Transforming Agrifood Systems in West and Central Africa Initiative

(TAFS-WCA)

Innovations scaling and assessment: spatial referencing and tracking of farmers in Democratic Republic of the Congo

Technical Report

Acknowledgements

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ABSTRACT

This report presents a dataset of the e-registration of actors in the agricultural production and value chains in Democratic Republic of the Congo for assessing the adoption of innovations and the diffusion of new technologies. Data was collected after a census conducted in three steps. In the first step, main crops production regions and value chain actors were identified. In the second step, we updated the list of actors based on membership of actors' associations. In the laststep, we did the census of all individual actors and geo-localized all farmers' fields and villages using GPS device. Data were collected for the 2022 growing seasons and the dataset contains 3,550 observations with 159 variables divided into six sections: (i) preliminary information on the respondents; (ii) socio-economic characteristics; (iii) information on the rice plots; (iv) knowledge, use and access to rice varieties; (v) knowledge, use and access to agricultural equipment and methods; and (vi) information on post-harvest activities. Six categories of actors were identified: seed producers (1,565), crops producers (1,539), parboilers (2), millers (39), traders (606) and service providers (98). On average, a farmer grows two crops. The main crops of farmers are beans (1,017) followed by maize (919), potato (359), cassava (325), rice (284) and soybean (203).

The dataset is valuable for the diffusion of a large scale of improved technologies and effective monitoring of the dissemination. Data can be used by scientists to have better understanding of crops value chains, production systems, the level of knowledge, accessibility and adoption of improved rice varieties and agricultural technologies, for further research regarding rice value chain development, technologies testing and socioeconomics studies of rice value chain actors and others crops such as maize, cassava, soybeans, sweet potato, banana and beans. Because of the large number of observations (3,550 actors), data can be used as sampling frame for further experiments or surveys based on random samples. Moreover, the dataset has the potential of generating descriptive statistics at the most disaggregated level of administrative units or villages for different equipment, methods and varieties adopted by gender and country.

Keywords

Crops, census, agricultural technologies, improved rice varieties, out-scaling, production systems, Democratic Republic of the Congo.

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Major abbreviations and acronyms

AfricaRice	:	Africa Rice Center
GDP	:	Gross Domestic Product
GEM	:	Grain quality enhancer, Energy-efficient and durable Material
ICT	:	Information and Communications Technology
IITA	:	International Institute of Tropical Agriculture
PII	:	Policy, Innovation Systems and Impact Assessment Program
SDG	:	Sustainable Development Goals
SSA	:	Sub-Saharan Africa
TAFS WCA	:	Transforming Agrifood Systems in West and Central Africa initiative

1. INTRODUCTION

1.1. Background

Agriculture represents more than one-third of the gross domestic product (GDP) of African countries and is considered the continent's single most important economic activity[1]. It can contribute towards major continental priorities, such as eradicating poverty and hunger, boosting intra-Africa trade and investments, rapid industrialization and economic diversification, jobs creation and shared prosperity[2]. Rice is one of the most important cereal crops in Africa () and now represents the staple food for more than 750 million people in Sub-Saharan Africa. Rice consumption is growing faster in Africa and particularly West Africa than any part of the World. In West Africa, about 310 million people derive about 20% of their daily calories from rice. However, rice demand in this region is growing faster than local supply, leading to substantial rice imports and dependence on international rice prices.

To reduce the importation bills and to achieve Sustainable Development Goals (SDG) in Africa, improved technologies including high yielding and climate smart varieties, good agronomic and postharvest practices are paramount. The diffusion of agricultural technologies faces enormous challenges in the region due to insufficient reach to the real actors in need. The diffusion at large scale of improved technologies, better targeting and effective monitoring of the dissemination required ex-ante information of the situation of the target population. Similarly, sampling frames required for assessing the achievements and impact are often lacking. To fill these gaps, e-registration and spatial referencing and tracking of farmers and values chain actors are essential. Although it was difficult in the past to map a whole population, today digital solutions offer the possibility of ex-ante registration of the potential beneficiaries using simple ICT tools.

Based on the successful experience of the e-registration of rice value chain actors conducted recently in Benin and Cote d'Ivoire [3] , this report presents the result obtained by extending the e-registration and spatial referencing and tracking system for rice value chain actors and others crops in Democratic Republic of the Congo (DRC).

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[1] https://education.nationalgeographic.org/resource/africa-resources/
[2] https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Inclusive_Growth-An_imperative_for_African_Agriculture.pdf

This report presents the main results of the e-registration and spatial referencing and tracking system for rice value chain actors and others crops such as maize, cassava, sweet potato, banana, soybean, beans, traditional African vegetables in Democratic Republic of the Congo.

1.2. Objectives of the e-registration in Democratic Republic of the Congo

The main objective of the e-registration is to collect reliable, accurate and sufficient data for better targeting and monitoring of interventions and accelerating the delivery of inputs and services as well as the tracking of improved technologies and beneficiaries, through an e-registration and spatial referencing of farmers. Specific objectives of the e-registration are:

1. To collect simple and robust socio-economic and geographic data on different types of producers (producers of foundation seed, producers of certified seed, producer of crops for consumption) and other actors (milers, parboilers, traders and service providers) in Democratic Republic of the Congo;

2. To collect GPS coordinates of actors surveyed;

3. To evaluate the knowledge, access to and use of agricultural technologies (new varieties, equipment and methods) by farmers.

2. SPECIFICATIONS TABLE

Subject	Social Sciences
Specific subject area	Agriculture, varieties adoption, agricultural equipment and methods used
Type of data	Table Figure Data in Excel format & STATA format (.dta)
How the data were acquired	Data were collected through census and surveys of rice value chain actors with structured questionnaire using android tablet
Data format	Raw Analyzed Cleaned
Parameters for data collection	Face-to-face interviews using structured questionnaire and geographic locations obtained with GPS device.

Description of data collection	Census of all rice value chain actors and others crops such as m*aize,* cassava, sweet potato, yams, banana, cocoa, soybean, bean, traditional African vegetables were done in three steps. In the first step, main rice production regions and rice value chain actors were identified. In the second step, we updated the list of actors based on memberships of actors' associations. Finally, we did the census and interviewed all actors and geo-localized farmers' fields and villages using GPS device.

Data source location	The data were collected in rice hubs:
	
	 1. Democratic Republic of the Congo: 3 regions
	
	     1.1. Bukavu (Kabare)
	
	     1.2. Uvira (Plaine de la Ruzizi)
	
	     1.3. Walungu

Data accessibility	Repository name: Mendeley Data Data identification number: N/A Direct URL to data:

3. VALUE OF THE DATA

- The data in this report is useful because it is a large multidisciplinary dataset comprising 3,550 observations of seven different categories of actors (foundation seed producers, certified seed producers, crops producers, parboilers, millers, traders and service providers) for better understanding of the rice value chains, rice production systems and adoption of improved rice varieties and agricultural technologies.

- This dataset can be used by scientists, policy makers, extensions officers, NGO and development agencies such as United Nations organizations.

- The data is valuable for further research regarding rice value chain development, socioeconomics studies of rice value chain actors, yield analysis (spatial distribution and yield gap), knowledge, accessibility and adoption of rice improved varieties and technologies [2] and to analyze rice cropping systems [3] . The dataset can be used to map and characterize rice value chain actors in West Africa and to develop appropriate technologies along the rice value chain. The dataset can be further analyzed using advanced methods (e.g. econometric models, spatial analysis).

- The data is valuable for diffusion at large scale of improved technologies and an effective monitoring of the dissemination.

- Because of the large number of observations (3,550), dataset is valuable as sampling frame for future experiment or surveys based on random samples.

4. DATA DESCRIPTION

The diffusion of agricultural technologies faces enormous challenges such as the identification and the geolocation of the real actors in need [2] . Sampling frames required for surveys are often missing. To fill these gaps and better fit the preference of actors, a census and interviews of all rice, maize, cassava, sweet potato, banana, soybean, bean, and traditional African vegetables value chain actors were conducted in production zones in DRC.

The questionnaire which is submitted as supplementary file (Appendix) was used to collect information on farmers and other actors' demographic characteristics and specific sections related to each category of actors. For producers (seeds producers, producers of each crop for consumption), 150 variables were grouped in five sections: preliminary information on the respondents; socio-economic characteristics; information on the rice plots; knowledge, use, and

access to rice varieties; and knowledge, use and access to agricultural equipment and methods. Parboilers, millers and traders were interviewed, in addition to preliminary information on the respondents and socio-economic characteristics (sections 1 and 2), on nine questions related to post-harvest activities (section 6 of the questionnaire). Table 1 summarizes the dataset and variables. The dataset is in Microsoft Excel (in one sheet) and STATA format (Appendix). The questionnaire, the excel sheet and STATA format provide labels and variable names definition.
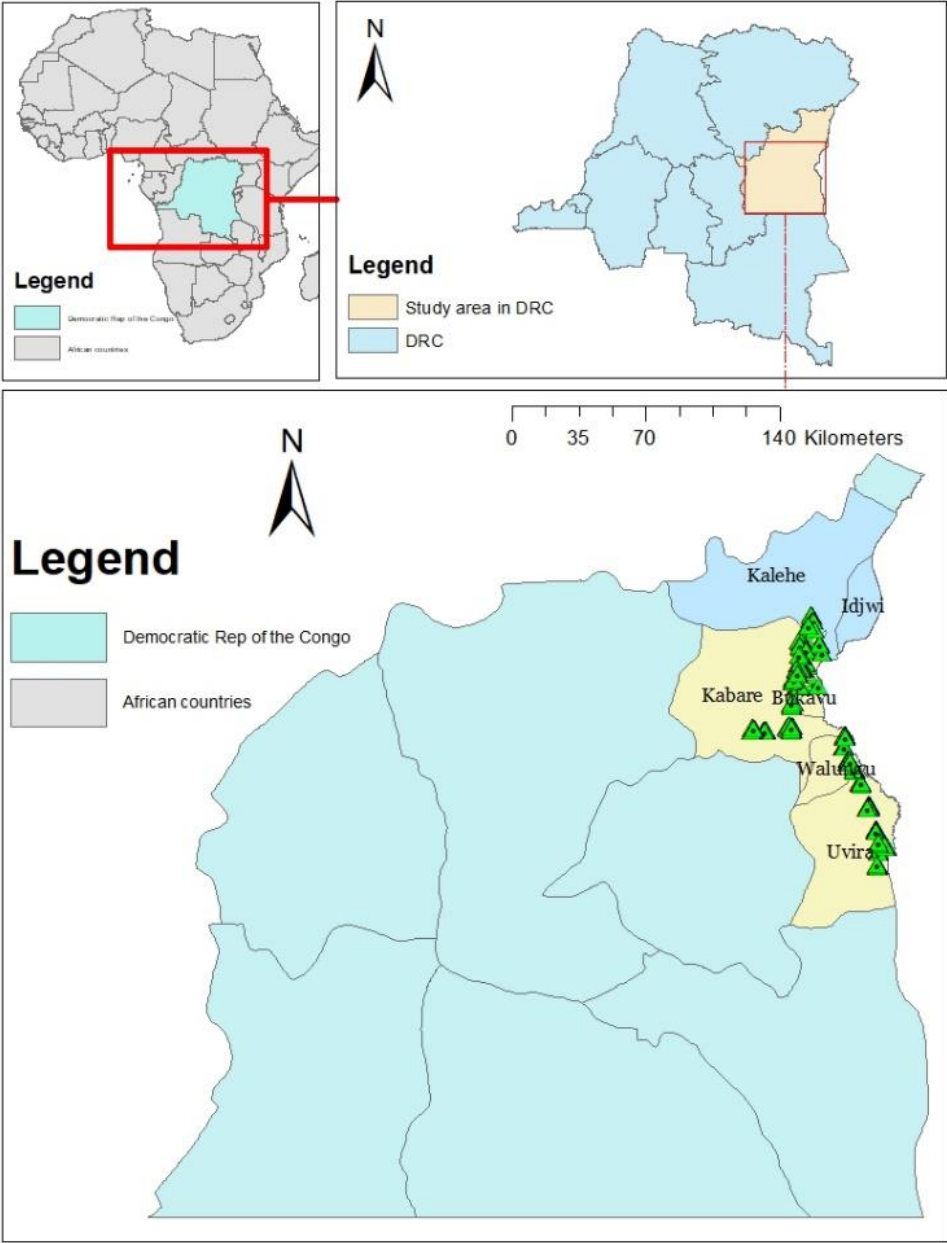
Figure 1: Map highlighting the study area of the E-registration and distribution of actors surveyed in DRC

The data resulted from surveys of seven main categories of rice value chain actors: foundation seeds producers, certified seeds producers, producers, parboilers, millers, traders and service providers. A total of 3,550 actors (farmers, postharvest actors and service providers) were interviewed and geo-localized. Data were collected for the 2022 growing seasons (first and second seasons). As an example of the potential use of the dataset, Fig. 1 shows a map representing the spatial distribution of the different actors surveyed. Fig 2. Present areas involved in the data collection in DRC.

Table 1: Summary of the variables included in the dataset grouped by section

Variables	Scale type	Scale class	Source of data
Section 1: Preliminary information on respondents			
Code of the respondent	Numeric	Unique code	surveys
Name of country	Nominal	Ghana, Nigeria, Cote d'Ivoire, Rwanda, Burundi, DRC	surveys
Name of region or district	Nominal		surveys
Name of town or village	Nominal		surveys
Date of survey	Numeric		surveys
Section 2: Socio-economic characteristics of respondents			
Name and surname of the actor	Nominal		surveys
Age	Numeric		surveys
Gender	Nominal	Female, Male	surveys
Education level attended	Ordinal	Illiterate, Primary, Junior high school, Senior high school, University.	surveys
Number of household members producing rice (Having a rice field)	Numeric		surveys
GPS coordinats	Numeric		surveys
Telephone number of the respondent	Numeric		surveys
Type of actors	Nominal	Foundation seeds producers, certified seeds producers, Producers for consumption (paddy rice producers, etc), Parboilers, Millers, Traders and Service providers.	surveys
Section 3: Information on the rice plots			
Number of crops cultivated	Numeric		surveys
Rice area for the first season 2022	Numeric		surveys
Production for the first season	Numeric		surveys
Rice area for the second season 2022	Numeric		surveys
Production for the second season 2022	Numeric		surveys
Section 4: Knowledge, use, access to rice varieties			
Name of variety	Nominal	NERICA, IR841, ARICA, SAHEL, WITA, FARO, BL, NL, BOUAKE, JT11, ORYLUX, AGRA, Jasmine.	surveys
Knowledge of the variety	Nominal	Yes, No	surveys

Name of the variety with its code if applicable	Nominal		surveys
Access to variety	Nominal	Yes, No	surveys
Grown at least once	Nominal	Yes, No	surveys
Grown the variety in 2018	Nominal	Yes, No	surveys

Section 5: Knowledge, use and access to equipment and methods

Equipment or method	Nominal	ASI thresher (for threshing and winnowing paddy rice), GEM (for rice parboiling), RiceAdvice, Smart-valley, SRI (Intensive Rice Farming System), Manual weeder, Power tiller	surveys
Knowledge of the equipment	Nominal	Yes, No	surveys
Access to the equipment	Nominal	Yes, No	surveys
Use at least one of the equipment	Nominal	Yes, No	surveys
Use in 2018	Nominal	Yes, No	surveys

Section 6: Information on post-harvest activities (for parboilers, millers and traders)

Quantity of parboiled rice per month	Numeric		surveys
Number of months of work in the year	Numeric		surveys
Knowledge of GEM equipment	Nominal	Yes, No	surveys
Access to GEM equipment	Nominal	Yes, No	surveys
Use of GEM equipment	Nominal	Yes, No	surveys
Quantity of milled rice per month	Numeric		surveys
Quantity of rice sold in the year	Numeric		surveys
Proportion of imported rice sold	Numeric		surveys
Proportion of local rice sold	Numeric		surveys
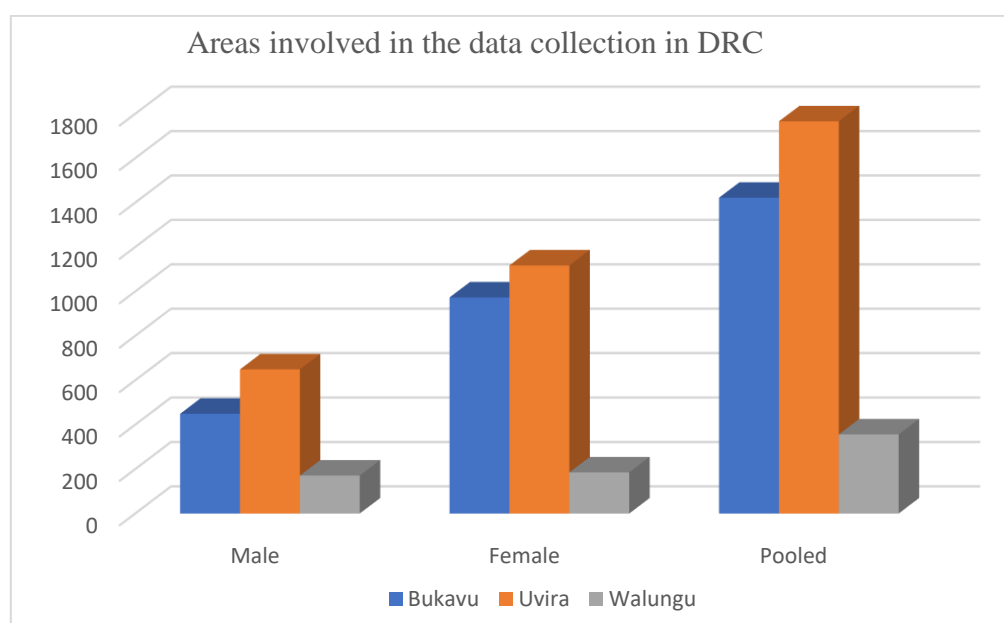
Figure 2: Frequency of actors surveyed per area and gender in DRC

Data were collected for the 2022 growing seasons and the dataset contains 3,550 observations (Table 2 & 3). Table 2 shows another use of the dataset by presenting the socioeconomic characteristics of farmers and other actors surveyed. The average age was 39 years old for all actors. Parboilers, traders and service providers tend to be younger (about 37 years old). Producers had about 30% illiterate, and about 30% had primary level of education (Table 2). About 36% of actors surveyed are male. Females are more involved in agricultural production activities in DRC.

Table 2: Selected socio-economic characteristics of actors registered in 2023 in DRC

Socioeconomic characteristics		Foundation seed producers	Certified seed producers	Crop producers	Parboilers	Millers	Traders	Service provider	Overall
Age		36.66 (12.87)	40.54 (14.64)	42.36 (13.76)	37 (12.72)	41.02 (13.6)	37.90 (13.4)	36.92 (11.08)	39.44 (13.69)
=1 if male (%)		30.02	39.00	41.85	100	56.41	28.88	56.12	35.77
Education level (%)	Illiterate	26.72	34.82	30.54	0	30.77	29.21	32.65	29.55
	Primary	30.11	30.08	30.47	0	17.95	27.89	28.57	29.52
	Junior high school	23.49	18.66	18.91	0	33.33	20.96	14.29	20.85
	Senior high school	18.36	14.21	17.74	100	17.95	19.64	17.35	18.14
	University	1.32	2.23	2.34	0	0	2.31	7.14	1.94

() standard deviation

Table 3 shows the distribution of the respondents by crops. Eight crops were involved in this study: rice, maize, cassava, sweet potato, banana, soybean, beans, traditional African vegetables in DRC. Among the producers in DRC, 53.77% (1,647) are Cassava producer, 49.69% (1,522) are Maize producers, 54.55% (1,671) are beans producers, 14.20% (435) are soybeans producers and 14.04% (430) are rice producers (Table 3). Data can be used as a sampling frame based on random samples.

Table 3: Frequency of producers surveyed in DRC in 2023 by crop

Type of crops	Frequency (%)	Number (N=3,063)
Rice	14.04	430
Maize	49.69	1,522
Cassava	53.77	1,647
Sweet potato	24.49	750
Banana	3.89	119
Soybean	14.20	435
Beans	54.55	1,671
Traditional African vegetables	1.14	35

Table 4 shows the population's adoption rates of technologies among rice producers registered in Democratic Republic of the Congo who have knowledge of the technologies. IR varieties are known and were adopted by 50% in DRC. NERICA, ARICA, SAHEL, WITA and JT varieties were not known and adopted in DRC (Table 4). Also, ASI thresher and RiceAdvice were not well known and adopted. Smart-Valley, Mechanical weeder and Power tiller are well known and adopted by 84.55%, 86.48% and 55.26%, respectively (Table 4).

Table 4: Population adoption rates of technologies among rice producers registered in 2023 in Democratic Republic of the Congo

Technologies	Democratic Republic of the Congo	
	%	N
Varieties		
NERICA	100	4
IR	50	37
ARICA	100	1
FARO	100	2
ORYLUX	100	1
Technologies		
ASI	40.91	9
Developed inland valleys (Smart-Valley)	84.55	197
SRI	51.35	19
Mechanical weeder	86.48	678
Power tiller	55.26	252

5. EXPERIMENTAL DESIGN, MATERIALS, AND METHODS

Data were collected from value chain actors after a census conducted in three steps. In the first step, rice value chain actors and the regions of rice production were identified in each country. Also, actors and regions of production of maize, cassava, sweet potato, banana, soybean, bean and traditional African vegetables were identified. For rice, the regions selected are the major rice growing areas named hubs. These hubs are zones of high potential impact where rice research innovations are integrated across the value chain to achieve development outcomes and impact [4] [4]. In the hubs, Africa Rice Center (AfricaRice) and national scientists are introducing, evaluating and validating new rice technologies, and work with development partners to facilitate the training of farmers, out-scaling of technologies and establishment of linkages among actors along the rice value chain. Hubs were selected in participatory approach with IITA, national partners and value chain actors. Data were collected in the hubs selected in Democratic Republic of the Congo. In the second step, the list of actors was obtained from actors' associations and updated through census. All individual actors were interviewed. The questionnaire and the design of an android-based application were developed for e-registration of farmers. Finally, enumerators were recruited and trained for data collection in each country. The questionnaire was pre-tested by enumerators before the beginning of the surveys. Data collection was coordinated and supervised by AfricaRice staffs, IITA staff in Bukavu and Uvira and. Actors' leaders facilitated contact with respondents. Face-to-face interviews were conducted, and the location of all ten crops farmers' and villages were geo-referenced using GPS device. Data were analyzed using STATA 15 software.

6. CONCLUSION

The e-registration and spatial referencing and tracking of value actor chains have been conducted in Democratic Republic of the Congo. The e-registration survey and spatial referencing and tracking of farmers were organized in the framework of the Transforming Agrifood Systems in West and Central Africa initiative (TAFS-WCA) for better targeting and effective monitoring of the diffusion at large scale of improved technologies. The purpose of the e-registration is to collect reliable, accurate and sufficient data that can be used as sampling frame based on random samples for TAFS-WCA baseline survey. The e-registration in DRC mainly focuses on eight crops: rice, maize, cassava, sweet potato, banana, soybean, bean, traditional African vegetables.

In Democratic Republic of the Congo, data were collected from 3,550 households in 3 regions including 1,422 in Bukavu; 1,766 in Uvira and 356 in Walungu. Five categories of actors have been identified: producers (3,063), millers (39), parboiler (2) traders (606) and service providers (98). Among the producers in DRC, 53.77% (1,647) are cassava producers, 49.69% (1,522) are maize producers, 54.55% (1,671) are beans producers, 14.20% (435) are soybeans producers and 14.04% (430) are rice producers.

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