Agriculture Policy Assessment for Fiji

Livestock & Rice Cultivation

ICAT Initiative for Climate Action Transparency

Initiative for Climate Action Transparency - ICAT

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1. Introduction

Globally, agricultural policies are often deemed essential to meeting the increasing demand for sustainable food and nutrition safety. The increasing demand for food presents an opportunity for local government ministries to develop agricultural policies the address the challenges related to increasing food productivity while at the same time, enhancing adaptation to climate change and building resilient farming practices.

To date, Fiji has placed a considerable amount of focus and emphasis on developing mitigation policies for the energy and forestry sector, overlooking the agriculture sector. The agriculture sector is the second largest emitter of greenhouse gases (GHG) for Fiji, therefore, requiring policy interventions to enhance mitigation.

To understand the implications of the various policies within the Ministry of Agriculture (MoA), the GHG and sustainable development impacts of the policies must be assessed. This assessment allows policy makers and decision makers to understand how the implementation of a policy (or group of policies) can alter the dynamics of possible sources and/or sinks of GHG emissions as well as have an impact on the sustainability of the agriculture sector.

Through the Initiative for Climate Action Transparency (ICAT) Fiji Project on the "Set-up of Sectoral MRV Systems for the Agriculture Sector", National Experts, in collaboration with the Greenhouse Gas Management Institute (GHGMI), Ministry of Economy - Climate Change Division and MoA, assessed the GHG and sustainable development impacts of two agriculture sector policies using the "ICAT Agriculture Policy Assessment Guides". The two policies being assessed focus on two important GHG source categories from the agriculture sector:

1. Livestock (Enteric Fermentation and Manure Management).
2. Rice cultivation.

The GHG impact assessment of the two agriculture sector policies were conducted with reference to the ICAT Policy Assessment Guides and the ICAT Agriculture Policy Assessment Matrix (see Annex). The assessment of these agriculture polices and their impact on GHG emissions informs decision- and policymakers of its mitigation impacts and provides information that can be used to improve policy design and implementation for a more robust GHG impact. The assessment of GHG impacts also sets the platform for developing Nationally Determined Contribution (NDC) target for the agriculture sector. Furthermore, it is necessary to understand the implications of mitigation and the associated impact on food production and availability. Therefore, the objective of this report is to:

1. Identify two agriculture sector policies for assessment.
2. Develop causal chains for the two policies for each agriculture sector.
3. Quantify the policy impacts on GHG emissions.
4. Qualitatively assess sustainable development impacts by the agriculture sector policies.
5. Identify policy impact indicators and develop technical guidance for tracking sustainable development and GHG impacts.
6. Develop recommendations for including agriculture sector policies in Fiji's enhanced Nationally Determined Contribution (NDC).

This report provides a holistic assessment of two prioritised MoA policies and their GHG and sustainable development impacts for Fiji using the following process:

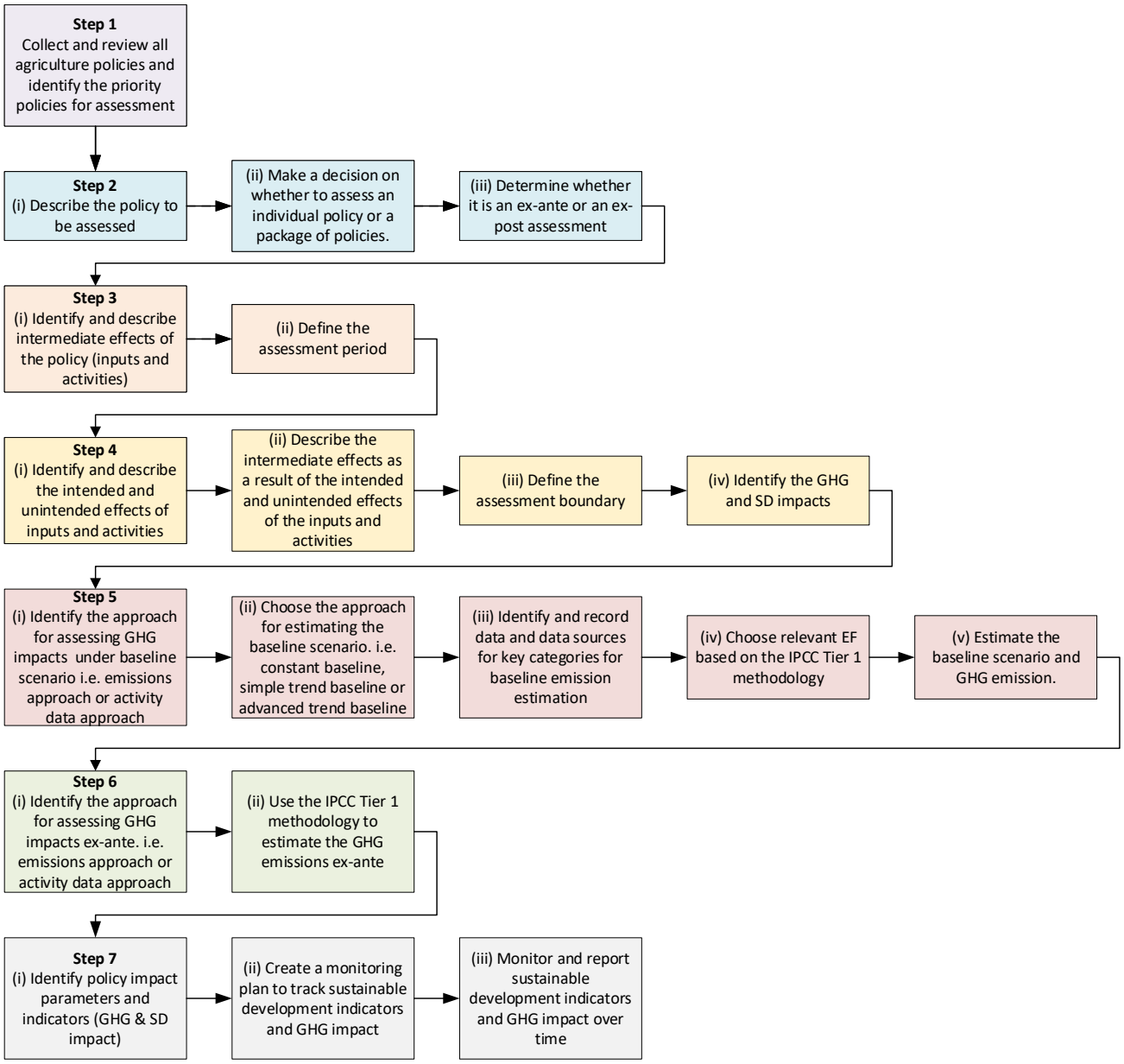

Figure 1: Overview of Steps for GHG Impact Assessment of Agriculture Policies

2. Review of Agriculture Sector Polices for Assessment

2.1. Step 1: Identifying Two Priority Agriculture Sector Policies

The agriculture sector policies for assessment prioritised for two important GHG source categories: (i) Livestock & (ii) Rice cultivation. Prior to selecting the policies for assessment, the national experts consulted the Policy Division[1] within the MoA to do a stocktake of the relevant agriculture policies.
The polices provided by the MoA for the review included:

Policy 1: The 5- Year Strategic Development Plan (2019 – 2023) – Strategic Priority (SP) 4 Establish and Improve Commercial Agriculture

The 5 Year Strategic Development Plan (SDP) (2019-2023) aims to build a "sustainable, competitive and resilient agriculture sector" for Fiji. The SDP is linked to the Fijian Governments 5-year and 20-year National Development Plan (NDP).

The SDP[2] aims to put forward interventions by providing a holistic approach for managing food security and resilient food systems as well as strengthening the transition of small holder farmers to the commercial level.

The SP4 is linked to increasing the production of livestock (beef cattle, dairy cattle, poultry, sheep, goat & swine) by providing improved livestock breeds and the development of a livestock rehabilitation centre. The purpose of SP4 is to increase commercial Agriculture production of livestock (beef cattle, dairy cattle, sheep, goat, poultry, and swine) by 10% by the end of 2023. The increase in local production of livestock ultimately targets a 5% reduction in agriculture imports, thus enhancing economic growth while at the same time, also creating job opportunities for local farmers/ machinery operators. The Ministry of Agriculture is committed to providing technical interventions such as the provision of improved breeding and genetic for livestock.

Policy 2: Intensive Dairy Farm Programme

The dairy industry operates with a range of large and small farmers supplying milk at wholesale prices to a small number of central manufacturers. This programme provides monetary incentives and upgrading of machinery and dairy farms.

This programme targets two individual dairy farms or clusters (assistance will be provided upon reviewing applications from farmers) and will focus on further developing existing large scale dairy farms into intensive dairy farming.

The programme focus is on developing large scale dairy farms where the total cost of development of $450,000 is co-shared between the Ministry and the farmer at the rate of one third or two-thirds paid by the Ministry. The targeted beneficiary for this programme is to receive the Ministry's contribution that will include provision of machines, fencing technology and other intensive dairy farming needs.

Policy 3: National Rice Development Strategy (2021 – 2024)

This strategic document will help guide the Ministry to achieve self-sufficiency by increasing the local rice

[1] Contact Person: Ms. Alitiana Mua

[2] NOTE: As per discussions with the policy team from MoA, the Strategic Priorities and their interventions are reported in the Strategic Development Plan for 2019-2023. This SDP forms the basis for key strategies (policies) for the Ministry which will be considered for this activity.

production consistently each year. The strategies proposed here aim to achieve this by increasing rice productivity in both wetland and dry land areas and by expanding the land area under rice cultivation. The Ministry through this strategy aims to achieve self-sufficiency in rice production in the next 5 years.

Policy 4: Mainstreaming Gender in Agriculture in Fiji (2022 – 2027)
This Policy for Mainstreaming Gender in Agriculture in Fiji has been developed as part of the Fijian Government's commitment to promote gender equity, equality, social justice, and sustainable development for all its citizens, including having a specific gender mainstreaming action plan for each sector and its ministry.

The National Gender Policy of 2014, aligned with the Republic of Fiji's obligations under the 1995 Beijing Declaration and Platform for Action (BPA) as well as the 1979 Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), seeks to promote active and visible gender mainstreaming in all sectors. The Policy for Mainstreaming Gender in Agriculture in Fiji thus aims to realise existing policy but in a more specific manner related to the agriculture, livestock, fisheries, and forestry sectors. It is designed to be integrated with and consistent with other policies, commitments, and strategic plans of the Fijian Government. The policy is horizontally integrated with the National Gender Policy and vertically integrated with the agriculture-related ministries' various strategic and operational plans.

The overall goal of the Policy for Mainstreaming Gender in Agriculture in Fiji is to institutionalise a gender mainstreaming strategy and realise better food and nutrition security, sustainable livelihoods, climate and disaster resilience and successful commercial agriculture for women and men in Fiji.

The intention of this goal is that agriculture-related ministries become fully aware and progressively integrate gender considerations into all their strategies and plans for the sector. This avoids the less effective approach of running a small number of women's equity initiatives while disregarding gender in mainstream programs and activities. In this way, all programs and activities will become gender-sensitive in their design and implementation.

The above four policies were collated and reviewed by the experts, in consultation with GHGMI. Information regarding the policy was collated by the experts in line with the pre-determined criterion as per the "Agriculture Sector Policy Review Matrix" created for this project (see Annex). This information was either directly extracted from the policy documents provided by MoA or through consultations with the relevant officers within the Livestock and Rice Divisions within the MoA. The criterion embedded within the matrix was aligned to the respective deliverables of the project pertaining to policy assessment. Therefore, the information noted in the matrix and its relevance/usefulness allowed the experts to make a judgement and to select the most relevant and applicable policies to review to achieve the expected deliverables, with respect to the livestock and rice cultivation sector.

Moreover, the matrix consists of the following criterion:

i. *Name of policy and cabinet approval date:* to determine whether the policy has been implemented, will be implemented or if it is still in the draft stages.
ii. *Description:* provides a brief write-up, summarising the policy being reviewed.
iii. *Purpose:* states what the policy is trying to achieve or why it has been developed by MoA.
iv. *Background & Scope:* outlines some of the circumstances that led to the development and need for the policy.
v. *Significance of the Policy:* provide a broader context to understand the importance, relevance, and purpose of the policy.

vi. *Responsible entities and key stakeholders:* identify who is responsible for the implementation of the policies as well as those who will be benefitting from it.
vii. *Key/specific interventions:* identify and state key interventions relevant to the policy.
viii. *Financial Implications:* state whether a designated budget or funding source has been committed for the policy to make it feasible for implementation.
ix. *Monitoring, Reporting and Verification of policy implementation:* state whether the policy has a defined MRV plan/process outlined. If yes, who are the responsible stakeholders involved? Is there a defined institutional arrangement to monitor, review and verify the policy implications on a regular basis in a timely manner?
x. *Status:* state whether the policy is planned or implemented.
xi. *Status of Implementation:* state the progress of the policy implementation phase.
xii. *Expected level of penetration:* quantitatively outline what the policy is targeting/expecting to achieve. E.g., 50% or idle land, etc.
xiii. *Potential agriculture GHG source categories impacted by the policy and the level of impact:* CH_4 from enteric fermentation, CH_4 and N_2O from manure management, CO_2 from liming, N_2O from soils, soil carbon and whether there will be a high, medium, or low impact on the level of GHG emissions.
xiv. *Current level of data availability for estimating GHG emissions from the impacted source categories:* state the level (High, Medium, Low, unknown) of data that is available and comment on the type of data that is/isn't available to estimate GHG emissions as per IPCC methodology.
xv. *Sustainable development impacts:* state the potential sustainable development impacts of the policy.
xvi. *Risks and barriers:* state the potential risks and/or barriers to successfully implementing the policy.
xvii. *Alignment to the Fiji Agriculture Sector Policy Agenda and/or 5-year Strategic Development Plan:* state whether the policy helps to achieve goals in the Fiji Agriculture Sector Policy Agenda and/or the 5-year SDP. Identify the goals and/or strategic priority areas the policy aims to address.
xviii. *Alignment to Fiji's Low Emissions Development Strategy (LEDS):* state whether the policy helps to achieve goals in Fijis LEDS and identify the goals. Are there any trade-offs between the LED's interventions and those identified for the policies? Are these similar or different. What is deemed as an entry point for the LEDS interventions for both rice and livestock?
xix. *Future NDC Update:* state how the implementation and outcomes of the policy would help to address the future NDC updates from Fiji.

Upon reviewing the relevant agriculture policies, the following were prioritized and assessed for the purpose of this project:

A. Livestock

Policy 1: 5 – Year Strategic Development Plan

Key Area: "Strategic Priority 4 (Outcome 4.2, Key Performance Indictor 4.2.2) – Establish and Improve Commercial Agriculture".

Strategic Theme: Farmer Technical Capacity

Rationale:

The agriculture sector polices that are either being developed or have been developed are aligned to the 5-Year Strategic Development Plan (SDP) under the MoA, which is directly aligned to Fiji's 5- and 20-Year National Development Plan (NDP). The purpose of the SDP is to build a **"sustainable, competitive and resilient agriculture sector"** to make Fiji a vibrant and progressive nation (Ministry of Agricultrure , 2019). The SDP aims to provide a ***holistic approach to manage food security and resilient food systems*** while ***strengthening the commercialisation of smallholder farmers.***

The Strategic Priority 4 focuses on increasing the production of livestock (beef cattle, dairy cattle, swine, poultry, goat, and sheep) by providing improved breeds, feed, and the development of a livestock rehabilitation centre. The MoA has developed three programmes which are aligned to increasing livestock population by 10% by the end of 2024. These programmes are:

i. **Climate Smart Agriculture (CSA) technology -** increase in the number of farms supported with quality/ resilient livestock breed for pigs, poultry and goat, nutritional enhancement plans, and veterinary services.
ii. **Optimising the Use of Juncao Grass to Enhance Livestock Production** - Juncao grass can be used as green forage during long dry spells to ensure livestock productivity. It contributes to an overall improvement in animal health, which ultimately results in an improvement of milk and meat production.
iii. **Waste Management System for Livestock Farmers** - To introduce and establish sustainable waste management and mitigate the adverse impact of animal effluent.

Considering the impact of these programmes under Strategic Priority 4 of the SDP, the increase in livestock population will have an impact on methane emissions from enteric fermentation and will also lead to an increase in manure excreted by the animals on the farms. Thus, it will also contribute to methane and nitrous oxide emissions from manure. The quantification of emissions due to this policy will allow the experts to make mitigation recommendations to be considered for future NDC updates. It will also inform policy and decision makers about options for mitigating GHG emissions effectively to ensure alignment to the Paris Agreement.

B. Rice Cultivation

Policy 3: National Rice Development Strategy (NRDS) 2021 – 2024 (Draft)

Rationale:

The Fijian Government fosters to create and maintain food and nutrition security. The trade volume of rice in the international market is very thin and vulnerable due to unpredictable factors like climate change, natural disasters, and the global Covid-19 pandemic. Therefore, it is imperative for Fiji to take a strategic step to escalate local rice production and decrease reliance on imported rice.

In Fiji, rice has a multi-dimensional role as the foundation of food security, economic growth, and social stability. Over the years, the rice industry has been increasingly weakened as rice area and production declined while the rice yield growth has been stagnant or marginal. Consequently, Fiji, which attained 66% percent of self-sufficiency in rice in 1980s, had to import more than 80 percent of the total rice demanded annually.

The Draft National Rice Development Strategy (NRDS) will focus on strengthening rice production efforts to maintain food security amidst the COVID 19 pandemic and to provide the guiding blueprint, focusing efforts on developing Fiji's rice sector. Therefore, it will help guide the MoA to achieve self-sufficiency by

increasing the local rice production consistently each year. The strategies proposed in the draft NRDS will aim to achieve this by increasing rice productivity in the next 5 years in both wetland and dry land areas and by expanding the land area under rice cultivation.

The increase in land area for rice cultivation and production will lead to further enhancement of methane emissions. Considering that this policy is currently in the draft stage, quantifying the GHG impact of increasing rice cultivation area will allow the national experts to inform policy/decision makers of the impact this policy will have on Fiji's GHG emissions while also providing mitigation recommendations which can be linked to the NRSD. Coupled with qualitative assessment of the policy's potential sustainable development impacts, the analysis can inform the NRSD on developing a sustainable rice industry in Fiji while also mitigating GHG emissions to keep in line with the Paris Agreement.

NOTE: Policy 2 was not selected for impact analysis as the policy has just recently been discontinued. Upon consultation with the Acting Director of the Animal Health and Production Division, it was brought to the attention of the experts that the policy was no longer being implemented due to as it was not regarded feasible. Considering that the policy will no longer be implemented, it was not selected for analysis. On the other hand, Policy 4 was not related to either the livestock or the rice cultivation sectors directly but focused more on having an increased representation and opportunities for women and youth in the agriculture sector. Therefore, Policy 2 and 4 were not regarded feasible for analysis for the purpose of this project.

3. Agriculture Policy Assessment Analysis for the Livestock Sector

3.1. Describing the Policy for Assessment

A detailed description of the livestock policy plays a significant role in understanding the policy being assessed and to assess the GHG impact of the policy. The three components that must be considered when providing the policy description include:

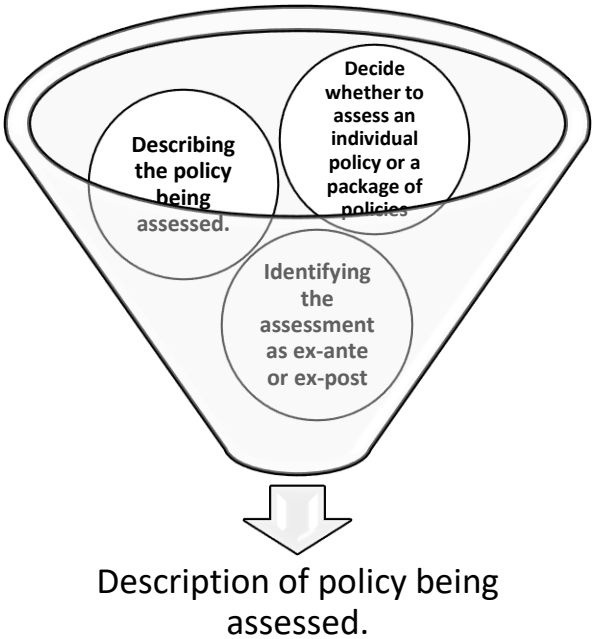

Figure 2: How to describe a policy for assessment.

A detailed description of the policy, aligned with the ICAT assessment guide and drawing from the ICAT Policy Assessment Matrix referenced above, is represented in the table below:

Table 1: Describing the Livestock Policy

Information	Guidance	Description
Title of policy	*Policy name*	**5 Year Strategic Development Plan 2019-2023 Strategic Priority 4 (Outcome 4.2, Key Performance Indictor 4.2.2):** Establish and Improve Commercial Agriculture. **Strategic Theme:** Farmer Technical Capacity
Type of policy	*The type of policy, such as those presented in Table 3.1, or other categories of policies that may be more relevant*	**Financing and Investment** – The development of a rehabilitation center for the treatment of Livestock and funding has been allocated by the Fiji government to assist farms by providing enhanced/ quality breed of livestock, and the set-up of livestock feed technology on selected farms. The Ministry has also planned to install biogas digesters on piggery and poultry farms.
Description of specific interventions	*The specific mitigation practice and/or technology carried out as part of the policy, such as those presented in Box 3.1.*	• The development of a rehabilitation center for treatment of livestock – reduce incidences of animal diseases through systematic BTEC and animal disease management. • The provision of enhanced/ quality breed of beef & dairy cattle, sheep, goat, swine, and poultry to increase livestock production. • The provision/ setup of livestock feed technology on farms – use of Juncao grass to produce quality livestock feed. • Installation of biogas digesters on piggery and poultry farms.
Status of the policy	*Whether the policy is planned, adopted, or implemented*	Adopted
Date of implementation	*The date the policy comes into effect (not the date that any supporting legislation is enacted)*	Estimated – 2019
Date of completion (if relevant)	*If relevant, the date the policy ceases, such as the date a tax is no longer levied or the end date of an incentive scheme with a limited duration (not the date that the policy no longer has an impact)*	Expected – 2024 The establishment of the relevant activities is expected to be completed by the end of 2024. However, the breeding center, rehabilitation center and fodder banks as well as the biogas digesters will remain operative after 2024. Therefore, while the policy implementation period is presumed to be complete by 2024, the outcomes of the policy will

Information	Guidance	Description
		remain in effect past 2024.
Implementing entity or entities	*The entity or entities that implement(s) the policy, including the role of various local, subnational, national, international or any other entities*	Ministry of Agriculture
Objectives and intended impacts or benefits of the policy	*The intended impact(s) or benefit(s) the policy intends to achieve (for example, the purpose stated in the legislation or regulation)*	The purpose of SP4 is to increase commercial Agriculture production of livestock (beef cattle, dairy cattle, sheep, goat, poultry, and swine) by 10% by the end of 2023. The increase in local production of livestock targets a 5% reduction in agriculture imports, thus enhancing economic growth while at the same time, also creating job opportunities for local farmers/ machinery operators. The Ministry of Agriculture is committed to providing technical interventions such as the provision of improved breeding and genetic stock for livestock, improved and quality livestock feed and the development of rehabilitation centers to monitor animal health and productivity. Moreover, methane captured through the biogas digesters can be used as a source of biofuel for cooking, thus, reducing reliance on fossil fuels as well as a substitute for wood for cooking.
Level of the policy	*The level of implementation, such as national level, subnational level, city level, sector level or project level*	National
Geographic coverage	*The jurisdiction or geographic area where the policy is implemented or enforced, which may be more limited than all the jurisdictions where the policy has an impact*	Provide improved feed, genetic breed, and accessibility to rehabilitation centre for all supervised cattle, piggery, and poultry farms in Fiji.
Sectors targeted	*Which sectors or*	Agriculture - Livestock Category

Information	Guidance	Description
	subsectors are targeted	
Greenhouse gases targeted	*Which GHG the policy aims to control, which may be more limited than the set of GHG that the policy affects*	GHG emissions are not targeted by this policy. However, there are likely to be unplanned or unintended GHG impacts of this policy, on the sources listed below: • CH_4 from enteric fermentation • CH_4 and N_2O from manure management • N_2O from soil due to urine and dung deposited by grazing animals in pasture/ paddock/range
Other related policies or actions	*Other policies or actions that may interact with the policy being assessed*	• Climate Smart Agriculture (CSA) technology - increase in the number of farms supported with quality/ resilient livestock breed for pigs, poultry and goat, nutritional enhancement plans, and veterinary services. • Optimizing the Use of Juncao Grass to Enhance Livestock Production - Juncao grass used as green forage during long dry spells to ensure livestock productivity. It contributes to an overall improvement in animal health, which results in an improvement in milk and meat production. • Waste Management System for Livestock Farmers – To introduce and establish a sustainable waste management mitigate the adverse impact of animal effluent.
Intended level of mitigation to be achieved and/or target level of other indicators (if relevant)	*If relevant and available, the total emissions and removals from the sources and carbon pools targeted; the target amount of emissions to be reduced or removals to be enhanced because of the policy, both annually and cumulatively over the life of the policy (or by stated date); and/or the target level of key indicators (such as hectares of land to conserve)*	• An increase in livestock population by 2.5% per year (10% increase by 2023). • Increase in manure deposits due to an increase in livestock population, leading to an increase in the establishment of manure management systems. • Installation of biogas digesters to trap methane emissions.
Title of establishing legislation, regulations, or other founding	*The name(s) of legislation or regulations authorising or establishing the policy*	• 5 Year Strategic Development Plan 2019-2023. • Fiji 2020 Agriculture Sector Policy Agenda

Information	Guidance	Description
documents	*(or other founding documents if there is no legislative basis)*	
Monitoring, reporting and verification procedures	*References to any monitoring, reporting and verification procedures associated with implementing the policy*	Monitoring the progress of the specific interventions requires the MoA officers to track and record the number of quality livestock produced and supplied to farmers. Moreover, the validation of the respective KPIs will be done through a review of the technical and research reports compiled and submitted by the Extension Division (DE) and the Director for Animal Health and Production (DAPH). It will also be verified through the publication of factsheets and the completion of Staff & Farmer training.
Enforcement mechanisms	*Any enforcement or compliance procedures, such as penalties for noncompliance or requirements for reporting*	n/a
Reference to relevant documents	*Information to allow practitioners and other interested parties to access any guidance documents related to the policy (for example, through websites)*	Ministry of Agriculture Website
The broader context or significance of the policy	*Broader context for understanding the policy*	**Background and Scope:** Over recent years, the rate of growth in agricultural production has stagnated and failed to keep pace with the needs of a rapidly growing population, resulting in a progressive increase in import bills for food (Livestock import increased from ~55.1M FJD in 2000 to ~97M FJD in 2008 - Source: 2016 Fiji Livestock Sector Strategy). Low agriculture productivity has a serious implication on the country's ability to produce enough food for its growing population and thus, undermines food security. The implementation of SP4 ensures an increase in local livestock production which will aim to meet the local demand for meat consumption, thus, enhancing food security **Significance:** The implementation of SP4 will lead to an increase in livestock production, thus increasing local meat

Information	Guidance	Description
		production to meet market demands. Therefore, it will reduce the costs associated with importing meat products, enhancing Fijis GDP. Additionally, an increase in local livestock production also enhances food security for the people of Fiji and reduces a dependency on imported goods for consumption.
Outline of sustainable development impacts of the policy	*Any anticipated sustainable development benefits other than GHG mitigation*	• Reduce agriculture import by 5% (COP 2020 - 2021). • Increase the livelihoods of people and reduce poverty. • Hence, addresses the National Development (NDP) Goals 3.2.10 (Expanding the Rural Economy); 3.2.12 (non-sugar agriculture[3]); 3.1.4 (Food and nutrition) (Ministry of Economy, Fiji, 2017) • SP4 also addresses Goal 2(Zero hunger), Goal 1 (No poverty) and Goal 8(Decent work and Economic Growth) of the SDGs.
Key stakeholders	*Key stakeholder groups affected by the policy*	• Ministry of Agriculture (implement) • Local Farmers (Beneficiaries)

Deliberation on the policy implementation phase iterates that MoA has adopted the policy and is currently in the initial stages of implementation. Therefore, the policy assessment objective is to help estimate the future effects of the policy upon successful implementation by 2024. Therefore, making the assessment an ***ex-ante assessment.***

In addition, the ICAT Agriculture Policy Assessment Guide also provided relevant criterion which allowed experts to assess the livestock policy as an *individual policy* rather than a package of policies. The individual assessment of this policy will provide integral details on GHG implication from enteric fermentation and manure management to allow decision- and policymakers to make informed judgements regarding the implementation, continuity, and feasibility of the policy. Additionally, it is a key policy that is currently available within the MoA that directly affects the key parameters (e.g., animal population) which will have a significant GHG impact because of the policy. Furthermore, the MoA and the relevant divisions within the Ministry do not have substantial data to understand the interactions

[3] With the agriculture sector proving to be an important source of livelihood in terms of food and nutrition security, income generation and providing employment opportunities, the government is focusing on promoting self-sufficiency by expanding and promoting the production and export of local agricultural products, where Fiji has a competitive advantage.

between the various agriculture policies for assessment as a package of policies as these policies have gained approval by the Cabinet recently for implementation. Therefore, the national experts have assessed it as an individual policy to provide a robust outlook at the GHG implications while also using it to make recommendations for Fijis future NDCs.

3.2. Identifying and Describing Intermediate Effects of the Livestock Policy for the Defined Assessment Period

To identify and assess the GHG impact of the livestock policy, it was important to first identify and describe the various inputs and activities relevant to successfully implementing and achieving the objectives of the policy. The input and activities lead to identifying the significant intermediate effects of policy implementation. The figure below illustrates the relationship between these components to identify the intermediate effects of policy implementation and its impact on GHG emissions:

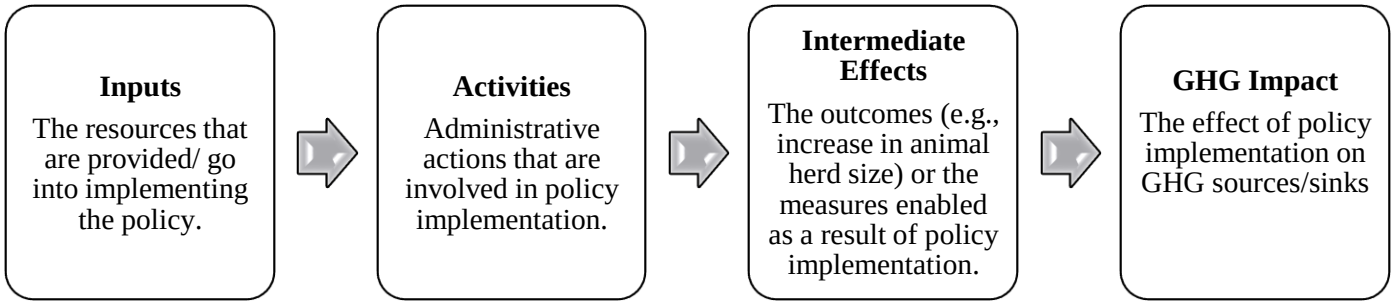

Figure 3: Process for Identifying & Describing Intermediate Effects of Policy Implementation

The following tables encapsulate and describe the various inputs and activities of the policy and its associated intermediate effects.

Table 2: Identifying and Describing Inputs and Activities of the Livestock Policy

	Detail/explanation	Geographic location of effect	Timing of effect
Inputs			
Improved livestock breed, Juncao feed and development of and accessibility to rehabilitation center provided to farmers.	1. Quality pasture and fodder materials made available to farms and demonstration plots developed so that other farmers can learn from the concepts and implement on their farm	Livestock farms located throughout Fiji	2021 onwards
	2. Improved genetic livestock breed provided to enhance meat and milk production.		• 2021-2024: to increase livestock production by 10% by the end of 2024. • Assistance provided after 2024 as well, however, the penetration of the assistance is not measurable for the population headcount
	3. The development of a livestock rehabilitation center to assess and screen livestock for diseases and treatment.		2021 – 2024: continue to provide farmers with accessibility to the rehabilitation centers after 2024 as well
Provide biogas digesters for piggery and poultry farms.	The installation of biogas digesters will allow the treatment of animal waste to trap methane for energy generation.	Supervised farms throughout Fiji	2021 onwards

	Detail/explanation	Geographic location of effect	Timing of effect
Activities			
Create a breeding center for genetic improvement of livestock through Embryo Transfer Technology (ETT) programme.	1. Produce genetically superior beef breeds which adapt well to the prevailing climatic conditions with prolific traits 2. Provision of improved breeds to smallholder piggery farms to increase production.	Livestock farms located throughout Fiji	• 2019 - 2021: Develop EET breeding center (Already in operation). • 2021-2024: to increase livestock production by 10% by the end of 2024. Assistance provided after 2024 as well, however, the penetration of the assistance is not measurable for the population headcount.
Develop Juncao fodder banks.	1 acre fodder bank developed on government stations to provide planting material to farmers.	This project supplies the planting material from Koronivia Research Station, Sigatoka Research Station, Legalega Research Station, Yaqara Pastoral company, and Nawaicoba Research station in Viti Levu while Mua Sheep Station, Batiri sheep station, Seaqaqa Research station will provide the planting material for Northern Farmers. The planting material will be supplied to all the interested farmers to address the nutrition problem all over Fiji. The major focus is dry zone where nutrition is a major problem during dry seasons for livestock.	2019 - 2021
Provide Juncao for livestock utilization.	Quarter acre of private farms used to grow Juncao for livestock utilization.	Selected livestock farms in the Western, Northern and Central Division.	2021 – 2024. Continue to provide fodder to farmers after 2024.

	Detail/explanation	Geographic location of effect	Timing of effect
Training provided to farmers by extension services.	Provide training to farmers on Juncao processing techniques as feed for livestock to increase the nutritional value of Juncao by chaffing and mixing it with livestock feed to enhance better growth performance of animals and supplement the nutritional requirements.	Selected livestock farms in the Western, Northern and Central Division.	2019 -2024
Adoption of appropriate technologies for post-harvest management.	Technologies, like fodder block-making units, shredder for processing and silage making will be promoted in the targeted clusters.	Dry zone in the Western, Northern and Central divisions, where nutrition is a major problem during dry seasons for livestock.	2019 - 2024
Establish sustainable manure management systems on piggery and poultry farms.	Biogas digesters installed on selected piggery and poultry farms to trap methane for energy production.	Supervised piggery and poultry farms throughout Fiji.	2019 onwards

The inputs and activities listed in the table above lead to the following intermediate effects. The intermediate effects are further characterized by:

a. Geographical location – a description of the location where the intermediate effect will most likely occur.
b. Timing of effect – identify the period during which the effect is most likely to occur to deduce whether the effects will be long-term or short-term.
c. Direction and amount of effect – identify whether there is an increase or decrease in the amount of the intermediate effects after the implementation of the policy.

Table 3: Identifying and Describing Intermediate Effects of the Livestock Policy

	Detail/explanation	Geographic location of effect	Timing of effect	Affected parameter	Direction of effect	Amount of effect
Intermediate Effects						
Herd size increase	Increase in 10% headcount in animal production due to introduction of quality breeds, better quality feeds such as Juncao grass and reduced incidence of animal diseases through systematic BTEC and animal disease management.	Enhanced Beef production at Yalavou Beef Scheme at Nadroga-Navosa province and for other animal farms will be selected by extension services.	2021 -2024	Livestock population numbers (average annual # of head)	Increase	10% increase in beef production including Yalavou Beef Scheme. 10% increase in production for dairy, poultry, sheep, goat, and pig. Assistance will be provided after 2024 as well, however, the penetration of the assistance is not measurable.
More manure produced	The policy also aims at developing better infrastructure for housing animals for feeding and milking through government assisted programmes. This will eventually lead to manure left in enclosures that needs proper removal and management as compared to manure left on pastures.	Enhanced Beef production at Yalavou Beef Scheme at Nadroga-Navosa province and for other animals' farms will be selected by extension services.	2021 -2030	Livestock population numbers (average annual # of head) and the % usage of MMS.	Increase	unknown

	Detail/explanation	Geographic location of effect	Timing of effect	Affected parameter	Direction of effect	Amount of effect
Cattle gain weight faster	Higher quality diet causes animals to grow faster	Enhanced Beef production at Yalavou Beef Scheme at Nadroga-Navosa province and for other animals' farms will be selected by extension services.	2021 - 2030	Average annual weight gain (kg/head/yr.)	Increase	Unknown
Dairy cattle produce more milk	Higher quality diet causes animals to produce more milk	Enhanced Beef production at Yalavou Beef Scheme at Nadroga-Navosa province and for other animals' farms will be selected by extension services.	2021 – 2030	Average daily milk production for human consumption (kg per head per day)	Increase	Unknown
Energy generation	Capture of methane from piggery and poultry farms using portable bio-digestors and using it for cooking.	Nationwide	2021 onwards	Fuel consumption (L) for cooking	decrease	unknown

3.3. Identifying Potential GHG Impact from the Intended and Unintended Effects of the Livestock Policy

The intermediate effects of the inputs and activities from Step 3 assist in identifying the intended and unintended effects of policy implementation. The intended effects are the anticipated consequences or outcomes to occur upon policy implementation whereas the unintended effects are compensating actions that can have an impact on other sectors not targeted by the policy. These effects help to identify the potential GHG impact as a result if the livestock policy implementation as per the table below:

Table 4: Identifying Potential GHG Impacts from Livestock Policy Implementation

Activity practice or technology	Intermediate effects			Potential GHG impact
	Effect 1	Effect 2	Effect 3	
Intended effect				
Provide improved genetic breeds of beef cattle, dairy cattle, swine, and poultry for livestock farming.	Increase in milk and meat production	Livestock breed is more resilient to climate change	Increase in population headcount	• Increase in methane emission from enteric fermentation. • Increase in methane emission from manure management. • Increase in nitrous oxide emission from manure management
Improving quality and quantity of fodder and feed for livestock.	Increase in milk and meat production	Increase in animal liveweight	Increase in population headcount	• Increase in methane emission from enteric fermentation. • Increase in methane emissions from manure management. • Increase in nitrous oxide emissions from manure management (liveweight)
Improving animal health through regular screening for BTEC on farms.	Livestock breed is more resilient to disease	Healthy livestock leading to increase in lifespan.	Increase in population headcount	• Increase in methane emission from enteric fermentation. • Increase in methane and nitrous oxide emission from

Activity practice or technology	Intermediate effects			Potential GHG impact
	Effect 1	Effect 2	Effect 3	
				manure Management.
Improved manure management practices resulting in energy generation.	Increase in number of biodigester installation on farms	Increase in methane capture for cooking	Decrease on reliance on wood and other fuel sources for cooking. Decrease in deforestation of mangroves.	• Decrease in methane emissions from manure management • Increase in uptake of CO_2 by plants/decrease in loss of CO_2 from wood harvesting for fuel • Decrease in CO_2 emissions from fossil fuel consumption
Unintended effect				
Provide improved genetic breeds of beef cattle, dairy cattle, swine, and poultry for livestock farming.	Increase in feed digestibility	Decrease in manure excreted		Decrease in methane and nitrous oxide emission from MMS
Improving quality and quantity of fodder and feed for livestock.	Increase in use of machinery for harvest and post-harvest management of fodder	Increase in fuel consumption		Increase in CO_2 emissions from use of machinery.
Improved manure management practices resulting in energy generation.	Decrease in volatilization of ammonia from manure	Increase in use of slurry as organic amendment	Decrease in N-based synthetic fertilizer	Decrease in N_2O emissions from soil.

From the table above, it is evident that improved genetic breed of livestock and the provision of improved feed has an impact on CH_4 emissions from enteric fermentation as well as CH_4 and N_2O emissions from MMS. Using the information collated in Table 1, Table 2, Table 3, and Table 4, a causal chain was developed to illustrate the inputs, activities, intermediate effects, market-based effects and the GHG impacts that would potentially occur because of policy implementation. The following figure illustrates the causal chain for the livestock policy implementation.

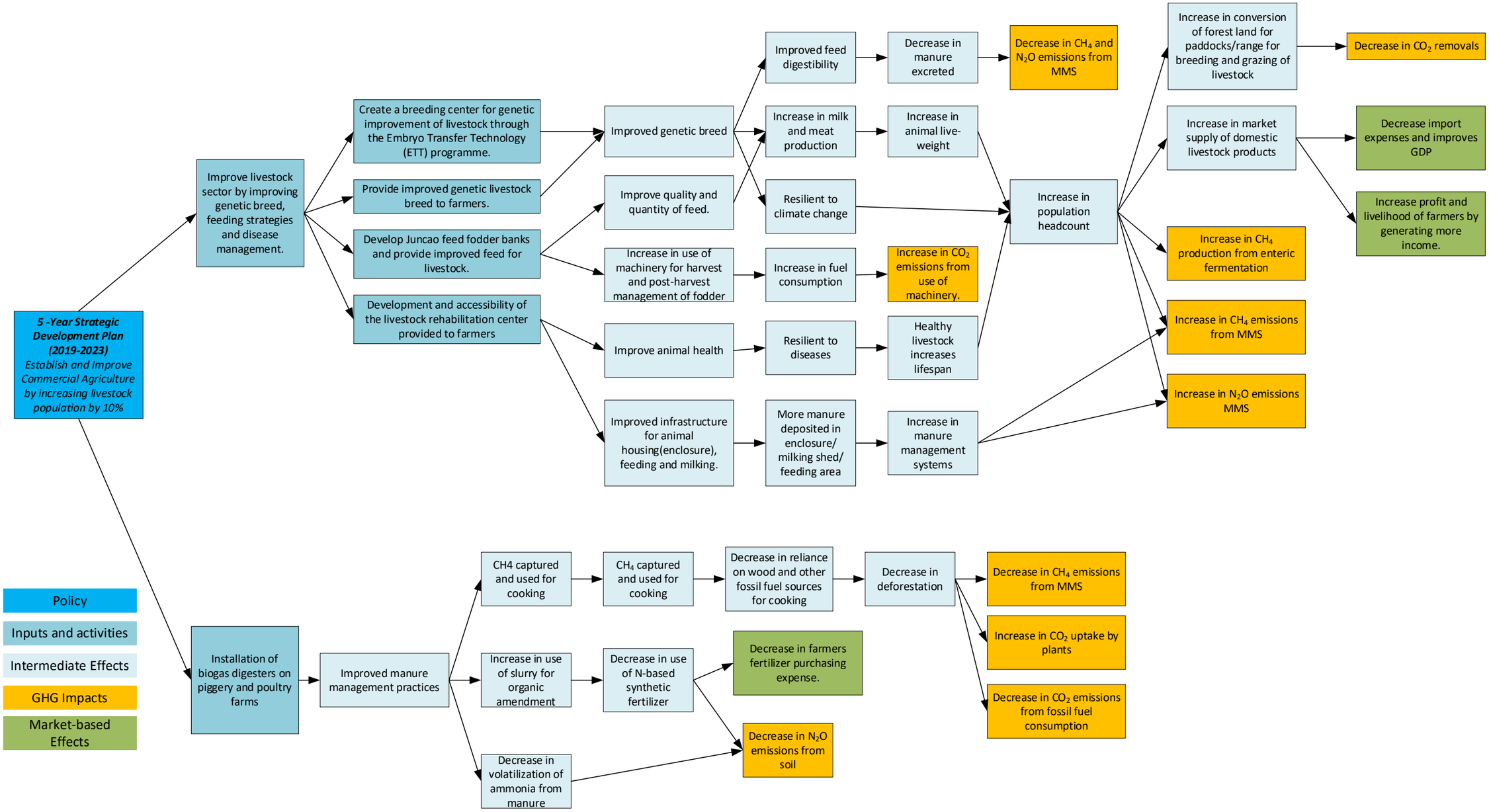

Figure 4: Causal Chain for the implementation of the livestock policy for Fiji

3.3.1 Defining the Livestock Policy GHG Assessment Boundary

The assessment boundary defines a range of significant GHG impact because of policy implementation. With reference to Figure 4, the causal chain illustrates various potential GHG sources, however, only the most significant GHG sources are included in the GHG assessment boundary. To identify the significant GHG sources/sinks for the analysis, the following steps were considered:

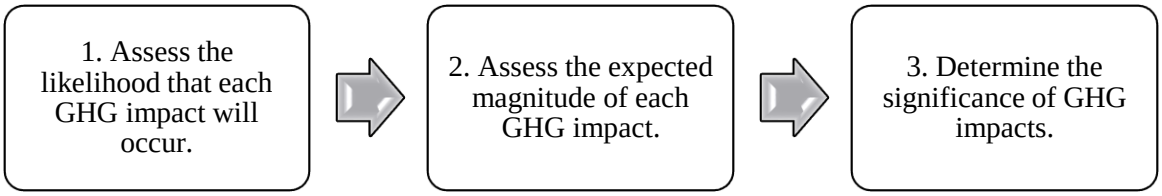

Figure 5: Steps used to define the GHG assessment Boundary

Prior to determining the GHG assessment boundary, the following potential GHG impact and sources/sinks were identified from the causal chain:

1. CH_4 emission from enteric fermentation.
2. CH_4 and N_2O emissions from MMS.
3. CO_2 emissions from use of machinery.
4. CO_2 removals and storage in woody biomass of plants.
5. N_2O emissions due to nutrient management.

With reference to the "ICAT Agriculture Policy Assessment Guides" (Table 6.6, Table 6.7, Table 6.8 & Table 6.9) and the following matrix helped determine the significance of GHG impacts while assessing its likelihood and magnitude.

Table 5: Determining the Significance of GHG Impacts to Define the GHG Assessment Boundary

Likelihood	Magnitude			Reason for choice
	Minor	Moderate	Major	
Very likely	N/A	N/A	CH_4 emissions from enteric fermentation. CH_4 and N_2O emissions from MMS.	With the targeted 10% increase in livestock population by 2024, the GHG impact will happen. Given that enteric fermentation and MMS are affected by animal headcount and are key categories for inventory estimations, the GHG impact is considered significant.
Likely	• CO_2 emissions from use of machinery • N_2O emissions due to nutrient management	N/A	N/A	The emissions due to fuel combustion is likely to occur for the preparation of fodder. However, considering that the development of fodder banks is not on a large scale ($\frac{1}{4}$ acre of selected farms in Fiji), the GHG impact is minor and considered insignificant at this stage. Further analysis on the amount of fuel used for this activity can be used to relook at the magnitude, however, this data is not available. Additionally, with the use of slurry as

Likelihood	Magnitude			Reason for choice
	Minor	Moderate	Major	
				organic amendment, it is likely that there will be a decrease in N_2O emissions with a decrease in use of N-fertilizers. However, this practice will only be available on selected supervised farms that have installed the biogas digestors to collect methane for cooking. Since this activity has been planned only for selected supervised piggery and poultry farms, the GHG impact may be considered negligible.
Possible	CO_2 removals and storage in woody biomass of plants	N/A	N/A	The use of methane for cooking reduces deforestation (decrease in need to use wood for cooking). However, methane will be captured for use on selected supervised farms only that have installed the biogas digestors. The area of trees that have not been removed may help to remove a negligible amount of CO_2, making the impact minor and insignificant.
Unlikely	N/A	N/A	N/A	N/A
Very unlikely	N/A	N/A	N/A	N/A

Key:	Significant	Insignificant	N/A = not applicable

Therefore, the emission of CH_4 from enteric fermentation, and CH_4 and N_2O emissions from MMS, are considered to have a significant GHG impact, defining them as the GHG boundary for quantitative assessment.

3.4. Estimating the Livestock Policy Baseline Scenario and Emissions

The purpose of estimating the baseline emissions is to quantify future GHG projections to understand its behaviour without the implementation of the livestock policy. Therefore, it allows decision- as well as policymakers to articulate informed decisions upon comparison with the ex-ante GHG impact assessment. In other words, estimation of the baseline emission scenario help to identify the GHG impacts brought about by the implementation of the livestock policy.

There are three approaches outlined in the "ICAT Agriculture Policy Assessment Guides" that can be used to determine the baseline scenario for the period of policy implementation. The three approaches are:

1. Constant baseline approach - assumes that there are no changes in agricultural practices, the use of technology, or land use during the baseline period with respect to the situation prior to policy implementation. To determine the baseline scenario, the most recent available data, or average data for a period of 3-years prior to baseline period, can be used. This approach also assumes that the baseline scenario remains constant and is a continuation of the current or historical situation. *For example, if there are 30000 dairy cattle in the year 2021, it will be assumed that this headcount will remain at 30000 dairy cattle for the baseline period.*
2. Simple trend baseline approach – assumes that the parameters during the baseline scenario evolve similarly as it did in the period prior to the baseline period. It requires historical data

of at least 5 – 10 years to which linear regression can be applied to and the parameters for the baseline period is determined.

3. Advanced trend baseline approach - models the impact of many interacting elements, including trends in macroeconomic conditions, demographics, and other non-policy drivers. A modelled baseline can be top-down or bottom-up.

Of the three, the simple trendline approach was identified based on expert judgement as the most reasonable approach to determine the baseline scenario. This approach assumes that the agricultural practices, use of technology and livestock management practices evolve in an equivalent manner as in the past (Business-as-usual, BAU approach). It requires historical data of at least 5 – 10 years prior to the policy implementation period where the historical data is extrapolated using the linear regression method to quantify trends. Given that one of the fundamental outcomes from Activity 1 of the ICAT Fiji project was to develop a GHG inventory with respect to emissions from enteric fermentation and MMS, the same inventory historical data was used to quantify the baseline emission scenario. Moreover, the following assumptions were applied to the historical data for extrapolation via linear regression:

Table 6: Assumptions for Estimating the Baseline Scenario and Emissions from Livestock

Key Parameters	Enteric Fermentation	Manure Management	
		CH_4	N_2O
Assessment period for baseline scenario	2021 – 2030: this period aligns with the NDC timeframe		
Key animal categories	Dairy cattle, beef cattle and swine (breeding & market) The policy description states that the interventions are targeted to increase the population of cattle, swine, poultry, sheep, and goat. However, the likely impacted livestock categories are cattle, poultry, and swine.	Cattle (dairy & beef), swine (breeding and market) and poultry. The policy description states that the interventions are targeted to increase the population of cattle, swine, poultry, sheep, and goat. However, the likely impacted livestock categories are cattle, poultry, and swine.	Swine (breeding and market) and poultry. Cattle is not included for this emission source for the assessment period as cattle manure is left on pasture/ paddock or used as dairy spread. Therefore, the emissions are not considered under MMS and should be considered under N_2O emissions from soil, which is not a key category and therefore may not have a significant impact on GHG
Population headcount	Historical data from 1995-2020 extrapolated to estimate the baseline population headcount until 2030. Specifically: Dairy Cattle: Population increase of 5.7% during 1995 – 2020. Beef Cattle: Population decrease of 63.6% during 1995 – 2020. Swine (Breeding): Population decrease of 33.6% during 1995 – 2020. Swine (Market): Population decrease of 33.6% during 1995 – 2020. Chicken (Layers): Population increase of 358.8% during 1995 – 2020. Chicken (Broilers): Population increase of 118.1% during 1995 – 2020.		
Typical Animal Mass,	Based on the historical data provided by the MoA. The TAM for the		

TAM	different livestock categories has been reported in the ICAT Fiji Project – Livestock Inventory Guidance Document & Manual.		
Default Excretion rate			Use default values from the IPCC guidelines for swine and poultry.
Emission Factor	**Dairy Cattle** – like Activity 1, extrapolate the historical milk production data for the assessment period and readjust the emission factor for emission calculation. **Beef Cattle, Swine, and poultry** – use the default IPCC emission factors from the 2006 IPCC Guidelines.	Use default emission factors from 2006 IPCC guidelines.	Use default emission factors from 2006 IPCC guidelines.

Using the assumptions outlined above and the simple trendline approach, the following baseline emissions were estimated, including enteric fermentation and MMS emissions from the total population of beef cattle, swine, and poultry in Fiji as per the IPCC Tier 1 methodology:

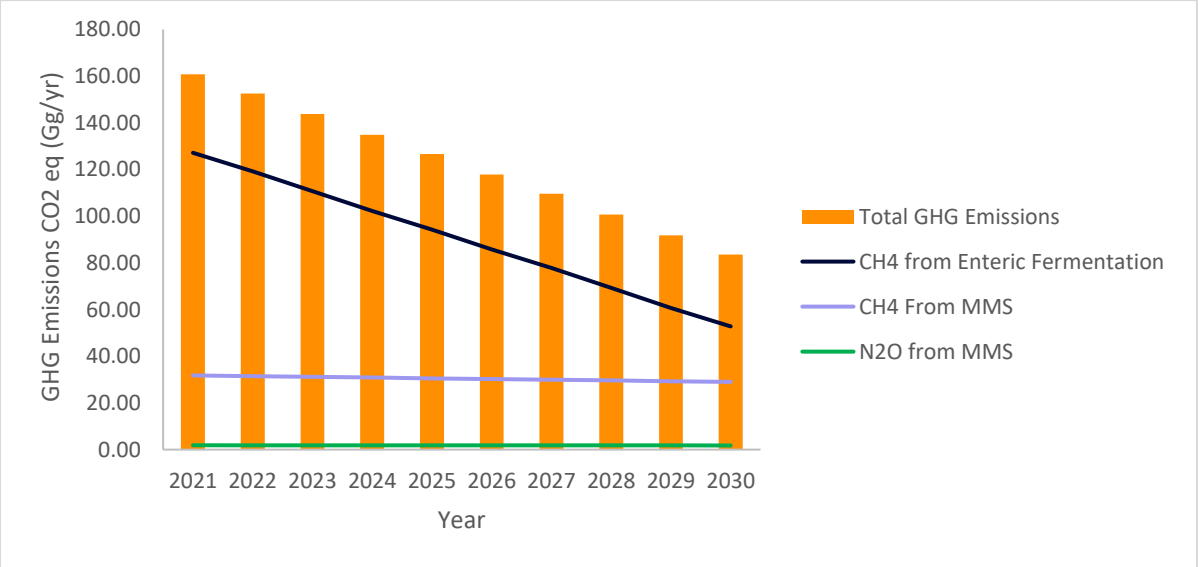

Figure 6: Baseline GHG emissions from enteric fermentation and MMS from 2021 – 2030.

The baseline total cumulative GHG emissions from the livestock sector for the assessment period, is 1222.17 CO_2-eq (Gg) with a 48% decrease in emissions from 2021 – 2030. The largest source of GHG emissions is expected to be through CH_4 emissions through enteric fermentation (899.96 CO_2-eq (Gg)) followed by CH_4 (304.06 CO_2-eq (Gg)) and N_2O (18.15 CO_2-eq (Gg)) emissions through MMS, respectively. Moreover, there is a 58.5% and 8.8% decrease in CH_4 emissions from enteric fermentation and MMS, respectively, whereas a 5.7% decrease can be reported for N_2O emissions from MMS, for the period 2021 - 2030.

3.5. Estimating Livestock Policy GHG Impact Ex-ante.

This section focuses on estimating the expected GHG emissions from enteric fermentation and MMS upon implementation of the livestock policy using the Tier 1 methodology. The first step to consider when determining the GHG impact ex-ante is the *maximum implementation potential of the policy.* The maximum implementation potential of the policy assumes that the inputs, activities, and intermediate effects identified in the causal chain are highly likely to occur as per the policy implementation plan. However, this is further refined to the *likely implementation potential* of the policy by considering the most plausible or realistic policy scenario based on potential barriers such as policy design characteristics, financial implications, national circumstances, etc.

The livestock policy for Fiji primarily focuses on increasing livestock production demands by increasing animal population headcount by 10% between 2021 – 2024. The policy design has supplementing inputs and activities as per the causal chain to achieve this policy goal. To determine the maximum implementation potential, the activity data for each GHG source from the GHG assessment boundary was assessed. The activity data in this case is any parameter that is expected to change upon implementation of the policy which is then used to estimate the GHG impact ex-ante.

Since the GHG impact estimates are to be determined using the IPCC Tier 1 methodology, the animal population headcount, and the impact the policy would have on that is the primary (if not the only) activity data of concern for enteric fermentation as well as MMS. The other parameters for GHG emission estimation, such as emission factors, excretion rate, typical animal mass, etc., were extracted from Chapter 10 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. With lack of relevant data (or non-existence of relevant data) the maximum policy implementation potential was considered to evaluate and quantify the activity data. While the policy also has a focus on establishing biofuel digesters and improving the quality of feed for livestock, the GHG impact of these activities are unknown. There are no clear targets for GHG mitigation through these activities or indication of the quantifiable impact it would have on reducing the GHG impact through the intermediate effects. Thus, due to insufficient data, the GHG impact could not be refined to determine the likely policy implementation potential.

Furthermore, considering that the animal population is expected to increase by 10% by the end of 2024, the impact of this increase in herd size would continue to have an impact on GHG emissions. Therefore, the GHG impact ex-ante is also estimated for the NDC timeframe (2021 – 2030) like the baseline estimates. Using these assumptions, the GHG impact was estimated as per the illustration below:

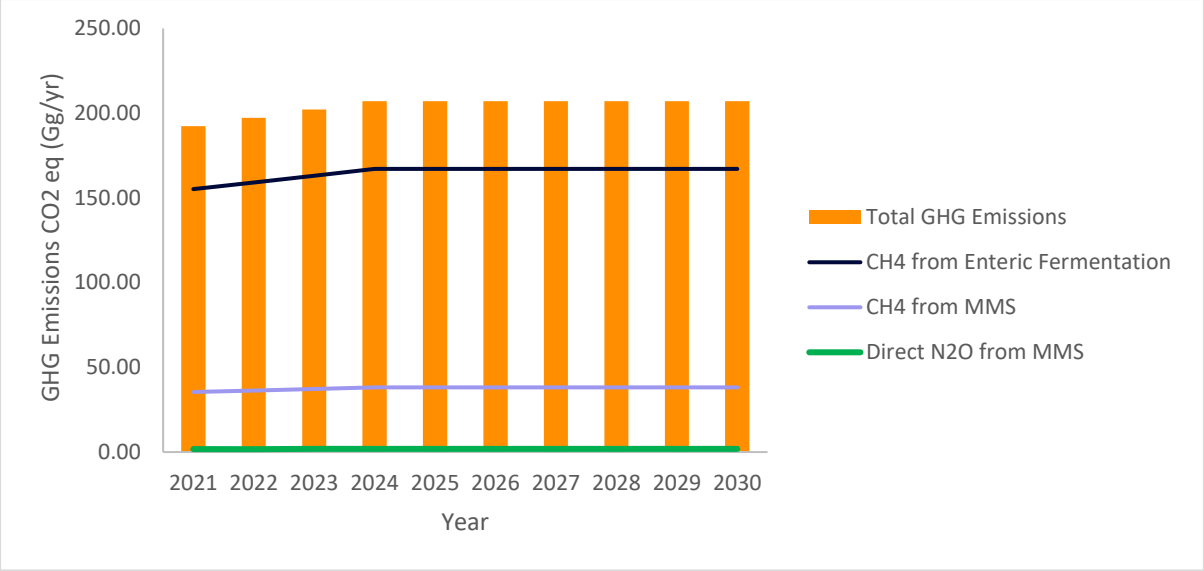

Figure 7: GHG emissions ex-ante from enteric fermentation and MMS from 2021 – 2023

The total expected cumulative GHG emissions after policy implementation from 2021 – 2030 is 1646.94 CO_2-eq (Gg) CH_4 emissions from enteric fermentation, 376.15 CO_2-eq (Gg) CH_4 emissions and 18.45 CO_2-eq (Gg) N_2O emissions from MMS. The total ex-ante GHG emissions from the livestock sector for the assessment period, is estimated to be 2041.54 CO_2-eq (Gg). The following figure provides an illustrative comparison between the total BAU and ex-ante emissions from enteric fermentation and MMS:

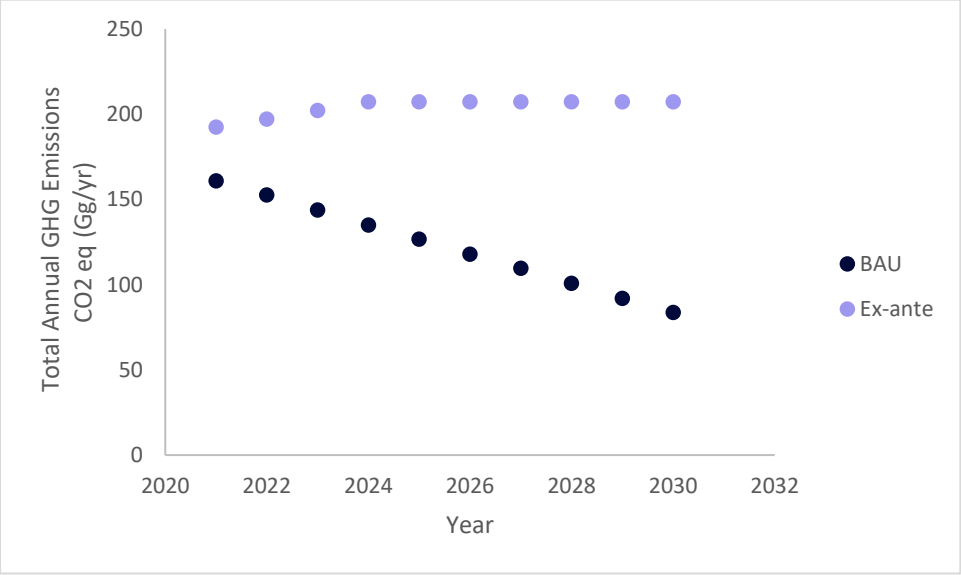

Figure 8: Comparison between the BAU and Ex-ante emissions from 2021 - 2030

The total cumulative emissions between the BAU and Ex-ante scenarios is 819.37 CO_2-eq (Gg). This indicates a 67 % increase in cumulative emissions for the assessment period upon implementation of the policy. While the quantitative target in Fiji's NDC is sector-specific to the energy sector, this projected increase in emissions occurring in the agriculture sector has implications for the broader objectives outlined in Fiji's NDC. Specifically, the Low Emissions Development Strategy (LEDS) for Fiji, referenced in Fiji's updated NDC (2021) aims to reach net zero carbon emissions by 2050 across all sectors of its economy. The AFOLU[4] sector is also largely considered under the LEDS to reduce emissions from enteric fermentation as well as manure management. Moreover, the projected

[4] AFOLU – Agriculture, Forestry, and Other Land Use.

reduction in emissions is considered under 4 mitigation scenarios from 2020 – 2050 with quantified projected emission estimates provided at 5-year intervals. The projected percent change in emission estimates for the period 2020- 2030 under the 4 mitigation scenarios in the LEDS are compiled in the following table and compared to the percent change in emissions estimated by this livestock policy assessment for the same period.

Table 7: Comparative analysis between LEDS and Policy Impact GHG Emissions

Scenarios	Percent Change in Emissions (2020 – 2030)
BAU Unconditional	-0.12%
BAU Conditional	-0.23%
High Ambition	-0.69%
Very High Ambition	-1.67%
Ex-ante (this assessment)	7.69%

As per Table 8 above, the estimated GHG emissions from enteric fermentation and MMS LEDS target indicate a decrease in emissions for the period 2020 – 2030. However, the trend for GHG emission estimated under policy assessment shows a 7.96 % increase in emissions for the same period. Thus, indicating that the implementation of the livestock policy will greatly deviate from the emission targets to reduce emissions in Fijis LEDS and would require the incorporation of possible GHG mitigation actions to counter the GHG impacts arising from the policy. Recommendations on this aspect is addressed in Section 3.7.

3.6. Qualitative Assessment of Sustainable Development Impacts for the Livestock Policy

3.6.1. Identifying the Sustainable Development Impacts and Indicators

While the livestock policy does have substantial impact on GHG emissions from various sources within (as well as outside) the agriculture sector, it also has an impact on sustainable development. The sustainable development impact assessment is based on three primary dimensions as illustrated in the figure below:

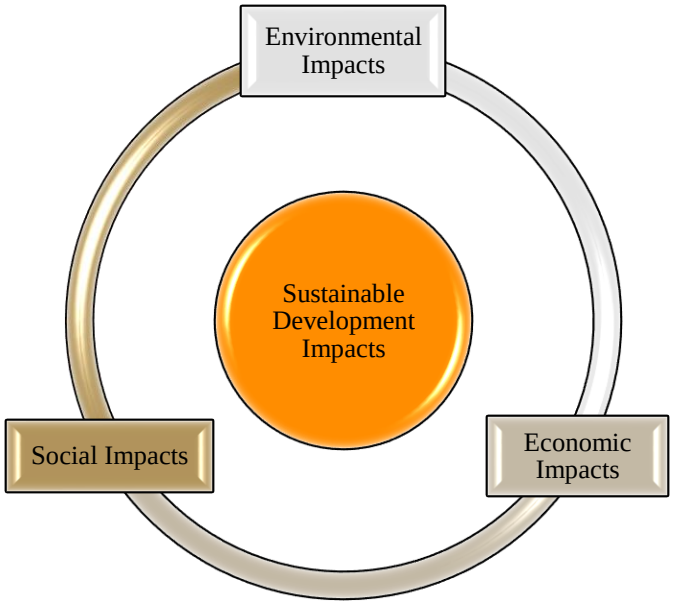

Figure 9: Dimensions for assessing sustainable development impacts of livestock policy implementation

These characterised dimensions allow experts to identify the impact categories which define the sustainable development impact of policy implementation. Examples of impact categories include poverty reduction, climate change mitigation, employment opportunities and land-management changes. Following the ICAT Guide for Sustainable Development Impacts, these impact categories were analysed and disaggregated into specific impacts. It is crucial to understand the specific sustainable development impacts that arise from each impact category to understand the direction of impact as well as key indicators for tracking, after the policy has been implemented. Table 8 highlights the impact categories, relevance and significance, specific impacts, and the indicators for assessing impacts.

Table 8: Identifying Sustainable Development Impacts and Indicators

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
Environmental impacts	Air	Climate change mitigation (SDG13)	Yes	Yes	Yes	This policy is expected to significantly increase the GHG emissions from enteric fermentation and MMS with an increase in animal headcount.	• Increase in CH_4 emissions from enteric fermentation. • Increase in CH_4 and N_2O emissions from MMS.	• Net GHG emissions (CH_4 and N_2O) from enteric fermentation and MMS in CO_2 -eq using appropriate global warming potentials.
		Air quality (SDG 3)	Yes	Uncertain	No	Carbon monoxide (CO) and particulate matter (PM) emissions expected to increase from biomass burning (combustion of biofuel generated from animal waste), but the expected impact is unknown due to lack of data.	Increase in CO and PM emissions from biomass burning	• Net emissions and concentrations of CO and PM ($PM_{2.5}$ and PM_{10}) from combustion of biofuel generated from animal waste.

[5] The addition of the SD impact categories to the assessment boundary is dependent on its relevancy and significance. For impacts categories where the significance is unknown or unclear (uncertain of) due to lack of preliminary data, the impact categories are then excluded from the assessment boundary.

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
	Waste	Energy (SDG 7)	Yes	Uncertain	No	Energy produced from anaerobic digestion of waste/manure is used for cooking (decrease in deforestation and reliance on fossil fuel). However, the impact is unknown due to lack of data.	• Decrease in CO_2 emissions from reduced fossil fuel consumption for cooking. • Increase in CO_2 removal due to reduced deforestation.	• Liter of fossil fuel consumed/yr. Amount of biogas produced (m^3). • Proportion of land area covered by forest.
		Treatment of solid waste and wastewater (SDG 6)	Yes	Yes	Yes	Waste management programme deals with the containment of waste in ponds to prevent contamination of the environment (land and water).	Decrease in wastewater leaching into soil and water.	• Proportion of solid waste and wastewater safely treated.

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
	Land	Land-use change (SDG 15)	Yes	Uncertain	No	Increase in animal headcount would result in the conversion of forest land for paddocks/range for breeding and grazing livestock. However, the amount of forest cover required for the implementation of this activity is unclear due to non-existence of relevant data. Thus, the level of impact cannot be assessed at this stage.	Decrease in forest cover resulting in decrease in CO_2 removals.	• Proportion of land area covered by forests.
		Soil quality (SDG 2)	Yes	Uncertain	No	Increase in poultry manure could be used for soil organic amendment to increase soil fertility. There is also the possibility of using slurry as an organic soil amendment to enhance soil fertility. However, the impact is unknown due to	Decrease in use of synthetic fertilizer as a soil enhancement and reduction in N_2O emissions.	• Amount of fertilizer bought by farmers (kg). • Area of land used for organic farming.

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
						non-existence of data.		
	Water	Water quality (SDG 6, 14)	Yes	Uncertain	No	Increase in animal headcount would lead to more manure productions, leading to leaching of wastewater into near-by waterways. However, the level of impact is unknown due to non-existence of data.	Decrease in water quality due to increase in water contaminants (heavy metals and nutrients) leading to eutrophication. This would lead to low dissolved oxygen (DO), creating a hypoxic environment.	• Acidity (pH). • Eutrophication from nutrient pollution (such as P and N compounds).
Social impacts	Health and wellbeing	Food security (SDG 2)	Yes	Yes	Yes	Increase in domestic animal production will impact milk and meat production for Fiji. Therefore, it will have a significant impact on enhancing food security for Fiji from the livestock sector.	Increase in domestic milk production from dairy cattle. Increase in domestic sources of meat supplied to market.	• Protein intake based on meat consumption per capita. • Total weight of meat produced (kg). Net production of milk (L) from dairy farms.
	Education	Training (SDG 4, SDG 12)	Yes	Yes	Yes	Development of capacity for farmers to produce Juncao for cattle feed.	Increase in knowledge transfer to farmers to produce their own Juncao feeds for cattle so that there is	• Number of farmers field school organized. • Number of demonstration

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
							sufficient feed especially during long periods of drought.	plots developed. • Training materials produced.
		Accessibility and quality of education (SDG 4)	Yes	Yes	Yes	The increase in revenue generated by farmers through increase in farm productivity through this policy will enhance the accessibility of children to quality education.	• Increase in the number of children enrolled in primary and secondary schools. • Increase in the number of children attending tertiary institutes for higher education.	• Proportion of children getting primary, secondary, and tertiary education. Average years of schooling

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
	Energy	Access to clean, reliable, and affordable energy (SDG 7)	Yes	Uncertain	No	Energy produced from anaerobic digestion of waste/manure is used for cooking (decrease in deforestation and reliance on fossil fuel). However, the impact is unknown due to lack of data.	Increase in access to cheap and reliable energy. Biogas generated can be used in gas turbines to generate electricity, providing ease of accessibility to electricity for longer period of lighting and use of household electrical appliances (fridge, TV, Laptop, etc.)	• Percentage of population with access to clean, reliable, and affordable energy for cooking. • Emissions per unit of energy. •
	Welfare	Reduction in Poverty (SDG 1)	Yes	Yes	Yes	The increase in revenue generated through the increase in livestock production due to this policy would allow farmers to increase living standards substantially.	• Increase in household income. • Decrease in number of households living below the national poverty line.	• Poverty rate (proportion of population living below the national poverty line. • Poverty rate of farmers • Proportion of people earning below the national minimum wage. • Number of people living in poverty. • Number of farmers living in

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
								poverty
Economic impacts	Overall economic activity.	Economic Activity and Productivity (SDG 2, SDG 8)	Yes	Yes	Yes	The implementation of this policy aims to enhance local milk and meat production from the livestock sector, leading to enhanced productivity. This would cause a decrease in annual import of milk and meat, thus, increasing Fiji's GDP.	• Increase in domestic livestock productivity. • Decrease in annual milk and meat import. • Increase in GDP.	• GDP, Gross National Income. • Annual growth rate of real GDP per capita. • Livestock productivity (number of animal population headcount per year) • Increase in milk production per unit of animal weight • Increase in meat production per unit of animal weight • Increase in egg production

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
	Business and Technology	Innovation (SDG 8, SDG 9)	Yes	Uncertain	No	The policy targets to develop innovative infrastructure for breeding center, rehabilitation, and animal shelter. It also targets establishment of energy generation in terms of biofuel. However, their development and economic impact on SD is unclear at this stage due to non-existence of data.	• Improved animal health and husbandry. • Establishment of rehabilitation center, breeding center and biofuel generators.	• Revenue and profit. • Number of active long-term partnerships. • Number of new animal rehabilitation centers. • Number of biofuel projects implemented.
	Income, prices, and costs	Income (SDG 8)	Yes	Yes	Yes	The targeted increase in animal production and productivity would lead to an increase in income for farmers.	Increase in household revenue from milk and meat production.	Annual growth in household income for farmers. Income per capita.

Dimension	Group of impact categories	Impact categories	Relevance?	Significance?	Included in assessment boundary[5]?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
		Costs and cost-savings (SDG 8)	Yes	Yes	Yes	Additionally, the manure generated/collected from the different MMS can be used as organic amendment, avoiding the need to purchase or use synthetic fertilizer. The generation of biofuel would also have an impact the purchase of fossil fuels or use of wood for cooking.	• Decrease in expenditure for fertilizer. • Decrease in purchase of fossil fuels for cooking.	• Fuel costs or cost-savings. • Fertilizer cost or cost-savings. • Amount of organic amendment produced/applied annually.
	Trade and balance of payments	Balance of trade (SDG 8, SDG 11)	Yes	Yes	Yes	The implementation of this policy aims to enhance local milk and meat production from the livestock sector, leading to enhanced productivity. This would cause a decrease in annual import of milk and meat, thus, increasing Fiji's GDP.	Decrease in annual import of milk and meat.	• Total annual imports of milk and meat. • Total annual exports of milk and meat. • Net imports of milk and meat.

3.6.2. Qualitative Assessment of SD Impacts

The SP4 of the SDP for Ministry of Agriculture has significant impact on the SDGs. The policy will see an increase in animal headcount and will certainly increase GHG emissions from enteric fermentation and MMS. This will have negative impact on SDG 13 Climate Action as it does not provide a mechanism to mitigate or decrease emissions but rather to increase Fiji's GHG emissions and is in contrary to national initiatives to reduce emissions such as the Fiji LEDS project.

Also, manure produced from these ruminant animals will have both positive and negative consequences. For instance, the impact on water and soil quality (SDG 6, 14 and 15) could be negative, although, the magnitude of impact is difficult to assess at this point. The manure produced and applied to land will increase the leaching potential and may lead to the contamination of groundwater sources and eutrophication in nearby waterways. This may affect SDG 6 and 14 negatively.

Also, application of animal manure as soil amendments to increase soil fertility, increasing agricultural produce and thereby positively impacting SDG 2 would also see decrease in the application of nitrogen-based fertilizer that will see the decrease in direct N_2O emissions from soil. This may enhance SDG 13 that is to enhance climate action. There is a work programme under the current policy to utilise waste to generate biogas for cooking and potentially for electricity generation. This will lead to generation of clean affordable fuel and therefore addresses SDG 7 and have a positive impact. If the work programme under the policy is implemented, then it will have a GHG impact as this will see a decrease in CH_4 emissions and CO_2 avoided emissions from the use of fossil fuels for cooking and electricity.

The implementation of the policy may also affect land-use changes, that is, clearing forest for development of paddocks or range or even clearing land for Juncao cultivation. Such practice will impact SDG 15 negatively that will see an increase in deforestation and will also decrease CO_2 removals and thereby impacting GHG (increasing GHG budget). The clearing of land could include biomass burning that could deteriorate air quality through emissions of CO and particulate matter and therefore affects SDG 3 negatively, although the magnitude of impact is highly uncertain.

The implementation of policy will see a positive impact on SDGs in the social dimension. The implementation of the policy will see an increase in the production of milk and meat and therefore will increase food security (SDG 2). The increase in revenue for farmers will help reduce poverty in the livestock sector (SDG 1) and will enable a good quality of life and well-being and will also allow children to higher accessibility to quality education (SDG 4). The access to cheap and reliable, clean energy generated from waste can also enhance the quality of life, whereby communities will have access to longer period of electricity and enjoying the luxury of household appliances such as TV, fridge, and computers to name a few.

There are three categories of impact for SDG impact identified under the economic dimension. Overall economic activity is impacted by the increase in domestic milk and meat production which will reduce the import of these goods and increase Fiji's GDP. This will positively impact SDG 8. The increase in household income through revenue generated from sales of milk and meat production will have a positive impact on SDG 8 directly. Additionally, the manure generated/collected from the different MMS can be used as organic amendment, avoiding the need to purchase or use synthetic fertilizer, thus, having a positive impact on SDG 8 through costs and cost-savings. The generation of biofuel would also have an impact the purchase of fossil fuels or use of wood for cooking, impacting SDG 12 (Responsible Consumption and Production), positively.

3.6.3. Technical Guidance for Tracking Sustainable Development and GHG Impacts

Section 3.4 and 3.5 looks at the SD and GHG impacts from the implementation of this policy separately. This section deals with tracking the performance of indicators in terms of SDG and GHG impacts arising from the implementation of the policy. The policy target is to increase 10% headcounts in beef, dairy cattle, poultry, pigs, goat, and sheep by 2024, this increase in livestock population certainly has SDG and GHG impacts.

To develop a technical guidance for monitoring GHG emissions and SDG impacts from policy implementation following 4 steps were used:

Step1: Identify indicators and parameters to monitor over time

In this step key performance indicators were identified to be monitored for performance of the livestock policy in terms of tracking the changes in the targeted impacts such as increase in CH_4 emissions from enteric fermentation. The parameters were also identified which will be used to estimate GHG emissions ex-post.

Step 2: Identify potential sources for data

Step 3: Monitoring Frequency or Monitoring Period

This is the period in which the policy is in effect or the timeframe over which the GHG impacts resulting from the policy are assessed. Although the policy implementation period is 2019 – 2024 its effect on GHG emissions will continue thereafter and will be tracked till 2030 in line with the NDC implementation. The key performance indicators identified in Table 9 below shows that these indicators need to be monitored annually to enable robust GHG estimation.

Step 4: Identifying responsible entity or institution

These are responsible entity or institution, possibly custodian of key performance indicator data through some institutional arrangements.

The application of these steps in the development of the tracking guidance for GHG and SD impacts are expressed in Table 10.

Table 9: GHG and SD Impact Monitoring Plan for the Livestock Policy

Categories	Parameter	Potential Sources for Data	Monitoring Frequency	Parameter Type	Responsible entity or institution
GHG Impact: Methane Emissions from Enteric Fermentation and MMS. Nitrous Oxide emissions from MMS	Livestock population characterization (Unitless)	National Agriculture or livestock census	Once - can be updated during National Animal Census	Assumption	MoA
	Average annual livestock population (head per year)	National Agriculture or livestock census. Department of Animal Health and Productivity, MoA.	Annual	Activity Data. Key Performance Indicator	MoA
	100-yr GWP of CH_4 and N_2O	IPCC Assessment Report	once	Convert CH_4 and N_2O to CO_2 -eq emissions	UNFCCC
	Average animal weight per category (kg)	National Agriculture or livestock census. Department of Animal Health and Productivity, MoA.	Annual	GHG emission factor (needed to choose Tier 1 emission factor). Key Performance Indicator.	MoA
	Average animal growth rate (weight gain) per category (kg per day)	National Agriculture or livestock census. Department of Animal Health and Productivity, MoA.	Annual	GHG emission factor (needed to choose Tier 1 emission factor). Key Performance Indicator.	MoA
	Average animal milk production per category (kg per head per day)	National Agriculture or livestock census. Department of Animal Health and Productivity, MoA.	Annual	GHG emission factor (needed to choose Tier 1 emission factor). Key Performance Indicator.	MoA

	CH_4 emission factor (kg CH_4 per head per year)	Tier 1, IPCC 2006 GL (Tables 10.11, 10A.1, 10A.2)	once	GHG emission factor (can also be updated to country specific emission factors).	IPCC
	N_2O emission factor (kg Nitrogen excreted)	Tier 1, IPCC 2006 GL (Table 10.21)	once	GHG emission factor (can also be updated to country specific emission factors).	IPCC
	Fractional usage of MMS for each species/livestock category	Department of Animal Health and Productivity, MoA.	periodically	Activity Data. Key Performance Indicator	MoA
	Average animal lifespan per category (yr.)	Department of Animal Health and Productivity, MoA.	once	Activity Data. Key Performance Indicator	MoA
Sustainable Development Impacts	GHG emission (CH_4 and N_2O) from enteric fermentation and MMS.	National GHG Inventory from Climate Change Division (CCD)	Annual	Key performance Indicator for SDG 13 - Climate Action	CCD
	Total weight of meat and milk produced (kg). Number of eggs produced.	Department of Animal Health and Productivity, MoA.	Annual	Key Performance Indicator for SDG 2 - Zero Hunger	MoA
	Poverty rate (proportion of population living below the national poverty line). Track farmers separately as a subgroup if possible.	Bureau of Statistics, Population Census Data	Annual	Key Performance Indicator for SDG 1 - No Poverty	Bureau of Statistics
	GDP, Gross National Income.	Ministry of Economy. Bureau of Statistics	Annual	Key Performance Indicator for SDG 2 (Zero Hunger) and SDG 8 (Decent Work & Economic Growth)	Ministry of Economy
	Household income; farm household income as a subgroup if possible	Ministry of Economy. Bureau of Statistics	Annual	Key Performance Indicator for SDG 8 - Decent Work and Economic Growth	Ministry of Economy

It is critical to develop a monitoring plan to track progress of indicators over time in relation to targeted outcomes of the policy. A more elaborated monitoring plan is recommended to encompasses as many of the elements highlighted in Table 10 above as possible and include the following:

• brief description of each indicator
• source of data for each indicator and parameter (if applicable) monitoring period
• monitoring frequency (fixed ex-ante during the monitoring period)
• measurement or data-collection methods (such as survey or census)
• historical value (baseline value)
• goal value
• entity(ies) or institution(s) responsible for monitoring the respective indicator and collecting parameter(s), if applicable.

In addition to the list given above, a robust monitoring plan should include details on the following:

- Collecting and managing data: Identify database and tools for collating and disseminating data. Define procedures for collating and documentation for data collection.
- Quality assurance and quality control: define methods for QA/QC procedures that will ensure good quality data for an accurate assessment of policy impacts.

3.7. Recommendations for including the Agriculture Sector in Fijis Enhanced NDC

Currently the updated Fiji NDC has three mitigation targets for the energy sector and 1 mitigation target for the marine transport sector. There is no mention of mitigation targets set for the agriculture sector although it contributes approximately 25% of the national GHG inventory. The LEDS indicate a decrease in GHG emissions from enteric fermentation and MMS under the 4 scenarios whereas an ~7% increase in emissions is reported for the same period under this policy assessment. It is evident that with the implementation of this policy, it is impossible to maintain the target outlined in the Fiji LEDS to achieve zero decarbonisation from the agriculture sector by 2050 unless further reduction targets are stipulated in the future NDC updates. To maintain the targets identified in LEDS it means that if the policy is implemented then further 56% reduction in emissions from enteric fermentation and manure management from the livestock sector needs to be achieved.

The following are recommended for future NDC to achieve emission reduction of approximately 50% from the livestock sector:

- The methane emissions from livestock manure should be captured and used for energy generation, to a much further extent than will be achieved by the livestock policy assessed here. This will not only decrease emissions directly but will also lead to avoided emissions of CO_2 from fossil fuel consumption. This will further enhance Target 1 of NDC to enhance renewable energy to meet energy demands.
- To mitigate methane emissions from livestock enteric fermentation by looking at breed of cattle or changing feed composition (including feed supplements (anti-methanogen chemicals) and higher feed digestibility) that would lead to decrease in GHG emissions but higher productivity in terms of milk and meat.
- Fiji should consider moving to a Tier 2 method to estimate enteric fermentation emissions in the national GHG inventory, to track changes in emissions over time from the action above (improving breed and diet to reduce emissions).

4. Agriculture Policy Assessment Analysis for Rice Cultivation

4.1. Describing the rice cultivation policy for assessment

Rice in Fiji has a multi-dimensional role as the foundation of food security, economic growth, and social stability. Over the years, the rice industry has been increasingly weakened as rice area and production declined while the rice yield growth has been stagnant or marginal. Consequently, In the past Fiji achieved self-sufficiency level of 66 percent in 1980s, but currently self-sufficiency level is 17.5% and Fiji imports more than 80 percent of the rice to meet the total rice demanded annually. Deregulation, which encouraged the importation of rice into the country, led to the drastic downfall of the rice industry. To meet the growing needs of the population, it is necessary to produce more rice in the future. This is a serious challenge as several biotic, abiotic, and social factors continue to limit productivity. Some of these challenges include a decrease in land and water resources, scarce and costly labour, use of single base fertilizers, high incidence of pests and diseases, the rising cost of agro-inputs, and impacts of climate change. To ensure food security concerns for rice, Fiji must align national goals toward achieving self-sufficiency in rice production. The rice development strategy is put together by the Ministry of Agriculture's (MoA) Research Division to investigate ways and means of cultivating rice nationally to meet growing demand.

(MoA) hopes to reduce the reliance on imported rice, which accounts for over 80% of the total rice consumption and costs FJD $42 million. This strategy is planned and is in the stage of adoption/implementation by the MOA. MoA will be providing subsidies and incentives to cultivate improved rice varieties, provide access to high-quality seeds, and adopt effective management, promoting these essential technologies and boosting rice yield in Fiji. A detailed description of the policy is given in Table 11. By this policy, MoA wishes to achieve self-sufficiency by increasing the local rice production consistently each year and it attempts to achieve this through enhancing rice yield in both wetland and dryland areas, as well as expanding the land area under rice cultivation, with the goal of helping Fiji attain rice self-sufficiency in the next five years. Grace Road Farm, Fiji Rice, and contractual farmers are key rice stakeholders. If this approach is successful, the area available for rice production will expand, as will overall rice production.

Table 10: Description of the Rice Policy

Information	*Guidance*	**Description**
Title of policy	*Policy name*	National Rice Development Strategy
Type of policy	*The type of policy, such as those presented in Table 3.1, or other categories of policies that may be more relevant*	Subsidies and incentives to rice growers, use of improved varieties

Description of specific interventions	*The specific mitigation practice and/or technology carried out as part of the policy, such as those presented in Box 3.1.*	• Rice production for a long time in Fiji has been focused on smallholder systems encouraging farmers to produce for domestic use and sell the surplus to Fiji Rice. Smallholder farmers shall be encouraged to form clusters and or cooperatives to qualify for assistance. Individual farmers will continue to receive land preparation and harvesting support at the current Government subsidized rates. This scheme will be undertaken through the following activities for farmers who will allocate a minimum of 5 acres towards Rice farming. • Improve productivity through the introduction of improved preferred rice varieties, purification of seeds, and crop breeding. • Improve seed production capacity for the quality of rice seeds and expanding rice area and production to new areas. • Improved mechanization support for Rice farming efficiencies strengthen technology integration with best farmer practices. • Policy Interventions through institutional reforms and investments in infrastructure development Development of market demand consumer preference survey. • Research and development will continue to play an integral role in enhancing production through technological interventions. • New varieties with improved performance will continue to be evaluated and released. • New farmers will be trained in production systems. Good quality seed production will also continue to support increased rice cultivation.
Status of the policy	*Whether the policy is planned, adopted, or implemented*	The policy is planned and in the stage of adoption/implementation
Date of implementation	*The date the policy comes into effect (not the date that any supporting legislation is enacted)*	To be determined

Date of completion (if relevant)	*If relevant, the date the policy ceases, such as the date a tax is no longer levied or the end date of an incentive scheme with a limited duration (not the date that the policy no longer has an impact)*	N/A
Implementing entity or entities	*The entity or entities that implement(s) the policy, including the role of various local, subnational, national, international or any other entities*	Ministry of Agriculture
Objectives and intended impacts or benefits of the policy	*The intended impact(s) or benefit(s) the policy intends to achieve (for example, the purpose stated in the legislation or regulation)*	1. Improved varieties, good seeds, and efficient nutrient and water management are key technologies to fast increase rice productivity in Fiji. 2. Encouraging private companies to invest in the seed business 3. It will motivate large scale landowners to lend leases to tenants 4. Encourage farmers to practice intercropping Incentives will be given to farmers for planting rice 5. Integrated Rice Crop Management Field Training 6. Increase investment in infrastructure 7. 1/3 and 2/3 basis subsidy subject to machine types 8. Technology guidance for rice production can be easily accessed. It will encourage private and public sectors to invest in rice production, inputs-seed, processing, and mechanization and selecting best rice variety for planting.
Level of the policy	*The level of implementation, such as national level, subnational level, city level, sector level or project level*	National level and sector level
Geographic coverage	*The jurisdiction or geographic area where the policy is implemented or enforced, which may be more limited than all*	Rice cultivating regions of Fiji

	the jurisdictions where the policy has an impact	
Sectors targeted	*Which sectors or subsectors are targeted*	Agriculture-small holder systems and commercial growers and farmers will be allocated a minimum of 5 acres for rice farming.
Greenhouse gases targeted	*Which GHG the policy aims to control, which may be more limited than the set of GHG that the policy affects*	None
Other related policies or actions	*Other policies or actions that may interact with the policy being assessed*	None identified
Intended level of mitigation to be achieved and/or target level of other indicators (if relevant)	*If relevant and available, the total emissions and removals from the sources and carbon pools targeted; the target amount of emissions to be reduced or removals to be enhanced because of the policy, both annually and cumulatively over the life of the policy (or by stated date); and/or the target level of key indicators (such as hectares of land to conserve)*	• To increase rice growing area to 8,000 ha and rice yield to 5 tonnes/ha. With this increase in rice area leading to increase in capacity of domestic rice production, Fiji could attain 60% self-sufficiency in rice by 2024.
Title of establishing legislation, regulations, or other founding documents	*The name(s) of legislation or regulations authorising or establishing the policy (or other founding documents if there is no legislative basis)*	The National Rice Development Strategy document aims to support Ministry's current initiatives to increase the level of self-sufficiency in rice production and consumption in Fiji. The document provides an essential guideline to achieve this target.
Monitoring, reporting, and verification procedures	*References to any monitoring, reporting and verification procedures associated with implementing the policy*	The project management team will closely monitor and provide necessary technical support to the participating farmers. All efforts should be undertaken to rectify problems and provide necessary solutions to make this program a success.
Enforcement mechanisms	*Any enforcement or compliance procedures, such as penalties for noncompliance or requirements for reporting*	1. The National Rice Development Program (NRDP) is specifically targeted at commercial growers; therefore, specific criteria need to be developed to involve these targeted farmers. Expression of Interest (EOI) can be called to attract interested farmers in this program. The National Rice Development Program (NRDP) team will be responsible for the

		relevant terms of reference (TOR) and its associated criteria eligibility. 2. A Performance-Based Rebate System is to be established to enhance and incentivize production. Individual farmers that produce and supply Fiji Rice with more than 8 tons of paddy per crop will be paid a rebate on their production. This will encourage farmers to increase their production and will also provide the catalyst for new farmers to start utilizing their land for rice production.
Outline of sustainable development impacts of the policy	*Any anticipated sustainable development benefits other than GHG mitigation*	Economic productivity, land-use change, food security
Key stakeholders	*Key stakeholder groups affected by the policy*	Key stakeholders are Grace Road Farm, Fiji Rice contracted farmers, Ministry of Agriculture, and consumers

Deliberation on the policy implementation phase iterates that MoA has not adopted the policy and is currently in the initial stages of implementation. Therefore, the policy assessment objective is to help estimate the future effects of the policy upon successful implementation by 2024. Therefore, making the assessment an ***ex-ante assessment.***

In addition, the ICAT Agriculture Policy Assessment Guide also provided relevant criteria which allowed experts to assess the rice strategy as an *individual policy* rather than a package of policies. The individual assessment of this policy will provide integral details on GHG implications from rice cultivation to allow decisions and policymakers to make informed judgments regarding the implementation, continuity, and feasibility of the policy. Additionally, it is a key policy that is currently available within the MoA that directly affects the key parameters (e.g., area of rice) which will have a significant GHG impact because of the policy. Therefore, the national experts have assessed it as an individual policy to provide a robust outlook on the GHG implications using it to make recommendations for Fiji's future NDCs.

4.2. Identifying Effects and Mapping the Causal Chain

4.2.1. Identifying the Inputs and Activities

To identify and assess the GHG impact of the rice policy, it was important to first identify and describe the various inputs and activities relevant to effectively carrying out and achieving the objectives of the policy. The input and activities lead to identifying the significant intermediate effects of policy implementation.

Table 11: Identifying and describing Inputs and activities of the Rice Policy

Inputs	Detail/explanation	Geographic location of effect	Timing of effect
Budget deployed for technical assistance and programme operations	1. Extension/Research, EP&S, and HR will 1. Promote Commercial rice production- this program is specifically targeted for commercial growers therefore specific criteria be developed to involve targeted farmers. Expression of Interest (EOI) can be called to attract interested farmers in this program. The National Rice Development program (RDP) team will be responsible for the relevant TOR and its associated criteria eligibility. There will be, Performance Based Rebate System, Machinery support for commercial farmers, Planting Material Support, Marketing support, financial support Governance and Control. 2. Small Holder farmers to form Clusters and land preparation and harvesting assistance 3. Research & Development- Introduction and evaluation of improved varieties, Seed Production, Farming Systems Research, Training/Demo plots.	National scale	Ongoing activity (2021 onwards)
Financial support	1. Discussion with iTaukei Land Trust Board *(iTLTB*) for release of land for rice cultivation. 2. A special package to be developed by Fiji Development Bank (FDB)and other commercial banks to assist farmers to acquire loans for farm machinery. 3. After a few years into successful entrepreneurship, subject to budgetary support, these farmers, and starter irrigation kits, including irrigation pumps, pipes, and water tanks will be provided. 4. After a few years into successful entrepreneurship, subject to budgetary support, these farmers will be provided with Starter	National scale	2021-2025 (ongoing)

	irrigation Kit, including irrigation pumps, pipe, and water tanks small to medium-sized dryers for drying of paddy, bags for dried paddy packing and storage.		

The inputs and activities listed in the table above lead to the following intermediate effects. The intermediate effects are further characterized by:

d. Geographical location – a description of the location where the intermediate effect will most likely occur.
e. Timing of effect – identify the period during which the effect is most likely to occur to deduce whether the effects will be long-term or short-term.
f. Direction and amount of effect – identify whether there is an increase or decrease in the amount of the intermediate effects after the implementation of the policy.

Table 12: Identifying Activities for Rice Policy Implementation

Activities	Detail/Explanation	Geographic location of effect	Timing of effect
Push for Commercial Entities-A dedicated team	1. Identify staff to form a dedicated team to work on this project. 2. Employ a Project manager 3. Develop a TOR; and 4 Identify suitable areas and farmers 4. Provision of financial support e.g., soft loan. 5. Fiji Rice to develop into industry-level i.e., market to guide production 6. Use of CBUL grant for displaced farmers	National scale	2021-2025 (ongoing)
Document criteria and selection process and Call for Expression of Interest	1. This program is specifically targeted at commercial growers therefore specific criteria need to be developed to involve these targeted farmers. 2. Farmers voluntarily sign up to participate in the programme;	Eligible rice commercial growers- National scale	2021-2025 (ongoing)

Administrative activities involved in implementing the activity	1. The project management team activities include registering of farmers, advertising the EOI, closely monitor and provide necessary technical support to the participating farmers. All efforts will be undertaken to rectify problems and provide necessary solutions to make this program a. Assist farmers in the purchase of correct machines for rice production through FDB loans and Government policy of one third and two third initiatives	Eligible rice commercial growers- National scale	Ongoing EOI from 2020 to Jan 2021 and monitoring ongoing
Machinery support for commercial farmers	1. Identify and allocate machines to farmers 2. Assist farmers in the purchase of correct machines for rice production through FDB loans and Government policy of one third and two third initiatives.	Eligible rice commercial growers- National scale	August 2022 onwards
Machinery use trainings	Provide training on the use of machines	Eligible rice commercial growers- National scale	Jan 2022 onwards 2 trainings per quarter in each division annually
Planting Material Support	Provide Seeds on a replacement basis	Eligible rice commercial growers- National scale	2022-2025 (ongoing)
Marketing support	Develop strategies to support purchasing of local rice	Eligible rice commercial growers- National scale	Ongoing
Financial support	Provision of financial support e.g., soft loan Fiji Rice to develop into industry level i.e., market to guide production A special package to be developed by Fiji Development and other commercial banks to assist farmers to acquire loans for farm machinery, Discussion with *iTLTB)*	Eligible rice commercial growers- National scale	2021

	for release of land for rice cultivation		
Governance and Control	Conduct regular monitoring and evaluation project management team activities include registering of farmers, advertising the EOI, closely monitor and provide necessary technical support to the participating farmers. All efforts will be undertaken to rectify problems and provide necessary solutions to make this program	Eligible rice commercial growers- National scale	Ongoing
Smallholder farmer - Formation of Clusters, Land preparation and harvesting	1. Smallholder farmers are encouraged to form clusters and or cooperatives to qualify for assistance. 2. Individual farmers will continue to receive support for land preparation and harvesting at the current Government subsidized rates.	Smallholder farmers- National scale	Ongoing (2022 - onwards)
Research & Development	1. three types of rice farming systems practiced in Fiji depend on the availability of water resources and topography. These three systems are irrigated, rainfed wetland and rain fed dryland which are planted with recommended varieties such as Sitara, Cagivou, Star, Boldgrain and NuiNui. 2. In Fiji, 60 percent of farmers are planting traditional varieties due to reduced costs particularly in the use of fertilizer. However, it has low yields and lodges easily due to heavy rain and strong winds. Some of these varieties are China Motka, Saraya,	National scale	Ongoing (2025 onwards)

	Kharapani, Phela Japani and Lal Jari. Selection and Evaluation of improved rice varieties Improve rice seed production and farming systems research by trainings/demo plots. 3. New varieties with improved performance will continue to be evaluated and released. New farmers will be trained on production systems. 4. Good quality seed production will also continue to support increased rice cultivation.		

Table 13: Identifying Other Intermediate Effects of the Rice Strategy

	Detail/explanation	Geographic location of effect	Timing of effect	Affected parameter	Direction of effect	Amount of effect
Other intermediate effects						
Encouraging private companies to invest in seed business	Improve seed production capacity for quality of rice seeds	Eligible rice commercial growers- National scale	2021-2025	Planting of two crops annually in Fiji	Increase	Unknown
Policy Interventions through institutional reforms and investments in infrastructure development	Public-Private Partnership will lead to encouragement of private and public sectors to invest in production, seeds, inputs, processing, and mechanization. Motivate large scale landowners to lend leases to tenants 1/3 and 2/3 basis subsidy subject to machines type. Strengthen technology integration with best farmer practices.	Eligible rice commercial growers- National scale	2021-2025	Identify potential areas to progressively expand rice production over the years, Expansion of Rice production to new areas, and extension of rice production in non-sugarcane Areas.	Increase	Unknown

Starter irrigation Kit, Small to medium sized dryers for drying of paddy and Bags for dried paddy packing and storage	After a few years into successful entrepreneurship, subject to budgetary support, these farmers will be provided with irrigation pumps, pipes, and water tanks.	Eligible rice commercial growers- National scale	Sometime after 2025, difficult to predict	Encouraging semi-commercial and commercial farmers in Rice production	Increase	Unknown
Availability of quality seeds	Farmers will be provided with seeds of rice which they will replace with the same amount progressively over three years.	Eligible participating rice commercial growers- National scale	Ongoing	Encouraging semi-commercial and commercial farmers in Rice production	Increase	Unknown
Soil erosion is reduced	Utilize the potential idle land for rice farming in Fiji and other interventions have the potential to increase soil quality, leading to increased soil carbon stocks.	Potential idle land will be used for rice farming.	Sometime after 2024, difficult to predict.	Soil carbon density (tonnes C/ha in soils).	Increase	Unknown
Nitrogen Fertilization	Farmers may apply synthetic or natural fertilizers to promote the growth of rice	Regions where rice farming will be done	Sometime after 2024, difficult to predict	Nitrogen applied to soils (mass/year)	Increase	Unknown

4.2.2. Identifying Potential GHG Impact from the Intended and Unintended Effects of the Rice Policy

The intermediate effects of the inputs and activities assist in identifying the intended and unintended effects of policy implementation. The intended effects are the anticipated consequences or outcomes to occur upon policy implementation whereas the unintended effects are compensating actions that can have an impact on other sectors not targeted by the policy. These effects help to identify the potential GHG impact because of the rice policy implementation as per the table below:

Table 14: Identifying Potential GHG Impacts from Rice Policy Implementation

Activity practice or technology	**Intermediate effects**		**Potential GHG impact**
Intended effect (s)	**Effect 1**	**Effect 2**	
Improved preferred Rice varieties, purification of seeds, and crop breeding	Improve seed production capacity for quality of rice seeds	New rice varieties with improved performance will continue to be evaluated and released	Decreased CH_4 emissions
Organic fertilizer application	Productivity increases	Soil organic matter increases	Increased CO_2 sequestration Possible increased N_2O
Synthetic fertilizer application	Productivity increases	Soil organic matter increases	Increased CO_2 sequestration Increased N_2O emissions
Unintended effect (s)			
Organic and Synthetic fertilizer application (e.g., N fertilizer, urea application)	Denitrification and volatilization increase		Increased N_2O emissions
	Emissions from the production increase		Increased CO_2 emissions
Liming to address soil acidity and improve productivity	Additional chemical reactions occur, depending on soil factors and climate regime		Increased CO_2 and N_2O emissions

From the table above, it is evident increase the in area of rice production and the increase in the application of urea, the use of synthetic and organic fertilizers will have an impact on Carbon dioxide (CO_2) and Nitrous oxide (N_2O) emissions.

4.2.3. Causal Chain for Rice Policy Implementation

Using the information collated in Tables 11, 12, 13, and 14, a causal chain is developed to illustrate the inputs, activities, intermediate effects, market-based results, and the GHG effects that would likely occur due to policy implementation. The following Figure 10 illustrates the causal chain for the rice policy implementation.

Developing a map of the causal chain allows understanding in visual terms how the policy or action leads to changes in emissions. Figure 10 below presents a causal chain for the National Rice development policy.

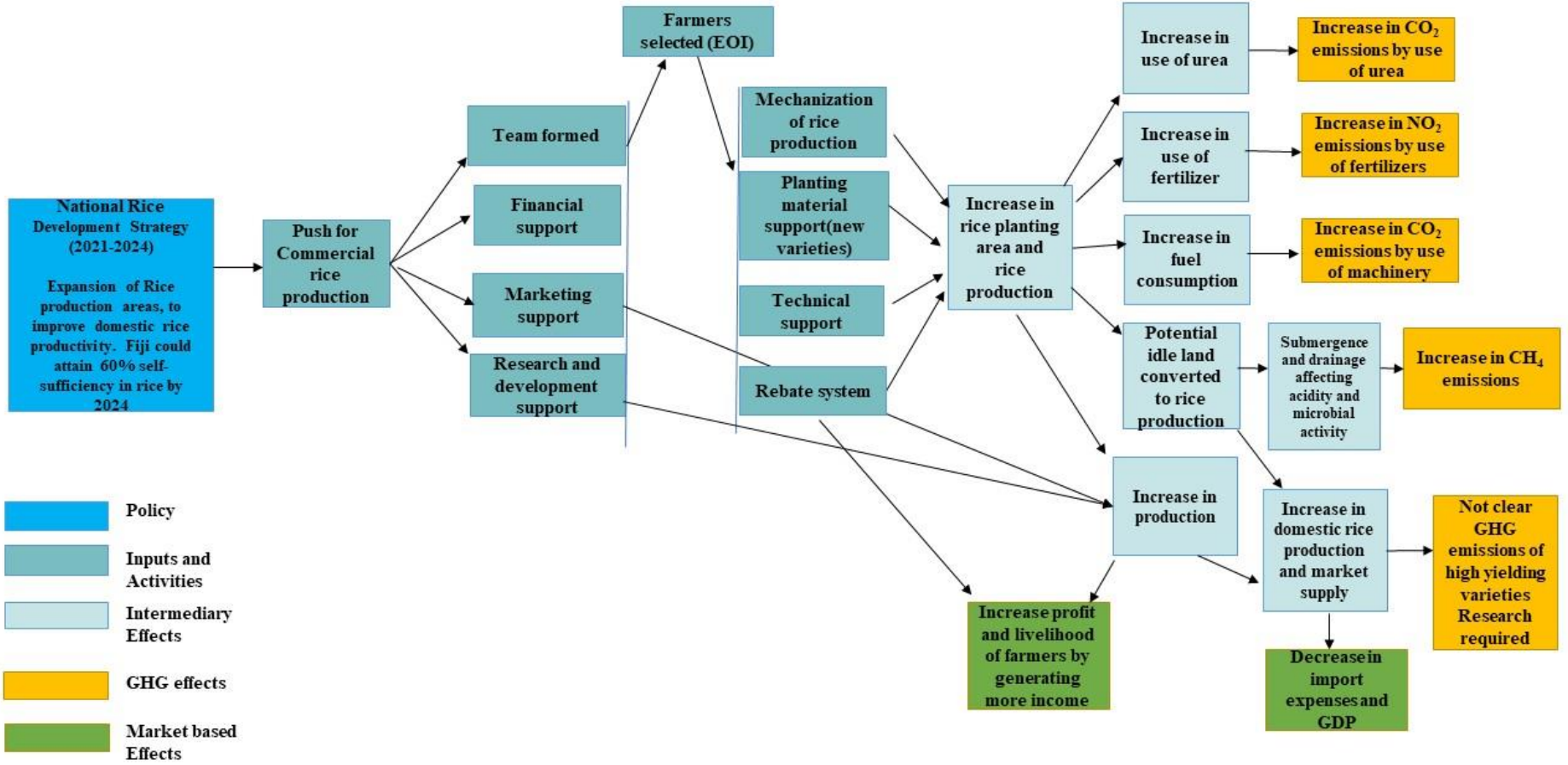

Figure 10: Causal Chain for Rice Policy Implementation

4.2.4 Defining the Rice Policy GHG Assessment Boundary

The assessment boundary defines a range of significant GHG impacts because of policy implementation. With reference to Figure 10, the causal chain illustrates various potential GHG sources, however, only the most significant GHG sources are included in the GHG assessment boundary. To identify the significant GHG sources/sinks for the analysis, the following steps were considered:

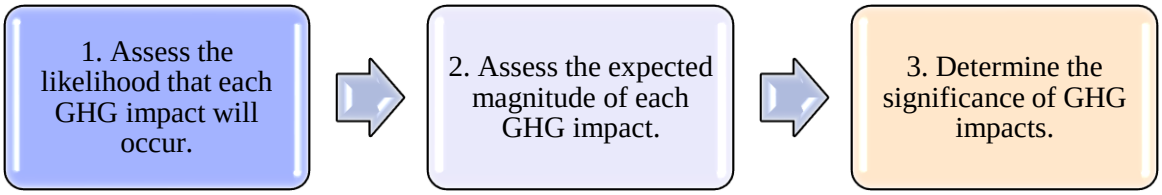

Figure 11: Steps used to define the GHG assessment Boundary

Prior to determining the GHG assessment boundary, the following potential GHG impact and sources/sinks were identified from the causal chain:

1. CH_4 emission from rice cultivation.
2. CO_2 and N_2O emissions from fertilizer application.
3. CO_2 emissions from the use of urea.
4. CO_2 emissions from the use of machinery.

Reference to the "ICAT Agriculture Policy Assessment Guides" (Table 6.6, Table 6.7, Table 6.8 & Table 6.9) and the following matrix helped determine the significance of GHG impacts while assessing its likelihood and magnitude.

Table 15: Determining the Significance of GHG Impacts to Define the GHG Assessment Boundary

Likelihood	Magnitude			Reason for choice
	Minor	Moderate	Major	
Very likely	n/a	n/a	CH_4 emissions from rice cultivation. CO_2 and N_2O emissions synthetic fertilizer and urea fertilizers.	Expanding rice production from rice planting area of 2,316 to 8,000 ha which is estimated for year 2024 is very likely to lead to an increase GHG emissions. Given that rice cultivation and fertilizer application are affected by the area of rice and are key categories for inventory estimations, the GHG impact is considered significant.
Likely	CO_2 emissions from the use of machinery	N_2O emissions due to fertilizer application	n/a	The emissions due to fuel combustion from use of machinery are likely to occur for rice harvesting and other farm operations. For the rice planting land area in acres of selected farms in Fiji, the GHG impact is minor and considered insignificant at this stage. Further analysis on the amount of fuel used for this activity can be used to relook at the magnitude, however, this data is not available. Additionally, with the increase in the planting area of rice, there will be an increase in the use of synthetic fertilizer to

Likelihood	Magnitude			Reason for choice
	Minor	Moderate	Major	
				increase productivity which will lead to increase in N_2O emissions. The use of organic manures and effective nutrient management will help curb emissions.
Possible	n/a	CO_2 emissions from urea application	n/a	With the increase in the planting area of rice, there will be an increase in the use of urea fertilizer for better production which will lead to an increase in CO_2 emissions. However, this impact on GHG can only be reduced if the use of ammonium sulphate or deep placement and effective nutrient management.
Unlikely	n/a	n/a	n/a	n/a
Very unlikely	n/a	n/a	n/a	n/a

Key:	Significant	Insignificant	n/a = not applicable

Therefore, the emission of CH_4 from rice cultivation, and CO_2 and N_2O emissions from urea and fertilizer application, are considered to have a significant GHG impact, defining them as the GHG boundary for quantitative assessment

4.2.5 Estimating the Rice Policy Baseline Scenario and Emissions

The purpose of estimating the baseline emissions is to quantify future GHG emissions to understand emissions behaviour without the implementation of the rice policy. Therefore, it allows decision- as well as policymakers to articulate informed decisions upon comparison with the ex-ante GHG impact assessment. In other words, estimation of the baseline emission scenario helps to identify the GHG impacts brought about by the implementation of the rice policy.

There are three approaches outlined in the "ICAT Agriculture Policy Assessment Guides" that can be used to determine the baseline scenario for the period of policy implementation. The three approaches are:

1. Constant baseline approach
2. Simple trend baseline approach
3. Advanced trend baseline approach

Of the three, the simple trendline approach was identified based on expert judgment as the most reasonable approach to determine the baseline scenario. This approach assumes that the agricultural practices, use of technology, and rice management practices evolve equivalently as in the past (Business-as-usual, BAU approach). It requires historical data of at least 5 – 10 years prior to the policy implementation period where the historical data is extrapolated using the linear regression method to quantify trends. Given that one of the fundamental outcomes of Activity 1 of the ICAT Fiji project was to develop a GHG inventory with respect to emissions from rice cultivation, the same inventory historical data was used to quantify the baseline emission scenario. Moreover, the following assumptions were applied to the historical data for extrapolation *via* linear regression:

Table 16: Assumptions for Estimating the Baseline Scenario and Emissions from Rice cultivation

Key Parameters	**Rice Cultivation**		
	CH_4	N_2O	CO_2
Assessment period for baseline scenario	2021 – 2030: this period aligns with the NDC timeframe		
Key categories	Rice area under cultivation The policy description states that the interventions are targeted to increase the planting area under rice cultivation to increase the production of rice in Fiji. However, the likely impacted categories are areas under rice cultivation.	Synthetic fertilizer used in rice production The policy description states that the interventions are targeted to increase the production of rice under the increasing area of rice planting likely to increase the use of fertilizer However, the likely impact can be taken care by implementing measures.	CO_2 from urea application in soil It would be higher in the policy scenario as compared to baseline as the area and production increased for rice. However, the use of nutrient management techniques and organic manures may likely be adopted.
Rice area	Historical data from 1995 to 2020 were extrapolated to estimate the baseline rice area until 2030. (In the BAU the area under rice planting remains constant whereas under the *Ex-ante* the policy intervention on expanding rice planting area from 2,316 to 8,000 ha which is estimated for year 2024 is taken under consideration))		
Emission Factor	**Rice area, urea, and fertilizer used** – like Activity 1, extrapolate the historical area production data for the assessment period and readjust the emission factor for emission calculation. Use the default IPCC emission factors from the 2006 IPCC Guidelines.	Use default emission factors from 2006 IPCC guidelines.	Use default emission factors from 2006 IPCC guidelines.

Using the assumptions outlined above and the simple trendline approach, the following baseline emissions were estimated, including area under rice cultivation, synthetic fertilizer used, and urea consumption in rice cultivation in Fiji (IPCC Tier 1 methodology).

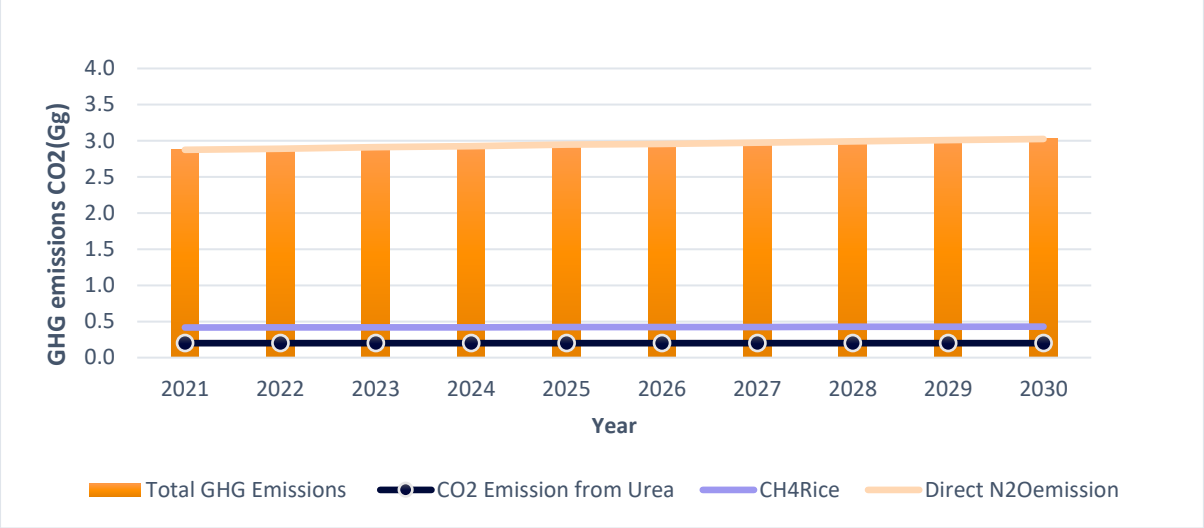

Figure 12: Baseline GHG emissions from rice cultivation 2021 – 2030.

The baseline total cumulative GHG emissions from rice cultivation for the assessment period is 29.5 CO_2-eq (Gg). The largest source of GHG emissions is expected to be CO_2 emissions from application of synthetic fertilizer (25.3 CO_2-eq (Gg)) followed by CH_4 from rice (2.2 CO_2-eq (Gg)) and CO_2 from urea (2.0 CO_2-eq (Gg)) emissions through urea, respectively.

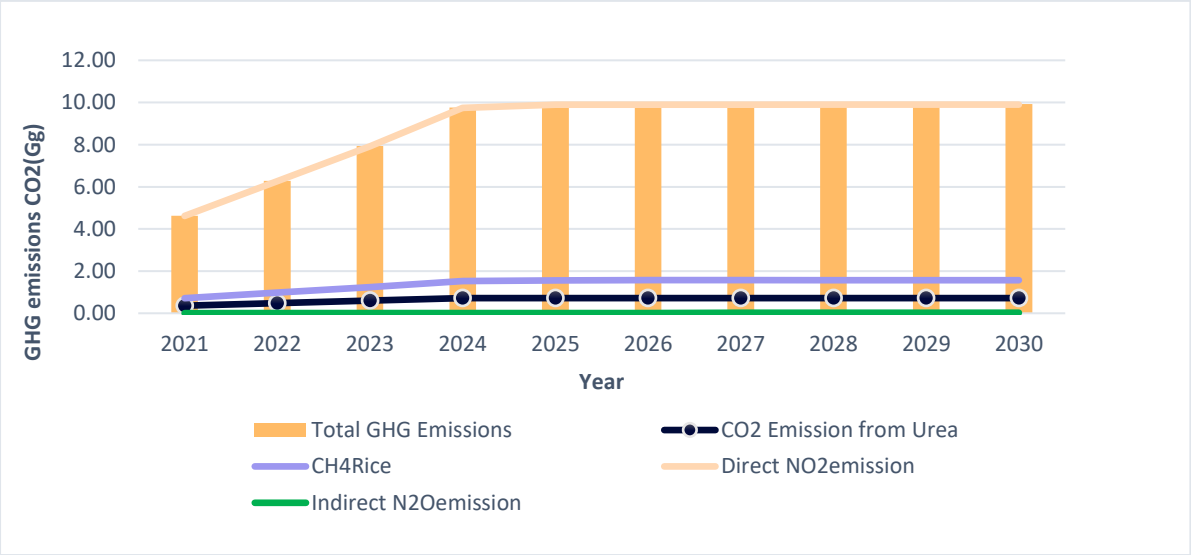

Figure 13:Estimating Rice Policy GHG Impact Ex-ante.

Estimation of expected GHG emissions from rice cultivation upon implementation of the rice policy was done using the IPCC *Tier 1 methodology*. The first step to consider when determining the GHG impact ex-ante is the maximum implementation potential of the policy. The maximum implementation potential of the policy assumes that the inputs, activities, and intermediate effects identified in the causal chain are highly likely to occur as per the policy implementation plan. However, this is further refined to the likely implementation potential of the policy by considering the most plausible or realistic policy scenario based on potential barriers such as policy design characteristics, financial implications, national circumstances, etc.

The rice strategy for Fiji primarily focuses on the expanding area for rice production from 2,316 to 8,000 ha which is estimated for year 2024. The policy design has supplemented inputs and activities

as per the causal chain to achieve this policy goal. To determine the maximum implementation potential, the activity data for each GHG source from the GHG assessment boundary was assessed. The activity data in this case is any parameter that is expected to change upon implementation of the policy which is then used to estimate the GHG impact ex-ante.

Since the GHG impact estimates are to be determined using the IPCC Tier 1 methodology, the key activity data is area under rice cultivation which will be impacted by the policy interventions.,. The other parameters for GHG emission estimation, such as emission factors, scaling factor for soil type, rice cultivar, water regime during the cultivation period, and types and amount of organic amendment applied etc., were extracted from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. With a lack of relevant data (or non-existence of relevant data), the maximum policy implementation potential was used to evaluate and quantify the activity data. While the policy also has a focus on providing high-yielding improved varieties of rice for improving the yield of rice, the GHG impact of these activities is unknown, and research is required to quantify the amount of GHG emissions using these high yielding improved varieties on different agroecosystems. There are no clear targets for GHG mitigation through these activities or indication of the quantifiable impact it would have on reducing the GHG impact through the intermediate effects. Thus, due to insufficient data, the GHG impact could not be refined to determine the likely policy implementation potential.

Furthermore, considering that the area under rice cultivation is expected to increase by 10% by the end of 2024, the impact of this increase would continue to have an impact on GHG emissions. Therefore, the GHG impact ex-ante is also estimated for the NDC timeframe (2021 – 2030) like the baseline estimates. Using these assumptions, the GHG impact was estimated as per the illustration below:

The total expected cumulative GHG emissions after policy implementation from 2021 to 2030 is 88.1 CO_2-eq (Gg) from N_2O emissions from fertilizer, CH_4 emissions from rice cultivation, and CO2 emissions from urea. The following figure 14 provides a comparison between the total BAU and ex-ante emissions from rice cultivation.

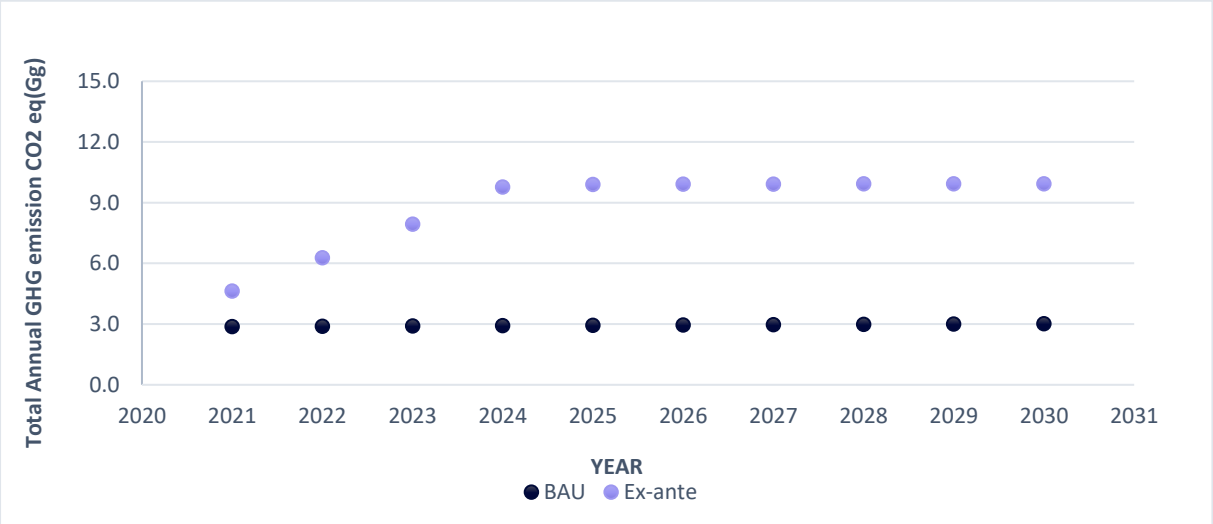

Figure 14:Comparison between the BAU and Ex-ante emissions from 2021 – 2030

In the long run, to expand rice production with relatively lower increases in emissions, steps for better nutrient and water management needs to take place. The use of organic manures may help in reducing N_2O emissions from use of chemical fertilizers. A more detailed assessment needs to be done to assess the potential impacts of these additional measures.

4.3. Qualitative Assessment of Sustainable Development Impacts on the Rice Policy

4.3.1 Identifying the Sustainable Development Impacts and Indicators

While the rice cultivation policy does have a substantial impact on GHG emissions from various sources within (as well as outside) the agriculture sector, it also has an impact on sustainable development. The sustainable development impact assessment is based on three primary dimensions environmental, economic, and social impacts.

These characterised dimensions allow experts to identify the impact categories which define the sustainable development impact of policy implementation. Examples of impact categories include poverty reduction, climate change mitigation, employment opportunities, and land-management changes. It is crucial to understand the specific sustainable development impacts that arise from each impact category to understand the direction of impact as well as key indicators for tracking after the policy has been implemented. Table 17 highlights the impact categories, relevance and significance, specific impacts, and the indicators for assessing impacts.

Table 17: Identifying Sustainable Development Impacts and Indicators

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
Environmental impacts	Air	Climate change mitigation (SDG13)	Yes	Yes	Yes	This policy is expected to significantly increase the GHG emissions from rice cultivation with an increase in area of rice planted.	Increase in CH_4 emissions from rice cultivation	• Net GHG emissions (CO_2, CH_4 and N_2O) from rice cultivation in CO_2-eq using appropriate global warming potentials.
							Increase in CO_2 and N_2O emissions from urea and fertilizers used in rice cultivation	
		Air quality (SDG 3)	Yes	Uncertain	No	Lack of data for Rice straw open burning or crop residue-rice straw burning and expected impact of carbon monoxide (CO) and particulate matter (PM) emissions are also unknown due to lack of data.	Expected increase in air pollution by CO and PM emissions from rice straw burning	• Net emissions and concentrations of CO and PM ($PM_{2.5}$ and PM_{10}) from rice straw burning if practiced.

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
	Land	Land-use change (SDG 15)	Yes	Uncertain	No	Increase in rice planting in idle land areas and barren land will restore degraded land and soil. However, the amount of forest cover required for the implementation of this activity is unclear due to the non-existence of relevant data. Thus, the level of impact cannot be assessed at this stage.	Restore degraded land and soil. The still unknown information on expanding rice area to forest land. Forest cover results in a decrease in CO_2 removals.	• Proportion of land area covered by forests.
		Soil quality (SDG 2)	Yes	Uncertain	No	Organic manure could be used for soil organic amendment to increase soil fertility. However, the	Decrease in use of synthetic fertilizer as a soil enhancement and reduction in N_2O emissions.	• Amount of fertilizer bought by rice farmers (kg). • Area of land used for organic rice farming.

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
						impact is unknown due to the non-existence of data.		
	Water	Water quality (SDG 6, 14)	Yes	Uncertain	No	An increase in area of rice production would lead to more fertilizer application, leading to the leaching of wastewater into nearby waterways. However, the level of impact is unknown due to the non-existence of data.	Decrease in water quality due to increase in water contaminants (heavy metals and nutrients) leading to eutrophication. This would lead to low DO, creating a hypoxic environment.	• Acidity (pH). • Eutrophication from nutrient pollution (such as P and N compounds).

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
Social impacts	Health and wellbeing	Food security (SDG 2)	Yes	Yes	Yes	An increase in domestic rice (food)production will impact production for Fiji. Therefore, it will have a significant impact on enhancing food security for Fiji from rice cultivation.	Increase in rice production Resilient rice management practices that close yield gaps Reduced post-harvest losses along the rice value chain. There is a requirement for climate-smart and stress-tolerant improved rice varieties	• Increase in consumption of rice.
	Education	Training (SDG 4, SDG 12)	Yes	Yes	Yes	Development of capacity for farmers to produce more rice and following nutrient and water management.	Enhanced resource-use efficiency and sustainability by guidelines, standards, and outreach for sustainable rice production and processing by the monitoring team. Best rice management practices that combine reduced environmental footprint with economic profitability are to be communicated to farmers.	• Number of farmers field schools organized. • Number of demonstration plots developed. • Training materials produced.

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
		Accessibility and quality of education (SDG 4)	Yes	Yes	No	The increase in revenue generated by farmers through the increase in farm productivity through this policy will enhance the accessibility of children to quality education.	Increase in the number of children enrolled in primary and secondary schools. An increase in the number of children attending tertiary institutes for higher education.	• Proportion of children getting primary, secondary, and tertiary education. • Average years of schooling
	Gender equality	Achieve gender equality and empower all women and girls (SDG 5)	Yes	Yes	No	However, the impact is unknown due to a lack of data.	Women make significant contributions to rice farming, processing, and marketing, and play a dominant role in buying rice for consumption	• Increased women's access to and control over resources (seed, inputs, technologies, and technical knowledge) in rice cultivation. • Increased women's productivity and production, thereby increasing

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
								their income share and purchasing power.
	Welfare	Reduction in Poverty (SDG 1)	Yes	Yes	Yes	The increase in revenue generated through the increase in rice production due to this policy would allow farmers to increase living standards substantially.	Increase in household income. Decrease in the number of households living below the national poverty line. High-yielding rice varieties with increased market value, lead to rice that is profitable to poor farmers and affordable to poor consumers.	• Poverty rate (proportion of the population living below the national poverty line. • Poverty rate of farmers • Proportion of people earning below the national minimum wage. • Number of people living in poverty. • Number of farmers living in poverty

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
Economic impacts	Overall economic activity	Economic Activity and Productivity (SDG 2, SDG 8)	Yes	Yes	Yes	The implementation of this policy aims to enhance rice cultivation, leading to enhanced productivity. This would cause a decrease in the annual import of rice thus, increasing Fiji's GDP.	Increase in domestic rice productivity. Decrease in annual rice import. Increase in GDP.	• GDP, Gross National Income. • Annual growth rate of real GDP per capita • Rice productivity (per year)
	Business and Technology	Innovation (SDG 8, SDG 9)	Yes	Uncertain	No	The policy targets to develop innovative infrastructure for rice cultivation However, their development and economic impact on SD is unclear at this stage due to the	Improved high yielding varieties of rice with mechanization support and monitoring	• Revenue and profit. • Number of active long-term partnerships with the private sector.

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
						non-existence of data.		
	Income, prices, and costs	Income (SDG 8)	Yes	Yes	Yes	The targeted increase in rice production and productivity would lead to an increase in income for farmers.	Increase in household revenue from rice production.	• There will be increased rice production and commercial rice cultivation in Fiji.
		Costs and cost-savings (SDG 8)	Yes	Yes	Yes	Improved participation of commercial farmers and dynamic rice agri-businesses through: • training of farmers • Development and delivery	Decrease in expenditure for farm activities	• The government-based machinery-based services such as harvesting or threshing or may start a business by producing and marketing new rice-based products.

Dimension	Group of impact categories	Impact categories	Relevance	Significance	Included in assessment boundary?	Rationale for determining relevance & Significance	Specific Impacts	Sustainable Development Indicators
						of mechanization options		

4.3.2. Qualitative Assessment of SD Impacts

The SP4 of the SDP for the Ministry of Agriculture has a significant impact on the SDGs. The policy will see an increase in area of rice cultivation and will certainly increase GHG emissions from the application of synthetic fertilizers and urea for boosting production. This will have a negative impact on SDG 13 Climate Action as it does not provide a mechanism to mitigate or decrease emissions but rather to increase Fiji's GHG emissions and is contrary to national initiatives to reduce emissions such as the Fiji LEDS project. However, the increase in planting rice in rainfed agroecosystem will reduce the methane emission, in comparison to the previous cultivation on 50% irrigated and 50% rainfed as described in the Fiji LEDS document. The rice area under rainfed and upland conditions (44% and 36%), due to the reduced usage of irrigation systems accounts for 20% of cultivation is considered for the policy implications (Bong,2017).

The impact on water and soil quality (SDG 6, 14, and 15) could be negative, although, the magnitude of impact is difficult to assess at this point. The fertilizers applied to land will increase the leaching potential and may lead to the contamination of groundwater sources and eutrophication in nearby waterways. This may affect SDGs 6 and 14 negatively.

In the long run, if the application of organic manure is practiced as soil amendments it will increase soil fertility, increase agricultural productivity, and thereby positively impact SDG 2 and decrease the application of nitrogen-based fertilizer, possibly decreasing direct N_2O emissions from soil. This may enhance SDG 13 which is to enhance climate action.

The implementation of the policy may also affect land-use changes, that is, planting of rice on the idle land areas which had uncleared land leases. Such practice will impact SDG 15 as the soil erosion due to barren land will be reduced.

The implementation of the policy will see a positive impact on SDGs in the social dimension. The implementation of the policy will see an increase in the production of rice and therefore will increase food security (SDG 2). The increase in revenue for farmers will help reduce poverty in the agriculture sector (SDG 1) and will enable a good quality of life and well-being and will also allow children to have higher accessibility to quality education (SDG 4).

There are three categories of impact for SDG impact identified under the economic dimension. Overall economic activity is impacted by the increase in rice production which will reduce the import of these goods and increase Fiji's GDP. This will positively impact SDG 8. The increase in household income through revenue generated from sales of rice will have a positive impact on SDG 8 directly.

4.3.3. Technical Guidance for Tracking Sustainable Development and GHG Impacts

This section deals with tracking the performance of indicators in terms of SDG and GHG impacts arising from the implementation of the policy. The policy target is to increase the rice area from 2,316 to 8,000 ha which is estimated for the year 2024, this increase in the rice planting area certainly has SDG and GHG impacts.

To develop technical guidance for monitoring GHG emissions and SDG impacts from policy implementation following 4 steps were used:

Step1: Identify indicators and parameters to monitor over time

In this step key performance indicators were identified to be monitored for the performance of the rice policy in terms of tracking the changes in the targeted impacts such as the increase in CH_4 emissions from rice cultivation. The parameters were also identified which will be used to estimate

GHG emissions ex-post.

Step 2: Identify potential sources for data

Step 3: Monitoring Frequency or Monitoring Period
This is the period in which the policy is in effect or the timeframe over which the GHG impacts resulting from the policy are assessed. Although the policy implementation period is 2019 – 2024 its effect on GHG emissions will continue thereafter and will be tracked till 2030 in line with the NDC implementation. The key performance indicators identified in Table 18 above show that these indicators need to be monitored annually to enable robust GHG estimation.

Step 4: Identifying the responsible entity or institution
These are responsible entities or institutions, possibly custodians of key performance indicator data through some institutional arrangements.
The application of these steps in the development of the tracking guidance for GHG and SD impacts is expressed in Table 18.

Table 18: GHG and SD Impact Monitoring Plan for the Rice Strategy

Categories	Parameter	Potential Sources for Data	Monitoring Frequency	Parameter Type	Responsible entity or institution
GHG Impact: Methane Emissions from Rice cultivation Nitrous Oxide emissions from Synthetic fertilizer and urea	Area of rice cultivation	National Agriculture census	Annual	Activity Data. Key Performance Indicator	MoA
	Number and length of season	MoA Rice research division	Annual	Activity Data. Key Performance Indicator	MoA
	100-yr GWP of CH_4 and N_2O	IPCC Assessment Report	once	Convert CH_4 and N_2O to CO_2-eq emissions	UNFCCC
	Amount of synthetic fertilizer and urea applied	MoA Rice research division	Annual	Activity Data Key Performance Indicator.	MoA
	Production and yield of rice	National Agriculture census And Rice division MoA	Annual	Activity Data Key Performance Indicator	MoA
	Water regime (volume of irrigation and drainage)	MoA Rice research division	Annual	Activity data Key Performance Indicator	MoA
	CH_4 emission factor	Tier 1, IPCC 2006	once	GHG emission factor can also be updated to country specific emission factors).	IPCC

	N_2O emission factor	Tier 1, IPCC 2006 GL	once	GHG emission factor (can also be updated to country specific emission factors).	IPCC
	Surface water level	MoA Rice research division	periodically	Activity Data. Key Performance Indicator	MoA
	Straw and organic manure management	MoA Rice research division	once	Activity Data. Key Performance Indicator	MoA
Sustainable Development Impacts	GHG emission, CH_4, N_2O, and CO_2) from rice, fertilizer, and urea	National GHG Inventory from Climate Change Division (CCD)	Annual	Key performance Indicator for SDG 13 - Climate Action	CCD
	Production and yield of rice	MoA Rice research division	Annual	Key Performance Indicator for SDG 2 - Zero Hunger	MoA
	Poverty rate (proportion of population living below the national poverty line). Track farmers separately as a subgroup if possible.	Bureau of Statistics, Population Census Data	Annual	Key Performance Indicator for SDG 1 - No Poverty	Bureau of Statistics
	GDP, Gross National Income.	Ministry of Economy. Bureau of Statistics	Annual	Key Performance Indicators for SDG 2 (Zero Hunger) and SDG 8 (Decent Work & Economic Growth)	Ministry of Economy
	Household income; farm household income as a subgroup if possible	Ministry of Economy. Bureau of Statistics	Annual	Key Performance Indicator for SDG 8 - Decent Work and Economic Growth	Ministry of Economy

It is critical to develop a monitoring plan to track the progress of indicators over time in relation to the targeted outcomes of the policy. A more elaborated monitoring plan is recommended to encompass as many of the elements highlighted in Table 18 above as possible and include the following:

- brief description of each indicator
- source of data for each indicator and parameter (if applicable) monitoring period
- monitoring frequency (fixed ex-ante during the monitoring period)
- measurement or data-collection methods (such as survey or census)
- historical value (baseline value)
- goal value
- entity (ies) or institution(s) responsible for monitoring the respective indicator and collecting parameter(s), if applicable.

In addition to the list given above, a robust monitoring plan should include details on the following:

- Collecting and managing data: Identify database and tools for collating and disseminating data. Define procedures for collating and documentation for data collection.
- Quality assurance and quality control: define methods for QA/QC procedures that will ensure good quality data for an accurate assessment of policy impacts.

4.4. Recommendations for including the Agriculture Sector in Fiji's Enhanced NDC

There is no mention of mitigation targets set for the agriculture sector in Fiji's NDC although it contributes approximately 25% of the national GHG inventory. The Fiji Low Emission Development Strategies (LEDS) shows that under the BAU scenario and the very high ambition scenario the total GHG emission in the agricultural sector, emission from the application of synthetic fertilizers will be reduced by 1% by 2035. The LEDs also indicates that emissions from the use of synthetic fertilizers will be reduced by changing fertilizer rates and types, adjusting the time of application, increasing the precision of application. It is evident that with the implementation of this policy, however, emissions from fertilizer application are likely to increase; therefore, there is a need to improve nutrient management to maintain the target outlined in the Fiji LEDs to achieve zero decarbonisation from the agriculture sector by 2050.

The following are recommended for future NDC to achieve emission reduction in the rice cultivation: Given the importance of rice, it is critical to establish management strategies that can maintain high yields while limiting negative environmental effects and maximizing its beneficial advantages. The broad challenges of water consumption, nutrient use efficiency, and greenhouse gas emissions are all major drivers of the rice system for long-term sustainability.

Furthermore, these elements are all linked. How one handles water, for example, has an impact on nutrient use efficiency, water quality, and GHG emissions. Rice farmers rely primarily on uncertain monsoon rainfall; but, due to recent climate change, the monsoon has become increasingly erratic, resulting in crop failure or low harvest, causing widespread food insecurity.

Better nutrient and water management with high yielding improved varieties and adjusting fertilizer rates and types, scheduling, and precision application be followed. Organic manures can be promoted, which reduces N_2O emissions from rice fields and nitrate leaching into groundwater. It also boosts microbial activity, which enhances soil quality.

5. Conclusion

In this report, the Strategic Priority Area 4 of the SDP was assessed for the livestock sector policy as well as the Draft Fiji National Rice Development Strategy. The assessment played a vital role in

identifying the potential GHG impact of policy implementation as well as to develop the relevant SD indicators and tools that are needed in tracking Fiji's progress towards the implementation and achievement of its NDC. By strengthening Fiji's agriculture policy assessment capacity, it can identify ways in which the sector can be included in future NDCs. It will also support the agriculture sector reporting for the next national GHG inventory within Fiji's First Biennial Transparency Report and the Fourth National Communication, building a solid platform for all future reporting of the agriculture sector under the Paris Agreement.

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Annex

ICAT Agriculture Policy Assessment Matrix

PART II Section 5.1: Describing the policy

Information	Guidance	Description
Title of policy	*Policy name*	
Type of policy	*The type of policy, such as those presented in Table 3.1, or other categories of policies that may be more relevant*	
Description of specific interventions	*The specific mitigation practice and/or technology carried out as part of the policy, such as those presented in Box 3.1.*	
Status of the policy	*Whether the policy is planned, adopted, or implemented*	
Date of implementation	*The date the policy comes into effect (not the date that any supporting legislation is enacted)*	
Date of completion (if relevant)	*If relevant, the date the policy ceases, such as the date a tax is no longer levied or the end date of an incentive scheme with a limited duration (not the date that the policy no longer has an impact)*	
Implementing entity or entities	*The entity or entities that implement(s) the policy, including the role of various local, subnational, national, international or any other entities*	

Information	Guidance	Description
Objectives and intended impacts or benefits of the policy	*The intended impact(s) or benefit(s) the policy intends to achieve (for example, the purpose stated in the legislation or regulation)*	
Level of the policy	*The level of implementation, such as national level, subnational level, city level, sector level or project level*	
Geographic coverage	*The jurisdiction or geographic area where the policy is implemented or enforced, which may be more limited than all the jurisdictions where the policy has an impact*	
Sectors targeted	*Which sectors or subsectors are targeted*	
Greenhouse gases targeted	*Which GHG the policy aims to control, which may be more limited than the set of GHG that the policy affects*	
Other related policies or actions	*Other policies or actions that may interact with the policy being assessed*	
Additional information	**Guidance**	**Description**
Intended level of mitigation to be achieved and/or target level of other indicators (if relevant)	*If relevant and available, the total emissions and removals from the sources and carbon pools targeted; the target amount of emissions to be reduced or removals to be enhanced because of the policy, both annually and cumulatively over the life of the policy (or by stated date); and/or the target level of key indicators (such as hectares of land to conserve)*	

Information	Guidance	Description
Title of establishing legislation, regulations, or other founding documents	*The name(s) of legislation or regulations authorising or establishing the policy (or other founding documents if there is no legislative basis)*	
Monitoring, reporting and verification procedures	*References to any monitoring, reporting and verification procedures associated with implementing the policy*	
Enforcement mechanisms	*Any enforcement or compliance procedures, such as penalties for noncompliance or requirements for reporting*	
Reference to relevant documents	*Information to allow practitioners and other interested parties to access any guidance documents related to the policy (for example, through websites)*	
The broader context or significance of the policy	*Broader context for understanding the policy*	
Outline of sustainable development impacts of the policy	*Any anticipated sustainable development benefits other than GHG mitigation*	
Key stakeholders	*Key stakeholder groups affected by the policy*	
Other relevant information	*Any other relevant information*	

PART II Section 6.1.1: Identifying and describing intermediate effects

	Detail/explanation	Geographic location of effect	Timing of effect
Inputs			
Activities			

T II Section 6.1.1: Identifying and describing intermediate effects

	Detail/explanation	Geographic location of effect	Timing of effect	Affected parameter	Direction of effect	Amount of effect
Other intermediate effects						

PART II Section 6.1.2: Identifying potential GHG impacts

Potential activities and effects for main types of mitigation practices/technologies

Activity practice or technology	Intermediate effects			Potential GHG impact
	Effect 1	Effect 2	Effect 3	
Intended effect				
Unintended effect				

PART II Section 6.4: Identifying sustainable development impacts

Dimension	Group of impact categories	Impact categories
Environmental impacts		
Social impacts		
Economic impacts		

Agriculture Sector Policy Review Matrix

Descriptors	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
Name of Policy					
Cabinet Approval Date					
Description (Provide a short summary of the policy being reviewed)					
Purpose (State the purpose of the policy. What is the policy trying to achieve or why has it been developed?)					
Background & Scope (What are some of the circumstances that led to the development and need for the policy?)					
Significance of the policy (Broader context for understanding the policy)					
Responsible entities/ key stakeholders (who will implement the policy? Who will be the beneficiaries of this policy?					
Are there any key/specific interventions? If yes, state them. (These may include specific mitigation practices and/or the use of technology as part of the policy. Are beneficiaries provided with start-up materials from the Ministry or partner agencies?).					

Descriptors	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
Financial implications (Does the policy have a designated budget or funding source to make it feasible for implementation?					
Monitoring, Reporting and Verification of the policy (Does the policy have a defined MRV plan/ process outlined? If yes, who are the responsible stakeholders involved? Is there a defined institutional arrangement to monitor, review and verify the policy implications on a regular basis in a timely manner?)					
Planned or implemented					
Status of implementation (Has funding been authorized; how many hectares or farmers have been impacted? How long until complete)					
Expected level of penetration (E.g., 50% of idle land; 25% of eligible households, etc.)					
Potential Ag GHG source categories impacted by the policies (CH4 from enteric fermentation, CH4 and N2O from manure management, CO2 from liming, N2O from soils, soil carbon)					
For each source listed above, will the impact be low, medium, high (will need to think of a qualitative scale for this; can be based on expert judgement and the NIR for Fiji)					

Descriptors	Policy 1	Policy 2	Policy 3	Policy 4	Policy 5
What is the current level of data availability for estimating GHG emissions from the impacted source categories? (e.g., High, Medium, Low, unknown)					
What are potential Sustainable Development impacts of the policy					
What is the level of barriers or risks to successful implementation of the policy					
Could the policy help achieve goals in Fiji's Agriculture Sector Policy Agenda and/or 5-year Strategic Development Plan? Which one's? Which priority area does this align with					
Could the policy help achieve goals in Fiji's Low Emissions Development Strategy? Which one's?					
Recommendations to consider for future NDC update					