

Cocoa Shell Upcycling and Eco-friendly Packaging for Sustainable Chocolate Production

P2 Intern - **Chidimma Ifeh**

Advisors – Paddy Fleming and Dr. Wan-Yuan Kuo

Employer – Greg and Theresa

MTP2  MONTANA POLLUTION PREVENTION PROGRAM

EMPOWERING BUSINESSES TO BE PART OF THE SOLUTION, NOT THE POLLUTION.



Self-Introduction

Chidimma Ifeh



- **Professional/career interest**
 - **BSc. Food Science and Technology**
 - **MSc. Sustainable Food Systems (In-view)**
- **Environmental challenges**
 - **Plastic waste reduction**
 - **Improper waste management**
- **Why join P2**
 - **Research on cocoa farming and chocolate making**
 - **Apply LEAN principles to identify environmental waste**



Significance - Chocolate Industry

Benefits

- Diversification
- Revenue generation
- Economic contribution



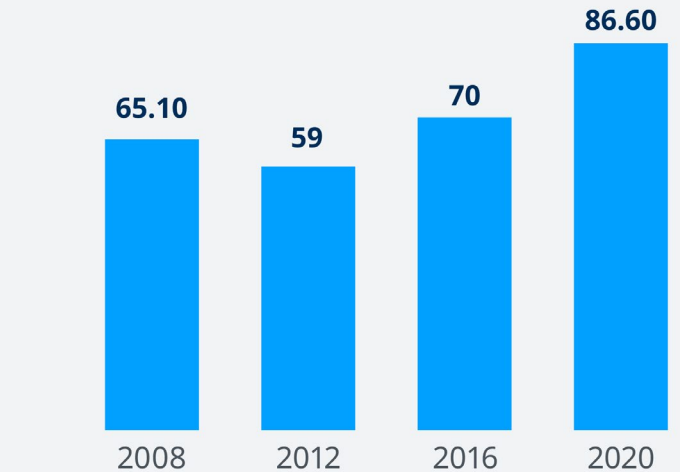
Front Porch chocolate



Cocoa pods

Child labor in sub-Saharan Africa

As of 2020, 86.6 million children aged 5-17 were estimated to be involved in child labor in the region. That means Africa has more children who are put to work than the rest of the world combined



Source: ILO; UNICEF

Issues

- Waste and packaging
- Deforestation
- Labor practices

Company Introduction



Front Porch Chocolate Business Owners

- **Owners**

- **GREG & T**

- Started in 2022

- **Products**

- Dark chocolate bars and sipping chocolate.

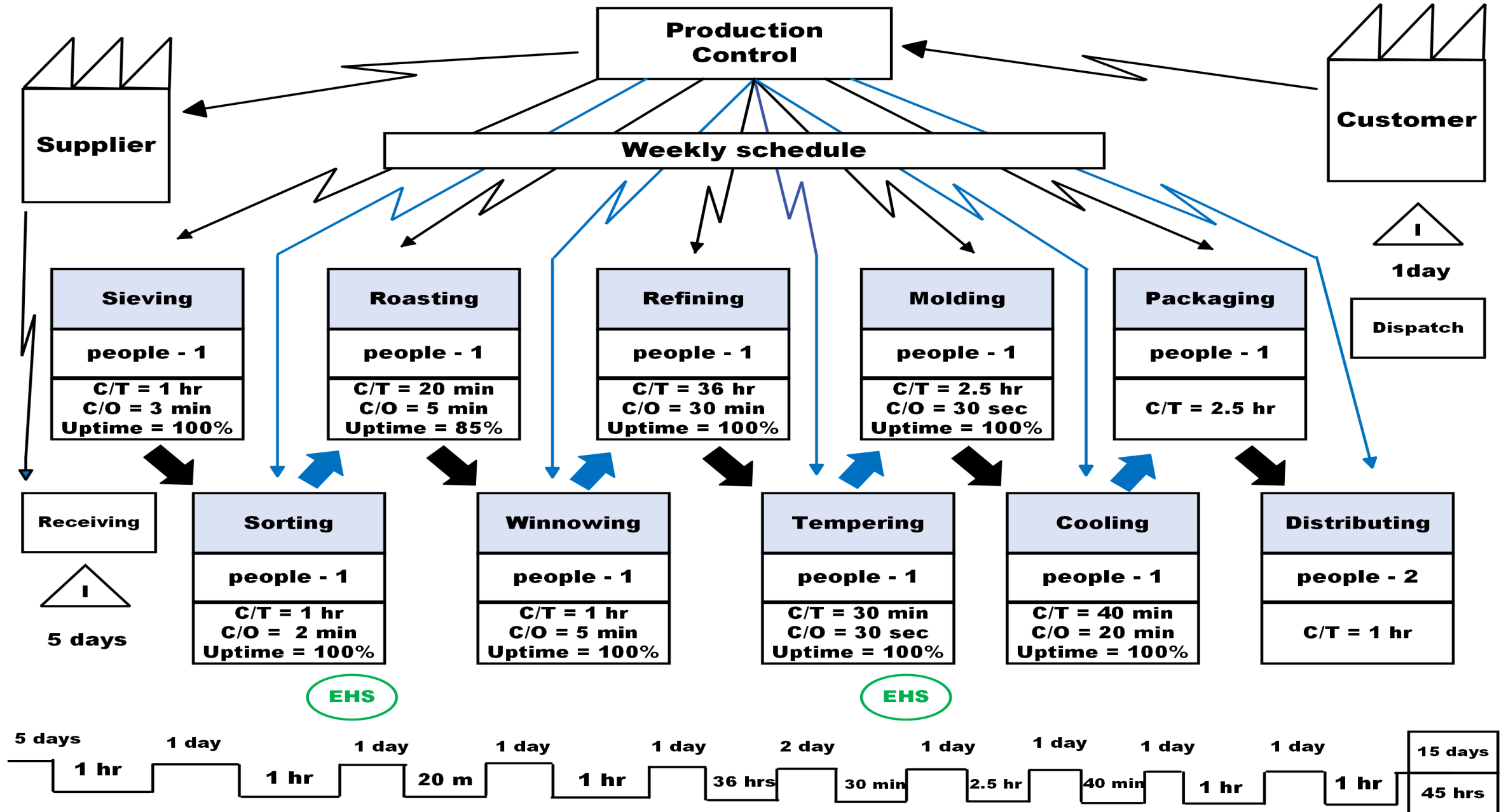
- **Expressed P2 interest**

- Cocoa shells

- Sustainable packaging



Value Stream Map of Chocolate Production



Pollution Prevention Focus – Waste Management

Waste Stream



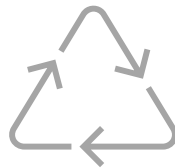
- **Cocoa shells**
- **packaging materials**
- **processing residues**

Goal



- **Minimize waste**
- **Reduce pollution**

Environmental Impact



- **Increased landfill waste**
- **Pollution of land/water/air**
- **Resource depletion**

Strategies



- **Upcycling: Utilize byproducts**
- **Product development: Steak rub**

Trials and results



Sorting cocoa beans



Refining cocoa nibs



Making hemp drink



Cocoa Shells



Hemp drink



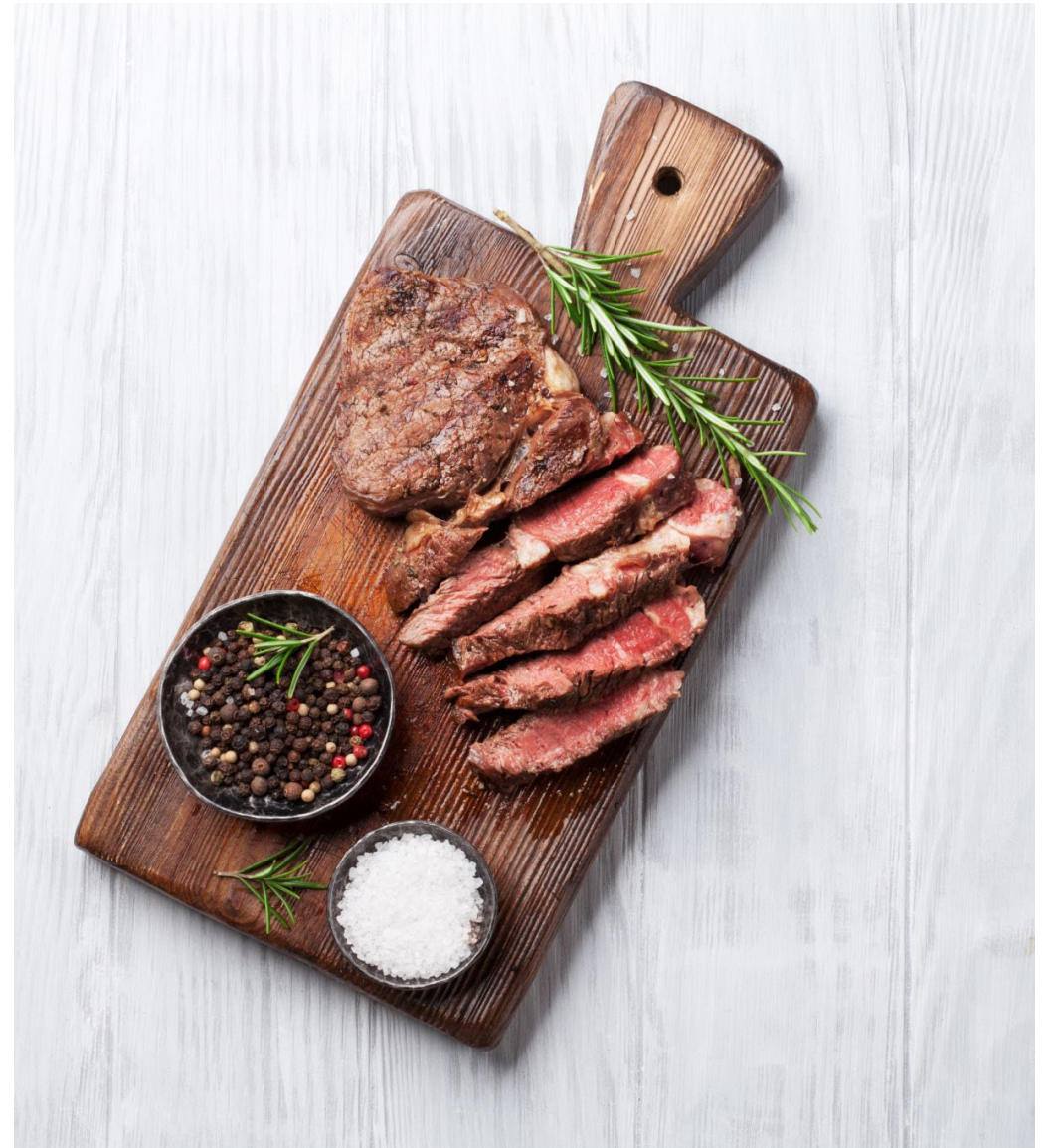
Granola bar



Steak rub

What Next?

- Food safety and quality control - Aflatoxin testing
- Preliminary sensory on protein sources - steak, pork
- Steak rub test marketing – farmers market



P2 outcomes

Recommended P2 Actions	If Implemented:				If Not Implemented:	
	One-time Cost to Implement (\$)	Annual Savings from P2 Action (\$)	Annual Waste (lbs.)	MTCO ₂ e emissions (tons)	Barrier to Implement	Plans to Implement within 5 years? (Pick Y/N)
Winnowing machine	500	1,108	-	-	-	Y
Upcycling cocoa shells	-	3,324	740	-	-	Y
Product sales (Natural gas vehicle)	10,000	-	-	0.0165	Funding	Y

How was these numbers generated?

Annual Waste (lbs.)

- 24kg cocoa beans => 7kg cocoa shells
- 7kg/48 weeks => 378kg ≈ **740 lbs.**

MTCO₂e emissions (tons)

- **EPA** - 0.404 lbs. of CO₂ per mile driven
- 30 miles/hour * 0.404 lbs./mi = 12.12 lbs./hr.
- 3 hr. Drive ==> 36.36 lbs. ≈ **0.0165 tons**

Annual Savings from P2 Action (\$)

Upcycling Cocoa Shell

- ✓ \$8.55/kg - Cocoa beans
- ✓ 24kg - \$205/wk.
- ✓ 30% of \$205 ==> **\$3,324/yr.**

Winnowing Machine

- ✓ 30% of shell ==> 20% of shell
- ✓ 10% ==> \$3,324/yr.
- ✓ **\$1,108/yr.**

Reflections/recommendations

Personal learning



- Applying LEAN principles
- Chocolate making technique, the knowledge and art
- Gained business and entrepreneurship insights

Recommendations for future P2 interns



- Be curious - ask questions!
- Be Proactive - try out new things
- Be adaptable - flexible and open

Recommendations for P2 advisors for future



- Divide the training into two phase
- Organize Q & A class for all interns and advisors

Acknowledgment



- We acknowledge and honor that we are on the ancestral territories of the Indigenous Nations and Peoples, including the Apsáalooke (Crow), Niim íipuu (Nez Perce), Šakówiŋ (Lakota), Piikáni (Black feet), Séliš (Salish), Shoshone-Bannock, and Tsétsêhéstâhese (Northern Cheyenne) Nations.



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THANK YOU