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### ► To cite this version:

Marina Dimitriou, Louis Olie. Reusing data for development: Lessons learned from an agricultural observatory in Madagascar. *Journal of Rural Studies*, 2025, 114, pp.103585. <10.1016/j.jrurstud.2025.103585>. <hal-05182785>

**HAL Id: hal-05182785**

**<https://hal.science/hal-05182785v1>**

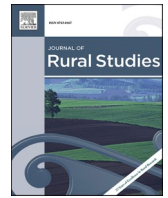
Submitted on 23 Jul 2025

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# Reusing data for development: Lessons learned from an agricultural observatory in Madagascar

Marina Dimitriou<sup>a</sup>, Louis Olié<sup>b,\*</sup> 

<sup>a</sup> European Central Bank, Frankfurt am Main, Germany

<sup>b</sup> CIRAD, UMR MoISA, La Réunion, France

## ARTICLE INFO

### JEL classification:

C81  
C83  
O13  
O20

### Keywords:

Data  
Development  
Rural  
Agriculture  
Africa  
Observatory

## ABSTRACT

We examine the issue of data reuse to bridge the data gap needed for advancing agricultural and rural development in Africa. We present the contributions of an observatory project in Madagascar—a low-income country with weak statistical capacity—and the lessons learned regarding its feasibility, challenges, and relevance. We argue that leveraging existing data to foster sustainable development in a key sector such as agriculture is achievable and depends largely on promoting collaborative academics and public-private partnerships.

## 1. Introduction

The concept of data reuse is becoming increasingly prominent in the academic sphere and public debate in the last decade, as evidenced by the recent World Bank Development Report (World Bank, 2021). Data reuse in development involves repurposing existing datasets for new purposes, to inform decision-making and policy development, without the need for new data collection efforts, leveraging administrative records, surveys, censuses, geospatial data, and others. In the context of rapid socioeconomic transformation, it is essential to expand on this issue, particularly in developing countries, which still need to catch up. Although there are many spheres in which data access and reuse are crucial, agriculture is seen as a priority on a global scale. As Carletto (2021) points out, the global community must address the challenges of the agricultural sector in order to meet its commitments to the 2030 Agenda for Sustainable Development. At the same time, agriculture remains an expected engine of economic growth for agriculture-based African countries—countries where it contributes significantly to GDP (de Janvry and Sadoulet, 2020). Agricultural data collected using various methods is vital for policy design and evaluation in developing

countries where agriculture remains a leading employer and major source of income (Abay et al., 2023).

Data reuse can be an important asset for gaining knowledge on agriculture in light of pressing global issues such as climate change, particularly for family farming, which is the dominant form of agriculture worldwide. Amongst those, smallholders have a crucial part to play, bringing about 35% of food production's value in Africa (Lowder et al., 2021). Family farming has multifunctional attributes spanning the economic, social, and environmental realms, which lead to various risks relative to the agricultural activity. A better understanding of these risks, the issues at stake regarding production trends and the mitigation strategies will enhance the design of tailored agricultural policies. Among others, family farming is crucial for ensuring food security with food provision (Frelat et al., 2016), rural livelihoods serving as a major source of income in rural areas (Davis et al., 2017), agro-environmental sustainability with the adoption of sustainable practices (Darnhofer et al., 2016) and promotion of resilience to climate change (Guth et al., 2022; Herrero et al., 2017). Monitoring the evolution and transformation of small-holding agriculture is therefore seen as pivotal for tackling poverty and food insecurity.

\* Corresponding author.

E-mail address: [louis.olie@cirad.fr](mailto:louis.olie@cirad.fr) (L. Olié).

<https://doi.org/10.1016/j.jrurstud.2025.103585>

Received 1 July 2024; Received in revised form 30 November 2024; Accepted 20 January 2025

Available online 27 January 2025

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For public agricultural policies to be effective, up-to-date and accurate information on family farming conditions is needed. Monitoring will help policy-makers understand the needs and priorities of family farmers, assess the effectiveness of existing policies, and design better-targeted and scaled interventions to ensure sustainable development. Indeed, family farming characterized by small land holdings, engages in diverse agricultural activities managed primarily by family labor and producing for both self-consumption and sale (Moyo, 2016). Despite their prominence, family farmers are still a vulnerable group often neglected by development policies (Fan and Rue, 2020), as the face of poverty is essentially rural, with 80% of the extremely poor and 75% of the moderately poor living in rural areas (Castañeda et al., 2018).

This paper addresses the following question: How can data reuse effectively bridge the agricultural data and knowledge gaps in low-capacity settings? Using Madagascar as a case study, we investigate this question through an observatory project that leverages secondary data from household and agricultural surveys. The project focuses on generating accurate and policy-relevant statistics on family farming at the national level. Rather than replacing tools like the Rural Observatory Surveys (Andrianjafindraine et al., 2024), which have provided localized insights since 1995 on various agroecological zones, this initiative complements and extends its contributions by using national-level datasets to monitor agricultural and rural transformations within a broader framework.

The aim of this paper is twofold: documenting the data gap in agriculture and bringing light to the public and private measures for addressing it in Africa. Firstly, we review and assess global and regional institutional initiatives in creating, accessing, and sharing data to bridge the gap between agricultural data, agricultural research, and related policies. Secondly, we present the observatory project as a complementary initiative in Madagascar, highlighting its methodology, findings, and lessons learned. By reusing data to characterize family farming, the project offers valuable insights for better rural and agricultural policy-making and contributes to the growing literature on leveraging public sector data for development (see e.g. Jolliffe et al., 2023).

The remainder of this paper is organized as follows. Section 2 examines the impact of data gaps on development policies in Africa and outlines the data-related initiatives to address them, while Section 3 focuses on Madagascar, detailing its agricultural data challenges and related efforts. Section 4 presents the methodology of an observatory project in Madagascar to meeting the challenges arising from this data scarcity. Section 5 presents the results and discusses the lessons learned to inform the approach of data reuse. Section 6 concludes.

## 2. Literature review: The agricultural data gap and initiatives to address it in Africa

### 2.1. Data gap and implications for development policies

The agricultural data gap in Africa poses significant challenges for evidence-based policymaking and sustainable rural development, as timely and accurate information remains scarce. The establishment of the Millennium Development Goals in the early 2000s was part of this response, emphasizing the necessity of statistical data to monitor the path towards the defined goals (Sanga, 2011). This need was already present and underscored by several initiatives, particularly in Africa, where weaknesses in statistical apparatus and data quality are prominent. More recently, the foundation of the 17 Sustainable Development Goals (SDGs) in 2015 and their respective indicators has reinforced the ambition for data availability to target policies more effectively.

The data gaps in Africa have been highlighted by many authors (see, e.g. Arthi et al., 2018; Carletto, 2021; Jerven, 2013), particularly

affecting agricultural statistics and the monitoring of agricultural progress. However, the data situation in Sub-Saharan Africa is complex. Their production, when undertaken, occurs under difficult circumstances. Financial constraints and political interference play a key role in this process (Jerven, 2013). Moreover, deficiencies in financial capital lead to sporadic data production, disregarding the best available practices.

In response, the African Development Bank launched a series of assessments starting in 2013 to evaluate and improve the capacity of African nations to produce timely, reliable and sustainable agricultural statistics. This initiative introduced Agricultural Statistics Capacity Indicators (ASCIs), covering institutional infrastructure (prerequisite dimension), resources (input dimension), statistical methods and practices (throughput dimension), and the availability of statistical information (output dimension), and monitored their evolution across 52 countries (AfDB, 2020). Countries are then divided into groups according to their ASCIs score, on a 5-point scale from very weak (20 to <40) to very strong (80–100). The ASCI score for Africa demonstrated promising trends in the last assessment cycle of 2017, increasing by 9.4 points from 46.6% in 2013 to 56.0%, and signaling improved capacity across African countries to produce quality agricultural and rural statistics.

While recognizing and addressing these data gaps is crucial for formulating evidence-based policies, data availability alone is not sufficient. Integration into political debates and research agendas is essential to achieve significant improvements in the sector. For instance, more research is needed to contribute to the knowledge of food system externalities, which limits our ability to quantify and link agricultural production decisions and consumption to external effects on the environment, health, and livelihoods in general. The lack of information on how food systems influence people's well-being is thus a major constraint for development policy formulation (Carletto, 2021). A recent World Bank report highlights that data gaps affect 78% of the most deprived people and are responsible for productivity and agricultural income losses.<sup>1</sup>

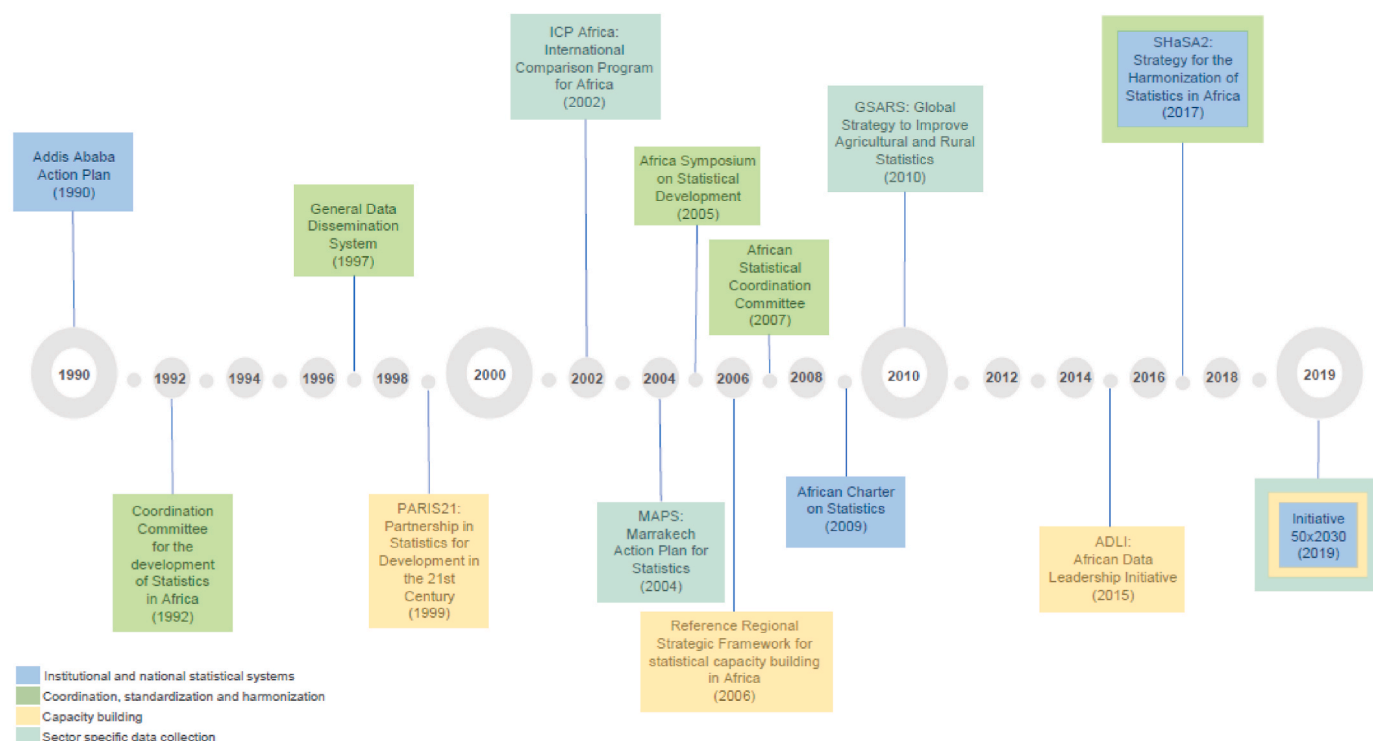
### 2.2. Data-related initiatives in Africa

During the 1990s, recognition of the shortcomings of the statistical system in Africa gradually gained in importance. In response, a wave of initiatives was launched across the continent. This momentum was reinforced by the growing consensus on the importance of data for decision-making. These initiatives testify to Africa's commitment to strengthening its statistical capabilities and guiding its efforts towards more sustainable economic and social development.

Fig. 1 presents a timeline of major data initiatives in Africa, showing how the continent's statistical landscape has evolved over time. These initiatives have emerged at national and then continental levels, and have aimed to strengthen statistical systems, promote coordination, collaboration, standardization and harmonization, and develop skills and awareness around data. From the introduction of the Addis Ababa Plan of Action (AAPA) in 1990 to the 50x2030 Initiative<sup>2</sup>

<sup>1</sup> Available at <https://www.worldbank.org/en/news/feature/2014/11/12/for-up-to-800-million-rural-poor-a-strong-world-bank-commitment-to-agriculture> (Last accessed, 10 February 2024).

<sup>2</sup> Launched at the Data to End Hunger event during the UN General Assembly in October 2018, the 50x2030 Initiative unites a multi-agency partnership of the World Bank, FAO and IFAD to minimize the agricultural data gap and promote data-smart agriculture through strengthening national agricultural data. Its goal is to conduct a fit-for-purpose, integrated and financially sustainable agricultural and rural surveys survey program that meets country data needs and fosters a culture of data use for decision-making in 50 low and lower-middle income countries by 2030. Available at <https://blogs.worldbank.org/en/opendata/mind-gap-enabling-data-smart-agriculture-all> (Last accessed, 10 February 2023).



Source: Authors

Fig. 1. Timeline of initiatives to improve data production and quality in Africa.

in 2019, these efforts have contributed to improving the quality, availability and use of data to guide development policies on the continent. To outline the scope and achievements of the initiatives, we group them by four topics—i.e. i) institutional strengthening and national statistical systems, ii) coordination, standardization, and harmonization, iii) capacity-building, and iv) sector-specific data collection—and summarize their primary objectives, before presenting their impacts. This approach distinguishes between foundational improvements and sector-specific efforts, providing a clear framework for understanding how these initiatives collectively strengthen Africa's data landscape although some overlap exists as initiatives often pursue multiple goals.

**Institutional strengthening and national statistical systems.**— This category focuses on initiatives aimed at building resilient national statistical systems that support consistent and reliable data production. The primary objective is to ensure that national institutions can independently produce, manage, and disseminate reliable data essential for evidence-based policymaking. National statistical systems play an essential role in the data revolutions since they are at the heart of a broader data ecosystem. Consequently, development stakeholders must prioritize developing national statistical systems. With this in mind, and given the primordial role of data in the design of development policies, numerous initiatives around the development of statistical systems have emerged. The AAPA was one of the first major initiatives to improve national systems. It focused on statistical self-sufficiency, improving data quality, and raising awareness of the importance of data. This initiative was supplemented by the 2009 African Charter on Statistics, which set out the principles to guide the development of national statistical systems across Africa, establishing a foundation for reliable, transparent, and standardized data. To a certain extent, the 2017 Strategy for the Harmonization of Statistics in Africa (SHaSA 2) also aimed, among its multiple strategic goals, to support the creation of robust national systems by promoting the harmonization of statistical methods between countries, thereby guaranteeing a high level of national data quality.

Finally, the 50x2030 Data Smart Agriculture Program played a crucial role in filling the global gap in agricultural data by transforming national data systems to track efforts, particularly on SDGs 2 and 5.<sup>3</sup>

**Coordination, standardization, and harmonization.**— This category covers initiatives that promote cross-country collaborative efforts and coordination, and the development of standardized statistical practices, making data comparable and fostering regional integration. The primary goals of including initiatives are built around the importance of having harmonized and standardized definitions and concepts, adapting international statistical standards to African realities and specificities; and using common methodologies for the production, management and dissemination of statistics by all African countries to facilitate data consistency and interoperability. The data ecosystem goes far beyond the boundaries of national statistical systems. It encompasses a variety of data producers and users, from academia to the private sector. Moreover, interactions transcend national boundaries, as data is often disseminated and shared internationally. As a result, some initiatives have been aimed at strengthening the coordination and collaboration of organizations involved in the production and use of statistics. Many of these are taking shape at the regional level to develop a spirit of collaboration in statistics across the continent.

The 1992 Coordinating Committee on African Statistical Development (CASD) was set up to oversee activities related to the AAPA and facilitate information exchange between African statistical agencies. In the same vein, the 1997 General Data Dissemination System (GDDS) encouraged the sharing of experience and the development of statistical systems while taking account of global trends. The 2005 African Symposium on Statistical Development (ASSD) thus provides a platform to discuss harmonized statistical practices, supporting cross-country data alignment. Due to the

<sup>3</sup> SDGs 2 and 5 stand for 'End hunger, achieve food security and improved nutrition and promote sustainable agriculture' and 'Achieve gender equality and empower all women and girls', respectively—available at <https://sdgs.un.org/goals> (last accessed, 4 March 2024).

encouraging results of the first implementation of SHaSA in allowing the African countries to implement the 2010 round of Population and Housing Censuses, the UN Economic Commission for Africa launched the second phase SHaSA in 2017 to move forward. SHaSA 2 primarily aims to harmonize statistical standards and methods across Africa, enhancing data comparability and supporting informed decision-making for development and integration by equipping the countries national statistical systems to produce reliable, harmonized data across key dimensions of sustainable development—environmental, social, economic, and politico-cultural. This strategic effort involves adapting international standards to African contexts and strengthening the African Statistical Coordination Committee (ASCC) to improve collaboration and coordination among key stakeholders. The ASCC was established in 2007 to coordinate statistical activities in Africa, improving technical assistance and raising awareness of the use of statistics.<sup>4</sup>

**Capacity-building and agricultural data collection.**— This category encompasses initiatives that aim to develop the human and technical resources required for high-quality statistical production including workshops, training sessions, and technical support initiatives that empower data practitioners across various sectors for better data collection, management, and analysis within statistical systems. Capacity-building is particularly crucial in settings with limited resources, where ongoing training can significantly enhance data reliability. In this contextline, the Partnership in Statistics for Development in Africa (PARIS21) was a global initiative established in 1999 dedicated to building capacity in low- and middle-income countries to enable effective data production and use. To supplement this, the 2006 Reference Regional Strategic Framework (RRSF) for statistical capacity building provides a regional approach to capacity-building, with guidelines for enhancing statistical skills and resources across African countries. The 50x2030 Initiative focuses specifically on agricultural and rural data, building capacity in African countries partners to ensure reliable agricultural data production. One of the challenges in developing solid national statistical systems in Africa has been raising awareness of data use for decision-making. Indeed, to increase statistical capacity, it is crucial to increase the demand for data at all levels. Suppose those responsible for development demand data on an ongoing basis; creating an environment conducive to data production will be facilitated. Thus, designing strategies to strengthen statistical capacity, raise awareness, and promote data use is paramount. Another major initiative on data leadership (ADLI, African Data Leadership Initiative), launched in 2015, primarily aims to strengthen the African continent's statistical skills by revolutionizing the approach to data collection and use. One of the initiative's central activities is creating a statistical programming language designed to meet Africa's specific needs (Stern, 2017).

**Sector-specific data collection.**— This category concerns initiatives aimed at filling data gaps within specific sectors, with a particular focus on agriculture and economic data collection in rural areas. The objective is to provide high-quality data specific to sectors that support targeted policymaking and development. The 2002 ICP-Africa is one of the first initiatives, though primarily economic, that addresses sector-specific data for regional economic comparisons, especially focused on purchasing power parity across African countries. The 2004 Marrakech Action Plan for Statistics (MAPS), drawn up in 2004 by the World Bank, represents a global framework that defines a comprehensive program identifying statistical imperatives in Africa. While also contributing to institutional strengthening, MAPS prioritizes poverty-related statistics, making it particularly relevant for data in sectors addressing socioeconomic conditions. The newest effort seeks to address the global agriculture data gap by revamping national data systems and builds on the precedent initiative, Global Strategy to Improve Agricultural and Rural

Statistics (GSARS), established in 2010—the largest and most widely recognized initiative for capacity building in agricultural statistics, serving as a reference framework for all key actors and stakeholders. The 50x2030 Initiative adds gender-disaggregated data to achieve more equitable agricultural development outcomes. Its goal is to conduct a fit-for-purpose, integrated and financially sustainable agricultural and rural surveys program that meets country data needs and fosters a culture of data use for decision-making in 50 low and lower-middle income countries by 2030.<sup>5</sup> Indeed, agricultural growth requires informed decisions, but low-income countries often invest billions of dollars without solid data to guide them. As a result, governments, companies and small-scale producers are making crucial decisions without evidence, which can compromise the effectiveness of their actions (Gautam et al., 2022).

**What are the achievements of these initiatives so far?**— Although data gaps in Africa persist today, significant progress has been made in the production, exchange, and use of data on the continent over recent decades. Since the launch of these initiatives, one of the significant achievements has been the 2010 population and housing census cycle, covering the period from 2005 to 2014. In addition, the 2020 census cycle has largely been completed, with a few countries still finalizing their activities.<sup>6</sup> Thirty-nine countries, some of which had not participated in previous cycles, were conducting or preparing for a census in 2017. Despite the various challenges underpinning such initiatives (see e.g., Glassman et al., 2014; Ngo, 2015), significant progress is being made in improving national statistical systems in Africa, particularly with regard to critical gaps in agricultural data and overall statistical capacity. Increasingly, institutional, organizational, and technical issues are being resolved, and better infrastructure and statistical capacity are being built (Kiregyera, 2020). Concerning agricultural data, the Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) project is another example of progress in agricultural statistics as it has allowed the development of surveys focused on livelihoods and smallholder agriculture in low-and-middle-income countries in Sub-Saharan Africa (Carletto and Gourlay, 2019). Further, GSARS has made significant progress in SSA in terms of training and statistical capacity building, mainly by providing data collection tools and developing methodology to reconcile census and survey to improve rural statistics and develop a culture of data use for policy formulation, monitoring and impact (GSARS, 2019).

### 3. Context: Madagascar's agricultural background and data gap

Agriculture generates 26% of the country's gross domestic product and is the primary source of income and livelihood for Madagascar's predominantly rural and poor population,<sup>7</sup> most of whose farms are family-run and subsistence-oriented (World Bank, 2024). The country is highly vulnerable to climatic shocks such as cyclones, which jeopardize national food security by causing significant damage (Rakotobe et al., 2016) and leading to effects such as income loss, decreased soil fertility, and reduced agricultural performance, including lower cereal yields (Gay-des-Combes et al., 2017). Despite such challenges, Madagascar still needs structural, up-to-date, and reliable statistical information on the agricultural and rural sector as a whole needed to plan sector development, formulate strategies and policies, and monitor sector performance (Garruchet et al., 2023). As a matter of fact, the last agricultural census in Madagascar was carried out in 2004/2005.

<sup>5</sup> Available at <https://blogs.worldbank.org/en/opendata/mind-gap-enablin-g-data-smart-agriculture-all> (Last accessed, 10 February 2023).

<sup>6</sup> On 10 June 2015, the Economic and Social Council adopted resolution 2015/10 on the 2020 World Population and Housing Census Programme running from 2015 to 2024. Available at <https://unstats.un.org/unsd/demographic-social/census/censusdates/> (Last accessed, 18 November 2024).

<sup>7</sup> Eight in ten people live in rural areas and rely on agriculture for their livelihoods (INSTAT, 2021).

<sup>4</sup> Available at <https://ecosoc.un.org/sites/default/files/documents/2023/2/008-14-eca-E.pdf> (last accessed, 4 March 2024).

Madagascar’s weak statistical capacity affects the measurement of economic and social activities and policymaking. Dang et al. (2024) find that the country ranks among the lowest-performing countries using the World Bank’s Statistical Performance Indicators and Index, especially in the pillar assessing data sources.<sup>8</sup> Regarding the AfDB ASCIs score, Madagascar remains among the countries with limited capacity for agricultural statistics, with its ranking moving only slightly from 49th in 2013 to 46th in 2017. Scoring below 40% in the overall assessment, Madagascar faces particular challenges in institutional infrastructure (18%) and resources (32.7%), underscoring a need for targeted efforts to address these weaknesses.

In recent years, several initiatives have been developed to address this gap, including financing large-scale surveys such as the LSMS survey in 2022 (World Bank, 2024) and the Population Census in 2018 (INSTAT, 2021), which include modules covering the agricultural sector and population. A commendable effort was carried out by multiple research institutions, mainly from France and Madagascar to fill a gap in socioeconomic data on rural areas in Madagascar by creating a Rural Observatory Survey (ROS) (see Razafindrakoto and Roubaud, 2003). The ROS collected panel data to understand poverty dynamics and help formulate and evaluate development policies. Politics and lack of sustained funding are among the main reasons for its demise. In addition to these earlier efforts, the agricultural observatory project described below aims to continue filling the data gap by proposing a more flexible and effective approach.

#### 4. Material and methods

This section present the objectives and the methodological framework from an ongoing observatory project aimed at leveraging existing data to bridge the knowledge and data gap on rural and agricultural transformations in Madagascar at the national level. By doing so, we clarify the selection criteria applied to a sample of the available datasets we examined and describe the analysis carried out to compute and monitor the WAW framework indicators.

##### 4.1. The observatory project overview

The Agricultural Observatory in Madagascar is part of the regional observatory project— *Observatoire des Agricultures de l’Océan Indien* (hereafter the English term, the *Indian Ocean Agriculture Observatory*). This observatory is a local offshoot of the World Agriculture Watch (WAW) initiative.<sup>9</sup> The WAW initiative is longstanding and has spurred numerous developments in the developing world under the guidance of the FAO (see e.g., Even and Matus, 2014). It aims to provide timely, reliable, and comprehensive information at the agricultural holding and farm household levels on global agriculture and rural conditions, particularly focusing on family farming. WAW’s auxiliary purpose is to facilitate decision-making and the adoption of agricultural policies that address the needs of different farm categories, from small, poor family-based farms to large corporation.<sup>10</sup>

<sup>8</sup> The World Bank’s Statistical Performance Indicators and Index evaluates countries’ statistical capacity across five pillars: data use, data services, data products, data sources, and data infrastructure (Dang et al., 2023). The ‘Data Sources Pillar’ broadly encompasses the timeliness, frequency, and availability of various data types including censuses, surveys, administrative data, and geospatial data.

<sup>9</sup> The Indian Ocean Agriculture Observatory is the sum of five territory/country observatories from Indian Ocean Commission member states (The Comoros, France on behalf of La Reunion, Madagascar, Mauritius, and Seychelles). More details are available at <https://www.fao.org/world-agriculture-watch/news-and-events/detail/en/c/1271018/> (Last accessed, 15 April 2024).

<sup>10</sup> Available at <https://www.fao.org/world-agriculture-watch/en/> (Last accessed, 15 April 2024).

The core of the Agricultural Observatory in Madagascar is to gather secondary data from public and private administrations on farms and rural households to track key indicators that allow the monitoring of transformations in national agriculture. The observatory has adopted a two-pronged approach to fulfill its main objectives fully. Firstly, it adapts the harmonized WAW framework to characterize agriculture and understand the livelihoods of rural households. This harmonized framework—drawing partly from the *Sustainable Rural Livelihoods* framework (Scoones, 1998; Ellis, 2000)—proposes indicators allowing for examining various themes covering performance, major challenges, and threats to rural areas in general and agriculture in particular (see Table 1). Thus, it serves as a synthesis tool, enabling a coherent, rigorous, and precise analysis of agriculture stemming from different contexts. Indeed, there is no standardized framework to monitor the evolutions and transformations of agriculture at the scale. Secondly, making the results available to stakeholders in the agricultural and rural development sectors through an information system housing a data visualization platform.

#### 4.2. Data and methodology

##### 4.2.1. Data sources

The project team carried out a survey in Madagascar to draw up a (non-exhaustive) inventory of agricultural and rural household’s data available in the country (see Garruchet et al., 2023 for a detailed description of the inventoried data). The inventory includes data from public institutions, such as Madagascar’s National Centre for Applied Research and Rural Development (FOFIFA), and the National Statistical Office (INSTAT), as well as from private research institutions, including the French Agricultural Research Centre for International Development (CIRAD), and other development actors.

Table 2 presents a sample of the data examined for the purpose of this study analysis, along with their main characteristics. We divided the data into *national data* and *research data*. National data refers to data sets obtained from sample surveys and censuses such as those from the National Agricultural Census, or Demographic and Health Surveys (DHS) while research data refers exclusively to sample surveys data from

**Table 1**  
Scope WAW framework indicators.

Dimensions	Topics
(1) Socio-demographic characteristics	Household structure and composition, education, training and farming experience
(2) Livelihood and income	Income (sources, types), wealth and poverty
(3) Farm labor	Labor force structure (status and gender), farm management arrangements
(4) Farm and non-farm activities	Structure of family (non-)farm labor supply, pluriactivity, specialization in agricultural production
(5) Agricultural land	Access to land, farming methods, surface areas (available and farmed)
(6) Farm equipment, buildings and materials	Equipment, materials, farm buildings and infrastructure, technology
(7) Crop production and use	Cropping systems, production allocation (self- and intra-consumption, post-harvest losses, gifts and sales)
(8) Livestock production and use	Livestock systems, production allocation (self- and intra-consumption, post-harvest losses, gifts and sales)
(9) Farming practices and operating costs	Agroecology (organic farming, quality or origin-linked products), inputs (access, origin and use), farm operating costs
(10) Financial services	Banking (access, origin and type of credit), savings
(11) Social and professional network	Self-help networks (labor and finance), access to agricultural extension services
(12) Household expenditures	Structure of current household expenditure
(13) Food security	Availability, access, use and nutrition
(14) Market access	Marketing, distance to market, and contract farming

Source: Authors

**Table 2**  
Sample data characteristics.

Data sample	Dimensions covered by the WAW framework ( Table 1)	Period or survey year	Observation unit	Spatial coverage (# of regions)	Representativeness of spatial unit
<b>National data</b>					
National Agricultural Census	(1) - (3) - (4) - (5) - (6) - (7) - (8) - (9)	2004–5	Agricultural holding	National (22)	District; region
Demographic and Health Survey (DHS)	(1) - (2) - (3) - (4) - (5) - (6) - (13)	1992–2021	Farm household	National (22)	Region
<b>Research data<sup>a</sup></b>					
Research data 1	(1) - (2) - (3) - (4) - (5) - (6) - (7) - (8) - (9) - (10) - (11) - (12) - (13)	2007–8	Agricultural holding and farm household	Alaotra, Antsirabe, Menabe, Itasy, Vakinankaratra (5)	Village
Research data 2	(1) - (2) - (3) - (4) - (5) - (6) - (7) - (8) - (9) - (10) - (11) - (14)	2018	Agricultural holding and farm household	Analanjirifo (1)	Village
Research data 3	(1) - (2) - (3) - (4) - (5) - (6) - (7) - (8) - (9) - (10) - (11) - (14)	2022	Agricultural holding and farm household	Analamanga, Bongolava, Diana (3)	None
Research data 4	(1) - (2) - (3) - (4) - (5) - (6) - (7) - (8) - (9) - (10) - (11) - (12) - (13) - (14)	1999–2015	Agricultural holding and farm household	Alaotra, Amoron'i Mania, Analamanga, Analanjirifo, Androy, Atsimo Atsinanana, Bongolava, Boeny, Ihorombe, Haute Matsiatra, Itasy, Menabe, Sophia, Sava, Vakinankaratra, Vatovav, Atsinanana (17)	Site <sup>b</sup>

Notes.  
<sup>a</sup> Research data 1 refers to the World Bank RuralStruct Household Survey (Losch et al., 2012), Research data 2 and 3 refer to data from projects conducted by the French Agricultural Research Centre for International Development (CIRAD), and Research data 4 refers to panel from the Rural Observatory Survey (Andrianjafindraine et al., 2024).  
<sup>b</sup> Site refers to a group of villages that may be spread across multiple regions but share the same agroecological conditions. All the datasets are described in details in Garruchet et al. (2023).  
 Source: Authors

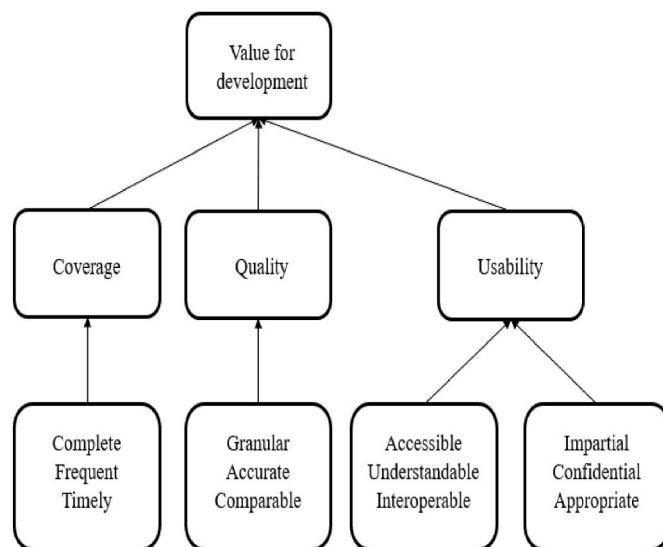
various research or development projects. For instance, research data 1 refers to the World Bank’s Rural Structure Household Survey conducted in 2007-8 (Losch et al., 2012), research data 2 and 3 are derived from household and agricultural surveys carried out as part of development projects led by the CIRAD, research data 4 refers to the Rural Observatory Survey panel data.

All the data provide information at agricultural holdings and farm households aligned with the WAW framework. For example, the DHS data covers only a limited set of dimensions, specifically dimensions (1) to (6) and (13), as presented in Table 1. In contrast, the ROS survey covers a broader range, encompassing all dimensions of the WAW framework, thus offering a more comprehensive view of farm household dynamics. National data, representative at the regional level, cover the entire territory. Research data, however, use a purposive sampling frame, with representativeness varying from none (data 3), to the village level (data 1 and 2), or at the site level, which represents the sum of multiple villages sharing the same agroecological conditions (data 4). Such data are therefore suitable for examining their potential for reuse.

4.2.2. Methodology: framework for data reuse

An essential characteristic of data is that its usefulness remains intact even after it has been used, enabling it to be reused for other purposes, as its application is unlimited (World Bank, 2021). In this study, we followed the theoretical framework proposed by Jolliffe et al. (2023) in selecting the data to be reused by using specific attributes that maximize their potential value for development. Fig. 2 illustrates an adaptation of this framework, emphasizing three critical features: coverage, quality, and usability. The study employed a rigorous screening process to identify datasets suitable for computing and monitoring indicators of family farming and rural sector in Madagascar.

**On coverage.**— Regarding the coverage feature, inferences from the data need to be valid for all relevant units and time periods. This implies that data should be complete, meaning they are representative of the entire population of interest, either through enumeration or a comprehensive sampling frame. They should be produced frequently to allow



**Fig. 2.** Key attributes enhancing data value for development.  
 Source: Authors, adapted from Jolliffe et al. (2023)

for timely policy implementation and monitoring of developments. Additionally, data must be timely and released shortly after collection, which is especially crucial for emergency responses, where immediate policy actions are required.

In this study, we pay particular attention to statistical representativeness in secondary data targeting agricultural holdings and farm households. This was crucial for evaluating trends in the WAW framework indicators, which provide an overview of agricultural and rural transformations at the national level. All data we examined contain information on farm households and their agricultural holdings, except for the DHS data. We take advantage of the more detailed occupational categories of the household head and spouse to identify farm

households. We then classified farm households based on two categories: self-employed agricultural workers (e.g., subsistence farmers, fishermen, hunters, and gatherers) or wage earners (e.g., farmers and skilled workers in commercial agriculture). This approach ensures consistency and comparability across surveys, unlike alternatives such as farmland or livestock ownership, which vary due to changes in survey design. Rural households were further categorized based on their reported place of residence.

**On quality.**— Regarding the quality feature, data should be accurate, measuring concepts with minimal error and comparable across space and time, conforming to standardized methods. Moreover, data must be granular, allowing breakdowns by subgroups like geographical areas or demographic factors while ensuring privacy.

In this study, we systematically verified accuracy, comparability, and granularity to ensure the reliability and robustness of the data used for computing WAW indicators. Accuracy was evaluated by examining the precision of measurements within each dataset, ensuring the data accurately represent the phenomena under study. Comparability was confirmed by selecting datasets that adhere to standardized sampling methods and variables definitions, enabling consistent analysis across time and space. This was particularly important for tracking temporal trends and aligning indicators with the WAW framework. Granularity was ensured by prioritizing datasets capable of disaggregation into relevant subgroups, namely the spatial unit most addressed, the geographic region.

**On usability.**— Finally, regarding the usability feature, data should be easy to use, i.e. accessible to a broad audience, machine-readable, and free of charge where relevant, with appropriate terms of use. They should be understandable, accompanied by metadata and visual aids, and interoperable, allowing linkage with other data sources to maximize utility while ensuring data security. Data should also be safe to use, i.e. they must have the following characteristics: impartiality (no influence of stakeholders on the data), confidentiality (anonymous data, not revealing personal identity) and appropriateness (the objectives of the data collection are clearly defined and fulfilled).

**On computation of WAW indicators.**— Once the data undergo the reuse evaluation, we use them to calculate the indicators provided by the WAW framework to assess various agricultural and rural conditions (see [Table 1](#)). These indicators track key aspects of agricultural conditions and rural development in Madagascar. The WAW framework contains over 80 indicators that we are continuing to consolidate, by integrating indicators that can be easily computed from costless data sources such as satellite imagery data or ancillary surveys related to rurality in general (e.g. Afrobarameter survey). To effectively inform public policy, the information produced by the observatory is linked to specific policy objectives. The primary goal is to provide data on national-level indicators, with varying levels of granularity depending on what the surveys allow, that reflect the overall situation of agricultural conditions and rural development in Madagascar. For example, macro-level public policies, such as national agricultural strategies aimed at increasing agricultural production for enhancing food security,<sup>11</sup> can be tracked within dimensions (7) and (8) from the WAW framework (see [Table 1](#)) or rural development policies aimed at reducing predominantly agricultural rural poverty within a dimension (2).

## 5. Results and discussion

### 5.1. Findings

**On data reuse.**— [Table 3](#) provides a comparative assessment of two types of data sources, national and research data, according to the key

attributes that enhance the value of data for development. Our analysis highlights significant differences in their usability, coverage, and quality, which directly influence their potential for reuse in understanding agricultural and rural transformations.

On coverage, the national data (National Agricultural Census and DHS) exhibit adequate coverage and high quality, with all of their respective features passing checks, making them highly suitable for broad, national-level analysis of agricultural and rural development. These datasets cover a representative sample of farm households or agricultural holdings, ensuring that the information gathered is comprehensive. The Agricultural Census, with its extensive focus on agricultural holdings, is particularly well-suited for monitoring agricultural systems, while DHS data, with its focus demographic aspects, effectively complements this by covering household-level socio-economic and health indicators. In contrast, research data often face limitations in coverage. While these datasets are typically complete and timely for specific projects, they lack regularity in collection frequency (panel data), which hinders their ability to track changes over time. Additionally, research data often rely on sampling frames that are not based on administrative records, which compromises their comparability. Granularity is also limited, reducing their utility for producing insights that require consistent spatial and temporal coverage. A notable exception is ROS panel data (research data 4), while valuable, faces comparability issues due to its purposive sampling frame, limiting statistical inference. The granularity of this data is also restricted; it does not allow for insights at broader regional levels, focusing instead on specific areas, which reduces its utility for generalizing findings.

On usability, all three data types meet essential criteria. The quality of Madagascar's public sector data has attracted numerous empirical research studies and policy monitoring efforts. Once acquired, the essential attributes of ease of use and safe to use are consistently upheld. The data is comprehensible thanks to the available and functional metadata, and robust privacy and confidentiality protections are ensured as the surveyed individuals cannot be identified.

On quality, national data meet high standards of accuracy, comparability, and granularity, enabling detailed disaggregation and analysis. These datasets conform to standardized methods, making them reliable for longitudinal and cross-regional analyses. Most research data, however, lack adequate spatial and temporal coverage, which limits their applicability for comprehensive assessments of agricultural and rural changes.

**On monitoring agricultural and rural transformations.**— Given the qualification of DHS data to provide information on the rural and agricultural population at the national level, we leverage these data to compute leading indicators of well-being and food security in rural and agricultural population. The temporal span offered by this survey (from 1992 to 2021) and the ability to target rural and agricultural households—using distinction between more detailed occupational categories of household head and spouse—allow us to monitor indicators such as household wealth based on durables ([Filmer and Pritchett, 2001](#)), multidimensional poverty ([Alkire and Santos, 2014](#)), and anthropometric indicators (stunting, wasting, and underweight) as food security measures ([de Onis, 2007](#)).

For the sake of conciseness, we present the results of food security indicators that enable us to assess the living conditions of agricultural and rural households concerning SDG Target 2.2. On food security issue, apprehended by child malnutrition, we observe an apparent reduction in wasting rates among children aged under 5, from around 14% (13%) in agricultural (rural) households to less than 9% respectively (see [Fig. 3](#)). On the other hand, we recognize that tracking changes in the livelihoods of agricultural and rural households is more challenging to assess, as we have only one point in time, the 2004/5 Agricultural Census. Unfortunately, the first agricultural census of 1984-5 does not have clearer and more precise survey instruments (metadata, questionnaires, reports, etc) and still needs to be machine-readable to integrate it. For now, no other nationally representative survey allows us to have a temporal dynamic

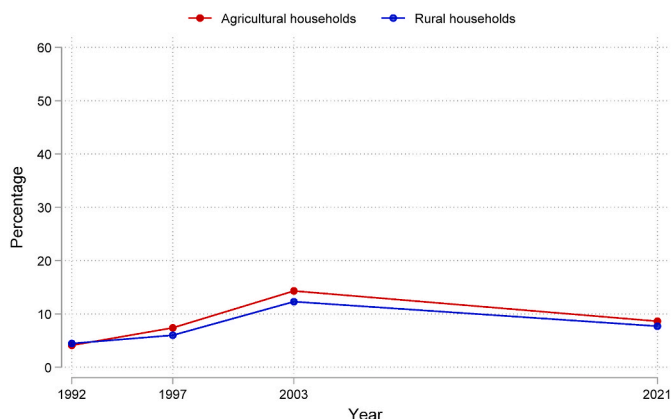
<sup>11</sup> See the current project on Madagascar's ambition to become the breadbasket of the Indian Ocean, available at <https://www.fao.org/madagascar/actualites/detail-events/es/c/1162570/> (Last accessed, 17 November 2024).

**Table 3**  
Screening procedure for data reuse.

	Agricultural Census 2004-5	DHS 1992	DHS 1997	DHS 2003	DHS 2021	Research data 1	Research data 2	Research data 3	Research data 4
<b>Coverage</b>									
Completeness	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Frequency	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes
Timeliness	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Quality</b>									
Accuracy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Comparability	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Granularity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
<b>Usability</b>									
Accessibility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Understandability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interoperability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Impartiality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Confidentiality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Appropriateness	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Research data 1 refers to the World Bank RuralStruct Household Survey (Losch et al., 2012), Research data 2 and 3 refer to data from projects conducted by the French Agricultural Research Centre for International Development (CIRAD), and Research data 4 refers to panel from the Rural Observatory Survey (Andrianjafindraine et al., 2024). All the datasets are described in details in Garruchet et al. (2023).

Source: Authors



**Fig. 3.** Child wasting rates by household status in Madagascar.  
Notes: This figure depicts the prevalence of child wasting among children under five living in agricultural or rural households. Wasting is defined as having weight-for-height < -2 standard deviation from the median of the World Health Organization Child Growth Standards among children under five.  
Source: Authors own calculations using DHS data.

on all indicators relating to the agricultural production system and household livelihoods. Our prospects are now pinned on the forthcoming 2024/2028 Agricultural Census of Madagascar (see Solontompoariny, 2023).

Although the secondary data from DHS enable us to assess the evolution of different situations relating to the agricultural and rural population (as illustrated in Fig. 3), those from the agricultural census are rich in information on the livelihoods of strictly farming households only. The frequency with which DHS is produced is a real advantage. However, due to the need for nationally representative agricultural information, these surveys do not allow the assessment of the evolution of indicators relating to natural, physical, financial, and human capital, labor, and farming practices, among others.

**5.2. What lessons have we learned, and how can these insights contribute to the scope of data reuse?**

Our experience of examining and reusing data from the perspective of providing information on agricultural and rural transformations leads us to draw up the following lessons learned.

**5.2.1. Lesson 1: research data offers timely insights but is limited in representativeness for national-level analysis**

Research data, while more focused and specific, is limited in its ability to offer a broader, national perspective. Research data can be limited in representativeness and scope for national-level analysis, but still provide timely insights for specific research purposes or localized studies. The research data, non-frequently collected and using often non-probabilistic sampling methods, present challenges of use for monitoring WAW framework indicators. The information they contain and their representativeness are often strongly conditioned by their collection purpose. These data typically serve multiple purposes, such as project diagnosis and evaluation, or characterization of certain situations, with geographical coverage often constrained by logistical limitations or the need to focus on particular agroecological zones. As a result, these data do not represent the broader rural and agricultural landscape, hindering their use for inference beyond the specific context of their project, especially in providing a complete and accurate picture of family farming and its evolution in Madagascar.

Despite these limitations, research data plays a crucial role in understanding the mechanisms driving the temporal dynamics observed in national-level indicators. By analyzing these data, we can identify and examine the factors that explain upward or downward trends in key indicators related to agricultural and rural conditions, such as household food security and use these insights to inform targeted interventions or policy adjustments. It is worth noting that while this on-going observatory project maximizes the utility of available data to monitor broad trends in agriculture and rural livelihoods, it cannot replicate the territorialized insights provided by tools like ROS survey (see Andrianjafindraine et al., 2024). The ROS framework offers depth and specificity at specific level (type of agriculture, village, etc.), which current national data sources cannot fully capture highlighting the importance of diverse data collection methods to understand Madagascar’s agricultural diversity comprehensively. Instead of replacing ROS’s ground-level methodology, the observatory complements it by utilizing and disseminating underutilized national data, making it more accessible for policy development.

**5.2.2. Lesson 2: data harmonization is key to maximizing the utility of diverse data sources**

The lack of harmonization in field approaches in terms of survey instruments limits the effective integration of data into decision-support systems, such as the observatory or other tools designed to enhance data utilization. A systematic selection of study sites (village, municipality, or district), based on the National Population or Agricultural Censuses

(even if outdated), could facilitate data harmonization for temporal or comparative analysis. Since the spatial units of representation vary as observed in [Tables 2](#) and it is challenging to leverage the fact that surveys are often conducted in the same regions across different years. Moreover, the small study areas used in most research data limit their applicability for national-level analysis, which is crucial for supporting agricultural planning and development at a larger scale.

### 5.2.3. Lesson 3: the need for multi-stakeholder collaboration in data reuse

Successful data reuse in the context of agricultural and rural development requires strong collaboration between multiple stakeholders, including public institutions, private sector organizations, and the academic community. Our experience in Madagascar has shown that leveraging existing data works best when there is coordinated effort and data sharing between these diverse groups. Most data produced in partnership with international institutions such as the National Agricultural Census (World Bank, European union, and FAO) and DHS (USAID and UNICEF) were relatively easy to access through simple requests to the hosting institutions.

However, as [Garruchet et al. \(2023\)](#) have pointed out, other valuable datasets remain inaccessible, hindering their ability to be examined for potential reuse. For instance, public sector data such as those used for the FAO/WFP Crop and Food Security Assessment Mission annual surveys (see [FAO & WFP, 2018](#))—conducted from 2009 to 2023 by the Ministry of Agriculture with support from the World Food Programme and FAO provide crucial insights into crop production and shock for food security, but the metadata and survey instruments are not publicly available. Similarly, in 2017, the National Statistical Office (INSTAT), with financial support from the UNDP, conducted a livestock survey for the Androy region. This survey aimed to assess livestock production and related characteristics, serving as a complement to the 2004/5 agricultural census by providing more recent and region-specific data. However, these data could not be extended to other regions due to lack of funding [Solonitompoinony \(2023\)](#), and remain inaccessible for public use. Even the 2018 population census and the 2022 permanent household survey (LSMS), which include modules for identifying agricultural households and characterizing farming activities, are not yet publicly available. These barriers to access demonstrate the need for greater collaboration in data sharing, which is essential to maximize the potential for informed decision-making and policymaking. Indeed, collaborative frameworks underpinning such partnerships could ensure that agricultural and rural policies are based on comprehensive and up-to-date information, and reflect stakeholders' diverse perspectives and expertise.

## 6. Conclusion

Public interest data is essential for guiding policy development and reaching vulnerable populations and areas ([World Bank, 2021](#)). It helps prioritize resource allocation based on urgency and holds governments and development actors accountable for their actions. Specifically, by observing the evolution of development indicators after implementing policies, we can assess how these policies have contributed to the progress of SDGs.

In this study, we address the issue of data reuse for development in a resource-constrained setting like Madagascar. We start by presenting and assessing regional and international initiatives to tackle data scarcity in Africa. These initiatives demonstrate Africa's commitment to enhancing its statistical capacities, thus guiding its efforts towards more sustainable economic and social development. We further present the contributions of an observatory project in Madagascar in which we examined secondary data from different sources, including national data and data from research projects, using the principal criteria outlined by [Jolliffe et al. \(2023\)](#) to evaluate their potential for reuse. Our analysis shows that each data set offers advantages and limitations regarding suitability to fit the database and calculating specific indicators. National data

provide comprehensive information on rural and agricultural populations but lack exhaustive information compatible with the WAW framework, which allows us to characterize family farming in all its diversity. In contrast, research data rich in information and also aligned with the WAW framework but are more localized, focusing on restricted geographical areas, preventing inference for national-level analysis. Combining these two data sources to maximize their potential value for development will significantly contribute to closing the knowledge gap regarding the transformations in family farming.

Addressing the agricultural data gap in developing countries, particularly in Madagascar, requires concerted efforts to strengthen institutional capacity, improve data collection methodologies, enhance infrastructure, and foster stakeholder collaboration. Bridging this gap will enable countries to better harness agricultural data for evidence-based decision-making, promote sustainable agricultural development, and improve welfare indicators. According to the [World Bank's \(2021\)](#) Development Report, countries must maximize data securely and according to their social, political, and economic context.

The aim of this paper was not to extol an observatory's virtues but to highlight initiatives that are actively working and can be replicated and adapted to help policymakers and countries consider opening up data. It also advocates for the adoption of a balanced approach by stakeholders in developing accompanying measures between the public and private sectors. Data reuse is feasible through coordinated efforts between the research community and the public and private sectors. Many organizations collect agricultural data for various purposes, and these data can fulfil multiple functions, helping to reduce data gaps and improve the monitoring of agricultural and rural transformations in developing countries. By sharing and integrating these data sources, stakeholders can gain a more comprehensive understanding of the topic studied, enhance decision-making processes, and create more effective strategies for sustainable development. This collaborative approach can also lead to the development of standardized methodologies and tools, further enhancing the quality and utility of such data.

### CRedit authorship contribution statement

**Marina Dimitriou:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Formal analysis, Data curation. **Louis Olié:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Conceptualization.

### Declaration of competing interest

The authors report there are no competing interests to declare.

### Acknowledgements

We would like to thank the handling editor and two anonymous reviewers for their comments and suggestions that made us improve the paper significantly. We gratefully acknowledge helpful comments from Jérôme Ballet and Cédric Gaillard. We thank Yannick Biard, Pascale Bonnet, Pierre-Marie Bosc, Isabelle Droy, Philippe Lemoisson, Patrick Rasolofo, Isabelle Mialet-Serra, and Jean-Michel Sourisseau for fruitful discussions during the "Observatories Workshop" in May 2022. We would also like to thank Jean-François Bélières, Adrien Brygo, Vincent Garruchet, and Claire Gondard-Delcroix for their support throughout this research.

The authors are grateful to the Regional Council of La Réunion (French overseas territory), the European Regional Development Fund (ERDF, programme INTERREG V) for their financial and technical assistance through the "Observatoire des Agricultures de l'Océan Indien (OAOI)" research project in the Indian Ocean. This work is co-financed by the European Union, the Réunion Region and CIRAD as part of the INTERREG VI Indian Ocean programme, for which the Réunion Region

is the Managing Authority. The views expressed herein are those of the authors and should not be reported as representing the views of the European Central Bank and Cirad. All errors are our own.

## Data availability

Data will be made available on request.

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