

PART 1: SOLUTION SUMMARY

REDEFINING has designed a solution that will help achieve a zero-waste-cocoa beans production process by upcycling cocoa pods husks (CPH) to produce organic fertilizers, bio-soaps and animal feeds. Our pilot project, which is the production of organic fertilizer, is motivated by our desire to create an environmentally and economically sustainable venture from a supposedly waste product. REDEFINING will be working closely with cocoa farmers and the community, buying their CPH, developing a database of cocoa production and offering advice on sustainable farm practices which will create additional income streams for farmers and improve the wellbeing of the community.



Figure 1 Fresh Cocoa Pod Husks

REDEFINING Team

REDEFINING consist of an interdisciplinary team studying in four different countries and represent five different majors, which are all relevant to the wicked problem we are tackling:

				
Aisha Balogun	Oluwakemi Badusi	Ohagwu Collins	Fatimah Owolabi	Mukhtar Hamzat
CTO	Research Lead	CEO	CFO	COO
University of Wyoming Computer Engineering	Wellesley University Chemistry	EARTH University, Agricultural Science	African Leadership University Entrepreneurship	Ashesi University Electrical Engineering

REDEFINING has been collaborating with several stakeholders and subject experts in our various institutions and beyond to realize the design of this product. We had collaborated in areas of financial modeling, prototyping, and product design.

Mentor

Respect Musiyiwa
Director and Founder,
Eco Connect Natural Foods

Partners



GAMFRUITS

PART 2: CONTEXT

Although Cocoa has been a major cash crop in West African countries like Nigeria, Ghana, and Cote d'Ivoire, research by Fair Trade International revealed that most of the cocoa farmers do not earn a livable income [1]. Also, a feasibility study conducted as part of the International Cocoa Organization project indicated that recycling cocoa waste will result in enhancement of farmer's revenues by up to 13% - 18% [2]. These statistics show the importance of harnessing these byproducts. Fortunately, these byproducts are available in large quantities as the World Cocoa Foundation predict that the quantity of cocoa pod husks waste lying annually in Nigerian farms is about 1 million tones (on a dry weight basis) [3]. This number seems plausible since each ton of dry cocoa represents 10 tons of CPH. Moreover, the CPH, which constitutes most of the cocoa byproducts, has proven to be the most useful. The main reasons for the low adoption of these waste materials borders on the poor education of farmers as well as inadequate investments to sustainably commercialize these opportunities.

Presently, cocoa pod husks are either left on farms, thrown away or used in small quantities in local soap production or as a source of energy. However, these uses have been recording poor growth recently. The following are the negative effects associated with the current disposal method.

Leaving CPH to rot on the Farms

Huge percentage of the cocoa pod husks are left to rotten on the farms as most farmers have no use for it and in need of an easy way to dispose it. However, this practice contributes to the propagation of pests diseases (e.g. pod rot) and serves as an abode for pests and pathogens of crop, livestock and humans. [13]. Others decide to **throw them away** to provide more space for their next farming circle [15]. With the increase in global demand for cocoa, the waste generated from the industry is becoming a more serious challenge.



Figure 2: Rotten Cocoa Pod Husks

Subsistent Uses

A very negligible amount of Cocoa pod husks is being used for local soap making [4], and sometimes a source of fuel. Many of these small-scale businesses are fading every day due to the inability of locals to compete with more modern brands. Hence, more of these CPHs is being considered as waste.

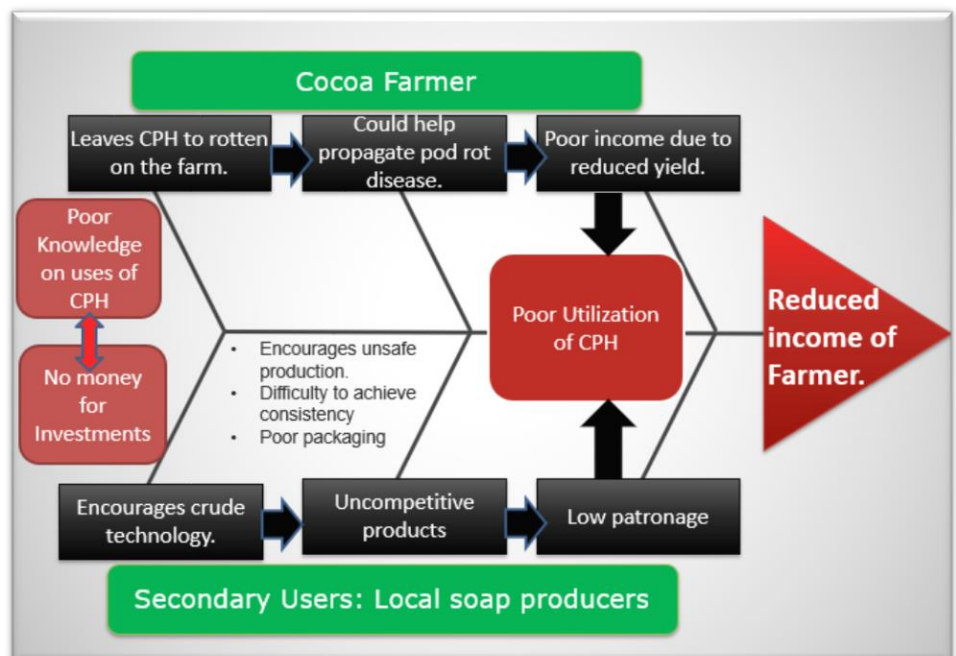


Figure 3: Problem Illustration

PART 3: SOLUTION OVERVIEW

REDEnt will work to reduce agricultural waste from cocoa production to create organic fertilizer. Organic fertilizer production is favored as the pilot project as our field research showed a ready market for them. Furthermore, organic production will ensure the conversion of the waste as a threat to the environment to a preserver of the environment. Our approach can be placed under two main headings: the fertilizer production and advisory services.

FERTILIZER: Nigeria has been implementing large-scale fertilizer subsidies since the 1970s with the broad objective of promoting agricultural productivity [5]. In 2014, the Federal Government of Nigeria Spends **76 Billion Naira (\$382 Million)** as Subsidy for Fertilizer [6]. Despite this, farmers' access to fertiliser has remained a huge challenge on a yearly basis in the country. the seasonal lack of fertilizer supply gives rise to high fertilizer price which is a factor that also causes low fertilizer usage.

Potassium is the highest nutrient uptaken by cocoa plants [7]. This nutrient is essentially used in the formation of the cocoa fruit. A research by the Cocoa Research Institute of Nigeria (CIN) showed that the economic efficiency index of using cocoa pod-based fertilizer was 4.41 and that of non-user to be 1.38 [8]. This study thus recommends the wide adoption of cocoa pod-based fertilizer. Its productivity is essentially affected by the late arrival of fertilizer to the market. In addition the two big fertiliser companies in Nigeria, Indorama Fertiliser and Chemical Limited and Notore, with a joint production capacity of 1 Million MT, only pay more attention to urea production [9].

Hence, REDEnt will be producing CPHs based fertilizers which are **41% rich in potassium** [10] , **environmentally friendly** and relatively **cheaper**.

Advisory Services: Much more than producing quality and plant friendly organic fertilizer, caring for our customers, who are the reason why we are in business, is going to be second to none as we will go the extra mile to get them satisfied. REDEnt is partnering with GamFruits to help roll out its data services platform that will provide farmers with reliable and accurate data on sustainable farm practices. The platform will also have information about other players in the industry such as NGOs and government programs that the farmers can benefit from. The goal is to ensure that the farmers can earn livable incomes whilst engaging in sustainable farming.

We will be sharing the information on the platform with farmers and collecting data on cocoa production during days meant for collecting cocoa pods from them.

REDEnt will collect, dry and store enough CPH during the harvest seasons to ensure consistency in the availability.

In line with the principles of the circular economy, REDEnt goal is to convert the “wastes” from cocoa bean production into useful product such as organic fertilizer which can help increase farmer’s income whilst preserving nature.

Mission Statement

Our mission is to establish a small scale but standard Cocoa Agricultural Waste Organic Fertilizer Company that will process cocoa pod husks (CPH) into organic fertilizer which will be sold within and beyond Kwara State, Nigeria.

Vision Statement

Our vision is to establish a small scale but standard Cocoa Agricultural Waste Processing Company with a 100% conversion of cocoa pod husk (CPH) into an ecosystem of high-quality and valuable products ranging from organic fertilizer, bio-soap and animal feed.

Why not inorganic fertilizer?

Excessive use of inorganic fertilizers leads to a decline in soil organic matter content, increased soil acidity, degradation of soil physical properties, nutrient toxicity and increased rate of erosion due to the instability of the soil aggregates [11].

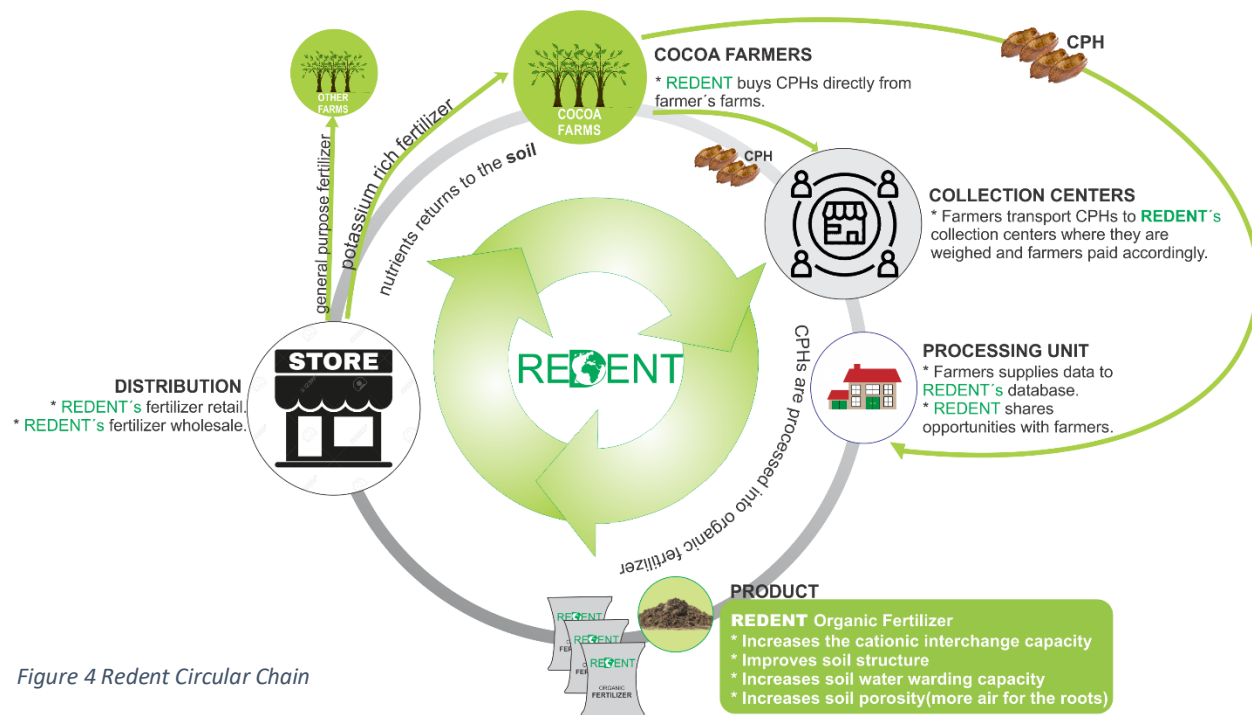


Figure 4 Redent Circular Chain

Next Step

Next Best Thing

SOAP PRODUCTION: CPH serves as a good source of potash gotten from the ashes after burning. However, the inevitable liberation of CO₂ during the burning process also poses an environmental challenge.

REDEnt is currently researching on the best carbon capturing techniques [14] and harnessing the generated heat energy.

Next Thing

ANIMAL FEED: Though CPH has been shown to be a viable constituent for animal feed, it contains theobromine which could be poisonous.

REDEnt is currently researching on the safe concentration of theobromine for different common farm animals like pig, cow, and chicken.

PART 4: DETAILED MATERIAL ANALYSIS

Input

The main raw materials required to make the organic fertilizer are CPHs and bovine feces (cow dungs). The CPHs will be sourced from cocoa farmers, and the cow dungs from Rosedale Farm (a large dairy farm in Ilorin, Kwara State, Nigeria with over 800 cows). The whole materials will be sourced within the state in order to reduce transportation cost.

Process

For the decomposition of the parent materials, a 1 x 1 x 2m brick collecting structure is vital. The base is designed to allow the flow of leaches through a pipe.

Output

The final products of this project are liquid organic fertilizer and solid organic fertilizer. They will be packaged in used gallons and sac bags respectively. We'll have a return policy to reduce the environmental risk and economic cost associated with using new ones.

PART 5: DETAILED ECONOMIC ANALYSIS

Redent BMC

<p>Key Partners</p> <ul style="list-style-type: none"> • Cocoa Farmers • Cocoa Research Institutes • Government Agencies • NGOs e.g. Solidaridad • FEPSAN (Fertilizer Producers and Suppliers Association of Nigeria) • Gamfruits 	<p>Key Activities</p> <ul style="list-style-type: none"> • Production • Collection of Pods • Data Collection • Distribution 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Organic Fertilizer • Affordable fertilizer • Data Provision • Easy Disposal of Waste • Subsidized fertilizers for supplying cocoa farmers. • Recycling 	<p>Customer Relationships</p> <ul style="list-style-type: none"> • Visiting Farms • Presentation at Farmers Associations • Data Provision 	<p>Customers</p> <ul style="list-style-type: none"> • Cocoa Farmers • Organic crop farmers • Non-organic crop farmers
<p>Key Resources</p> <ul style="list-style-type: none"> • Raw materials • Compost plant • Employees 		<p>Channels</p> <ul style="list-style-type: none"> • Point of Sales • Direct Delivery • Online Platforms • Retailers • Wholesalers & Retail shops. 		
<p>Cost Structure</p> <ul style="list-style-type: none"> • Payment for pods • Salaries for workers • Rent for production center • Cost for compost structures 			<p>Revenue Streams</p> <ul style="list-style-type: none"> • Selling fertilizers • Delivery services 	

Redent SWOT Analysis

INTERNAL FACTORS

STRENGTHS (+)	WEAKNESSES (-)
<ul style="list-style-type: none"> • Geographical proximity to raw materials and our ideal market. • Partnership with our various educational institutions for research and resources. • Diverse team all related to the wicked problem. • Data Services: Through partnership with GamFruits. • Varieties of products to reach our customer needs <ul style="list-style-type: none"> ◦ Liquid and solid fertilizer ◦ General and Specific purpose fertilizer (potassium rich). 	<ul style="list-style-type: none"> • Team members are relatively new to managing an actual business. • We do not have the financial capacity to start-up or engage in the kind of publicity we intend giving the business.

EXTERNAL FACTORS

OPPORTUNITIES (+)	THREATS (-)
<ul style="list-style-type: none"> • WEGE Prize competition: potential seed funding and expert feedback on project summary and executing our business plan. • Government policies aimed at supporting sustainable farming. • Increasing call for "organic" products around the world. • Increasing need for managing cocoa waste. 	<ul style="list-style-type: none"> • Resistance to change. • Disadvantaged at economies of scale. • Aggressive competition from inorganic fertilizer producers or other organic fertilizer producers. • Illiteracy of local farmers could affect their understanding of data provided.

REDEnt Marketing Strategy

Product:

With the current promotion for organic farm produce. REDEnt organic fertilizer is the ideal choice for organic food promoters like the Organic Livestock and Crops Owners Association of Nigeria

Place:

Our fertilizer plant is raw material based; hence, it is located close to the source of raw materials to reduce transport cost.

We are also close to our market who are the cocoa farmers

Pricing:

The market price is based on production cost and mark up. The segmented market price is also determined based on the economic level of the client.

We will be selling at 23% cheaper than our competitors

Promotion:

Our penetrative marketing strategy will include

- Demonstration plots with partners.
- Leverage on the internet (and social media platforms), local TV and radio stations to promote our organic fertilizer brands
- Encourage the use of Word of mouth marketing (referrals)

REDEnt Sustainability and Expansion Strategy (SES)

REDEnt SES is aimed at building a business that, once it is officially running, will survive off its own cash flow without the need for injecting finance from external sources.

In order to gain customer's approval and penetrate the market, we will be retailing our organic fertilizer cheaper than what is obtainable in the market. For this we have planned to survive on a low profit margin at least for the first year of operation.

In order to have a more stable market on the longer run, we are also making plans to strike strategic partnership with large-scale commercial farmers especially in the northern part of Nigeria, where there are vast but nutrient-deficient agricultural lands.

In order to build the business of our dreams, we will also sort to hire and retain the best professional and laboral hands we can get in the industry and establish more partnerships.

PART 6: IMPACT ASSESSMENT

REDENT is inspired by the abundance of cocoa plantations in states across Nigeria and the CPH wastes generated, farmers struggle to get rid of CPH and increase income and the propagation of cocoa pod disease by CPH's in farms.

Furthermore, the project will help to encourage sustainable practices through our partnership with Gamfruits by providing relevant agricultural information on opportunities available to help farmers in their agricultural practices. The database will help the farmers get access to weather forecasts, lists of NGOs involved in farmers training, organizations providing loans and better markets.

Also:

- Increase farmers yield and their overall income.
- Encourage sustainable farm practices at grassroots level.
- Reigniting interest in the cocoa industry amongst youths.
- Through our work with cocoa farmers, we will be able to provide further data on cocoa production in the state we work in.

Our fertilizer, however, is not exclusively distributed to cocoa farmers. Our business model is designed around the basic principles of sustainability.



PART 7: PROTOTYPING

LIQUID AND SOLID ORGANIC FERTILIZERS.

Production by the Leachate Process

A mixture of meshed CPHs and bovine feces (cow dungs) were placed in a brick leachate plant as illustrated in the photo at the right. The bovine feces serve as an organic source of carbon to enrich the leaches. The leaches were collected in a plastic container for 6 weeks (which is the period for optimum concentration of the following environmentally important soil elements, i.e., N, P, K, Na, Mg, and Ca).

The mixture was then removed and mixed with used vegetable oil to serve as a source of energy to feed the fragmentation and decomposition organisms

Two Products Advantage

Liquid - Highly concentrated enriched leaches as Liquid Organic Fertilizer

Solid - Compost



Figure 5 Liquid Compost



Figure 6 solid compost

PART 8: BARRIER ACKNOWLEDGEMENT

Our major challenge is getting early adopters since we are completely new to the market. However, we hope to tackle this through our strong relationships with the farmers we get CPH from and our partner farmer's associations. We hope to conduct free field demonstrations with the local farmers to easily prove our product without having to be too technical.

We also think that the relative difference in distance of our collection center and the farms may be challenging to some of the farmers. We will try as much to pitch in a centralized location and encourage small cocoa farmers to park and transport their CPHs in bulk. The other possibility would be to have as several collection centers as necessary.

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