



CREATING MORE VALUE FROM ALMOND BIOMASS

Moderator: Josette Lewis (ABC)

Speaker: Marc Privitera (PreProcess Inc.),
Maddison Gurrola (Mattson)



Creating More Value from Almond Biomass

Josette Lewis, Chief Scientific Officer, Almond Board

Marc Privitera, CEO/CEO/Principal Engineer, PreProcess Inc.

Maddison Gurrola, Food Technologist, Mattson

Almond Biomass: Putting Co-products to Optimal Use

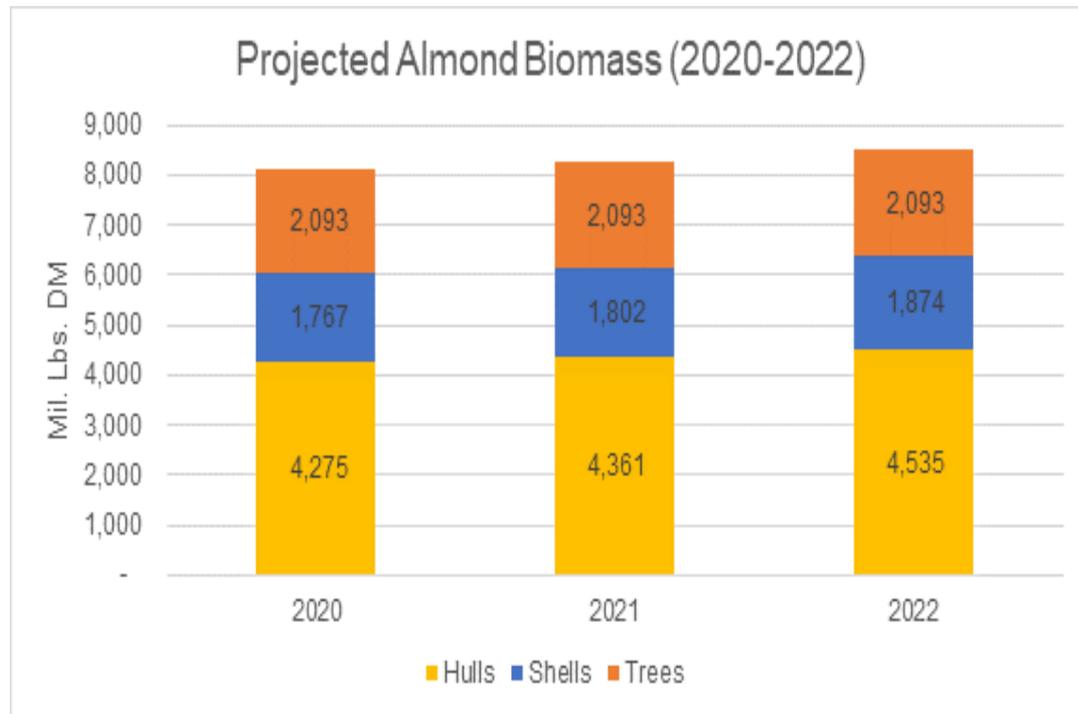
Josette Lewis, Ph.D.
Chief Scientific Officer
jlewis@almondboard.com

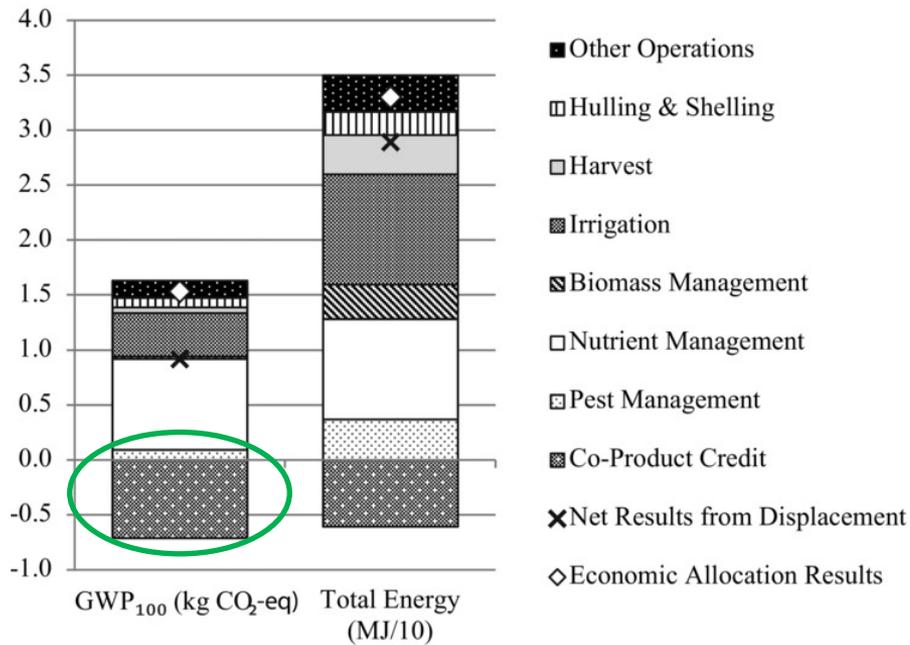


**Kernel is 1/3
of what comes from
orchard each year**



Adding value & Growing tomorrow's circular economy

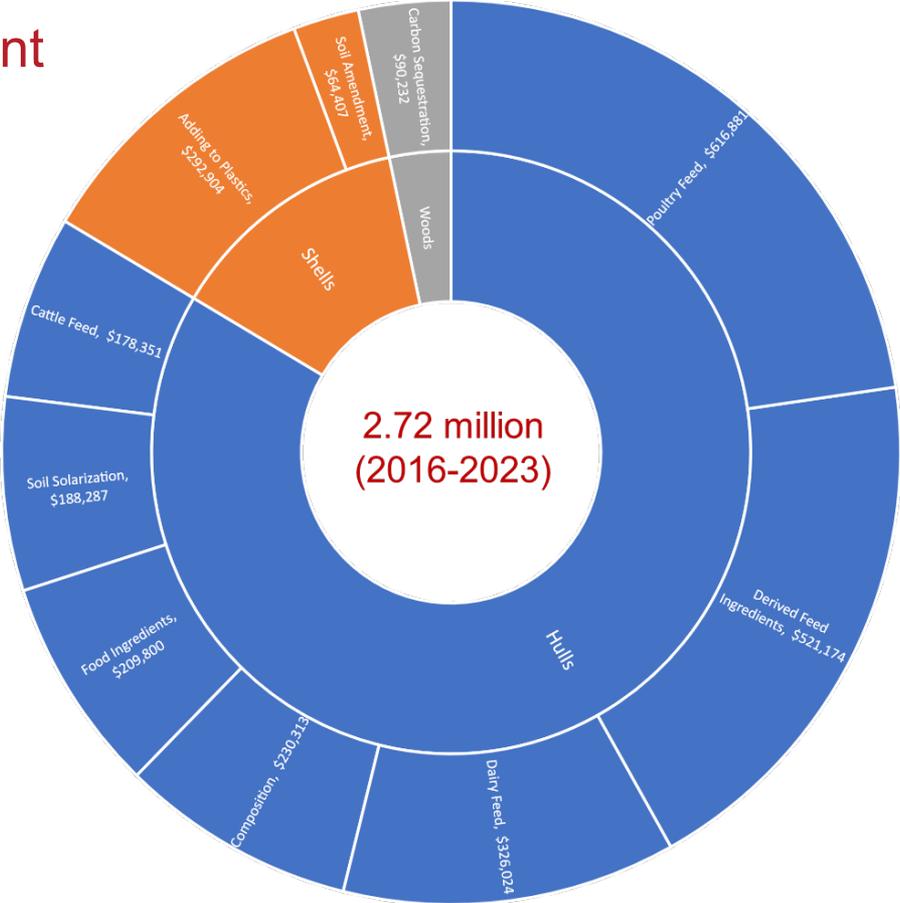




Coproduct utilization reduces carbon footprint of almonds

Journal of Industrial Ecology, Volume: 19, Issue: 6, Pages: 1008-1018, First published: 19 July 2015, DOI: (10.1111/jiec.12332)

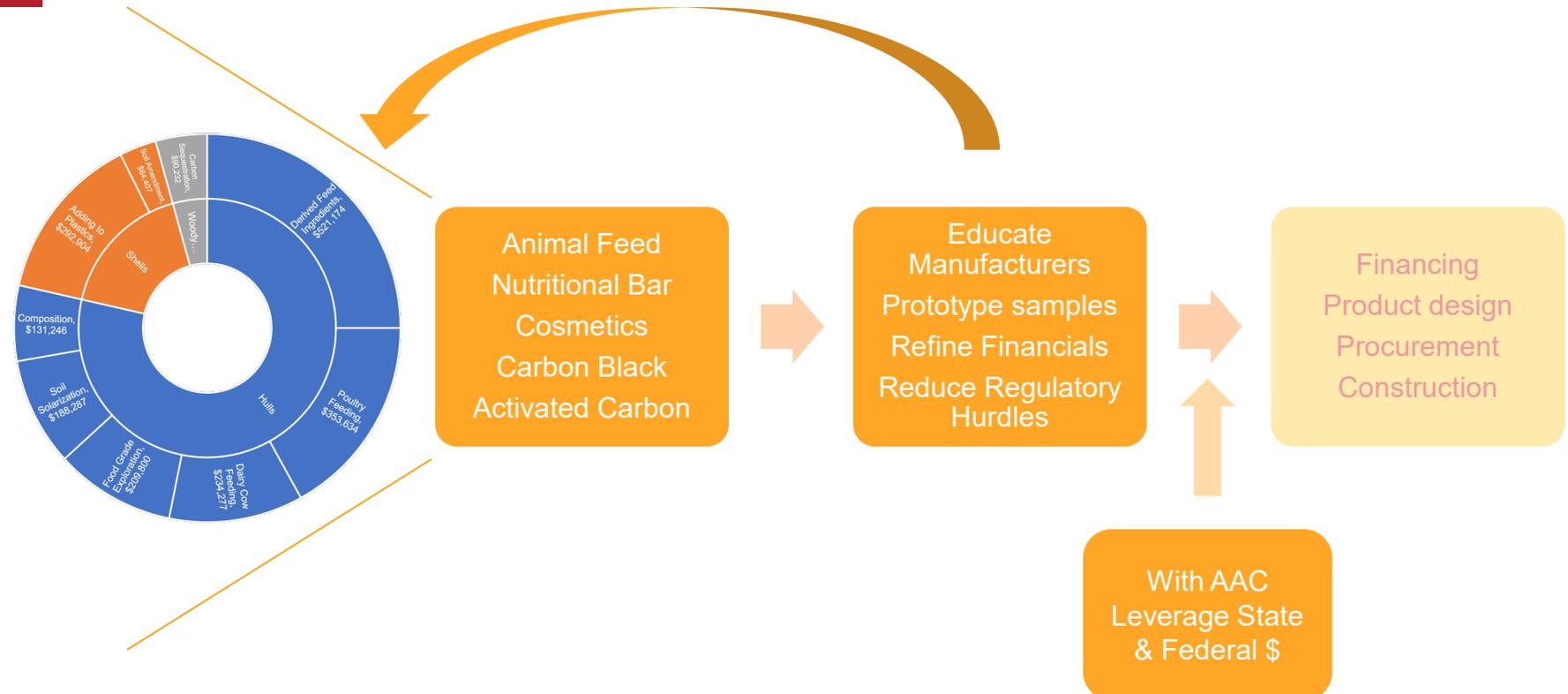
Biomass Research Investment



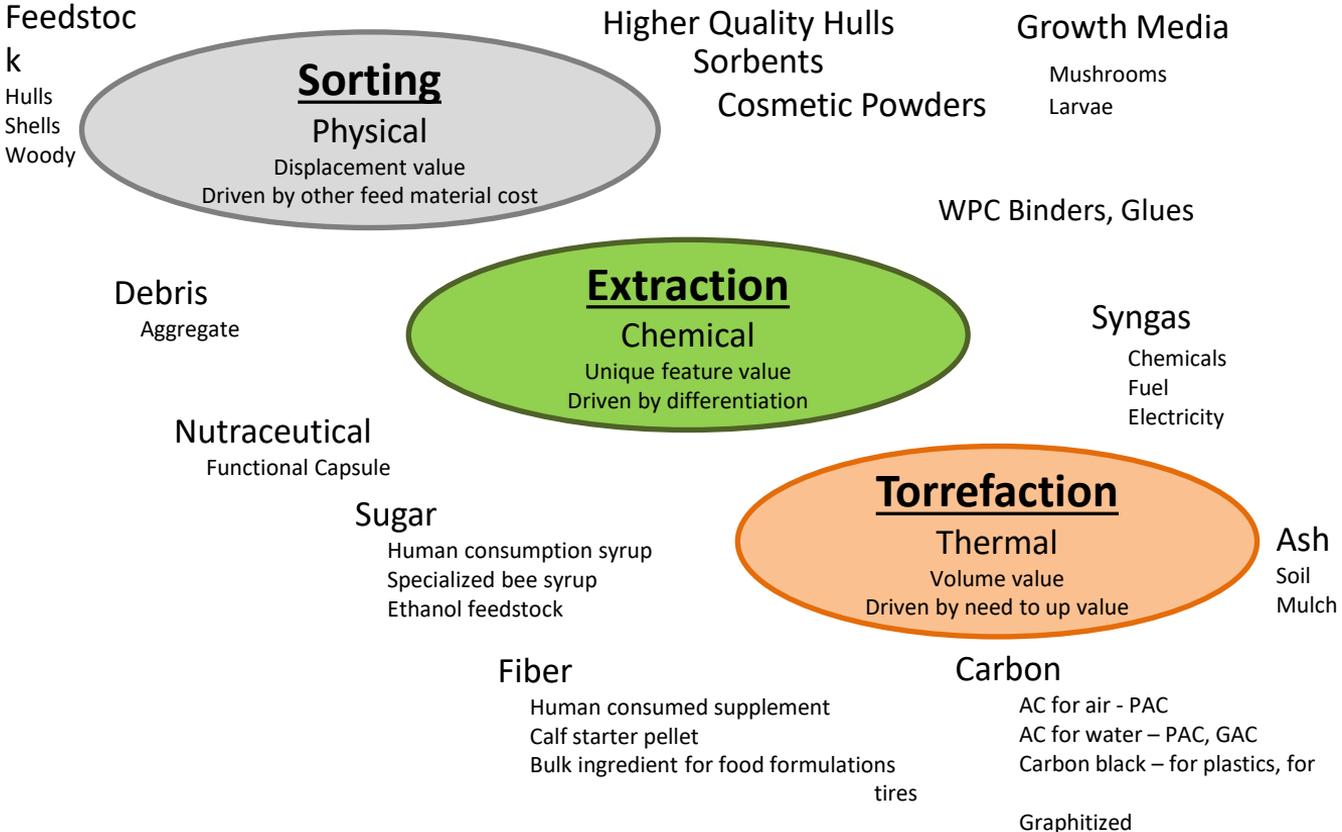
Research

Development

Commercialization



Revenue Generation Platforms



New Market Development	v.	Competitive Displacement
Functional Value	v.	Lowest Cost
Incumbent Use	v.	Education of Supply Chain
Displaced Incumbent Exit Dynamics	v	New Entrant Market Motivation
Feature Differentiation	v	Same Specification, Different Supplier
Stakeholder Stomach for Turmoil	v	Easy Drop In

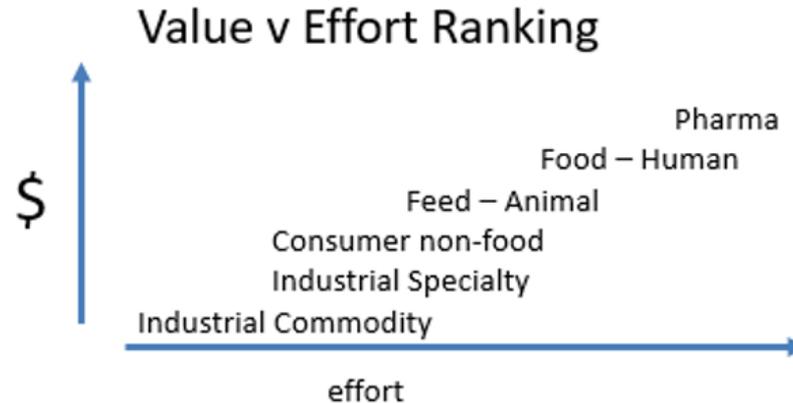


Figure 1: Market development considerations ranking value against effort

Product Actions for ABC to Consider to Get to FEL2

- **Animal Feed Expansion**
 - Continue existing disposition pathway expansion with dairy and cattle industries
- **Nutritional Bar Development**
 - Complete the GRAS dossier
 - Develop ingredient regulatory community introduction
 - Begin ingredient taste profiling and prototype formulations
 - Produce ingredient recipe guidance document
- **Cosmetic Moisturizer (FEL1.5)**
 - Develop prototype formulas and determine performance
 - Complete preliminary safety testing and regulatory community introduction
 - Develop influencer ethnographies
- **Activated Carbon**
 - Produce material for performance testing on scalable system
 - Submit material to use in test protocols
 - Industrial application
 - Retail application
- **Carbon Black**
 - Produce material for quality evaluation and grading from scalable system
 - Produce in use demonstration prototypes
 - Progress study of thermal conversion system include disposition of biogas byproduct

The Answer So Far

	Products	Value	Effort to Implement	Value Stability	Potential Volume Growth	Multiplicative Total	Likely HSW Uptake	
Sorting Platform		3 = highest	3 = easiest	3 = most stable	3 = highest potential			
	Increase Hulls to Animal Feed	1	3	1	1	3	H	
	Industrial Sorbent	2	1	2	1	4	H S	
	Soil Amendment - Bulk	1	3	2	1	6	H S W	
	Soil Amendment - Retail	0	2	2	1	0	H S W	
	Animal Bedding - Bulk	1	3	2	1	6	H S W	
	Animal Bedding - Retail	1	2	2	1	4	H S W	
	Cat Litter	0	2	2	1	0	H S	
	Shell Blast Media	2	2	2	1	8	S	
	Media for Black Fly Larvae	Looks promising, may be ready for scale up, competitive waste feeds affects value						H
Extraction Platform	Neutraceutical Extract	1	1	2	2	4	H	
	Food Grade Almond Hull Sugar Extract Syrup	2	1	2	2	8	H	
	Almond Hull Sugar Neutraceutical Bar	2	1	2	2	8	H	
	Soluable and Insoluable Fiber Nutrition Product	2	1	2	2	8	H	
	Newborn Calf Early Feed Ration Pellet	1	2	2	1	4	H	
	Peat Moss Replacement for Mycellium Production	1	2	2	1	4	H	
	Cosmetic Functional Ingredient	2	2	2	2	16	H	
	Pulp for Thermoformed Containers	2	1	2	1	4	H S	
	Nanocellulose	Looks promising, but may still yet be in "research" phase versus ready for scale up						S
Torrefaction Platform	Carbon Black	3	1	2	2	12	H S W	
	Activated Carbon	3	1	2	2	12	H S	
	Graphitized Carbon Equivalents	Looks promising, but may still yet be in "research" phase versus ready for scale up						H S W
	Syngas Products	2	1	2	2	8	H S W	
	Industrial Sorbent, carbon base	1	1	2	1	2	H S	

Product v Product Considerations for First Entries

- Why charcoal and not cat litter
 - Premium whole product versus ingredient
 - Market share and premium messaging versus functional and three label competition
- Retail versus industrial water treatment
 - Retail branding and messaging
 - Industrial is focused on specification performance and lowest cost
- Chipped wood soil amendment versus biochar carbon
 - Already established internal recycle and value
 - Carbon has added processing costs
- Food product versus food ingredient
 - Food product carries whole supply chain value to market whereas ingredient has to yield to majority ingredient brand message; however product risk is higher
 - Hull bar “high fiber, high energy, unique phytochemicals” messaging versus oatmeal “now with almond hull fiber” messaging; both could work, but oatmeal almond hull product value is at the mercy of the oatmeal brand owner
- Why not pulp
 - Sustainable circular economy message has to take more hold into pricing structures for products
- Why not black fly larvae
 - Need scalable engineering work to demonstrate production economics

Many choices depend on product set platform allocated manufacturing facility infrastructure.

Cosmetic Functional Ingredient

- A cosmetic product would face similar choices to a food product.
 - Do you build a finished product brand, or
 - do you offer a new intermediate functional ingredient for additive claims to an already existing brand.
- Cosmetics would require skin and eye safety testing but would not require the nutritional information development required of a food product. Accidental ingestion disposition and safety would also be a factor with a non-edible skin care product.
- Almond hulls having a unique composite of various antioxidants as already mentioned allows that functionality to be included in a skin care product which may give some benefit or some unique effect perceivable to certain portions of the market population.
- Skin care products hold value throughout the supply chain, but the effort to establish a new brand or add a functional ingredient to an existing brand is significant.
- Introducing a mid-market priced product with a claim built on the moisture retention aspects of the use of the hull fiber might be the most straightforward way to enter the market.
- An e-commerce entry for the first three years would build a loyal customer base.
 - Show that the product claim is not compelling to the intended user.
 - After establishing e-commerce metrics, then the product could be offered to a strategic.
 - Any strategic in the market would want to see proven financial metrics with a the pathway for growth that would fit into the strategic organizations overall financial delivery model for the suite of products they would support.
- Metrics might include a 5% market development potential with a 50% potential margin.
 - A strategic would also be more inclined to be interested if the product had flanking potential or if the ingredient that caused the compelling story to the customer is able to be used in other existing strategic brand formulations.
- A 1,000,000-unit market delivery would more than likely require two years and upwards of \$10,000,000 in pre-market development support.
- A 12 oz lotion product sold at \$7.00/unit retail would deliver \$7,000,000 in revenue potential from the early market entry positioning.
 - No margin should be expected the first three years if trying to build a new brand on entry to an already competitive market, however, the goal of the entry would be to establish the functional claim and market validity for presentation to a future strategic buyer.

Carbon – Commodity Value Product

Carbon Black		as of August 2021				
Industrial Delivered Bulk Price						\$2.00 per lb
Industrial Commerce Mark Up		0% of delivered cost at user site	\$ -	per lb	\$ 2.00	
Transportation to User	\$ 0.01	per lb	\$ 0.01		\$ 1.99	
Warehousing and Handling Cost at Distributor		2% of wholesale value	\$ 0.04		\$ 1.95	
Distribution Administrative Cost		1% of wholesale value	\$ 0.02		\$ 1.93	
Distributor Profit		10% of distributor cost	\$ 0.01		\$ 1.92	
Sales Channel Support Cost for Product		2% of wholesale value	\$ 0.04		\$ 1.88	
Marketing Support Cost for Product		2% of wholesale value	\$ 0.04		\$ 1.84	
Regulatory Requirement Support Cost for Product		1% of wholesale value	\$ 0.02		\$ 1.82	
Legal Support Cost for Product		2% of wholesale value	\$ 0.04		\$ 1.79	
Returns and Refund Loss Support Cost		0% of wholesale value	\$ -		\$ 1.79	
Product Development and Claim Support Cost		1% of wholesale value	\$ 0.02		\$ 1.77	
Transportation to Distribution	\$ 0.01	per lb	\$ 0.01		\$ 1.76	
Manufacturing Cost	\$ -	per lb	\$ -		\$ 1.76	
Manufacturer Profit		10% of manufacturing cost	\$ 0.00		\$ 1.75	
Warehousing Cost of Intermediate		0% of intermediate value	\$ -		\$ 1.75	
Handling Cost of Intermediate		0% of intermediate value	\$ -		\$ 1.75	
Profit to Bulk Warehouser		0% of intermediate ware and dist cost	\$ -		\$ 1.75	
Transportation to Bulk Ingredient Warehouse	\$ 0.01	per lb	\$ 0.01		\$ 1.74	
Intermediate Ingredient Extraction and Processing	\$ 1.37	per lb	\$ 1.37		\$ 0.37	
Intermediate Processor Profit		10% of intermediate processing cost	\$ 0.14		\$ 0.24	
Transportation to Processor	\$ 0.01	per lb	\$ 0.01		\$ 0.23	per lb
Yield (raw to finished) ****(considers parasitic energy value in processing cost)				100%		
Value Possibility					\$ 453	per ton

Value Chain for Cosmetic Ingredient

Cosmetic Ingredient Shell Powder Value Chain Calculator					
Retail Price					\$ 20.00 per lb
Retail Mark Up	100%	of delivered cost at retailer site	\$ 10.00	per lb	\$ 10.00
Transportation to Retailer	\$ 0.01	per lb	\$ 0.01		\$ 9.99
Warehousing and Handling Cost at Distributor	5%	of wholesale value	\$ 0.50		\$ 9.49
Distribution Administrative Cost	3%	of wholesale value	\$ 0.30		\$ 9.19
Distributor Profit	30%	of distributor cost	\$ 0.24		\$ 8.95
Sales Channel Support Cost for Product	15%	of wholesale value	\$ 1.50		\$ 7.45
Marketing Support Cost for Product	15%	of wholesale value	\$ 1.50		\$ 5.95
Regulatory Requirement Support Cost for Product	5%	of wholesale value	\$ 0.50		\$ 5.45
Legal Support Cost for Product	10%	of wholesale value	\$ 1.00		\$ 4.46
Returns and Refund Loss Support Cost	1%	of wholesale value	\$ 0.10		\$ 4.36
Product Development and Claim Support Cost	10%	of wholesale value	\$ 1.00		\$ 3.36
Transportation to Distribution	\$ 0.01	per lb	\$ 0.01		\$ 3.35
Manufacturing Cost	\$ 2.00	per lb	\$ 2.00		\$ 1.35
Manufacturer Profit	10%	of manufacturing cost	\$ 0.20		\$ 1.15
Additional Raw Materials in Product	70% of formulation in manufacturing costs				
Warehousing Cost of Intermediate	5%	of intermediate value	\$ 0.06		\$ 1.09
Handling Cost of Intermediate	3%	of intermediate value	\$ 0.03		\$ 1.05
Profit to Bulk Warehouse	10%	of intermediate ware and dist cost	\$ 0.01		\$ 1.04
Transportation to Bulk Ingredient Warehouse	\$ 0.01	per lb	\$ 0.01		\$ 1.04
Intermediate Ingredient Extraction and Processing	\$ 0.36	per lb	\$ 0.36		\$ 0.68
Intermediate Processor Profit	10%	of intermediate processing cost	\$ 0.04		\$ 0.64
Transportation to Processor	\$ 0.01	per lb	\$ 0.01		\$ 0.63 per lb
Yield (raw to finished)	30%				
Value Possibility					\$ 377 per ton

Value Chain for Hull Nutrition Bar

Hull Nutrition Bar

as of August 2021

based on \$1.50 per 2 oz (60 g) retail bar or \$11.35 /lb finished product

			\$11.35 per lb
Retail Price			\$ 5.68 per lb
Retail Mark Up	100% of retail price	\$ 5.68 per lb	\$ 5.68
Transportation to Retailer	\$ 0.01 per lb	\$ 0.01	\$ 5.67
Warehousing and Handling Cost at Distributor	3% of wholesale value	\$ 0.17	\$ 5.50
Distribution Administrative Cost	1% of wholesale value	\$ 0.06	\$ 5.44
Distributor Profit	10% of distributor cost	\$ 0.02	\$ 5.42
Sales Channel Support Cost for Product	15% of wholesale value	\$ 0.85	\$ 4.57
Marketing Support Cost for Product	10% of wholesale value	\$ 0.57	\$ 4.00
Regulatory Requirement Support Cost for Product	10% of wholesale value	\$ 0.57	\$ 3.43
Legal Support Cost for Product	10% of wholesale value	\$ 0.57	\$ 2.87
Returns and Refund Loss Support Cost	1% of wholesale value	\$ 0.06	\$ 2.81
Product Development and Claim Support Cost	10% of wholesale value	\$ 0.57	\$ 2.24
Transportation to Distribution	\$ 0.01 per lb	\$ 0.01	\$ 2.23
Manufacturing Cost	\$ 0.83 per lb	\$ 0.83	\$ 1.40
Manufacturer Profit	10% of manufacturing cost	\$ 0.08	\$ 1.32
Warehousing Cost of Intermediate	5% of intermediate value	\$ 0.07	\$ 1.25
Handling Cost of Intermediate	5% of intermediate value	\$ 0.07	\$ 1.19
Profit to Bulk Warehouse	10% of intermediate ware and dist cost	\$ 0.01	\$ 1.17
Transportation to Bulk Ingredient Warehouse	\$ 0.01 per lb	\$ 0.01	\$ 1.16
Intermediate Ingredient Extraction and Processing	\$ 0.75 per lb	\$ 0.75	\$ 0.41
Intermediate Processor Profit	10% of intermediate processing cost	\$ 0.08	\$ 0.34
Transportation to Processor	\$ 0.01 per lb	\$ 0.01	\$ 0.33 per lb
Ingredient Mass to Total Mass Yield	95%		\$ 0.31
Value Possibility for Huller/Sheller			\$ 624 per ton



Thank You

Rooted
IN SUCCESS :: 2021
the almond conference