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IIT Bombay

SUN TZU

GREENGROW

TARUN SHARMA | SJMSOM, IIT Bombay

AVALON
Consulting

About the Case

GreenGrow is **establishing RNG plants to convert agricultural waste,** specificall y paddy straw, into renewable natural gas.

Farmers are generally **unaware of the demand for paddy straw** from RNG plants and the negative effects of burning it.

Paddy straw, a vital feedstock, **must be collected within 15-20 days** post-harvest to prevent burning and prepare for the next planting season.

Straw quality parameters including **seed quality, moisture, dust, and density i nfluence the Gross Calorific Value** (GCV) for energy production.

Procurement costs fluctuate due to seasonal availability, with **off-season prices often doubling,** emphasizing strateg ic timing.

GreenGrow seeks consulting expertise to **design a procurement strategy**, ensuring sustainable supply, high GCV, and cost efficiency.

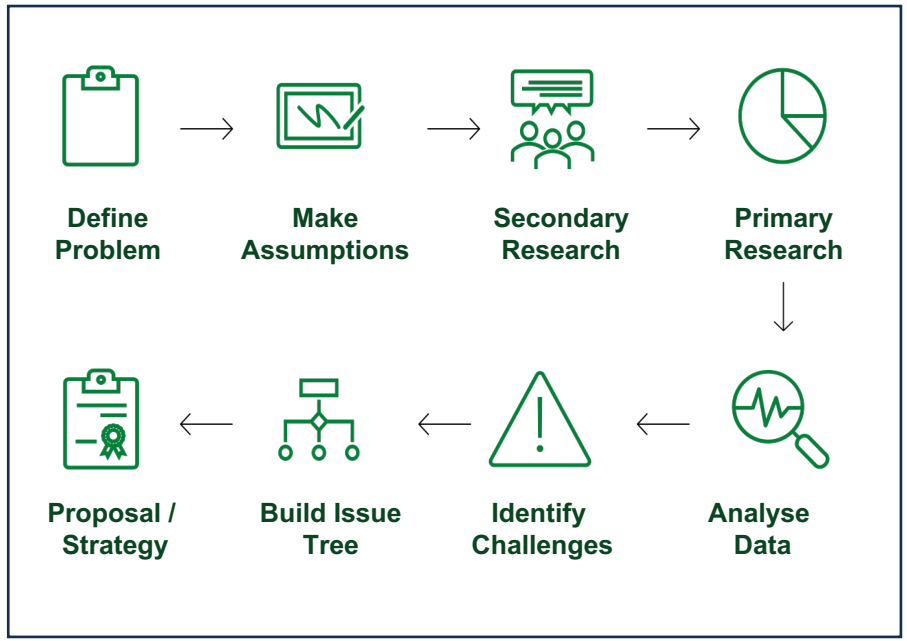
Problem Statement

To establish an effective procurement strategy for sourcing paddy straw from the agriculture sector to fuel the client's RNG plant

Key Deliverables

- Issue tree
- Plan for Procurement strategy
- Questions to client for further analysis

Approach



Key Players: Farmers, Collector, Brokers
Key Challenges: Price Fluctuations, Weather conditions, availability of equipment, awareness among farmers

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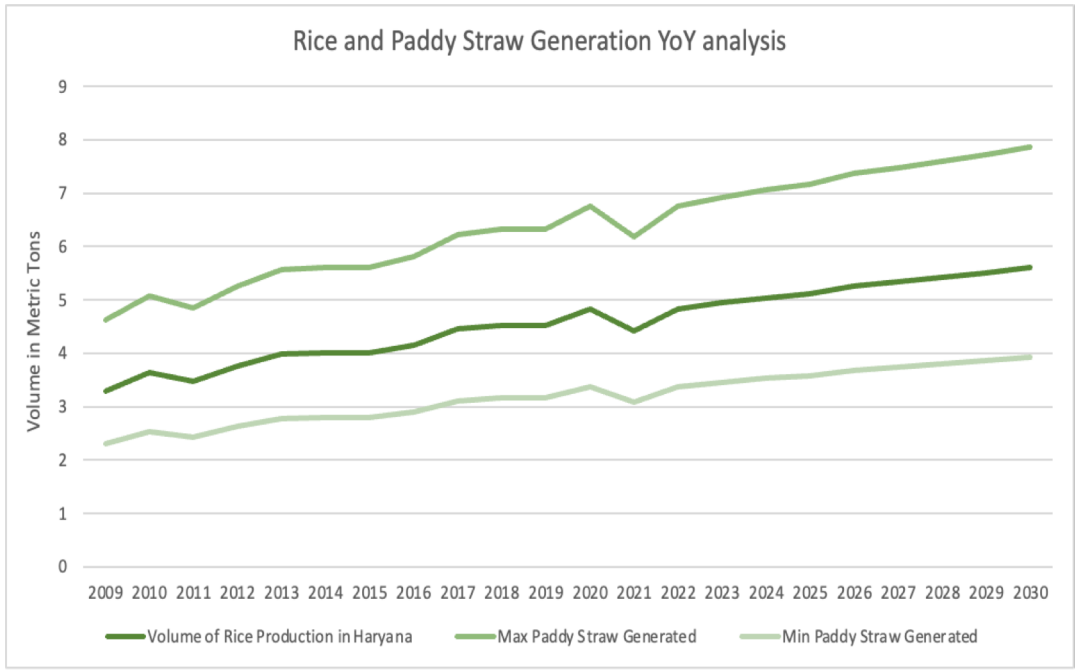
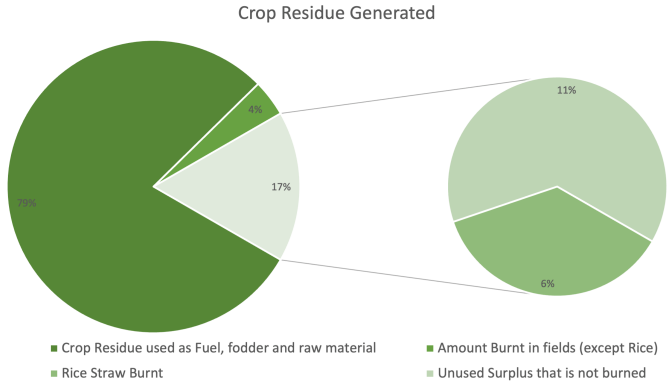
Depending on the variety and growth of paddy, the ratio of straw to paddy varies from 0.7 to 1.4

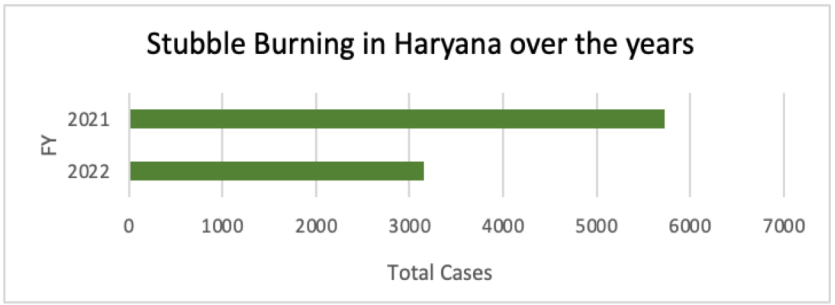
Using Forecast function in Excel the estimated Paddy Straw generation is calculated for the period of 2023 - 2030





Data representing the amount of crop residue generated and burnt (in the year 2021) and the percentage of paddy straw in that

Haryana government has claimed that it has successfully achieved **45% decline** in stubble burning last year from September 25 to November 15 as the state recorded 3,149 incidents of farm fires in 2022, compared to 5,724 in the corresponding period in 2021.



Decrease in Calorific Value over the Period in a Year

Color Code	% Decrease of GCV from Initial
	0% - 1%
	1% - 2%
	2% - 5%
	5% - 10%
	10% - 20%

20.49% ↓

total decrease of from the initial value after one year.

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Focused Interview

28, Male, Haryana
Plant Owner, 3 Years Work Experience

Q. What time is paddy straw available?
A. 1st Sep to 15th Nov

Q. What is the general amount of paddy that one can get per acre of land?
A. 15 quintals to 35 quintals depending on the variety of paddy.

Q. The quality of paddy straw can be affected by many factors like the quality of paddy, soil, variety of paddy, moisture content, dust particles etc. How does one take all this into account while procuring straw?
A. It is not possible to keep all these factors into account, and it is very difficult to have reliable data on these points. We consider only moisture content as the metric while procuring paddy straw.

Q. How much moisture content is acceptable?
A. Moisture up to 22% is acceptable, above which there will be a deduction in prices.

Q. What is the general mode of transportation used to move straw from farms to plants?
A. Trolleys

Q. How is paddy straw made ready for transportation?
A. Cutter, then racker and ultimately baler puts the paddy straw ready for transportation.

Q. How much does a baler typically cost?
A. 18 lakhs to 1 crore, depending upon the size, model and manufacturing company brand.

Q. How does one store the paddy straw if he/she wants to sell it at a better price during the off-season?
A. Farmers store it in open farms only, dedicating a certain part of their farmland to this activity.

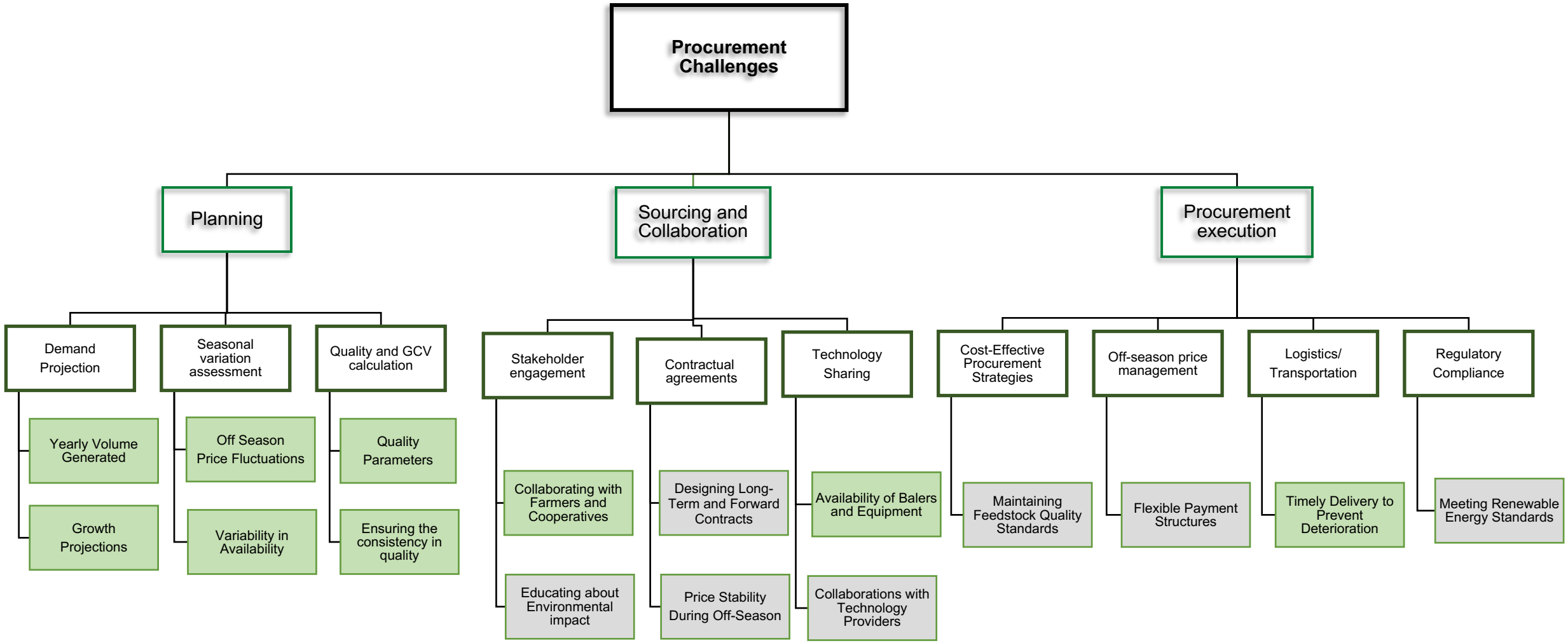
Q. What amount of paddy straw can typically be stored per acre?
A. 12 quintal/acre

Q. What is the ballpark figure at which paddy straw is generally bought?
A. INR 160/quintal

Q. What are the general expenses incurred in the power plant?
A. In broad headers are machinery costs, diesel for transportation, labor costs, and repairment costs.

Q. One would like to procure year-long paddy straw requirement in season only. How does this play out, and is it possible to buy these huge quantities at once?
A. Funds/capital requirements will be huge for this, which is the major reason and also the seller side is also aware that off-season could fetch them better prices.

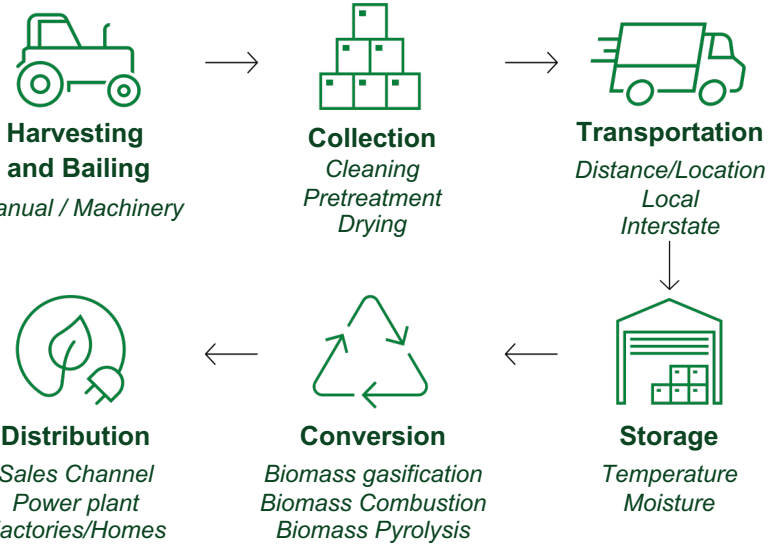
Q. There is improvement seen in the amount of paddy straw being burnt by the farmers YoY. Does the government have any role to play in this?
A. Yes, the government in Haryana is giving INR 1000/acre for not burning paddy straw so that it can be used for different purposes and to reduce the air pollution from burning.



Quantitative Factors for Procurement Strategy

Qualitative Factors for Procurement Strategy

Supply Chain



Assumptions

- Each RNG plant has a fixed and consistent capacity to process paddy straw.
- Relatively balanced distribution of straw collection across the 3-month period when paddy straw is available.
- Balers are available for rent during the entire paddy straw collection period.
- There is a linear relationship between the area of paddy fields harvested and the amount of paddy straw produced.
- Demand for RNG production remains relatively steady throughout the year, without significant fluctuations.

Questions for Client

Current Situation

- Can you provide an overview of GreenGrow's existing RNG plants and their capacity?
- What's the requirement annually to operate these plants at full capacity?
- What are the geographical locations of the existing and planned RNG plants in Haryana?
- Are there any existing contracts or agreements with farmers, baler owners, or other stakeholders for straw supply?
- Can you provide insights into the distribution of your current paddy straw suppliers?

Feedstock Requirements

- Have you identified specific quality parameters of paddy straw as most critical for your RNG plant's efficiency?
- Should we evaluate the feasibility of using other agricultural waste as potential feedstock during off-seasons?
- Can we explore the opportunity to incentivize farmers to adopt alternative straw disposal methods?

Supply Chain and Logistics

- How is the current transportation and storage facility of GreenGrow?
- Can we explore the opportunities for collaboration with baler owners to ensure a more consistent supply?

Future Expansion and Predicted Demand

- What is the plan for the upcoming GreenGrow's plant in terms of capacity, timeline and locations?
- What is the predicted growth in existing RNG plant capacity and corresponding paddy straw demand?

Budget and Investment

- What is GreenGrow's budget for feedstock procurement and associated logistics?
- Are there any cost constraints or optimization goals that need to be considered?
- Can you provide GreenGrow's financial statements to understand the expense components?

Paddy Straw Collection Using Baler	First Mile Transportation (Deal with the Contractor)	Interim Storage Location (Optional)	End Mile Transportation	Plant Storage and Preparation of for feeding into burner
Paddy Residue is chopped off from the field and collected using baler	The bales are loaded in a trolley/trailer and delivered to nearest straw bank	Bales are unloaded and stored in the straw bank. This stage is optional as it can be directly sent to the plant for processing.	The bales are palletized and sent to the factory for further process.	The bales are then processed for biomass production to generate energy

Observable Points in the Procurement Strategy

Accurate prediction of yearly paddy straw for power, awareness campaigns for farmers and villagers, discouraging burning, promoting sales, and motivating local collectors.

Post-harvest, gather paddy straw using baler machines, potentially rented from power plants or contractors. Government subsidies promote eco-friendly practices, reducing burning. Transport and storage follow.

Storage facility preparation crucial. Open areas benefit from cement or wood flooring to prevent rain damage. Covered storage minimizes weather impact, affecting land cost and fuel expenses.

Transportation expenses cover labour, loading, unloading, vehicle rent, and fuel. It involves moving straw from fields to storage or power plant.

Microbes and moisture cause paddy straw deterioration during storage due to biomass composition and environmental conditions.

Higher generation costs can impact annual returns. Efficient study should be made to promote efficient paddy straw utilization for power generation, reducing procurement losses.

TEAM DETAILS

COLLEGE: SJMSOM, IIT BOMBAY

Chief Strategist

Tarun Sharma

Email id: tarun.sharma@sjmsom.in