



Santos Foundation PNG Sago Program

Community and Economic Development through the
introduction of sago processing mechanization



Sago Program Development

The Santos Foundation is a development partner dedicated to improving the lives of Papua New Guineans. The Foundation and its parent company Santos have implemented a Youth Program in the Nipa-Kutubu District of Southern Highlands province to create new opportunities for young people in Kutubu which is a core site for Santos operations.



Kutubu has a significant youth bulge and there are emerging signs of many young people feeling disenfranchised. This poses a risk to communities in the District with a growing number of youths lacking access to basic services and economic opportunities. The Youth Program seeks to support and empower youth by developing employment opportunities through supporting local agriculture and other pathways to employment. Limited commercially viable products and access to markets remain major constraints to jobs growth in the agriculture sector in Kutubu, and across many parts of PNG more generally. One potential agricultural opportunity is for commercial production of sago, a viable crop in the region.



By targeting sago, a food that is integral to community life, relevance to the surrounding region's population is high and this could facilitate the engagement of youth. Extraction of sago starch is traditionally achieved by manual processing by women and is very labour intensive. Small scale mechanised processing units may reduce labour demands on women, increase food availability and generate the potential for income generation from sales of processed product. Widespread adoption of mechanised sago processing will require unit fabrication and maintenance capacity in the region providing a skills training opportunity. This could equip young people with trade capabilities applicable to resource industry development in the region.

The Santos Foundation engaged CQUniversity to undertake a scoping and feasibility study for the development of a mechanised sago processing capability in the Nipa-Kutubu District in the Southern Highlands Province. The study evaluated

the feasibility of introducing mechanized sago processing and associated training and community support activities to deliver livelihood improvement for the communities, and particularly the young people, in the Nipa-Kutubu District. The study found that there were clear benefits from the introduction of mechanized sago processing, with potential for positive social, economic and environmental outcomes if managed appropriately. An implementation program was proposed to support the communities in the Kutubu region and to progress the introduction of mechanized sago processing capacity.

Recognising the importance of community engagement in the development program, the Santos Foundation is sharing the outcomes of the feasibility study and proposed implementation plan with interested stakeholders with a view to establishing collaboration in program implementation.

Why Sago?

Key reasons to support the Sago Program and industry expansion

1



Papua New Guineans are expert sago farmers.

Combining this traditional expertise with technology has the potential to unlock scalability and better yields for economic growth.



2



Sago is an abundant species in Papua New Guinea covering an estimated 1 million hectares and it has been estimated that **300,000 ha are easily accessible and harvestable.**

3



As the industry matures, promote PNG Made agricultural produce by **expanding the market base through export opportunities**

4



Alignment with PNG's Government Strategy & Goals - Vision 2050 and Medium Term Development Plan IV (MTDP IV)

4





5 Capitalise on Food and Nutrition Security for PNG

whilst investing in a crop that commands global interest for its climate-change adaptability.

Sago is resilient to climate change impact, therefore is a reliable food supply during natural disasters like droughts. It also contributes to global warming mitigation through carbon (CO₂) sequestration and its hardy survival in hostile, non-arable environments unsuitable for agriculture.



6 Growth in the International Demand

- Valued at USD363M in 2022 and forecasted to grow to USD506M by 2029.



Learn more about PNG Sago



4

Sago offers two important health benefits in comparison to white rice:

1) Sago starch is high in dietary fibres and 2) Sago has a very low glycaemic index (GI)



1

Sago plays a significant cultural role as a commodity of trade or being used in barter exchanges for other foods or goods, and in bride price ceremonies and for many other special occasions. Its importance is evident in oral traditions and storytelling, art and craftsmanship, culinary traditions, traditional medicine and healing practices.

2

Approximately 30% of the PNG population rely on sago as the dominant staple food source.



5

Sago yield is very high. **Starch yield per unit area is 3 to 4 times higher than that of rice**



3

Sustainable harvesting of both cultivated and wild sago is feasible as mature palms are only harvested at early flowering stage to maximise starch yields, and these stems would naturally die and be replaced by suckers if not harvested.



6



6

79-88% starch & sugars

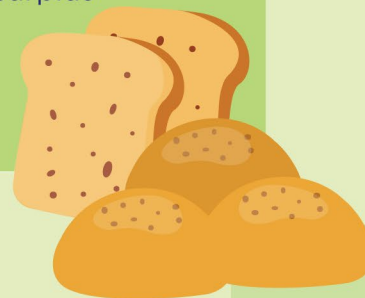
Sago stem pith tissue contains 79–88% starch and sugars, making the sago palm one of the most productive sources of starch of all food crops.

The production capacity of the sago palm varies from **2-5 tons of dry starch/ha for wild** harvested to **10-25 tons/ha for cultivated plants**.



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Virtually all sago starch in PNG is produced on a subsistence level in the villages with only the surplus being sold.



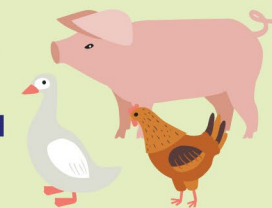
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The sago palm has many secondary uses in PNG in addition to being a staple food. The fronds of the sago palm are used for thatching, the bark may be used as a floor material or as a fuel, and the leaf sheaths and fibre from young leaves are sometimes used for mats, and can be woven into bags, baskets or ropes.



8

As the waste pith material left after starch extraction still contains a high amount of starch, **this material can be used as a feedstock for livestock.**



10

Partial replacement of wheat flour with sago starch has been used successfully in the **baking industry for biscuit and bread products**, while sago is also widely used, together with rice, corn, and potato starch, in the **manufacture of noodles**.

11

Another secondary product of the sago palm is the sago grub, the larva of the Sago or Black Palm beetle (Rhynchophorus spp).

The high protein and fat content of the grubs is beneficial in a starch-rich sago diet. The sago grub is a delicacy in PNG and can sometimes be traded in local markets.



12

Rapid expansion of the palm oil industry and rubber plantations in Indonesia, Malaysia, and Thailand has resulted in sago palm forests rapidly disappearing and being replaced by industrial crop plantations.

This trend is leading to diminished capacity to source sago palms for commercial processing. **Any expansion on global trade of sago starch will therefore require access to new areas of sago such as the vast sago regions in PNG.**



Feasibility of Introducing Sago Mechanisation in the Kutubu District





The Santos Foundation engaged CQUniversity to undertake a scoping and feasibility study for the development of a mechanised sago processing capability in the Kutubu District in the Southern Highlands Province. Analysis focused on three aspects:

- the technical feasibility of a sago rasping machine to be manufactured for PNG conditions
- the likelihood of the technology and associated support and market development activities being accepted by the Kutubu communities
- and the economic feasibility of mechanized sago production in the short, medium and longer terms.

“If one woman does one sago tree herself without any assistance it will take her up to a month or more to process”. Therefore, perhaps the sago machine will help mothers reduce the workload and allow mothers more time to focus on other crops as well”

Social considerations (community acceptance)

The Kutubu community expressed overwhelming support for the sago project, believing that it would greatly benefit the community if implemented with “careful consideration”. In terms of anticipated benefits, the community highlighted increased income from selling sago and the potential for improved living standards. Women, who are traditionally involved in sago processing, emphasised how the project could reduce their workload and alleviate physical burdens. As highlighted “If one woman does one sago tree herself without any assistance it will take her up to a month or more to process. Therefore, perhaps the sago machine will help mothers reduce the workload and allow mothers more time to focus on other crops as well”.


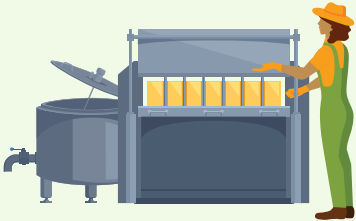
Women did, however, stress the importance of considering gender dynamics and ensuring women’s participation in decision-making. Men were also positive about the impact on livelihoods but stressed the need for inclusivity, acknowledging that both men and women have roles in the sago industry. As highlighted in a men’s Focus Group Discussion (FGD) “..this sago project should be a community initiative and will require all community members to participate. Men own sago and women make sago, so both parties must participate”. Managing potential tensions between genders will be crucial in the sago program. Both men and women emphasised the need for transparency throughout the program at all stages.



Men and women also stressed the importance of involving all communities, not just specific groups or individuals. Young people were invited and included in the FGDs, but future engagement methods should consider their preferences and communication styles to foster more inclusivity and ensure their voices are heard. Of note, the community emphasised the importance of a cautious and inclusive approach to program implementation that considers the “needs and aspirations of all community members”. The community also expressed a specific request for a trial demonstration of the sago machine as a prerequisite for further discussions, so “... we can be prepared to plan and implement well following the trial. Right now, some of us are still confused”. This request aligns with the ‘do no harm’ approach, highlighting the importance of informed decision-making and ensuring the community has a realistic understanding of the program.

To adhere to the ‘do no harm’ perspective, it will also be essential to effectively manage community expectations. The program team must communicate that progress will be gradual and that immediate financial gains may not be realised. By setting realistic expectations, the community can better understand the timeline and potential outcomes of the project, minimising any potential disappointment or misunderstanding. As highlighted in the men’s focus group at Daga 2, the community require “...sufficient time for community discussions to agree on approach that will benefit all community members. It should be an approach that will not benefit only some people and create many problems”.



Summary of key issues raised by communities.

Main Issue	Typical Questions	Feedback (via community meetings and flyers)
Markets/Business Related 	<p>Where can we find markets for sago?</p> <p>Can you help us with this?</p> <p>Can you help us with business skills – markets, and making a profit from sago?</p>	<p>If the project is funded, financial literacy training/ business skills will be embedded as part of the implementation phase. We will conduct a skills audit with community to see what is required and offer training to meet these needs. We will also help to identify and establish new markets for sago, and potential secondary income sources (eg sago grubs).</p>
Machine Related 	<p>Where will the machine be based? Who provides the machines, who maintains the machines? How do we use the machines – will you provide training? Will we hire the machines – will it cost money or are they free? Who will pay for fuel for the machines?</p>	<p>If project is funded, we will provide machines for pilot project and full training on how to use the machine safely. Machines will be portable so we can bring the machine to the log. We will work with community to identify a process for hire/fueling of machines so that the project is sustainable. There will be a youth training/skills component to the project so hopefully machines can eventually be built and repaired within the community.</p>

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Sago Related 	<p>What can we do with the sago waste? Can we repurpose? How can we improve storage?</p> <p>Will the project be sustainable? What happens if we cut down all the trees?</p>	<p>We will explore options to repurpose sago (for example, charcoal briquettes). Sustainability is important, so we will work with community to identify what is happening now (replanting sago) and what we need to do to ensure trees are replaced.</p>
General Concerns 	<p>There are 6 clans and 17 Incorporated land groups. Who will take the lead on the project? Clan approach or Ward approach?</p> <p>Can we witness the trial demonstration first, then discuss at the community level on how best to do the sago project?</p> <p>Will there be sufficient time for community discussions to agree on an approach? Will the process be transparent?</p>	<p>If we receive funding for the project, it will be community led and we will work closely with the community to identify how to implement the project in a way that benefits everyone in the community. The purpose of these initial meetings and group discussions is to find out if the community are interested and to get general feedback about the idea. We will have lots of discussions before the project is implemented – these consultations are a very important part of the project.</p> <p>Yes, we will bring the sago machine to the community if the project is funded. Once you have seen the machine, we can have more discussions about the project.</p>

Technical Feasibility

Small scale sago rasping equipment is widely used in Indonesia and Malaysia and has been successfully trialed at the Poroi2 site in Gulf Province. Extraction efficiency (% of the starch contained in the sago log that is extracted) has been demonstrated to be significantly higher when using the mechanical rasping equipment in comparison to manual separation of the sago pith from the logs. It is clear that the technology is effective and feasible for use in PNG.

While the small scale rasping equipment available in Indonesia and Malaysia is effective, an appropriate design for PNG requires the equipment to be portable, durable, repairable, affordable and safe to use. Design features being incorporated in the unit under consideration for the project include easily replaceable teeth in the rasper, a dual rasping drum system to facilitate feeding of sago billets into the rasper, safety cowling around the intake area to reduce the risk of injury from hands pushing sago billets into the rasper, and capacity to separate into sections for transport and easily combine for operation. Detailed drawings of the unit will enable fabricators (either in Australia or PNG) to manufacture the equipment and supply parts for repairs.

Training will be required to establish the capacity to operate and repair mechanized sago processing equipment. Inspection of the Poroi2 site and interviews with community members participating in the sago processing at that site indicate that this capacity will be easy to establish for small scale processing. The equipment at Poroi2 has not been extensively used so there is no indication of capacity to repair the rasper if a breakdown occurs. Training of young people to maintain and repair equipment is an opportunity to build community capacity and equip youth with portable skills applicable to a range of possible career paths.

Stakeholder consultations have indicated that commencing with small scale equipment is the preferred path to ensure community acceptance of the intervention, but that commercial scale activities are where significant impact can occur in the communities. Scaling up of sago processing beyond a simple mechanization of current subsistence level sago harvesting would require capacity for second stage processing (capability to produce in larger volumes and at the required quality for markets) and/or development of larger capacity equipment.

It is difficult to judge the feasibility of this scaling up as all stakeholder feedback has suggested the community needs to direct the development for it to be sustainable, so the form that scaling up would take is very much dependent on how the initial introduction of mechanized sago processing is integrated into the communities.

It is worthwhile noting that during the stakeholder consultations significant interest in the project has been evident from outside Southern Highlands Province. The feasibility of scaling commercial sago production in PNG is greater if mechanized sago processing is adopted across different sago growing regions. The long term potential for sago flour exports from PNG would almost certainly require establishment of sago processing capability outside of the Southern Highlands given the transport logistics challenges of road connections to ports.

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Economic considerations

The sago processing equipment proposed in the project is unlikely to be affordable to smallholders without an income from sago sales or other sources. Community consultations and feedback from stakeholders suggested strongly that an initial phase of technology introduction without a strong commercial production focus would be preferable to ensure community acceptance. The feasibility of introduction therefore is dependent on donor support or investment from landowner groups or government sources. The feasibility of the program is dependent on financial support for this initial phase of technology introduction and acceptance. The strong support expressed by several stakeholders during the feasibility study suggests that investment to support Kutubu communities could contribute to financing of this initial phase.

Commercial production and sales of sago will need to be supported to facilitate the expansion of mechanized sago processing following introduction and acceptance of the technology. One strategy for transition to self-funding was presented in the stakeholder consultation with Mama Bank. A microfinancing project similar to that provided to small groups of women working in vegetable production in Morobe Province would be applicable to small scale sago processing. Loans can

be provided where evidence of some commercial production and sales history as well as a pattern of savings from commercial sales exists. Support from a guarantor would allow scaling of a loans scheme throughout the community. Mama Bank programs also feature financial literacy training and business development training, and provide assistance for women/families to open bank accounts.


Small volumes of sago are currently traded in open markets outside of sago growing regions in PNG. Stakeholder feedback confirmed sales through the supermarket and catering sectors with interest in greater volumes if quality, competitive pricing and supply consistency can be assured. Two priority areas for establishing commercial sago production are analysis of potential market characteristics and building business acumen within the community. A sago demand study is recommended to fill the market assessment need. The Community Development Worker training generated in part through an Australian Centre for International Agricultural Research (ACIAR) funded project is a good option for guiding implementation of training in commercial business skills. Santos are already supporting CDW training for community engagement, and delivery of associated financial

framework would strengthen community support capability as well as positioning community members to be successful in commercial sago ventures.

Transport logistics will always be a challenge for commercial sago production from Kutubu given distances to major population centres. Scaling from supply to local markets, with potential support from transport logistics stakeholders via backfill in vehicles going to villages to pick up vegetables, through to supplying Mt Hagen open market and other Highland centres and long distance movement via road and ocean routes utilizing existing logistics would appear feasible given enthusiasm expressed in stakeholder discussions.


The opportunity for increased commercial trade of sago flour that is processed to a suitable standard (moisture content, food safety, labelling, etc) appears clear. Import replacement of wheat flour as a minor component of flour blends in bakery products is desired by PNG food processing companies, and volumes that could be absorbed in those markets are substantial. If the capacity to process sago flour to a high standard is able to be established, export markets may also be explored.

One important aspect of commercial significance is the ownership of sago resources. Appropriate modes of acquisition of sago palms must be established including clarification of the ownership structure if larger scale sago starch production and utilization systems are to be developed. Social mapping to identify clear ownership claims may be an effective medium through which to identify and organize sago starch utilization on a more commercially oriented basis.



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Anticipated Sago Program Impacts



Feedback from community and other stakeholders highlighted a number of significant potential impacts associated with the proposed introduction of mechanized sago processing. These impacts were both positive and negative, and would have social, financial and environmental impacts.



Social Benefits

The potential social benefits of sago mechanisation include direct impacts associated with use of the technology and indirect impacts derived from the increased efficiency of starch extraction and associated commercial opportunities derived from increased volumes of sago becoming available. While there are many challenges to manage in establishing sago as a commercial crop in PNG, success in launching sago-based businesses has obvious potential to achieve desired community and livelihood improvements through greater community-driven business activity and employment opportunities.

Women, who are traditionally involved in sago processing, may benefit from a reduction in their workload and alleviation of physical burdens. Young women and girls in particular may benefit from this reduction in time spent processing sago, with potentially more time being available for education. Where other forms of agriculture are practiced alongside sago production, women can allocate additional time to gardens thereby increasing the variety, quality and quantity of food to complement the starch of sago. Improved diet and associated positive health outcomes may therefore be another spin off benefit derived from mechanisation.

Multiple opportunities for engagement of youth may emerge from the introduction of mechanized sago processing. Business development associated with sago commercialization provides an array of employment possibilities. Training in the use and maintenance of sago processing machinery, and development of new equipment to address emerging

opportunities during commercialization, is an opportunity for transferrable skills to be obtained through involvement in activity directly relevant to the community. This may also support mechanization in other agricultural developments in the region.

Sago starch extraction efficiency using the traditional manual process is low due to the difficulty in releasing a high proportion of the starch in the pith from the cells in which it is held using manual milling of the pith. Introducing mechanisation of sago processing, even at the small scale, results in the doubling of the amount of starch recovered and improves sago quality. Increased food security from improved extraction efficiency is a potential social gain for communities in sago growing regions, particularly during periods of natural disasters such as drought, and may impact more broadly across PNG if distribution logistics can connect supply centres to areas of need during disaster periods.

The introduction of the sago mechanisation presents an opportunity to elevate sago's status. Traditional crops tend to decline in status as development occurs in any country, with imported and processed food increasing in popularity. The introduction of novel technology such as mechanized rasping in sago extraction can change community perception of the product, and along with the opportunity for commercial development of value added and subsidiary products the image and sago can be modernized. The flow on impact is increased community pride in sago producing regions and greater impetus to preserve the important cultural aspects of sago in those communities.



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Economic Benefits

Mechanisation will increase sago processing productivity, opening opportunities to market surplus product. Increased yield per sago log will deliver higher volumes for family and community consumption, and where a pathway to market exists will also permit increased engagement in the cash economy. Transitioning sago from a subsistence food source to a commercial crop with multiple raw and processed product markets will deliver economic benefits to communities in sago producing regions.

Communities in the Kutubu region have a very low rate of participation in commercial business activities. Establishing sago as a viable business opportunity, and provision of appropriate training and support to build business acumen in the community, will open further opportunities for new business ventures. This may, for example, include other agricultural crop opportunities as well as new subsidiary sago products such as sago grubs and baked products for sale at local markets.

Components of the sago project may be delivered through the proposed Agriculture Service and Training Hub at Pimaga Station, contributing to the viability and sustainability of the hub as an

important driver of economic benefit to the region. Integration of multiple activities targeting economic development and community benefit is desirable for a robust community support program, delivering synergies between activities and reducing risks of community dissatisfaction through provision of multiple services and impact points. Support for the sago project would contribute to the establishment of this community resource in the Kutubu District.

In the longer term, establishing a processing capability to supply dried sago flour to domestic and export markets has the potential to become a major industry for PNG. A significant market size exists and there is enthusiasm from domestic industries to engage with PNG communities to develop the production and supply capability. As a potential export crop, sago is in the unique position of filling an important staple food product role as well as delivering export possibilities. Development of sustainable production and processing systems would therefore support both domestic food security as well as national economic development agendas.



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Markets for sago

Multiple commercial market opportunities exist for sago. Currently, sago is sold in wet cake form in local community markets in many areas of PNG. The volumes are highest in sago producing regions but stakeholders confirmed that limited volumes are also currently traded in major urban centres. Large price differentials exist between local markets and urban centres such as Port Moresby, suggesting that increased volumes may be sold in the urban centres if appropriate business structures, transport logistics and storage capacity are in place. Interest was expressed by a major supermarket, with some sago currently being sold through that retailer, so expansion in domestic sales via a higher value market may be possible with appropriate processing, packaging and

labelling in addition to business structures, transport logistics and storage capacity.

Processed and dried sago flour has both domestic and export markets. PNG based baking companies are interested in replacing 5-10% of the imported wheat flour used in their production with locally produced starch alternatives. This market may be in the order of 3-500 t/week. Quality assurance systems and processing capacity would need to be developed for market access. Export markets for sago flour are likely to be accessible if the domestic supply capacity is developed.



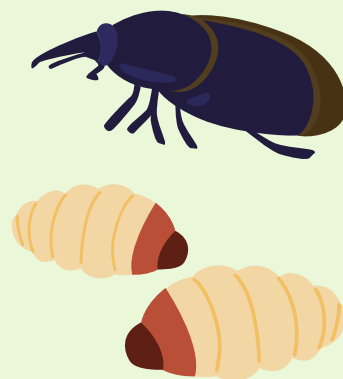
Subsidiary opportunities

The fibrous residue or 'hampas' left over after extraction of starch from the sago palm pith is composed of lignocellulosic material and starch that was not removed during extraction. While in PNG it is generally treated as waste or for stockfeed in some situations, it

can be used in other commercial activities. Scaling of commercial sago processing would open up opportunities for new commercial ventures utilizing the hampas.

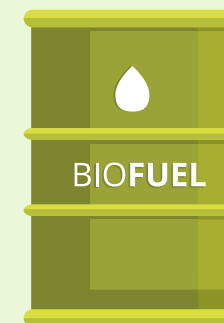
Sago grub

The sago grub is the larvae of the Capricorn beetle (*Rhynchophorus ferrugineus/bilineatus*). The adult beetles lay eggs in sago substrate and in approximately 6 weeks the larvae are ready to pupate and can be harvested. The sago grubs are a traditional food in PNG and traded commercially in open markets.



Biofuel production

Dried hampas may contain up to 60-70% starch, and enzymatic degradation of this starch to produce glucose followed by fermentation to convert glucose to ethanol is the basis of biofuel production.



Mushroom cultivation

The hampas is lignocellulosic, and mushrooms thrive on this waste. The cultivation of edible mushrooms on lignocellulosic and cellulosic residues is well known, and mushroom cultivation from sago extraction waste is practiced commercially in Malaysia and Indonesia.



Charcoal briquettes

Kilning of hampas and sago bark in a furnace with restricted airflow generates a charcoal product which can be pelletised to form briquettes. These are a cleaner burn product than timber and generate a high heat/energy output and may be a valuable fuel source in areas such as major urban centres where timber sources are limited.





Environmental Impacts

The swampy regions where sago grows are ecologically important and are sensitive to disturbances such as land clearing for agricultural development. Large scale commercial production of sago palm could help preserve these sensitive areas with appropriate sustainable management of the resource. By growing sago instead of other commercial crops that require the draining of peat swamps, the benefits of such swamps (preventing floods and maintaining a source of clean ground water) can be retained. The sago palm's large fibrous roots trap silt and remove heavy metals and minerals that may adversely impact life further downstream. The sago palm also requires no fertilisation and has few natural pests or diseases.

There is a risk of loss of genetic resources if commercial sago production results in intensification of production using only the highest yielding/best performing cultivars. Loss of some of the wild diversity in sago that exists in PNG is thus a risk that requires careful management. Mapping current diversity and conserving areas of high diversity should be considered. The lack of intensive cultivation of sago in PNG is beneficial as planning can occur to ensure development is sustainable.

Sago also offers potential as a carbon sink and sago swamps are important for biodiversity conservation. Management strategies that enhance these aspects will be beneficial in any international trade that developed for PNG sago.


Socio-economic Risks

Implementation of a change within a community can lead to unintended adverse social and economic impacts. These include disputes over ownership of resources, jealousies induced by perceived advantages provided to particular members within the community, adverse financial outcomes, changes in work expectations and decision-making responsibilities, and changes in perceived status. While the sago program offers many potential benefits to the community, the risk of adverse social and economic outcomes must be acknowledged and appropriate strategies established to mitigate risks. In particular, managing potential tensions between genders will be crucial moving forward. Both men and women emphasised the need for transparency throughout the program at all stages. The community engagement strategy and do-no-harm philosophy are central to this risk mitigation approach.



Recommended Sago Program Implementation Plan





A core program of activities designed to introduce mechanized sago processing into the Kutubu communities and support the development of economic and employment opportunities in the communities has been recommended. Change in PNG communities, particularly when economic opportunities are involved, needs to be managed carefully to avoid unintended consequences from any interventions in the communities. An overarching philosophy of 'do no harm' and strategy of community-led development is therefore proposed across all implementation activities.

The implementation plan describes recommended component activities that may be managed individually but are designed to integrate with other component activities so an overall program coordination component is required. The program coordination component would also include responsibility for oversight of the community-led development and do no harm strategies to ensure consistency across component activities.

Commercialization of sago production has the potential to impact communities across PNG, and additional component activities are proposed that would guide the development beyond the Kutubu region. These components are detailed in the implementation plan but are not presented as core program activities. Further consultation with stakeholders in other sago producing regions to refine the proposed components is recommended if expansion of the sago project beyond the Kutubu region is pursued.

Core Program Components

Six core projects are recommended. These are:



1 Introduction of small-scale mechanized sago processing



2 Development of commercial markets and supply chains



3 Community capacity building



4 Establishing subsidiary opportunities



5 Scaling up processing capacity



6 Sustainable production practices

In addition to these core components, four additional components may be considered if the sago project is expanded beyond the Kutubu region:



7 Introduction of sago processing to other sago production regions



8 Value chain analysis and market development



9 Mapping of the PNG sago resource



10 International engagement

The following sections detail the proposed activities, timelines, potential project partners, alignment with other components and indicative budgets. It is important to recognize that for community-led development the Kutubu community (and communities in other sago producing regions if the project expands beyond Kutubu) must be consulted and have a strong say in the nature and direction of the activities, so the proposed program has to be considered as an active document with modifications likely via community feedback and involvement. The Program Coordination component is central to management of this process.

Core Projects in the Sago Program



1. Introduction of small-scale mechanized sago processing

Activities

- One prototype small-scale sago processing unit based on the concept design developed in the evaluation project to be fabricated in Australia and transported to Pimaga (Agricultural Service and Training Site) for assessment.
- Evaluation of prototype unit at Pimaga, and refinement of design if required. Detailed drawings completed for mechanized rasping unit and a further three units fabricated.
- Community introduction and familiarization for mechanized sago processing technology. Community representatives (selection via community engagement processes run by Program Coordination team) visit Pimaga for demonstration of the mechanized sago processing.

- Identify three locations (villages/wards) to be involved in small scale, mobile sago processing activities. Work with community to identify strategies for access and use of the units that will be accepted by the community. Aim for units to replace manual processing for domestic consumption within the community rather than production of sago for commercial sales.
- Research undertaken to identify challenges and opportunities associated with community use of the units in the three communities. Refinement of familiarization training and community selection mechanisms based on research findings to inform roll out of further units to other communities in Kutubu.
- Establish fabrication capability for sago rasping units in PNG. Training in fabrication and unit repair skills may be possible at Training College at Pimaga.
- Establish supply chains for parts and operating inputs to support continued operation of mechanized sag processing units.

Timeline (indicative based on commencement of program Q1 2024)

first half of 2024	mid 2024, & ongoing.	end of 2024	end of 2024	start of 2025	start of 2025
Supply of demonstration unit by first half of 2024	Initial community familiarization and training in use of units completed by mid 2024, and ongoing.	Units supplied to 3 communities by end of 2024	PNG fabrication capability established by end of 2024, with locally fabricated units produced in early 2025	Fabrication and repair training established for implementation at start of 2025	Supply chains for parts and operating inputs in place and functional by start of 2025

Alignment with other projects

- Introduction of the units into communities must be done in coordination with the community capacity building component to ensure the introduction is community-led
- Research on the unit introduction process will inform development of strategies in Project 7 (introduction of sago processing units into other regions)
- Feedback on unit performance will inform development of new mechanized units (including starch separation/cleaning steps) in Project 5 (scale up of mechanized sago processing)



2. Development of commercial markets and supply chains

Activities

- Conduct a scoping study of markets applicable to the scale of production possible with small scale units. Identification of markets, price and demand elasticity, and supply chain logistics options to be included in the study.
- Establish a local supply chain servicing health facilities, schools and other institutions nearby to Pimaga. This will require a sago consolidation point to be established to manage supply from communities using the mechanized sago units supplied in the project, supplemented with product generated through use of the demonstration unit in Pimaga.
- Engage with logistics partners to trial commercial supply to nearby large town markets including Mt Hagen and to resource sector bases. Support for community members to establish consolidator capacity to deliver sufficient volumes and quality to logistics partners. Market development through promotion of recipes using sago that are suitable for institutional markets, resource industry bases and open markets (cakes, biscuits, muffins).
- Expand on Highlands partnerships or establish new partnerships to establish supply chains able to deliver sago to markets including Lae and Port Moresby.
- Research completed on supply chain functionality, mapping production processes to assess product flows (physical and monetary) and evaluate the overall usage of time and resources. Identification of areas of chain function that may require strengthening to ensure long term sustainability.
- Establish supply chains to deliver sago flour to baking businesses in PNG. Processing capability in place to deliver required quality, including packaging and labelling.

Timeline (indicative based on commencement of program Q1 2024)

mid 2024	end of 2024	end of 2024	end of 2024	2027
Market scoping study to be completed by mid 2024	Supply to local markets to be in place by end of 2024	Supply chains delivering sago to Highlands towns and resource sector bases in place by end of 2024	Supply chain analysis research commencing in mid 2024 and ongoing.	Supply chains delivering sago and processed sago flour to coastal urban markets and baking businesses by 2027

Alignment with other projects

- Timing of market supply, and agreement on volumes, requires alignment with Project 1 (introduction of small-scale processing units).
- Community capacity building in financial literacy and business acumen skills delivered in Project 3 (community capacity building) is needed for community members engaging in commercial market development.
- Development of recipes suitable for institutional markets, resource industry bases and open markets will require development research and training delivered in Project 4 (establishing subsidiary opportunities).
- Drying, packaging and labelling of sago will be needed to deliver consistent quality sago into more distant markets. Project 5 (scaling up processing capacity) will deliver this capability before the activity targeting coastal markets is initiated.





3. Community capacity building

Activities

- Conduct a basic training skills assessment to identify existing assets and training needs within Kutubu.
- Develop and implement a community training plan for the demonstration and implementation phase of sago mechanization in communities. Exact training to be negotiated with community.
- Integrate the Family Farm Team (FFT) training or Family Business Management Team (FBMT) training into the community to build women's economic empowerment and promote gender equity. Training of approximately 30 community members.
- Community Development Workers (Santos officers) to work with an experienced trainer as part of a mentoring and assessment process as per CDW National Standard.
- In each location, CDWs to facilitate a one-day community planning exercise. Each location (village/ward) identifies their priorities for achieving their sago project goals. Road A priority – what they can achieve themselves; Road B priority– what they need help with.
- Develop a 'Sago Action Plan' for each location in collaboration with CDW.

- Deliver the Sago Action Plan following a participatory project cycle.
- Continuously monitor and assess risks and impacts associated with execution of Sago Action Plans.

Timeline (indicative based on commencement of program Q1 2024)

early 2024	mid 2024
Training assessment and planning completed by early 2024	Family Farm Team (FFT) training or Family Business Management Team (FBMT) training commencing by mid 2024
end of 2024	training programs
CDW facilitated one-day community planning exercises completed in each community by end of 2024	Sago action plans implemented in communities, including reviews and delivery of training and support identified through the training program.

Alignment with other projects

- Community views gathered in this project are required to guide program coordination in a community-led approach for the program. This input will then flow through to influence the timing and delivery of activities in all other projects.



4. Establishing subsidiary opportunities

Activities

- Establish and deliver a recipe development program for institutional markets, resource sector camps and open market snack food markets. Establish facilities at the Pimaga Agricultural Service and Training site for this development research, and for training of community members in cooking items suitable for sale as snacks at local marketplaces.
- Research production practices suitable for growth of sago grub under managed culturing conditions using products from mechanized sago processing.
- Document instructions for sago grub production and train community members in production practices to facilitate sago grub production for community consumption and/or to be traded commercially in open markets.
- Research production practices suitable for growth of mushrooms under managed culturing conditions using products from mechanized sago processing.
- Document instructions for mushroom production and train community members in production practices to facilitate mushroom production for community consumption and/or to be traded commercially in open markets.
- Establish the research and development capability to investigate additional subsidiary opportunities including biofuel production and charcoal briquettes.

Timeline (indicative based on commencement of program Q1 2024)

mid 2024	mid 2024
Recipe development to commence mid 2024 as sago from mechanized processing becomes available.	Sago grub research and mushroom production research to commence in mid 2024.
Alignment with other projects <ul style="list-style-type: none"> • Project 3 Community capacity building should inform strategies for integrating subsidiary opportunities into their sago action plans. • Information from Project 2 (supply chains and markets) is required for commercial development of subsidiary opportunities. 	





5. Scaling up processing capacity

Activities

- Establish capability to wash and purify sago wet cake material delivered to the central consolidation site at Pimaga, and package for target markets. Capacity to test sago samples for quality control is also recommended. This capability will facilitate supply of sago from Kutubu to more distant markets with reduced risk of loss of shelf life before sales and of health risks from sago consumption.
- Investigation of drying technologies to reduce moisture content to levels where extended shelf life can be achieved. Research drying rates using selected drying technologies to identify optimum product flow, timing and management to achieve an acceptable quality product.
- Undertake analysis of sago starch samples produced in the Kutubu region to confirm composition, physical properties and nutritional information. Confirm suitability of product for supermarket and bakery sector market in PNG, and complete economic analysis to assess viability of those markets.
- If market access is assessed as viable, establish packaging and labelling capacity at Pimaga to deliver sago to supermarkets in major urban centres.
- Engage engineering/fabrication firm to prepare concept plans and detailed drawings for equipment suitable for starch extraction, purification, drying and packaging at a fixed-site processing facility.

- Establish sago flour production capability able to supply the volumes and quality needed to supply the baking sector in PNG.

Timeline

2026	2027
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Timing dependent on rate of development of commercial sago processing. Anticipated timing in 2026 with supply chains then delivering sago and processed sago flour to coastal urban markets and baking businesses by 2027.

Alignment with other projects

- Information from Project 2 (supply chains and markets) is required for commercial development of processing capacity.
- Project 3 Community capacity building should inform strategies for integrating processing scale up opportunities into community sago action plans.



6. Sustainable production practices

Activities

- Undertake detailed research to determine the impact of changing from manual to mechanized sago processing on volume of sago produced. Model the impact of that change on available sago starch based on current rates of sago harvesting to determine volume of sago potentially available for commercial markets (to be used in analysis with the market scoping study in component 3).

- Develop and implement a program to promote best practice in replanting of high yielding sago palms, and management of sago resources to optime productivity.
- Document biomass production and ecological diversity in areas where sago is being extracted in the Kutubu region as baseline data for potential use when opportunities for sago projects to be included in carbon markets and/or biodiversity markets are identified.

Timeline

2024	2026
Data collection process to be implemented in 2024 when mechanized sago processing is introduced, and ongoing throughout the program.	Best practice program and biomass/ecological diversity mapping processes developed in 2026 (timing dependent on rate of uptake of mechanized sago processing and sago market development)

Alignment with other projects

- Project 3 Community capacity building should inform strategies for development of sustainable production practices into community sago action plans.



7. Introduction of sago processing to other sago production regions

Activities

- Develop a process for evaluating opportunities in other sago production regions. The process should include assessment of nature and amount of partner engagement and investment in supporting the introduction of mechanized sago processing units.
- Generate full costing data for fabrication and delivery of the small-scale processing units, and information package on training and operation of the units. Long term aim is for commercial suppliers of small-scale processing units in PNG to operate independently of donor support programs.
- Facilitate connections between key participants in sago production, processing, distribution and regulation throughout PNG to position for potential export market development. An annual sago meeting to discuss and disseminate information on activity in PNG is an option to strengthen connections.

Timeline

2024	2026	2026
Evaluation process can be undertaken after establishment of sago processing in Kutubu, and collation of learnings from that process.	Costings process able to be undertaken when PNG fabrication capacity is established.	Annual sago meeting could be initiated within the core sago program and continued beyond life of the program.



8. Value chain analysis and market development

Activities

- Full value chain analysis of functioning chains operating in PNG for sago flour supply to better understand the key control steps and pricing points. Document findings to support existing PNG chains and support development of export chains.
- Identification and assessment of potential export markets. Review major international users of sago flour, including where possible existing supply chains, volumes, prices and product specifications. Generate full production and supply to port costings, and product composition descriptors, for dried sago flour in PNG.
- Engagement with international players in the sago industry to establish access to priority export markets.

Timeline

- Timing of activities is dependent on rate of development of the sago industry in PNG



9. Mapping of the PNG sago resource

Activities

- Survey of communities in sago production areas to estimate current sago harvest rates and available resources.
- Research the genetic diversity of sago in PNG and identify high performing material from different production regions.
- Establish a sago germplasm repository to assist in conservation of the diversity present in PNG.
- Undertake research to establish a remote sensing capability to map number and distribution of sago palms in PNG based on satellite imagery. Ground-truthing of the remote sensing methodology (physically mapping location of individual palms in different regions and assessing the accuracy of the remote sensing in detect those palms) is required.

Timeline

- Timing of activities is dependent on rate of development of the sago industry in PNG





10. International engagement

Activities

- Identify key participants in sago production, processing, distribution and regulation throughout PNG. Support key participants to engage in international sago events such as the regular research symposiums held every 2-3 years.
- Establish research capability in PNG to support sago industry development. Support key researchers to undertake studies on aspects of sago production, processing and use, in partnership with communities and businesses involved in the sago industry. Encourage researchers to collaborate with international colleagues.
- Support international sago industry representatives to visit PNG and engage with the key industry stakeholders and researchers.

Timeline

- Timing of activities is dependent on rate of development of the sago industry in PNG

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Santos Foundation Limited

OFFICE

Stanley Esplanade,
Harbourside East Building
Level 1,
Port Moresby
Papua New Guinea

MAIL

PO Box 842
Port Moresby
NCD 121
Papua New Guinea

PHONE

+ (675) 322 5599

www.santosfoundation.org

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