This document has been modified by CARD Secretariat, deleting personal information that the original version contained, as indicated below, for the purpose of making it publicly available on CARD website.

Modified sections	Pages in the original document	Modifications made
Annex 1: contact list of interviewed rice stakeholders	44-45	Removed

FINAL REPORT

2023

Manual of Procedures for the Calculation of CARD and Mozambique Specific Indicators

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ACRONYMS AND ABBREVIATIONS

ASCAS	Accumulative Saving and Credit Associations
ATM	Mozambique Revenue Authority
CAIC	Chokwe Agro-Industrial Complex
CARD	Coalition for Africa Rice Development
CIAT	International Center for Tropical Agriculture
CIS	Chokwe Irrigation Scheme
FAO	Food and Agriculture Organization of the United Nations
GoM	Government of Mozambique
IAI	Integrated Agriculture Survey
IIAM	Mozambique Agricultural Research Institute
INE	National Institute of Statistics
INIR	National Institute of Irrigation
IRRI	International Rice Research Institute
ITC	International Trade Center
MADER	Ministry of Agriculture and Rural Development
MASA	Ministry of Agriculture and Food Security
M&E	Monitoring and Evaluation
MIC	Ministry of Industry and Trade
MT	Metric tons
NRDS	National Rice Development Strategy
PACEs	Small Commercial Producer
PEDSA	Agriculture Sector Development Strategy
PESOE	Economic and Social Plan and State Budget
PNA	National Rice Program
RBL	Low Limpopo Irrigation Scheme
ROSCA	Rotating Savings and Credit Groups
SPAE	Provincial Services of Economic Activities

SSA	Sub-Saharan Africa
USAID	United States Agency for International Development
ADZ	Zambezi Vale Development Agency

1 INTRODUCTION

The Coalition for African Rice Development (CARD) is implementing the second phase of rice development program with aim to double rice production in SubSaharan Africa (SSA) from 28 million reached in the first phase to 56 million metric tons (MT) by 2030. In this regard, the CARD monitoring and evaluation (M&E) is accessing the progress of the program through using four global indicators namely quantity of paddy produced (MT), harvested area under rice production (hectares), paddy yield (MT per hectare) and rate of self-sufficiency in rice (%). In addition to these four global indicators, there are eight other indicators grouped into four categories with two indicators in each category (Resilience, Industrialization, Competitiveness, and Empowerment indicators); totalizing 12 indicators. These 12 indicators are complemented with an indicator regarding price levels for the domestic and imported rice at retail levels. This group of indicators named as CARD indicators are added by other Mozambique specific indicators demanded by the Mozambique Rice Task Force, which will be used to monitor the implementation of the National Rice Program referred to as *Programa Nacional de Arroz (PNA*). The baseline values of these indicators were calculated using CARD proposed methodology and data from different sources.

To facilitate the computation of these indicators for the future M&E exercise by the Mozambique Rice Task Force, the present manual of procedures is produced with the aim of:

1. Explaining in detail each indicator and the methodology used for its calculation;
2. Explaining in detail the data sources including the possible contact details (names, institutions, and the respective addresses) for data gathering; and

Demonstrating the procedures used to compute each indicator by presenting the calculation formulas in an Excel spreadsheet and STATA commands whichever deemed appropriate for each indicator. The present manual of procedures is composed of four main chapters including this introductory chapter. The second chapter presents a brief overview of M&E indicators, while the third chapter describes the procedure for the calculation of each indicator separately. Under the third chapter, we first present the definition of the indicators, followed by the methodological approach for their computation, possible data sources including potential contact details for gathering the required data, and step-by-step demonstration of how the indicators' baseline values were calculated. Lastly, chapter four presents the challenges and recommendations.

2 OVERVIEW OF THE MONITORING AND EVALUATION INDICATORS

Most African countries including Mozambique are facing rice deficit with considerably high reliance on imports to meet the respective domestic demand for rice. To overcome this deficit, Alliance for a Green Revolution in Africa (AGRA), Japan International Cooperation Agency (JICA) and New Partnership for Africa's Development (NEPAD) joined forces to lead the process of establishment of CARD mainly to respond to the increasing importance of rice production in Africa. The CARD initiative was successfully launched during the fourth Tokyo International Conference on African Development (TICAD IV) taken place in Yokohama from 28-30 May 2008. This initiative supports the development of the rice sector in 32 SSA countries including Mozambique. The first phase of the initiative aimed at doubling rice production in SSA countries by 2018. The second phase started in 2019 renewed the target of further doubling rice production in SSA from 28 million to 56 million MT by 2030.

The CARD M&E is assessing the progress of the initiative using four global indicators and eight other indicators grouped into four categories (Resilience, Industrialization, Competitiveness, and Empowerment indicators). This grouping of indicators is referred to as "RICE" approach. Table 2.1 presents the definitions, and the corresponding type of data needed, of the 12 CARD indicators; while Table 2.2 presents the Mozambique specific indicators.

Table 2.1 Definition of CARD indicators covered in this report

Category	Indicator	Code	Definition	Data needed	Data source
CARD Overall Indicators	Quantity of paddy produced (MT)	O1	Sum of the quantity of paddy produced domestically at different ecologies	Secondary dada	PESOE
	Harvested area under rice production (hectare)	O2	Sum of the area harvested of domestically produced paddy at different ecologies	Secondary data	PESOE
	Paddy rice yield (MT per hectare)	O3	Average quantity of domestically produced paddy per unit of harvested area	Secondary data	PESOE
	Rate of self-sufficiency in rice (%)	O4	Rate of coverage of rice needs by local production	Secondary data	PESOE/USDA/INE
CARD Resilience Indicators	Irrigated area under rice production (hectare)	R1	Sum of area under rice production with supplementary irrigation to mitigate the negative impacts of climate variability in rice production	Primary data	SPAE
	Quantity of certified seed of resilient rice varieties (MT)	R2	Sum of quantity of certified rice seed varieties produced domestically with resilience characteristics, which are locally preferred	Primary data	Seed Certification Laboratories
CARD Industrialization Indicators	Rice milling capacity (%)	I1	Rate of the installed capacity of the medium and large processing factories to all operating processing factories	Primary data	Rice Millers
	Level of mechanization in production	I2	Number of machines available for plowing and harvesting rice fields		
	Number of tractors	I2.1	Number of tractor used in rice land preparation	Secondary data	Rice focal point/MADER
	Number of harrows	I2.2	Number of harrows used in rice land leveling	Secondary data	Rice focal point/MADER
	Number of ploughs	I2.3	Number of ploughs used in rice plowing	Secondary data	Rice focal point/MADER
	Number of seed-fertilizer applicatordistributors	I2.4	Number of seed-fertilizer applicator used in rice seed and fertilizer application	Secondary data	Rice focal point/MADER
	Number of combine harvesters	I2.5	Number of combine harvester used in rice harvesting	Primary data	SPAE
CARD Competitiveness Indicators	Market share of domestic rice (%)	C1	Percentage of the domestic rice in relation to the total rice at the retail shops	Primary/secondary data	IAI/USDA/INE
	Quantity of certified seed of high-yielding rice varieties (MT)	C2	Sum of quantity of certified seed varieties of locally preferred varieties with high-yielding attributes, locally produced.	Primary data	Seed Certification Laboratories
CARD Empowerment Indicators	Rice growers with access to financial services (%)	E1	Percentage of rice farmers accessing financial services	Secondary data	IAI
	Rice growers with access to technical services and training (%)	E2	Percentage of rice farmers accessing technical services and training	Secondary data	SPAE
CARD Price Indicators	Level of retail rice prices	P1	The annual average of retail rice prices		
	Retail rice price of imported rice	P1.1	The annual average of retail price of imported rice	Secondary data	MIC
	Retail rice price of locally produced rice	P1.2	The annual average of retail price of locally produced rice	Primary data	Rice Millers

Table 2.2 Definition of the Mozambique specific indicators covered in this report

Category	Indicator	Code	Definition	Data needed	Data source
Mozambique Rice seed production indicators	Quantity of breeder rice seed (kg)	MZ1	Sum of quantity of breeder rice seed varieties produced domestically	Primary data	IIAM
	Quantity of pre-basic rice seed (MT)	MZ2	Sum of quantity of pre-basic rice seed varieties produced domestically	Primary data	IIAM
	Quantity of basic rice seed (MT)	MZ3	Sum of quantity of basic rice seed varieties produced domestically	Primary data	IIAM
	Quantity of certified rice seed (MT)	MZ4	Sum of quantity of certified rice seed varieties produced domestically	Primary data	Seed Certification Laboratories
	Harvested area under certified seed production(hectare)	MZ5	Sum of the area harvested of domestically produced certified seed	Primary data	Seed Certification Laboratories
Mozambique Access to high yield agriculture inputs indicators	Quantity of fertilizer used in rice production (MT)	MZ6	Sum of the quantity of fertilizer by type used in rice production per year		
	Quantity of urea used in rice production (MT)	MZ6.1	Sum of the quantity of urea used in rice production per year	Primary/secondary data	RBL and SPAE
	Quantity of NPK used in rice production (MT)	MZ6.2	Sum of the quantity of urea used in rice production per year	Secondary data	SPAE
	Quantity of herbicide used in rice production	MZ7	Sum of the quantity of herbicide by type used in rice production per year		
	Quantity of MCPA used in rice production (Liters)	MZ7.1	Sum of the quantity of MCPA used in rice production per year	Primary data	RBL and SPAE
	Quantity of Propanil used in rice production (Liters)	MZ7.2	Sum of the quantity of Propanil used in rice production per year	Primary data	RBL and SPAE
	Quantity of Roster used in rice production (Liters)	MZ7.3	Sum of the quantity of Roster used in rice production per year	Primary data	RBL and SPAE
	Quantity of Vega used in rice production (Kg)	MZ7.4	Sum of the quantity of Vega used in rice production per year	Primary data	RBL and SPAE
Mozambique Access to agricultural services indicators	Number of extension agents assisting rice growers	MZ8	Sum of extension agents assisting rice producers	Primary data	RBL and SPAE
	Number of rice growers trained in the best production practices	MZ9	Sum of rice producer trained in the best production practices per year	Secondary data	SPAE
	Number of equipment used in rice post-harvest handling	MZ10	Number of equipment used in rice post-harvest handling		
	Number of rice thresher	MZ10.1	Number of rice thresher used in rice threshing	Primary data	SPAE
	Number of rice dryer	MZ10.2	Number of rice dryers used in rice post-harvest handling	Primary data	SPAE

	Number of quality control labs	MZ10.3	Number of quality control labs used in rice post-harvest handling	Primary data	SPAE
Mozambique Rice production and productivity indicators	Quantity of irrigated paddy produced (MT)	MZ11	Sum of the quantity of irrigated paddy domestically produced	Primary data	SPAE
	Irrigated paddy yield (MT per hectare)	MZ12	Average quantity of domestically produced paddy under irrigation system per unit of harvested area	Primary data	SPAE
	Quantity of rain-fed paddy under input intensification (MT)	MZ13	Sum of the quantity of paddy produced domestically under rain-fed systems with input intensification	Secondary data	MADER
	Quantity of rain-fed paddy under no input intensification (MT)	MZ14	Sum of the quantity of paddy domestically produced under rain-fed system with no input intensification	Secondary data	PESOE/MADER/SPAE
	Cultivated land under rain-fed rice with input intensification (hectare)	MZ15	Sum of the area with rice under rain-fed with intensification	Secondary data	MADER
	Cultivated land under rain-fed rice with no input intensification: (hectare)	MZ16	Sum of the area with rice under rain-fed with no intensification	Secondary data	PESOE/MADER/SPAE
	Rain-fed paddy yield with input intensification (MT per hectare)	MZ17	Average quantity of domestically produced paddy per unit of harvested area under rain-fed with intensification	Secondary data	MADER
	Rain-fed paddy yield with no input intensification (MT per hectare)	MZ18	Average quantity of domestically produced paddy rice per unit of harvested area under rain-fed with no intensification	Secondary data	PESOE/MADER/SPAE

3 PROCEDURES FOR THE CALCULATION OF THE INDICATORS

The CARD M&E exercise demands annual updates of the values of the above listed indicators (CARD indicators and Mozambique specific indicators). These updates should be done by the Mozambique Rice Task Force and therefore, it should know how the baseline indicators were calculated and especially the applied methodology, data collection and source as well as the calculation procedures. As indicated in the introduction section, the objective of this manual is to expand the explanation regarding these issues (methodology, data collection and source, and the calculation procedure) to facilitate the work of the national team in their duty for the future M&E exercise. Therefore, this chapter presents the definition of each indicator and more importantly describes the methodology, data collection, source, and calculation procedure for each indicator starting from the CARD indicators and closing with the Mozambique specific indicators. A complimentary Excel spreadsheet – containing the original required data and the corresponding formulae (Excel formulae) to both make any necessary data transformation and compute all indicators – is attached to this manual to guide the Mozambique Rice Task Force in the computation of indicators values for future M&E exercises.

A sizable share of the secondary data used to compute the baseline value of the CARD and Mozambique specific indicators are sourced from PESOE annual monitoring reports, which are available in the first quarter of each calendar year. Complementary secondary from administrative systems and primary data used in the computation of the indicators are available soon after the closure of the cropping season spanning October through September. For the next M&E period, data for the 2022/2023 cropping season are to be used. Combining the timing at which both secondary and primary data are available, we recommend that the M&E evaluation be conducted in the second quarter of each calendar year. The following sections detail the procedures for the calculation of the values of each indicator.

3.1 CARD Indicators

3.1.1 Global indicators

Indicator O1: Quantity of paddy production

Definition: Quantity of paddy production represents the sum of the quantity of paddy produced domestically at different ecologies.

Methodology: The baseline value for this indicator is computed as the average country-wide quantity of paddy production, measured in MT and reported in the PESOE annual monitoring reports, for the 2019/2020, 2020/2021 and 2021/2022 cropping seasons.

Data collection and sources: For this indicator, two main sources of data are available, namely (i) the annual monitoring report of Economic and Social Plan and State Budget (referred to as PESOE) for the agriculture sector, using administrative data with national coverage, produced by MADER and available at the Department of Moniting and Evaluation of the MADER's Directorate of Planning and Policy, which can be obtained by visiting MADER and (ii) the statistically nationally representative agriculture integrated survey known as *Inquérito Agrário Integrado* (IAI) administered by MADER in close collaboration with the National Institute of Statistics (INE) using internationally accepted data standards and protocols. The PESOE annual monitoring reports are produced annually, while IAI data are basically available every two years due mainly to financial constraints although the survey is supposed to be administered annually.

Demonstration of calculations: As shown in the Excel spreadsheet (see cell B7 in worksheet named INDICATOR O1), the baseline value for this indicator is computed by averaging the quantity of paddy production, measured in MT, over the last three cropping season (shown in cells B4:B6).

Indicator O2: Harvested area under rice production

Definition: This indicator denotes the sum of the area harvested of domestically produced paddy at different ecologies.

Methodology: The baseline value for the harvested area under rice production is computed as the average quantity of the harvested area under rice production for the last three cropping seasons. The data regarding harvested area, measured in hectares is gathered from the PESOE annual monitoring reports, which can be obtainined by visiting MADER and especially the Department of Monitoring and Evaluation under the MADER's Directorate of Planning and Policy. Therefore, for the next M&E period, we recommend to take the reported value of the quantity of the harvested land under rice production in the 2022/2023 cropping season from the PESOE annual monitoring report.

Data collection and sources: As in the case of the previous indicator, both the PESOE annual monitoring reports and IAI are the data sources for the harvested area under rice production. The PESOE annual monitoring reports document both planned and realized area and the corresponding planned and realized production. We take the realized area as the harvested area and the realized production as the actual production from the harvested area. Therefore, we hereafter refer the realized area from PESOE annual monitoring reports as the harvested area in the computation of all indicators demanding data on the harvested area. For the same reason presented for the previous indicator, the data gathered from the PESOE annual monitoring reports are used to estimate the baseline value for this indicator.

Demonstration of calculations: The harvested area from the last three cropping seasons (shown in cells C4:C6 in the worksheet INDICATOR O2 of the Excel spreadsheet) are averaged to obtain the baseline value for this indicator as illustrated in cell C7 in the worksheet INDICATOR O2. For the next M&E exercise, the quantity of the harvested area under rice production in the 2022/2023 cropping season is to be obtained from the PESOE annual monitoring report and this process should be the same for future M&E exercises.

Indicator O3: Paddy yield

Definition: This indicator denotes the average quantity of domestically produced paddy per unit of harvested area.

Methodology: This indicator is estimated by dividing the country-wide paddy production measured in MT by the corresponding harvested area under rice production measured in hectares for each of the last three cropping seasons, both gathered from the PESOE annual monitoring reports. The baseline value is calculated as the average of the resulting three paddy yields.

Data collection and sources: Computation of this indicator (O3) requires data on paddy production and harvested area under rice production. See the previous two indicators (O1 and O2) for the description of the data collection and sources for the required data for this indicator.

Demonstration of calculations: The baseline value for this indicator is computed by dividing the pady production by the respective harvested area. For the baseline value, is done by dividing the paddy production by the respective harvested area for each cropping season, as shown in cells D4:D6 in the worksheet INDICATOR O3 of the Excel spreadsheet and then average the results of the yield for the three cropping seasons as shown in cell D7 in the worksheet INDICATOR O3). For the next M&E period, computethe value of this indicator by dividing the quantity of paddy production in the 2022/2023 cropping season by the respective harvested area. The PESOE annual monitoring report is the data source for both values (quantity of paddy production and of harvested area under rice production).

Indicator O4: Rate of selfsufficiency in rice

Definition: Rate of self-sufficiency is defined as the percentage of coverage of rice needs by local production.

Methodology: To calculate the rice selfsufficiency rate, we considered milled rice production, import and export in the year 2020. Using the formula specified by the Food and Agriculture Organization of the United Nations (FAO), the self-sufficiency rate was calculated as:

$$\text{self-sufficiency rate} = \frac{prod}{prod + imp - \exp} \quad (1)$$

where $prod$ is the quantity of the domestic milled rice produced (MT), imp is the quantity of imported milled rice (MT), and $\exp$ is the quantity of the domestic milled rice exported (MT).

Data collection and sources: As described above for the indicator O1, rice production statistics, gathered from the PESOE annual monitoring reports, are reported in paddy equivalent. Hence, we multiplied the quantity of paddy production by 0.63 to obtain the quantity of milled rice production for each of the last three years. Data on milled rice exports are obtained from INE and on milled rice imports from United States Department of Agriculture USDA. As discussed in the main document, data on import volumes from USDA appear more reliable than that from INE, but this data reliability should be assessed on a yearly basis. We take the baseline value for this indicator as the average rate of selfsufficiency over the last three years.

Demonstration of calculations: The baseline value for this indicator is computed as follows:

Step 1 Estimation of the quantity of milled rice production: For each year, we take paddy production (reported in cells B4:D4 in the worksheet INDICATOR O4 of the Excel spreadsheet) and multiply by 0.63 (cells B5:D5) to obtain milled rice production as illustrated in cells B6:D6.

Step 2 Estimation of the net imported milled rice: For each year, we calculate the differences between the quantity of imported milled rice (for example, cell B7 for 2020) and of exported milled rice (for example, cell B8 for year 2020) to obtain the quantity of the net imported milled rice reported in cells B9:D9.*Step 3 Estimation of the average rate of self-sufficiency in rice:* For each year, we divide the quantity of milled rice production obtained in step 1 (for example, cell B6 for year 2020) by the sum of milled rice production and the net quantity of milled rice (for examples, cell B6 plus cell B9 for year 2020) and then multiply by 100 to calculate the rate of self-sufficiency in rice (reported in cells B10:D10). The baseline value for this indicator is obtained as the average rate of self-sufficiency across the last three years as illustrated in cell E10.

3.1.2 Resilience indicators

Indicator R1: ***Irrigated area under rice production (hectares)***

Definition: This indicator represents the sum of the area under rice production with supplementary irrigation to mitigate the negative impacts of climate variability in rice production.

Methodology: The computation of the amount of irrigated area under rice production is done through summing the countrywide amount of irrigated area under rice production, measured in hectares, for the 2021/2022 cropping season.

Data collection and sources: Data on the amount of irrigated area under rice production can be collected from both secondary and primary sources. A nationally representative Integrated Agriculture Survey – known as *Inquérito Agrário Integrado* (IAI) and administered by MADER in close partnership with Mozambique National Institute of Statistics (INE) using internationally accepted data standards and protocols – could be a potential secondary data source. However, the IAI data are not reliable for this indicator because the data tend to overestimate the irrigated area under rice production. Additionally, the IAI data are not available yearly, which can limit the annual monitoring of this indicator. The National Institute of Irrigation known as the *Instituto Nacional de Irrigação (*INIR) is also another source of data on irrigated area under rice production. However, INIR currently does not have data on irrigated area disaggregated by crop. Therefore, we recommend that INIR collect data on irrigated area disaggregated by crop for a better understanding of the needs in terms of irrigation for various crops and at the same time feed the data needs for different analysis on agriculture performance. As a result of these shortcomings, primary data are recommended to compute this indicator. Primary data is collected using a structured questionnaire (ANNEX 6 in the main report) administered to the rice focal points based at Provincial Services of Economic Activities known as *Servicos Provinciais de Actividades Eocnomicas* (SPAE) and District Services of Economic Activities known as *Servicos Distritais de Actividades Economicas* (SDAE). The questionnaire collects data on the amount of area, measured in hectares, under rice production with and without supplementary irrigation to mitigate the negative impacts of climate variability. Table 3.1 presents the potential rice stakeholders who could be contacted for gathering the required data to calculate the value of this indicator.

Table 3.1 Contact details for irrigated area under rice production

Institution	Province	District
SPAE (rice focal point)	Gaza	Xai-Xai
SPAE	Zambezia	Quelimane
SDAE (rice focal point)	Zambezia	Mopeia

Demonstration of the calculation: The collected data indicate that irrigated area under rice production in the 2021/2022 cropping season amounts to 9,910 hectares in Gaza province (see cell C3 in the worksheet INDICATOR R1 in the Excel spreadsheet) and 165 hectares in Zambezia province (see cell C4), totaling 10,075 hectares as shown in cell C6. Data from Gaza covers the Low Limpopo Irrigation Scheme in XaiXai, Chokwe, and Chibuto districts, while the data from Zambezia covers the Paz Irrigation Scheme in Mopeia district. This procedure is recommended for the upcoming M&E exercises if data from INIR are not available.

Indicator R2: Quantity of certified seed of resilient rice varieties (MT)

Definition: The quantity of certified seed of resilient rice varieties is the sum of quantity of certified rice seed varieties produced domestically with locally preferred resilience characteristics.

Methodology: Resilience is defined as the ability of the different rice varieties to be tolerant to yield-reducing factors such as drought, and salinity, among others. According to the Mozambique Agricultural Research Institute [referred to as *Instituto de Investigação Agrária de Moçambique* (IIAM) from its Portuguese acronym], drought tolerant rice varieties include CHUPA, NÉNÉ, M'ZIVA, MUCELO, OFOANHELA, and OZIVELIWA. Additionally, MACASSANE, M'ZIVA, LIMPOPO and SIMÃO rice varieties are resilient to lodging. This indicator is calculated by summing the quantities of certified seed of the rice varieties classified as resilient.

Data collection and sources: Data on rice seed can be obtained from the PESOE annual monitoring reports, Seed Department of the National Directorate for Agriculture Health and Biosafety and the National Seed Authority. However, these sources do not report the quantities of rice seed disaggregated by variety. Therefore, secondary data on the quantity of certified seed of resilient varieties are unavailable. Primary data is collected through a structured questionnaire (ANNEX 3 in the main report) to compute this indicator. The respondents can list the rice varieties and report the respective quantities of certified rice seed. The data is collected from the regional seed certification laboratories (SCL) of (a) Chokwe in Gaza province, (b) Namacurra in Zambezia province, and (c) Chimoio in Manica province. The Southern region SCL in Chokwe district provides only one observation of the required data for the calculation of baseline value and therefore is excluded in the estimation of the baseline value for this indicator. For future M&E rounds, the sources of data are SCL. Table 3.2 presents the rice stakeholders to be contacted for providing the data to be used to calculate the value of this indicator.

Table 3.2 Contact details for the quantity of certified seed varieties

Institution	Province	District
Southern region SCL	Gaza	Chokwe
Namacurra SCL	Zambezia	Namacurra
Central region SCL	Manica	Chimoio

***Demonstration of the calculation*:** The seed certification laboratories provide data on the quantities of certified seed production across rice varieties and seed companies and for the baseline value was for the last three cropping seasons. Using these data, the following steps are followed to compute the value of this indicator:

Step 1 Computation of the total quantities of certified seed of a given variety in each cropping season: For each cropping season, add the quantity of certified seed production of a given rice variety across seed certification laboratories (for example, for the 2019/2020 cropping season, cell B6 plus cell B12 for variety MACASSANE and cell B7 plus cell B13 for variety MOCUBA, and so on, in the worksheet INDICATOR R2 in the Excel spreadsheet). The results for MACASSANE for example are given in cells E22:E26.

Step 2 Computation of the total amount of the certified seed across three cropping seasons: The total amounts of the certified seed production for each rice variety (cells E22:E26 in the worksheet INDICATOR R2) is obtained by adding the quantities of certified seed production for the last three cropping seasons (2019/2020, 2020/2021, and 2021/2022) for each variety (for example, cells B22:D22 for variety MACASSANE, cells B23:D23 for variety MOCUBA, and so on).

Step 3 Estimation of the average quantity of the certified seed production of each variety: This is done by dividing the total amounts of the certified seed variety production obtained in the previous steps (cells E22:E26 in the worksheet INDICATOR R2) by the corresponding number of non-missing data points for each variety to obtain the average quantity of certified seed production across rice varieties (cells F22:F26). For example, the total amount of the certified seed production is divided by three for variety SIMÃO and by two for variety NÉNÉ.

Step 4: Computation of the quantity of certified seed of resilient rice varieties: As explained above, resilient rice varieties include CHUPA, NÉNÉ, M'ZIVA, MUCELO, OFOANHELA, OZIVELIWA, MACASSANE, LIMPOPO and SIMÃO. Thus, the baseline value for this indicator is computed by adding the average quantity of certified seed production (obtained in the previous step) of these resilient varieties to obtain 270.9 MT as shown in cell F27 in the worksheet INDICATOR R2. The procedure is recommended to be used for future M&E exercises but using data of only one cropping season and especially the last cropping season.

3.1.3 Industrialization indicators

Indicator I1: Rice milling capacity

Definition: This indicator is given as the ratio of the installed capacity of the medium and large processing factories to all operating processing factories.

Methodology*:* Rice milling capacity is calculated by dividing the installed capacity of medium- and large-scale rice processing factories by that of all (small, medium and large scale) rice processing factories and then multiplying by 100. First, it is necessary to classify rice processing factories as small, medium and large-scale based on their installed capacity measured in MT per hour. The rice processing factories are identified in rice producing areas with guidance from the rice stakeholders namely the rice focal point based at SPAEs of the rice producing provinces (Gaza, Sofala and Zambezia) and SDAEs of the rice producing districts in each province.

Data collection and sources: Primary data are gathered from the rice processing factories in the three main rice producing provinces (Gaza, Sofala and Zambezia) using a structured questionnaire presented in ANNEX 5 in the main report. Table 3.3 shows the rice millers to be interviewed during field visits in the three main rice producing provinces.

Demonstration of the calculation: This indicator is calculated as follows:

Step 1 Classification of rice processing factories: The rice processing factories are classified as small and medium-to-large scale using the installed processing capacity of 2 MT per hour as the cutoff. Rice processing factories are categorized as small scale if their installed processing capacities are less than 2 MT per hour and as medium-to-large scale if their installed processing capacities are at least 2 MT per hour; as illustrated in cells F3:F17 in the worksheet INDICATOR I1 in the Excel spreadsheet.

Step 2 Estimation of the total installed processing capacities for small and medium to large scale rice millers: It is done by adding the installed processing capacities across separately small-scale rice millers (cell E18 in the worksheet INDICATOR I1) and medium to large scale rice millers (cell E19 in the same worksheet).

Step 3 Computation of industrial processing capacity: It is done by dividing the total installed capacity among medium to largescale rice millers obtained in the previous step (cell E19) by the sum of the installed processing capacities across all rice milers (cell E20 equals to cell E18 plus cell E19) and then multiply by 100 to obtain the industrial processing capacity (cell E21). This procedure is recommended for future M&E exercises. Table 3.3 presents the factories to be contacted for providing the data to be used to calculate the value of this indicator.

Table 3.3 Contact details for rice milling capacity

Factory	District
LIAN FENG	Xai-Xai
WANBAO	Chongoene
AFROMOZ	Bilene
LIA	Chokwe

HICEP	Chokwe
CAIC	Chokwe
INACIO DE SOUSA	Manhiça
LIANHE AGRICULTURE DEVELOPMENT AFRICA	Buzi
INVESTAGRO	Buzi
CHIMUNDA AGROBUSINESS	Dondo
TONGAAT HULLET	Dondo
PROMAIC	Maganja da Costa
TIA RUQUIA	Nicoadala
FABRICA IMPER	Nicoadala
FABRICA DE NAMACURRA	Namacurra

Indicator I2: Level of mechanization in rice production

Definition: This indicator corresponds to the number of machines used in land preparation and harvesting operations in rice production. Specifically, the level of mechanization is measured by the number of tractors, harrows, ploughs, seed-fertilizer applicators and combine harvesters engaged in rice production.

Methodology: This indicator is calculated as the sum of machines used in land preparation and harvesting operations in rice production. The indicator on the level of mechanization in rice production is composed of five sub-indicators consisting respectively of the sum of the number of:

(i) Tractors used in rice production in the country;
ii) Harrows used in rice production in the country;
iii) Ploughs used in rice production in the country;
(iv) Seed-fertilizer applicator used in rice production in the country; and
(v) Combine harvesters used in the rice harvesting in the country.

Data collection and sources: The data on the number of machines, equipment and implements described above except for the number of combine harvesters are provided by the Rice Focal Point at the MADER's Directorate of Small scale Agriculture and the number of combine harvesters are collected from Rice Focal Points based at SPAE of the rice producing provinces using a structured questionnaire (see ANNEX 6 in the main report). Table 3.4 summarizes the contact details for the stakeholders from whom data on the level of mechanization can be gathered.

Table 3.4 Contact details for level of mechanization in rice production

Institution	Province	District
MADER (rice focal point)	Maputo City	Maputo City
SPAE (rice focal point)	Gaza	Xai-Xai
SPAE (rice focal point)	Sofala	Beira
SPAE	Zambezia	Quelimane
SDAE (rice focal point)	Zambezia	Mopeia

Demonstration of the calculation: This indicator value is calculated as follows:

Step 1 Estimation of the number of machines and implements in land preparation in rice production: For each year, it is done by summing up the number of tractors, harrows, ploughs, seed-fertilizer applicator across provinces (for example, for the year 2022, the sum of data from cells B4:B10 for tractors; cells C4:C10 for harrows; cells D4:D10 for ploughs and cells E4:E10 for seed-fertilizer applicator, all in the worksheet INDICATOR I2) to get the respective total numbers shown in cells B11:E11 for the 2022/2023 cropping season and cells B14:E14 for the 2021/2022 cropping season in the in the worksheet INDICATOR I2. The total amounts calculated above are added (corresponding cells B11:E11 plus cells B14:E14) to get the data presented at cells B15:E15 for the number of these machines and implements (baseline values).

Step 2 Estimation of the number of combiner harvesters used in harvesting by province in rice production: It is done by first adding the number of combiner harvesters across districts within the same province (for example sum of cells J3:J11 for Zambezia province, J13:J15 for Gaza province, and J17:J19 for Sofala) as indicated in worksheet INDICATOR I2 to get the total number of combine harvesters by province; results reported in cells J12 for Zambezia, J16 for Gaza and J20 for Sofala. Finally, the number of combine harvesters is calculated by adding the results obtained above (totals of each province) as reported in cell J21. We recommend that a similar approach is used for the upcoming M&E periods.

3.1.4 Competitiveness indicators

Indicator C1: Market share of domestic rice

Definition: This indicator is defined as the percentage of the domestic rice in relation to the total rice at the retail shops.

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Methodology: According to the definition, data on the quantity of domestically produced rice should be collected from retail outlets. However, retail outlets sell almost solely imported rice, and thus gathering reliable data on the quantities of locally produced rice from these outlets becomes extremely challenging. As a mitigative measure to overcome this data challenge, the market share of domestic rice was computed as follows:

$$\text{market share} = \frac{sales}{sales + imp - \exp} \tag{2}$$

where $sales$ denotes the quantity of the domestic milled rice sales (MT), imp is the quantity of imported milled rice (MT), and $\exp$ is the quantity of the domestic milled rice exported (MT).

Data collection and sources: We use secondary data to compute this indicator. Import and export data for year 2020 are gathered from USDA and INE, respectively, while the quantity of sales of domestically produced rice is taken from IAI 2020.

Demonstration of the calculation: This indicator is calculated as follows:

Step 1 Estimation of the quantity of sales of domestically produced milled rice: This is computed using data from IAI 2020 in STATA format and the following STATA commands:

```
use "c:\sec_gv1.dta", clear                    // opening the data file
keep if g01 == 2                               // keeping only rice
collapse (sum) qntvnkg, by(prov dist upa af)       // HH level rice sales
merge 1:1 prov dist upa af using "c:\weightv0.dta"      /// breaking line
      , keepusing(wgt) update replace          // adding sampling weights
replace qntvnkg = 0.63*qntvnkg                 // conversion to milled rice
total qntvnkg [pw = wgt]                       // quantity of rice sales
```

The estimated quantity of domestically produced milled rice is reported in cell B3 in the worksheet INDICATOR C1 in the Excel spreadsheet.

Step 2 Estimation of the net imported milled rice: We calculate the differences between the quantity of imported milled rice (cell B4) and exported milled rice (cell B5) to obtain the quantity of the net imported milled rice reported in cell B6.

Step 3 Computation of the share of domestic rice in the market: This baseline value is calculated (see cell B7) by taking the quantity of sales of domestically produced milled rice obtained in the first step (cell B3) and dividing by the total quantity of milled rice available in the market given by the sum of the quantity of domestic rice sales and the quantity of net imported milled rice obtained in the second step (cell B6), and finally we multiply by 100.

Indicator C2: Quantity of certified seed of high -yielding rice varieties

Definition: This indicator corresponds to the sum of the quantity of certified seed of locally preferred and produced rice varieties with high-yielding attributes.

Methodology: According to the interviewed rice breeders, high-yielding rice varieties are those whose potential yield is at least 7.0 MT per hectare. According to IIAM, high-yielding varieties include MACASSANE, TUMBETA, SIMAO, OFOANHELA, HUWA, OZIVELIWA, and TCHULULA. The indicator is calculated by summing the quantities of certified seed of the rice varieties classified as high-yielding.

Data collection and sources: As explained above (Indicator R2), secondary data on the quantity of certified seed of high-yielding varieties are not readily available and it is recommended that the PESOE annual reports, Seed Department of the National Directorate for Agriculture Health and Biosafety and the National Seed Authority start to produce rice seed statistics by rice variety Therefore, data gathered from primary sources, covering the last three cropping seasons and using a structured questionnaire (see ANNEX 3 in the main report) are used. The data are collected from the regional SCLs of (a) Chokwe in Gaza province, (b) Namacurra in Zambezia province and (c) Chimoio in Manica province. Table 3.5 presents the rice stakeholders to be contacted for providing the data to be used to calculate the value of this indicator.

Table 3.5 Contact details for certified seed of high-yielding rice varieties

Institution	Province	District
Southern Region SCL	Gaza	Chokwe

Namacurra SCL	Zambezia	Namacurra
Central Region SCL	Manica	Chimoio

Demonstration of the calculation**:** The following steps are used to compute the baseline value of this indicator:

Step 1 Computation of the total quantities of certified seed of a given variety in each cropping season: For each cropping season, we first add the quantity of certified seed production of a given rice variety across seed certification laboratories (for example, for the 2019/2020 cropping season, cell B6 plus cell B12 for variety MACASSANE and cell B7 plus cell B13 for variety MOCUBA, and so on, in the worksheet INDICATOR C2 in the Excel spreadsheet).

Step 2 Computation of the total amount of the certified seed across three cropping seasons: The total amounts of the certified seed production for each rice variety (cells E22:E26 in the worksheet INDICATOR C2) is obtained by adding the quantities of certified seed production for the last three cropping seasons (2019/2020, 2020/2021, and 2021/2022) for each variety (for example, cells B22:D22 for variety MACASSANE, cells B23:D23 for variety MOCUBA, and so on).

Step 3 Estimation of the average quantity of the certified seed production of each variety: It is done by dividing the total amounts of the certified seed variety production obtained in the previous steps (cells E22:E26 in the worksheet INDICATOR C2) by the corresponding number of non-missing data points for each variety to obtain the average quantity of certified seed production across rice varieties (cells F22:F26). For example, the total amount of the certified seed production is divided by three for variety SIMÃO and by two for variety NÉNÉ.

Step 4: Computation of the quantity of certified seed of high-yielding rice varieties: As explained above, among the five rice varieties with available data on seed production, only MACASSANE and SIMÃO are considered high-yielding rice varieties. Thus, the baseline value for this indicator is computed by adding the average quantity of certified seed production (obtained in the previous step) of varieties MACASSANE (219.8 MT) and SIMÃO (42.2 MT) to obtain 262.0 MT as shown in cell F27 in the worksheet INDICATOR C2. The procedure is recommended to be used for the future M&E exercises but using data of only one cropping season and especially the last cropping season.

3.1.5 Empowerment indicators

Indicator E1: Access of rice growers to financial services:

Definition: This indicator is given as the percentage of rice growers accessing financial services.

Methodology: A rice grower is said to have access to financial services if the farmer accessed at least one financial service (credit, ROSCA, banking account, and mobile money services such as MPESA, MKESH, eMOLA and *conta movel*). We avoid double counting by ensuring that rice growers having access to two or more financial services (for example, a combination of credit, ROSCA and a banking account) are counted only once. The baseline value of this indicator is computed by dividing the number of rice farmers who have access to at least one financial service by the total number of rice farmers.

Data collection and sources: MADER's Agriculture Promotion and Rural Extension Agency is the institution responsible for agriculture extension, and consequently, it is a potential source of the required data for estimation of this indicator. However, MADER's Agriculture Promotion and Rural Extension Agency does not have data on farmers' access to financial services. Hence, we recommend that this institution collect this type of data for feeding the future M&E reports. Data on rice farmers' access to financial services are not readily available except from IAI 2020 data. However, as previously discussed, IAI 2020 is conducted on an annual basis due to financial constraints. The alternative would be to conduct farmers' surveys on an annual basis at the rice-producing provinces, but this option is quite expensive. Therefore, we recommend that IAI 2020 data be used to estimate this indicator given mainly that the interviewed rice growers are asked whether they had access to each one of the above-mentioned financial services.

Demonstration of the calculation: Using IAI 2020 data in STATA format, this indicator is obtained using the following steps:

Step 1 Computation of the number of rice growers accessing each financial service: The following STATA commands were used:

```
use "c:/sec_cv1.dta", clear          // reading the data
merge 1:1 prov dist upa af using “c:\weightv0.dta”     /// breaking line
       , keepusing(wgt) update replace     // adding sampling weights
```

```
foreach var in varlist c09 c10 c11 c12a c12b c12c c12d       {
       recode `var' (1 = 1) (2 = 0) if !missing(`var') // variavel dummy
}
saveold "c:/financial service.dta”, replace      // saving the data

use “c:\sec_gv1.dta”, clear                // opening the data file
keep if g01 == 2                           // keeping only rice
generate growrice = (qntkg > 0 & qntkg < .)      // rice growers
collapse (max) growrice, by(prov dist upa af)    // HH level rice grower
merge 1:1 prov dist upa af using “c:\financial service.dta”  ///
       , update replace                    // adding financial services
foreach var in c09 c10 c11 c12a c12b c12c c12d         {
       total `var' [pw = wgt] if growrice == 1   // number rice growers
}
```

The estimates are reported in cells B3:B9 in the worksheet INDICATOR E1 in the Excel spreadsheet.

Step 2 Estimation of the number of rice growers accessing at least one financial service: This is calculated using the following STATA commands:

```
generate finservice = (c09 == 1 | c10 == 1 | c11 == 1 |      ///
  c12a == 1 | c12b == 1 | c12c == 1 | c12d == 1) // at least one service
total finservice [pw = wgt] if growrice == 1
```

The estimate is reported in cell B10.

Step 3 Estimation of the total number of rice growers: This is calculated using the following STATA command:

```
total growrice [pw = wgt] if growrice == 1
```

The estimate is reported in cell B11.

Step 4 Share of rice growers having access to financial services: This is obtained by dividing the number of rice growers accessing at least one financial service by the total number of rice growers as shown in cell B12.

Indicator E2: Share of rice growers with access to technical training and service

Definition: This indicator is defined as the percentage of rice growers accessing technical services and training.

Methodology: Data on the number of rice growers having access to technical training and service are available from the IAI 2020 database. However, these data are not reliable for annual M&E because the survey is not annually administered due to financial constraints. To overcome this limitation, primary data regarding the number of rice farmers who had access to technical training and services in the past three cropping seasons are collected in the three main rice-producing provinces (Gaza, Sofala and Zambezia). And this indicator is then computed as the ratio of the number of rice growers who receives technical training and service to the total number of rice growers in those three rice-producing provinces, and then multiply by 100.

Data collection and sources: Required data for computation of this indicator is collected from rice focal points based at SPAE in the three main rice-producing provinces. ANNEX 6 in the main report presents the questionnaire used, while Table 3.6 summarizes the rice stakeholders to be contacted for providing the required data to compute this indicator.

Table 3.6 Contact details for data on access to technical training and service

Institution	Province	District
SPAE (rice focal point)	Gaza	Xai-Xai
SPAE (rice focal point)	Sofala	Beira
SPAE	Zambezia	Quelimane
SDAE (rice focal point)	Zambezia	Mopeia

Demonstration of the calculation: This indicator is calculated using the following steps:

Step 1 Computation of the total number of rice growers and the number of rice growers having access to technical training and service in each province: The number of rice growers across districts in each province (cells C4:C15 for Zambezia, cells C17:C20 for Sofala and cells C22: C29 for Gaza in the worksheet INDICATOR E2 in the Excel spreadsheet) is summed to obtain the total number of rice growers in each province (cell C16 for Zambezia, cell C21 for Sofala and cell C30 for Gaza). A similar procedure is used for estimation of the number of rice growers who had access to technical training and service using the corresponding data presented in column D.

Step 2 Computation of the total number of rice growers and the number of rice growers having access to technical training and service across provinces: It is done by taking the total numbers of rice growers in each province obtained in the previous step and add them to obtain the country-wide number of rice growers (cell C31). As in the previous step, a similar procedure is used to obtain the country-wide number of rice growers accessing technical training and service using the corresponding data (column D) and reported in cell D32.

Step 3 Share of rice growers with access to technical training and service: This baseline value (see cell C33:D33) is obtained by dividing the number of rice growers having access to technical training and service (cell D32) by the total number of rice growers (cell C31), both values obtained in the previous step, and finally multiplied by 100.

Indicator P1: Level of retail rice prices

Indicator P1.1: Level of retail rice price of imported rice

Definition: This indicator is defined as the average monetary amount paid per MT (or equivalently per kg) of imported milled rice in the domestic retail markets.

Methodology: The Ministry of Industry and Trade (MIC) data of imported rice price is agregated in two categories based on the rice quality (low and high). To establish a baseline value for this indicator, calculate the average price of both types of rice in the three main domestic cereal markets (Maputo, Beira and Nampula) of the country between 2021 and 2022.

Data collection and sources: Secondary data for the imported rice prices covering the years 2021 and 2022 in Maputo, Beira and Nampula markets are used. These data are obtained from the MIC's National Directorate of Domestic Trade (DNCI).

Demonstration of the calculation: This indicator is calculated as follows:

Step 1 Estimation of average price of imported milled rice in each market and rice quality: It is done by averaging retail prices of the high-quality imported milled rice across years in each market (for example, cells B6:C6 for Maputo and B7:C7 for Beira in worksheet INDICATOR P1.1 in the Excel spreadsheet) to obtain average price in each market reported in cell D6 for Maputo, D7 for Beira, and D8 for Nampula. A similar procedure is used for the low-quality imported milled rice using the corresponding data presented in the cell range B11:C13.

Step 2 Estimation of the average price of imported milled rice in each market: It is done by taking the average prices in each market obtained in the previous step (cells D6 and D11 for Maputo, D7 and D12 for Beira and D8 and D13 for Nampula) and averaged them across imported rice quality to obtain average price of imported milled rice (combining high- and low-quality imported milled rice as illustrated in cell D16 for Maputo, D17 for Beira and D18 for Nampula.

Step 3 Computation of the average price of imported milled rice: It is done by taking the market-level average prices estimated in the previous step (cell D16 for Maputo, D17 for Beira and D18 for Nampula) and average them to obtain the baseline value for the price of imported milled rice as shown in cell D19.

Indicator P1.2: Level of retail rice price of locally produced rice

Definition: The indicator is defined as the average monetary amount paid per MT (or equivalently per kg) of domestically produced milled rice in the domestic retail markets.

Methodology: Given that MIC data do not report prices for domestically produced milled rice, the average retail price of domestic milled rice for year 2022 was collected during field visits and came from eight rice brands commercialized in Gaza, Sofala and Zambezia provinces. Then, compute the average price of these eight rice brands as the baseline value.

Data collection and sources: Data for domestic rice prices are collected during field visits and come from eight rice brands commercialized in Gaza, Sofala e Zambezia provinces. Table 3.7 presents the contact details for the stakeholders who can be reached to gather retail price for domestically produced milled prices. SDAEs could also be another data source for retail prices of domestically produced milled rice.

Table 3.7 Contact details for data on access to technical training and service

District	Company	Brand
Chokwe	LIA	TIA LIA
Xai Xai	WAMBAO	WAMBAO
	LIAN FENG	AMIZADE
Buzi	LIAN AGRICULTURE DEVELOPMENT AFRICA	BUZI RICE
Dondo	TONGAAT HULLET	HULETTS RICE
Nicoadala	TIA RUQUIA	TIA RUQUIA RICE
	IMPER	OKALELAMO
Maganja da Costa	PROIMAC	LICUNGO RICE

Demonstration of the calculation: This indicator is calculated as follows:

Step 1 Estimation of retail price per kg for each domestic rice brand: It is done by taking the retail prices measured in MZN per 25 kg and divide them by 25 to obtain retail prices in MZN per kg as shown in cells F4:F11 in the worksheet INDICATOR P1.2 in the Excel spreadsheet.

Step 2 Estimation of average retail price of domestically produced milled rice: The baseline value (cell F12) is obtained by averaging retail prices of domestic rice brands obtained in the previous step (cells F4:F11).

3.2 Mozambique Specific Indicators

3.2.1 Rice seed production

Indicator MZ1: Quantity of breeder rice seed

Definition: The quantity of breeder rice seed is the sum of quantity of breeder rice seed varieties produced domestically.

Methodology: The baseline value is calculated as the sum of the average quantities of breeder seed of the different rice varieties produced in the last two cropping seasons.

Data collection and sources: Secondary data on the quantity of breeder rice seed are not readily available as the sources reporting seed data mainly the PESOE annual reports, Seed Department of the National Directorate for Agriculture Health and Biosafety and the National Seed Authority does not report seed data by variety. Therefore, the data should be collected from primary sources. In Mozambique, the early generation rice seeds are produced in Umbeluzi in Maputo province, Chokwe in Gaza province, as well as Nicoadala and Namacurra in Zambezia province. Required data to estimate this indicator can be collected from IIAM, especially their respective breeders using structured questionnaire (see ANNEX 2 in the main report). Table 3.8 shows the contact details of rice breeders who can provide the data to be used to calculate the baseline value of this indicator.

Table 3.8 Contact details for data on breeder rice seed

Institution	Province	District
IIAM-Umbeluzi	Maputo	Boane
IIAM-Chokwe	Gaza	Chokwe
IIAM-Chokwe	Gaza	Chokwe
IIAM-Namacurra	Zambezia	Namacurra

Demonstration of the calculation: Rice breeders from Umbeluzi, Chokwe and Namacurra research stations are the sources of data on the quantity of breeder seed produced across rice varieties in the last two cropping seasons. Using these data, the following steps are applied to compute the baseline value of this indicator:

Step 1 Computation of the total quantities of breeder seed for each rice variety and cropping season across locations: For each cropping season, add the quantities of breeder seed for each variety across the three locations (for example, for the 2020/2021 cropping season, cells B5:D5 for variety MACASSANE and cells B6:D6 for variety TIO TAKA in the worksheet INDICATOR MZ1 in the Excel spreadsheet) to obtain the total quantity of breeder seed for each variety (for example, for variety MACASSANE, cell E5 for the 2020/2021 cropping season and cell I5 for the 2021/2022 cropping season).

Step 2 Computation of the total amount of breeder seed for each rice variety across cropping season: For each rice variety, take the total quantities of breeder seed for each cropping season estimated in the previous step (for example, cells E5 and I5 for variety MACASSANE and cells E8 and I8 for variety HUWA) and sum them to obtain the total quantity of breeder seed for each rice variety reported in cell J5 for variety MACASSANE and cell J8 for variety HUWA just to mention a few examples.

Step 3 Computation of the average quantity of breeder seed for each rice variety: This average quantity (for example, cell K5 for variety MACASSANE and cell K9 for variety SIMÃO) is obtained by dividing the total amount of breeder seed for each rice variety obtained in the previous step (for example, cell J5 for variety MACASSANE and cell J8 for variety HUWA) by the number of non-missing values (we have two non-missing values for all rice varieties).

Step 4 Computation of the quantity of breeder rice seed: This baseline value (cell K11) is calculated by summing the average quantities of breeder seed across rice varieties obtained in the previous step (cells K5:K10). The above procedure is recommended to be used for the future M&E exercises but using data of only one cropping season and especially the latest cropping season.

Indicator MZ2: Quantity of pre-basic rice seed

Definition: This indicator corresponds to the sum of the quantity of pre-basic rice seed varieties produced domestically.

Methodology: For this indicator, the same procedures like those for the previous indicator (quantity of breeder rice seed) are employed. See indicator MZ1 for the descrition of the methodology.

Data collection and sources: Like in the case of the methodology for this indicator, see indicator MZ1 for description of the data collection and sources.

***Demonstration of the calculation*:** Computation of the baseline value for this indicator is as follows:

Step 1 Computation of the total quantities of pre-basic seed for each rice variety and cropping season across locations: For each cropping season, add the quantities of pre-basic seed for each variety across the three locations (for example, for the 2020/2021 cropping season, cells B5:D5 for variety MACASSANE and cells B9:D9 for variety SIMÃO in the worksheet INDICATOR MZ2 in the Excel spreadsheet) to obtain the total quantity of pre-basic seed for each variety (for example, for variety MACASSANE, cell E5 for the 2020/2021 cropping season and cell I5 for the 2021/2022 cropping season).

Step 2 Computation of the total amount of pre-basic seed for each rice variety across cropping season: For each rice variety, take the total quantities of pre-basic seed for each cropping season estimated in the previous step (for example, cells E5 and I5 for variety MACASSANE and cells E9 and I9 for variety SIMÃO) and sum them to obtain the total quantity of pre-basic seed for each rice variety reported in cell J5 for variety MACASSANE and cell J9 for variety SIMÃO just to mention a few examples.

Step 3 Computation of the average quantity of pre-basic seed for each rice variety: This average quantity (for example, cell K5 for variety MACASSANE and cell K9 for variety SIMÃO) is obtained by dividing the total amount of pre-basic seed for each rice variety obtained in the previous step (for example, cell J5 for variety MACASSANE and cell J9 for variety SIMÃO) by the number of non-missing values (we have two non-missing values for varieties MACASSANE and SIMÃO and only one for variety TCHULULA).

Step 4 Computation of the quantity of pre-basic rice seed: This baseline value (cell K12) is calculated by summing the average quantities of pre-basic seed across rice varieties obtained in the previous step (cells K5:K11). The above procedure is recommended to be used for the future M&E exercises but using data of only one cropping season and especially the latest cropping season.

Indicator MZ3: Quantity of basic rice seed

Definition: This indicator denotes the sum of the quantity of basic rice seed varieties produced domestically.

Methodology: For the reason presented in the previous indicator (MZ2), see indicator MZ1 for the description of the methodology for this indicator.

Data collection and sources: See indicator MZ2 for the description of the data collection and sources for this indicator.

***Demonstration of the calculation*:** The following steps are used to compute the baseline value of this indicator:

Step 1 Computation of the total quantities of basic seed for each rice variety and cropping season across locations: For each cropping season, add the quantities of basic seed for each variety across the three locations (for example, for the 2020/2021 cropping season, cells B5:D5 for variety MACASSANE and cells C9:D9 for variety SIMÃO in the worksheet INDICATOR MZ3 in the Excel spreadsheet) to obtain the total quantity of basic seed for each variety (for example, for variety MACASSANE, cell E5 for the 2020/2021 cropping season and cell I5 for the 2021/2022 cropping season).

Step 2 Computation of the total amount of basic seed for each rice variety across cropping season: For each rice variety, take the total quantities of basic seed for each cropping season estimated in the previous step (for example, cells E5 and I5 for variety MACASSANE and cells E9 and I9 for variety SIMÃO) and sum them to obtain the total quantity of basic seed for each rice variety reported in cell J5 for variety MACASSANE and cell J9 for variety SIMÃO just to mention a few examples.

Step 3 Computation of the average quantity of basic seed for each rice variety: This average quantity (for example, cell K5 for variety MACASSANE and cell K9 for variety SIMÃO) is obtained by dividing the total amount of basic seed for each rice variety obtained in the previous step (for example, cell J5 for variety MACASSANE and cell J9 for variety SIMÃO) by the number of non-missing values (we have two non-missing values for varieties MACASSANE and SIMÃO and only one for variety TCHULULA).

Step 4 Computation of the quantity of basic rice seed: This baseline value (cell K12) is calculated by summing the average quantities of basic seed across rice varieties obtained in the previous step (cells K5:K11). The above procedure is recommended to be used for the future M&E exercises but using data of only one cropping season and especially the latest cropping season.

Indicator MZ4: Quantity of certified rice seed

Definition: This indicator is defined as the sum of the quantity of certified rice seed varieties produced domestically.

Methodology: This indicator is computed by summing the quantities of certified rice seed of all rice varieties produced across the country. The baseline value corresponds to the sum of the average quantities of the certified seeds of the different varieties produced in the last three cropping seasons.

Data collection and sources: Secondary data on the quantity of certified rice seed are not readily available. Therefore, it is gathered from primary sources using a structured questionnaire (ANNEX 3 in the main report). The data are collected from the regional SCLs of (a) Chokwe in Gaza province, (b) Namacurra in Zambezia province, and (c) Chimoio in Manica province. Table 3.9 shows the contact details of the stakeholders who can provide the data used to calculate the value of this indicator.

Table 3.9 Contact details for data on certified rice seed

Institution	Province	District
Southern Region SCL	Gaza	Chokwe
Namacurra SCL	Zambezia	Namacurra
Central Region SCL	Manica	Chimoio

Demonstration of the calculation: This indicator is calculated using the following steps:

Step 1 Computation of the total quantities of certified seed for each rice variety across locations: For each rice variety and cropping season, add the quantities of certified seed across locations (for example, for 2020/2021 cropping season, cell B6 and B12 for variety MACASSANE and cell B8 and B14 for variety SIMÃO in the worksheet INDICATOR MZ4 in the Excel spreadsheet) and the resulting values are reported in cells B22:D26 (for example, cells B22:D22 for variety MACASSANE and cells B24:D24 for variety SIMÃO).

Step 2 Computation of the total quantities of certified seed for each rice variety across cropping seasons: Take the total quantities of certified seed for each rice variety obtained in the previous step (cells B22:D26) and add them across cropping seasons to yield the total quantities of certified seed for each rice variety reported in cells E22:E26 (cell E22 for variety MACASSANE, E23 for variety MOCUBA, E24 for variety SIMÃO, and so on).

Step 3 Computation of the average quantity of certified seed for each rice variety: It is done by dividing the total quantities of certified seed for each rice variety obtained in the previous step (cells E22 for variety MACASSANE, E23 for variety MOCUBA, E24 for variety SIMÃO, and so on) by the corresponding number of non-missing observations (we have three non-missing observations for varieties MACASSANE and SIMÃO, two for variety MOCUBA and one for varieties NÉNÉ and LIMPOPO) to obtain the average quantity of certified seed for each variety reported in cells F22:F26.

Step 4 Computation of the quantity of certified rice seed: This baseline value (reported in cell F27) is calculated by adding the average quantities of certified seed of all rice varieties obtained the previous step (cells F22:F26). The above procedure is recommended to be used for the future M&E exercises but using data of only one cropping season and especially the latest cropping season.

Indicator MZ5: Harvested area under certified seed production (hectares)

***Definition**:* This indicator is given by the sum of the harvested area under domestically produced certified rice seed production.

Methodology: This indicator is calculated as the sum of the harvested area, measured in hectares, used to produce certified rice seed of all varieties across the country. The baseline value corresponds to the sum of the average quantities of the harvested area used to produce certified seed of the different rice varieties in the last three cropping seasons.

Data collection and sources: Due to unavailability of secondary data on the quantity of area used to produce certified rice seeds, it can be collected from primary sources using a structured questionnaire presented in ANNEX 3 in the main report. The data are collected from the regional SCLs of (a) Chokwe in Gaza province, (b) Namacurra in Zambezia province, and (c) Chimoio in Manica province. Southern region SCL in Chokwe provided only one observation over the last three cropping seasons and this value was not used in the computation of this indicator. Table 3.9 on page 28 (indicator MZ4) presents the contact details of rice stakeholders to be approached for providing the data to be used for the calculation of the value of this indicator.

***Demonstration of the calculation*:** The following steps are used to compute the baseline value of this indicator:

Step 1 Computation of the total quantities of harvested area for each rice seed variety across locations: For each rice seed variety and cropping season, add the quantities of harvested area across locations (for example, for 2020/2021 cropping season, cell B6 and B12 for variety MACASSANE and cell B8 and B14 for variety SIMÃO in the worksheet INDICATOR MZ5 in the Excel spreadsheet) and the resulting values are reported in cells B22:D26 (for example, cells B22:D22 for variety MACASSANE and cells B24:D24 for variety SIMÃO).

Step 2 Computation of the total quantities of harvested area for each rice seed variety across cropping seasons: It is done by taking the total quantities of harvested area for each rice variety obtained in the previous step (cells B22:D26) and add them across cropping seasons to yield the total quantities of harvested area for each rice variety reported in cells E22:E26 (cell E22 for variety MACASSANE, E23 for variety MOCUBA, E24 for variety SIMÃO, and so on).

Step 3 Computation of the average quantity of harvested area for each rice seed variety: It is done by dividing the total quantities of harvested area for each rice seed variety obtained in the previous step (cells E22 for variety MACASSANE, E23 for variety MOCUBA, E24 for variety SIMÃO, and so on) by the corresponding number of non-missing observations (we have three non-missing observations for varieties MACASSANE and SIMÃO, two for variety MOCUBA and one for varieties NÉNÉ and LIMPOPO) to obtain the average quantity of harvested area for each rice seed variety reported in cells F22:F26.

Step 4 Computation of the quantity of harvested area under certified rice seed production: This baseline value (reported in cell F27) is calculated by adding the average quantities of harvested area under seed production of all rice varieties obtained in the previous step (cells F22:F26). The above procedure is recommended to be used for the future M&E exercises but using data of only one cropping season and especially the latest cropping season.

3.2.2 Access to high-yielding agricultural inputs

Indicator MZ6: Quantity of fertilizer used in rice production:

Definition: This indicator corresponds to the sum of the quantity of fertilizer by type used in rice production per year. For the baseline study, two sub indicators are considered: one for urea (indicator MZ6.1) and another for NPK (indicator MZ6.2). Indicator MZ6.1 (quantity of urea used in rice production) corresponds to the sum of the quantity of urea used in rice production per year; while indicator MZ6.2 (quantity of NPK used in rice production) corresponds to the sum of the quantity of NPK used in rice production per year.

Methodology: This indicator is calculated for each type of fertilizer but not summing the quantities across fertilizer types**.** As mentioned above, this indicator is composed of two sub indicators: Indicator MZ6.1 (quantity of urea used in rice production) and indicator MZ6.2 (quantity of NPK used in rice production). Indicator MZ6.1 is defined as the sum of the reported quantities of urea used in rice production in rice producing provinces (Gaza, Sofala and Zambezia). Alternatively, this indicator can be computed using data from MADER at Directorate of Smallholder Agriculture. However, this data are not representative because it is only for the SUSTENTA program which covers few farmers (small commercial emergent farmers and small farmers). Therefore, the above procedure is used for calculation of the quantity of NPK (indicator MZ6.2) used in rice production.

Data collection and sources: As mentioned above, the available secondary data is regarding small amounts that covered few farmers (small commercial emergent farmers and small farmers) under SUSTENTA program and therefore primary data was gathered from rice stakeholders in Gaza, Sofala and Zambezia provinces using a structured questionnaire (see ANNEX 4 in the main report). The data to compute this indicator are provided by the Baixo Limpopo Irrigation Scheme managers in Xai-Xai and Chokwe districts in Gaza province and the rice focal points based at SPAE Zambezia and SPAE Sofala (see Table 3.10 for their contact details).

Table 3.10 Contact details for fertilizer use in rice production

Institution	Province	District
Regadio de Baixo Limpopo	Gaza	Xai-Xai
Regadio de Baixo Limpopo	Gaza	Chokwe
SPAE (rice focal point)	Sofala	Beira
SPAE	Zambezia	Quelimane
SDAE (rice focal point)	Zambezia	Mopeia

***Demonstration of the calculation*:** The data provided in Gaza were given in terms of the quantity of fertilizer used per hectare with the respective amount of area to which fertilizer was applied. The data provided in Sofala and Zambezia were given in terms of the total quantities of fertilizer applied. Therefore, the following steps are used to compute the indicator values regarding the quantity of urea (indicator MZ6.1) and quantity of NPK (indicator MZ6.2)

Step 1: Computation of the total quantity of urea applied for each location: For Xai-Xai and Chokwe districts, the computation is done by multiplying the urea application rate measured in kg per hectare (column B in the worksheet INDICATOR MZ6.1 in the Excel spreadsheet) by the total area (measured in hectares) to which urea is applied (column C), and then divided by 1,000 to covert kg to MT, yielding the total quantity of urea applied (column D: rows 4 and 5 for Xai-Xai and rows 6 and 7 for Chokwe). For Zambezia (row 8) and Sofala (row 9), no conversion is done because the data were provided in total quantities applied in each province.

Step 2 Computation of the total quantity of urea applied in rice production: It is done by taking the quantities of applied urea obtained in the previous step (cells D4:D9) and sum them across locations to obtain the total quantity of urea applied in rice production reported in cell D10.

Step 3 Computation of the quantity of NPK applied in rice production: The baseline value for this indicator (cell B8 in the worksheet INDICATOR MZ6.2 in the Excel spreadsheet) is calculated by adding the quantities of NPK applied in rice fields across provinces (cells B4:B5).

The above procedure is recommended to be used for the future monitoring and evaluation exercises but using data of only one cropping season and especially the last cropping season.

***Indicator MZ7: Quantity of herbicide used in rice production*:**

Definition: This indicator corresponds to the sum of the quantity of herbicide by type used in rice production per year. For the baseline study, the indicator is composed of four sub indicators: indicator MZ7.1 (defined as the quantity of MCPA used in rice production), indicator MZ7.2 (given as the quantity of Propanil), indicator MZ7.3 (defined as the quantity of Roster), and indicator MZ7.4 (given as the quantity of Vega).

Methodology: Like in the case of fertilizer, this indicator is calculated for each type of herbicide but not summed across herbicide types. As mentioned above, the reported herbicides are MCPA (indicator MZ7.1), Propanil (indicator MZ7.2), Roster (indicator 7.3) and Vega (indicator 7.4). Each one of these indicators is defined as the quantity of the respective herbicide used in rice production in the main rice-producing provinces of Gaza, Sofala and Zambezia.

Data collection and sources: Similar to fertilizer, the data regarding pesticide available at MADER is regarding small amounts that covered few farmers (small commercial emergent farmers and small farmers) under SUSTENTA program and therefore primary data was gathered from rice stakeholders in Gaza, Sofala and Zambezia provinces using a structured questionnaire presented in ANNEX 3 in the main report. The data to compute this indicator is provided by the Baixo Limpopo Irrigation Scheme managers in Xai-Xai and Chokwe districts in Gaza province and the rice focal points based at SPAEs Zambezia and SPAE Sofala (see Table 3.10 for their contact details).

Demonstration of the calculation: The following steps are used to calculate the baseline values for this indicator:

Step 1 Computation of the quantity of herbicide for each herbicide type: For MCPA and Propanil in Xai-Xai district, the computation is done by multiplying the application rate (cells C6 for MCPA and C9 for Propanil in the worksheet INDICATOR MZ7 in the Excel spreadsheet) by the corresponding area to which the herbicide was applied (cells E6 for MCPA and E9 for Propanil) to yield the quantities of MCPA (cell F6) and Propanil (cell F9). For the same herbicides (MCPA and Propanil) in Chokwe, the data were provided in total amounts applied and consequently no conversion is needed (cells F7 for MCPA and F10 for Propanil). The latter is also the case for Roster in Chokwe (cell F12) and Vega in Zambezia (cell F14).

Step 2 Computation of the total quantity of herbicide in rice production: For MCPA and Propanil, it is done by summing the quantities of the respective herbicide across locations (cells F6 and F7 for MCPA and cells F9 and F10 for Propanil) to obtain the baseline values for indicator MZ7.1 (cell F8) and MZ7.2 (cell F11). For Roster (indicator MZ7.3) and Vega (indicator MZ7.4), the baseline values correspond to the same total quantities obtained in the previous step (cells F13 for Roster and F15 for Vega) given that is only one data point.

For the next M&E period, it is recommended to use the same procedures collecting data for the 2022/2023 cropping season using the sources listed above.

3.2.3 Access to agricultural services

Indicator MZ8: Number of extension agents assisting rice growers

Definition: This indicator is defined as the sum of extension agents assisting rice growers in rice producing areas.

Methodology: This indicator is computed by summing the number of extension agents who assist rice growers in the main rice producing areas (Gaza, Sofala and Zambezia provinces).

Data collection and sources: Three providers of extension services to farmers exist in Mozambique: (i) the Government through the public network; (ii) the private sector essentially for crops promoted by this sector such as cotton, sugar cane, tobacco, and rice; and (iii) non-governmental organizations (NGOs) through the implementation of development activities. The readily available data on the number of extension agents is regarding the public network, which can be obtained from the Fund for Agriculture Promotion and Agriculture Extension known as by its Portuguese name as *Fundo de Fomento Agrário e Extensão Rural (FAR)*. However, these data are not disaggregated by crop; therefore, estimation of the number of extension agents especifically assisting rice farmers is not possible. One possibility is to sum the number of public network extension agents working in rice-producing districts. This procedure could lead to an overestimation of the number of extension agents assisting rice growers for at least two main reasons. First, extension agents operating in rice producing districts assist not only rice growers but also growers of other crops grown in these districts. Second, but related to the first, some extension agents within each district operate in locations in which rice is not grown. To correct this potential overestimation, it is necessary to establish a data reporting system from which the district and provincial rice coordinator identify the number of extension agents assisting rice farmers and channel the respecitive numbers to the MADER rice focal point. However, this system of data gathering is not yet well established at MADER. Therefore, for the baseline report, in collaboration with MADER (including provincial rice focal points), primary data were collected on the number of extension agents who especifically assist rice growers in the main rice producing areas (Gaza, Sofala and Zambezia provinces). The source of data are the rice focal points based at SPAE of those provinces (see Table 3.11 for their contact details).

Table 3.11 Contact details for data on extension agents assisting rice growers

Institution	Province	District
SPAE (rice focal point)	Gaza	Xai-Xai
SPAE (rice focal point)	Sofala	Beira
SPAE Zambezia	Zambezia	Quelimane
SDAE (rice focal point)	Zambezia	Mopeia

***Demonstration of the calculation*:** The following steps are used to compute the baseline value for this indicator:

Step 1 Computation of the number of extension agents in each rice producing province: For each province, sum up the number of extension agents across districts (cells C4:C10 for Gaza, C12:C13 for Sofala and C15:C22 for Zambezia in the worksheet INDICATOR MZ8 in the Excel spreadsheet) to obtain the number of extension agents (cell C11 for Gaza, C14 for Sofala and C23 for Zambezia).

Step 2 Estimation of the number of extension agents assisting rice producers: Take the number of extension agents obtained in the previous step and add them across provinces to yield the baseline value for this indicator (cell C24).

Indicator MZ9: Number of producers trained in the best production practices:

Definition: This indicator is defined as the sum of rice producers trained in the best production practices per year.

***Methodology*:** This indicator is computed by summing all rice producers who benefited from technical training across rice-producing provinces in the last cropping season.

Data collection and sources: During the IAI 2020 interviews, farmers were asked if they received extension services. However, IAI data are not annually published, which can limit the yearly monitoring of this indicator Primary data is collected using structured questionnaire (ANNEX 6 in the main report) from rice focal points based at SPAEs (Gaza, Sofala and Zambezia provinces) and whose contact details are presented in Table 3.11. For future M&E exercises, it is recommended that data be gathered using a questionnaire like that presented in ANNEX 6 in the main report.

Demonstration of the calculation: This indicator is computed as follows:

Step 1 Computation of the number of trained rice growers in each rice producing province: For each province, sumthe number of trained rice growers across districts (cells C4:C15 for Zambezia, C17:C20 for Sofala and C22:C29 for Gaza in the worksheet INDICATOR MZ9 in the Excel spreadsheet) to obtain the number of trained rice growers (cell C16 for Zambezia, C21 for Sofala and C30 for Gaza).

Step 2 Estimation of the number of rice growers trained in the best rice production practices: It is calculated by taking the number of trained rice growers obtained in the previous step and add them across provinces to yield the baseline value for this indicator (cell C31).

Indicator MZ10: Number of equipments used in post-harvest handling

Definition: This indicator corresponds to the number of implements and equipments used in rice post-harvest handling and especifically rice threshers, rice dryers and quality control labs.

Methodology: To compute this indicator, we sum the number of each equipment at the three rice producing provinces based on the data gathered from the rice focal points. There are three sub indicators: Indicator MZ10.1 (number of threshers in rice production), indicator MZ10.2 (number of dryers), and indicator MZ10.3 (number of quality control labs).

Data collection and sources: To gather data to compute this indicator, administrate a survey to rice focal points based at SPAEs and mainly of the rice producing provinces. Table 3.12 summarizes the contact details of rice stakeholders at the three rice producing provinces who can provide required data for computation of this indicator. For further data collection for the M&E process, a questionnaire like that presented in ANNEX 6 in the main report can be administered.

Table 3.12 Contact details for data on production and processing equipment

Institution	Province	District
SPAE (rice focal point)	Gaza	Xai-Xai

SPAE (rice focal point)	Sofala	Beira
SPAE	Zambezia	Quelimane
SDAE (rice focal point)	Zambezia	Mopeia
AVZ (rice promoter)	Zambezia	Quelimane

Demonstration of the calculation: This indicator is calculated as follows:

Step 1 Computation of the number of equipment used in rice post-harvest handling at producing province: For each province each equipment and/or implement, summ the number of equipment across districts (for example, for threshers, cells C4:C12 for Zambezia, C14:C16 for Gaza and C18:C20 for Sofala in the worksheet INDICATOR MZ10 in the Excel spreadsheet) to obtain the number of equipment in each province (for example, for dryers, cell C13 for Zambezia, C17 for Gaza and C21 for Sofala).

Step 2 Estimation of the number of equipment used in rice production: For each equipment, sum the number of equipment obtained in the previous step across provinces to yield the baseline value for this indicator (for example, cell C22 for indicator MZ10.1, D22 for indicator MZ10.2 and E22 for indicator MZ10.3).

3.2.4 Rice production and productivity

Indicator MZ11: Quantity of irrigated paddy production

Definition: This indicator is the sum of the quantity of domestically produced irrigated paddy.

Methodology: This indicator is computed by summing the quantity of paddy locally produced under irrigation. The baseline value for this indicator is estimated as the average quantity of paddy produced under irrigation systems in the last three cropping seasons..

Data collection and sources: Irrigated rice is produced mainly in Gaza province and some but very little in Zambezia province. Available data on paddy production are not disaggregated by irrigation system (irrigated versus rain-fed). Disaggregated data is only available for Gaza province and these data are used to compute the value of this indicator. These data would provide a reliable estimate because irrigated rice is predominantly produced in Gaza province as discussed earlier. The required data for this indicator can be obtained from rice focal point from SPAE Gaza. IAI data is not used for estimation of this indicator because this data tend to underestimate paddy production.

Demonstration of the calculation: For the calculation, take the quantities of paddy produced under irrigation (cells B4:B6 in the worksheet INDICATOR MZ11 in the Excel spreadsheet) and average them to yield the quantity of irrigated paddy production reported in cell B7. For future M&E exercises, the indicator can be calculated as the sum of paddy production under irrigation in the latest cropping season. The sum should include all available data on the quantity of paddy produced under the irrigation systems.

Indicator MZ12: Irrigated paddy yield

Definition: This indicator represents the quantity of paddy domestically produced under irrigation systems per unit of harvested area in the rice producing areas.

Methodology: Irrigated paddy yield is given as the ratio of the quantity of paddy production to the respective amount of harvested area under irrigation systems in the last three cropping seasons. The baseline value for this indicator represents the average paddy yield over the last three cropping seasons.

***Data collection and sources*:** As mentioned above, the only rice producing areas, which provided data of rice production disaggregated by irrigated and not irrigated was Gaza province. This province provided data on the amount of harvested area under rice production in irrigated systems. These data (production and harvested area) are used to estimate paddy yield.

***Demonstration of the calculation*:** This indicator is computed as follows:

Step 1 Computation of paddy yield for each cropping season: For each cropping season, divide the quantity of paddy production (for example, cell B4 for the 2019/2020 cropping season) by the amount of respective harvested area (for example, cell C4 for the 2019/2020 cropping season in the worksheet INDICATOR MZ12 in the Excel spreadsheet), both under irrigation systems, to obtain paddy yield (cell D4 for the 2019/2020 cropping season, D5 for the 2020/2021 cropping season and D6 for the 2021/2022 cropping season).

Step 2 Computation of irrigated paddy yield: The baseline value for this indicator (cell D7) is computed by averaging paddy yield across cropping seasons (cells D4:D6) obtained in the previous step.

For future M&E exercises, it is recommended to follow similar procedure but using data for the latest cropping season.

Indicator MZ13: Quantity of rain-fed paddy under input intensification

Definition: This indicator represents the sum of the quantity of paddy production, measured in MT, across rice plots and rice growers who did not irrigate their plots but used input intensification (improved rice seed plus fertilizer).

Methodology: This indicator is calculated by summing the quantities of paddy produced under rain-fed and input intensification. This scenarios is mostly represented by the benefeciaries of SUSTENTA program, who are especially the Small Comercial Emergent Farmers and Small Farmers receiving seed and fertilizer. Therefore, the calculation is done through averaging the quantity of paddy produced by these farmers in the last two cropping seasons (2020/2021 and 2021/2022).

Data Collection: The data for this indicator is available at MADER and especially from rice focal point.

Demonstration of the calculation: The calculation of the value of this indicator is done as follows: first compute the quantity produced rice by multiplying the yields (values in column G) and the harvested area (values in colmun H) in the worksheet INDICATOR MZ13 to result in the respective production (column I of the same sheet). Secondly sum the production in MT of each producer at a given year to get the total production of each year (cell I34 for 2021 and I74 for 2022) and lastly compute the average of the two computed quantities of the two years as described above to have the indicator value (cell I75).

For future M&E exercises, it is recommended to follow similar procedure but using data for the latest cropping season.

Indicator MZ14: Quantity of rain-fed paddy produced with no input intensification

Definition: This indicator represents the quantity of rain-fed paddy production, measured in MT produced under no input intensification. The majority of rice producers in the country produces rice under rain-fed and does not use improved inputs (seed and fertilizer). Therefore, the data on quantity of rice reported in the PESOE annual reports represent largerly and significantly the quantity of paddy produced under rain-fed and without input intensification and it is used to compute the baseline value of this indicator. The methodology, data collection and demonstration of the calculation is the same as reported under Indicator O1. The result is adjusted to better reflect rain-fed paddy production with no input intensification by subtracting the quantity of paddy obtained under Indicator O1 by the quantity of paddy production under rain-fed and input intensification calculated in indicator MZ13 and the quantity of paddy production under irrigation calculated in indicator MZ11. The estimated result is presented in cell B10 in Excell file labeled INDICATOR MZ14.

Indicator MZ15: Harvested area under rain-fed paddy with input intensification

Definition: This indicator is given as the sum of the cultivated area under paddy produced domestically under rain-fed systems with input intensification.

Data Collection: The data for this indicator is available at MADER and especially from rice focal point.

Demonstration of the calculation: The calculation of the value of this indicator is done as follows: first sum the area in hectares of each producer at a given year to get the total production of each year (cell H34 for 2021 and H74 for 2022) and lastly compute the average of the two computed quantities of the two years as described above to have the indicator value (cell H75).

For future M&E exercises, it is recommended to follow similar procedure but using data for the latest cropping season.

MZ16: Harvested area under rain-fed paddy production with no input intensification

Definition: This indicator is given as the sum of the cultivated area under paddy produced domestically under rain-fed systems with no input intensification. Similar do Indicator MZ14, the majority of rice producers in the country produces rice under rain-fed and does not use improved inputs (seed and fertilizer). Therefore, the data on harvested area reported in the PESOE annual reports represent largerly and significantly the harvested area under rain-fed and without input intensification and it is used to compute the baseline value of this indicator. The methodology, data collection and demonstration of the calculation is the same as reported under Indicator O2. The results are adjusted to better reflect harvested area of rain-fed paddy with no input intensification by subtracting the harvested area obtained under Indicator O1 by the harvested area of ain-fed paddy under input intensification calculated in indicator MZ15 and the harvested area of paddy under irrigation calculated in indicator R1. The estimated result is presented in cell C10 in Excell file labeled INDICATOR MZ16.

Indicator MZ17: Rain-fed paddy yield with input intensification

Definition: This indicator is defined as the quantity of domestically produced paddy per unit of harvested area under rain-fed system with input intensification.

Methodology: It is calculated dividing the quantity of rain-fed paddy under input intensification by the amount of harvested area under rain-fed paddy with input intensification**.**

Data Collection: The data for the calculation of this indicator are the results of the Indicator MZ13: Quantity of rain-fed paddy produced with input intensification and Indicator MZ15: harvested area under rain-fed paddy production with input intensification calculated above.

Demonstration of the calculation: The indicator value is computed dividing the value in cell C5 (paddy produced in MT) and the value of the cell C6 (harvested area in hectares) to have the indicator value in the cell C7 (paddy yield in MT per hectare) as shown in the worksheet INDICATOR MZ17 in the Excel spreadsheet.

Indicator MZ18: Rain-fed paddy yield with no input intensification

Definition: This indicator is defined as the quantity of domestically produced paddy per unit of harvested area under rain-fed system with no intensification.

Data Collection: The data for the calculation of this indicator are the results of the Indicator MZ14: Quantity of rain-fed paddy produced with no input intensification and Indicator MZ16: harvested area under rain-fed paddy production with no input intensification calculated above.

Demonstration of the calculation: The indicator value is computed dividing the value in cell C5 (paddy produced in MT) and the value of the cell C6 (harvested area in hectares) to have the indicator value in the cell C7 (paddy yield in MT per hectare) as shown in the worksheet INDICATOR MZ18.

4 Challenges and Recomendations

4.1 Challenges

The key challenges to mention arising from the baseline monitoring and evaluation of CARD and PNA indicators are summarized as follows:

1. The data systems are still not effective and efficient. Better structured and coordinated data systems are nonexistent specifically for secondary data on (i) irrigated area by crop; (ii) quantities of seed of different generations (breeder, pre-basic, basic, and certified) by variety; (iii) number of extension agents assisting rice farmers; (iv) quantity of and harvested area under rain-fed paddy production with input intensification; (v) quantity of and harvested area under rain-fed paddy production without input intensification; and (vi) time series data on domestic retail price of domestically produced rice brands.
2. The quality of data regarding the quantity of imported milled rice is questionable as it is inconsistent with the current rice consumption requirements. This results from the fact that the Mozambique Revenue Authority, known as *Autoridade Tributaria de Mocambique* (ATM), captures with higher reliability the monetary values of imported and exported commodities compared to their counterpart tonnage, data on exported rice are also questionable; and
3. The system of data reporting from the district level to the province level rice focal points and finally to the national rice focal point is not effectively and efficiently working for some of the key required data for the assessment.

4.2 Recommendations

From the above shortcoming and for sustaining the following M&E exercises, it is recommended to:

1. The National Institute of Irrigation, known as *Instituto Nacional de Irrigacao* (INIR), collect data on irrigated area by crop and specifically the irrigated area under rice production throughout the country;
2. The National Seed Authority demand data on quantities of seed of various generations by variety throughout the country;

3. The Agriculture Promotion and Rural Extension Agency collect data on number of extension agents from both public and private sectors engaged in assisting rice farmers;
4. The MADER's Directorate of Small-scale Agriculture develop and operationalize data reporting system from the rice producing districts, provinces to the national level;
5. The MADER's Directorate of Small-scale Agriculture establish a M&E system for CARD and PNA 2030 indicator guided by the results of the baseline M&E report;
6. The Ministry of Industry and Trade/Customs to track data on quantity and value of imported and exported rice; and
7. The Ministry of Industry and Trade to collect data on retail prices of locally produced rice brands.

The above recommendations are centered in improving data system and therefore the Rice Task Force is recommended to communicate the above recommendations to the respective institutions to implement them and also produce data base aiming to track all the required data for the M&E to be used by the different institutions (public and private) at all levels in the country. This should be accompanied by the identification of focal points in the different institutions to provide the required data and the list of data sources provided in this manual can be used for that purpose.

ANNEX 1: CONTACT LIST OF INTERVIEWED RICE STAKEHOLDERS

REMOVED