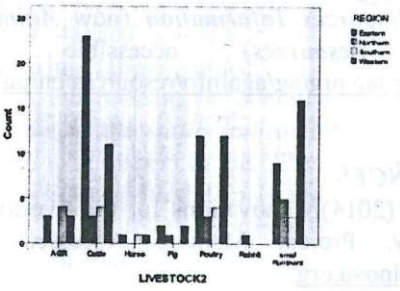


Figure 2a (Left): Distribution of AGR studies across livestock within regions
Figure 2b (Right): Funding pattern of AGR studies across livestock



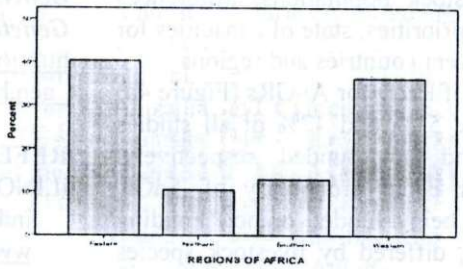
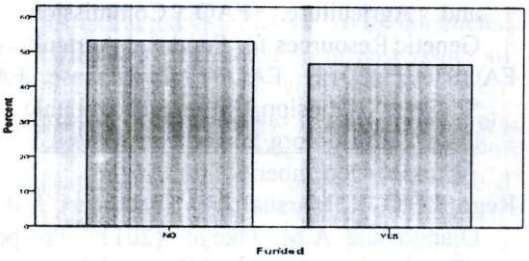


Figure 3a (Left): Distribution of AGR studies across livestock within regions
Figure 3b (Right): Ranking of AGR studies across regions of Africa



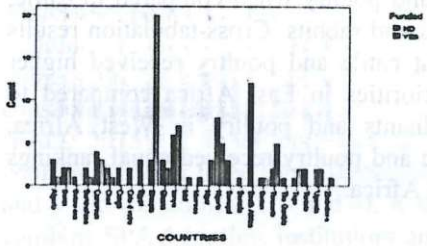


Figure 4a (Left): Distribution of AGR studies based on the funding criterion
Figure 4b (Right): Distribution of AGR studies based on funded research within country