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AN EVALUATION TO DETERMINE THE FEASIBILITY OF AN OAT MILLING/PROCESSING FACILITY

by

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Overview

The objective of this feasibility study is to provide an overview of the oat milling infrastructure needs and challenges for the client and offer potential options and practical advice. It provides an example of the investment and infrastructure required to build an oat mill sized and scaled appropriately for the client, makes recommendations for the equipment required and the costs for build out of a new facility, estimates what it might cost to operate such a milling operation, including pricing and markets, and establishes whether there would be a market for the milling operation and the financial feasibility of such a venture.

Market research was conducted to assess the feasibility of the client providing milling services to oat growers and selling milled oat products to buyers in the South Dakota area. This research identifies target markets and potential clients for the client and provides a market assessment of the projected growth of various markets, including oats and oat products, gluten free oat products, craft breweries, bakeries, and specialty stores.

Milling costs associated with oat milling are very similar to other grains, such as barley and wheat, as much of the same equipment and processes are used.

Conclusions

Market Size and Saturation

The study found that the South Dakota oat market is somewhat saturated with high quality oats being produced by established providers with a loyal customer following. Commercial buyers have access to high quality milled oats for as little as $440 per ton. The study found that the market size for oats in the client's region is between 1,200 and 1,500 tons per year. It was also found that the overall perception in the market is one of satisfaction with current suppliers and no strong evidence of market growth.

Market research confirmed that the largest market for oats in the 150-mile region surrounding the client, in South Dakota, is in commercial baked goods (estimated 800 tons of oats annually). However, a substantial number of commercial bakeries do not source oats at all. Specialty food stores—including food cooperatives and health stores with an interest in a new line of gluten free oats—account for approximately 80 tons of oats annually. If all grocery stores, excluding convenience stores, were counted, the market demand would equate to approximately 500 tons of oats sold within the 150-mile radius, however, this demand is already being supplied. Breweries, in contrast, source approximately 225 tons of oats annually to produce stout beers, where oats are used as a main ingredient.

Milling Operation EBIDTA Breakeven: The Client's 700 acres

A commercial scale oat milling operation located at the client and milling 700 acres of oat production **will not breakeven on an EBIDTA cash flow basis** (earnings before interest, depreciation, taxes, and amortization), selling milled oats at $440 per ton, based on the calculated total revenue, variable costs and capital costs.

	Median Price	Price Variance (+30%)	Price Variance (-30%)
Total Revenue	$93,278	$121,261	$65,295
Final Total Capital Costs	$674,465	$674,465	$674,465
Total Variable Costs	$124,728	$124,728	$124,728
Total Revenue Less Variable Costs (EBTIDA)	-$31,450	-$3,467	-$59,433
Breakeven Point (years)	**Never**	**Never**	**Never**

Start Up Capital

Gaining traction in a saturated market is the most difficult type of product entry, requiring a prolonged market adoption rate and increased marketing efforts and investment. This, in addition to the price being too low, is the main obstacle to entering the market.

Market research found that the cost of oat milling equipment is $135,277 for the scale the client would be operating. Utilizing an average selling price of $440 per ton for oat flakes with a 30% variance and oat yields from the past five years, a breakeven point will not be reached from the 700 acres the client already owns. It should be noted that the current price per ton of oats is roughly $481, however the recent spike in oat prices may not be sustainable. Even at a price of $481 per ton, a net loss would still be realized.

Start Up Capital for Small-scale Operations

	Small-scale Capital
Total Storage of Oats & Equipment	$ 550,834
Cost of New Facility	$ 323,504
Oat Milling and Packaging Equipment Costs	$ 135,227
Sub Total Capital Costs	$ 1,009,565
Contingency Cost (10%)	$ 100,957
Total Capital Costs	$ 1,110,522

Note: Contingency Cost is the cost of permits, licenses, and other startup costs.

Recommendation

FERC recommends that the client does not use their financial resources to expand into the production and milling of oats, due to the fact that the market is already saturated and current demand is being met with satisfaction from established milling operations with loyal customers. In addition, the market research showed no incremental forecasted increase in demand in the foreseeable future. Other factors for this recommendation include substantial capital costs associated with purchasing the equipment, building the facility, and unfavorable timelines to breakeven points. Oat pricing elasticity and variances favor this recommendation as well.

Findings - Breakeven Analysis

Scenario 1: Small Scale milling Operation - The Client's 700 acres

In this scenario, the client expends the capital necessary to start and launch the small-scale oat mill. The company uses their 700 acres of farmland to grow oats. After harvest, the oats will be transported to a mill, which will also be owned by the client. Here, the oats will be processed and packaged to be shipped to customers. The price for oats over the past 18 years has reflected a 30% price variance. In this scenario, the client will only be purchasing small-scale oat milling equipment due to the small volume of oats being harvested from their 700 acres of production. The following table reflects the revenue and pricing of this scenario:

Revenue	Median Price	Price Variance (+30%)	Price Variance (-30%)
Selling Price of Processed Oats per Ton	440	572	308
Amount of Farming Land (Acres)	700	700	700
Amount of Raw Oats Produced (Tons)	379	379	379
Amount of Processed Oats (Tons)	212	212	212
Total Revenue	$ 93,278	$ 121,261	$ 65,295

Note: The amount of raw oats produced in this Scenario is 379 tons. After processing, 379 tons is reduced to 212 tons of oats. Ref: [15]

Storage Costs

After the oats are harvested, they must be stored. The storage costs associated with the 379 tons of raw oats, the estimated production from 700 acres, are indicated below.

	Median Price
Storage per Ton	$ 407
Total Storage	$ 154,418

Reference: [18]

Facility Costs

The costs of building a new facility for the oat milling operation, based on constructing a 4,928 square foot building, are estimated below.

	Costs
Facility Electrical Costs	$ 50,000
Facility Price per square foot	$ 50
Square Footage needed	4,928
Cost of New Facility	$ 323,504

Packaging Equipment

The Oat Milling and Packaging Equipment Costs are indicated below for the small-scale equipment capable of milling 5 tons of oats per hour. A more in-depth analysis of the list of equipment needed to mill oats can be found in the milling section of this study.

	Median Price
Oat Milling & Packaging Equipment Costs	$ 135,227

Note: This equipment can mill and package oats at 11 tons per hour, derived from the processing time of each piece of equipment. This can be seen in the mill section of this study. Reference: [19]

Total Capital Costs for Oat Milling Operation

	Costs
Total Storage	$ 154,418
Cost of New Facility	$ 323,504
Oat Milling and Packaging Equipment Costs	$ 135,227
Total Capital Costs	$ 613,150
Contingency Cost (10%)	$ 61,315
Final Total Capital Costs	$ 674,465

Note: Contingency Cost is the cost of permits, licenses, and other startup costs.

Variable Costs

	Median Price
Amount of Farming area (Acres)	700
Amount of Raw Oats Produced (Tons)	379
Processing Capacities (Tons Per Hour)	5
Time to complete Oat Milling and packaging (Hours)	76

Reference: [15] [16]

Equipment Power Costs

	Median Price
Equipment Power Costs per hour	$ 12.66
Total Equipment Power Costs	$ 959

Reference: [19]

Planting Costs based on 700 acres of Oats

	Median Price
Cost of Planting Oats per Acre	$ 133
Total Cost of Planting Oats	$ 93,548

Note: A further breakdown of how the $133.64 was found can be seen in the production cost section of the report.
Reference: [15]

Labor Costs

	Median Price
Labor Costs per hour	$ 261
Total Labor Costs	$ 19,758

Note: A further breakdown of how the $261 was found can be seen in the labor subsection within the mill section of the report.
Reference: [10]

Transportation Costs

The cost to transport grain from the farm to the mill was estimated at five miles for this scenario.

	Median Price
Price per Bushel	$ 0.19
Number of bushels to transport	22,740
Base fee	$ 350
Transportation cost	$ 4,671

Total Variable Costs

	Median Price
Total Machine Power Costs	$ 959
Total Cost of Planting Oats	$ 93,548
Total Labor Costs	$ 19,758
Transportation cost	$ 4,671
Maintenance Costs (2%)	$ 5,792
Total Variable Costs	$ 124,728

Note: Maintenance costs est. at 2% of the total equipment cost.

Breakeven Point – Oat Milling Operation

	Median Price	Price Variance (+30%)	Price Variance (-30%)
Total Revenue	$93,278	$121,261	$65,295
Final Total Capital Costs	$674,465	$674,465	$674,465
Total Variable Costs	$124,728	$124,728	$124,728
Total Revenue Less Variable Costs (EBTIDA)	-$31,450	-$3,467	-$59,433
Breakeven Point (years)	**Never**	**Never**	**Never**

Scenario 2: Depreciation Model – Mill (The Client 700 Acres)

In this scenario, IRS Depreciation schedules for the equipment and the cost of the new facility are applied. For equipment, a seven-year depreciation period is used, and a 20-year depreciation schedule is used for the building [14]. This table shows that the client will not break even due to the price not being high enough.

Breakeven Analysis – Depreciation – Small-scale Mill

	First 7 Years	Next 13 Years	After 20 years
Total Revenue	$ 93,278	$ 93,278	$ 93,278
Capital Costs			
Machinery Depreciated Over 7-yr Period	$ 45,516	$ 45,516	$ 45,516
Farming Facility Depreciated Over 20-yr Period	$ 17,793	$ 17,793	-
Total Capital Costs	$ 63,309	$ 63,309	$ 45,516
Variable Costs			
Planting Oats	$ 93,548	$ 93,548	$ 93,548
Maintenance	$ 5,793	$ 5,793	$ 5,793
Machine Power	$ 959	$ 959	$ 959
Labor	$ 19,758	$ 19,758	$ 19,758
Transportation	$ 4,671	$ 4,671	$ 4,671
Total Variable Costs	$ 124,728	$ 124,728	$ 124,728
Profit	($ 94,758)	($ 94,758)	($ 31,450)
ROI	-149.68%	-149.68%	-69.10%

Conclusion

When it comes to businesses investing capital into new projects, the standard is an expected payback of 5 to 7 years. In scenario 1, 'never' is not an acceptable return period. Scenario 2, in which the depreciation model is used, shows breakeven can never be reached. The caution here is that the market is already saturated and highly competitive.

Value Chain

Oats are grown in temperate regions where there is a low summer heat and great rainfall. Typically, they are grown in northwest Europe, Central Canada, and the Midwestern United States. Oats are an annual plant, which, in South Dakota, can be planted from mid-April to early August. During the early South Dakota spring, the late thaw may present a challenge when planting oats. The challenge is in drilling the land to plant the seeds. The ground has to be thawed enough to use the no-till drill and other farming equipment but still firm enough to support the weight of such equipment. To decrease the difficulty of this problem, it is important not to till the ground in the fall prior to planting oats. Growers also need to pay close attention to spring weather patterns, looking for spring mornings in which the ground is firm enough to hold the equipment but soft enough to drill. [7][13][8]

Growing oats with other crops involves a degree of uncertainty. Relevant factors include weather, insects, and weeds. Some of these can be insured through the USDA, which has varying rates based on planting and harvest dates and yield history. To protect the farmer from this uncertainty, a contracted price is determined between the producer and the processor. The processor agrees to buy the harvest at the price if it meets the specified standards. At harvest, the oats are stored in grain elevators with the producer until the processor calls for delivery. Once sold, the oats are transported by bulk truck or railcars to cleaners who process the oats for buyers. [11]

In some cases, the processor does the cleaning and hulling; in other cases, it is contracted to a third party. Cleaned oats are sampled to ensure quality, and are inspected for weather damage, insects, disease, and mold. Cleaning also removes unsuitable oats for milling. These are doubled, pin, light, and hulled oats. Doubled oats are oats with two groats, which are not well developed. Pin oats contain thin groats, while light oats contain a high percentage of hulls. Materials such as dust, stems, and weed seeds are also removed.[6]

After cleaning, oats are heated to allow the oat hulls to brittle, which facilitates de-hulling. Heating also gives them a roasted flavor and partially deactivates lipase enzymes. The temperature of the heating ranges from 190 to 208 degrees Fahrenheit, and moisture content is reduced from 12% to 7-10% during the process. [10]

Oat processing is the conversion of raw oats into oat flakes. The initial step is to clean, grade, and de-hull the raw oats. This requires the uneatable outer shell of the oat to be separated from the inner oat groat. Centrifugal acceleration is used in this process. The oats are fed by gravity onto the center of a horizontally spinning stone, which accelerates them towards the outer ring. Groats and hulls are separated on impact with this ring. The oat groats are steamed, softened, and rolled to make flattened oats—rolled oats. They acquire a flake type structure of varying thickness. The oat hulls are used as feed, processed further into insoluble oat fiber, or used as a biomass fuel.

In the processing operations, the dehulling efforts face conflicting controls. For example, dehulling efficiency and groat breakage both increase with rotor speed. Groat yield increases with efficiency and decreases with breakage. However, these results are optimal, depending upon genotypes and the external environment. Yield varies from 50% at a low rotor speed and specific genotypes to just above 70% for faster speeds and alternative genotypes. As a result, this report will focus on a yield of 60% of

tonnage. In addition, with an anticipated loss of 4% of tonnage being lost during the cleaning, steaming, and flaking of the rolled oats, the remaining 36% is converted to husks and hulls.

After the groats are separated from the hull, they are passed through a steamer. This is done to bring the moisture content up from 7-10% to 10-12%. It also increases the temperature of groats to between 210 and 220 degrees Fahrenheit, which ensures lipolytic enzymes are inactive. They are again cooled to produce quality flakes. To increase taste, gum, sugar, salt, or other malt and syrups can be added. [10][12][9][6][5]

Finally, the regular and quick oat flakes are rolled to uniform thickness and specifications based on the final product they will become an ingredient in. They are then packed and distributed for the next step in the process.

Between the producers and processors are grain companies or commission brokers; the grain company connects buyers and sellers by buying the oats from the producer and selling to the processors. Commission brokers also connect buyers and sellers but, instead of taking ownership of the oats, they charge a commission for their services.

Once the processors have purchased the oats, they can use them as an ingredient in the creation of another product or treat and process them for human consumption. When they are processed, oats go through several steps to be edible. They are dry heated and steamed with enzymes to give them a nutty flavor. The small and large groats are separated, with the large groats entering the groat steam and the smaller groats into the cutting system. They then pass through a steel cutter turning them into flakes. Then, they are bed dried before being packaged. They also can be rolled into hammer mills where they are ground to create flour or bran. Once the processors have completed the processing of the oats, distributors connect the processors with retailers. The distributor takes ownership of the oat product and takes care of storage and transportation to retailers. The retailers are the final stage of the oat supply chain. They are responsible for selling the final good that was produced by the farmer and processed by food processors. [4]

Throughout the oat supply chain, regulatory bodies are involved, such as the Food and Drug Administration (FDA) and United States Department of Agriculture (USDA). Regulations often add costs to production. There are also transportation costs when transporting the oats from the producers to the cleaners and then to processors and the distributors. [13]

Production Costs

The following table breaks down the potential production costs of farming oats in dollars per acre.

Production Costs [16]

	United States
Operating costs:	
Seed	$ 16.28
Fertilizer	$ 46.19
Chemicals	$ 2.76
Custom operations	$ 10.14
Fuel, lube, and electricity	$ 24.09
Repairs	$ 14.57
Straw baling	$ 3.38
Interest on operating inputs	$ 0.04
Total, operating costs	**$ 117.45**
Allocated overhead:	
Hired labor	$ 0.87
Opportunity cost of unpaid labor	$ 38.83
Capital recovery of equipment and equipment	$ 84.08
Opportunity cost of land	$ 108.31
Taxes and insurance	$ 6.29
General farm overhead	$ 9.99
Total, allocated overhead	**$ 248.37**
Actual Costs paid	$ 16.28
Total costs	**$ 365.82**

The Oat Mill

Capital Costs

The capital costs of the equipment needed to transform the raw oats into finished oat products can range from $135,288.33 to $1,932,083.33, depending on the scale of the equipment. The equipment needed for such an operation is listed below.

Equipment Costs

Machine Name	Price
Professional Oat Dehuller Machine	$ 7,500
Pre-Cleaning Machine	$ 3,300
Oats Boiling Machine	$ 550
Oat Kiln Machine	$ 1,050
Sieving Machine	$ 833
Color Sorting Machine	$ 16,250
Grain Magnet	$ 100
Dicing Cutter Machine	$ 1,767
Dust Separator Machine	$ 917
Sorting Machine	$ 22,945
Twill Steamer	$ 7,500
Roller Mill	$ 3,267
Drying Machine	$ 60,000
Plan sifter Machine	$ 3,500
Oat Packaging Machine	$ 5,750
Total	**$135,228.33**

Note: These figures are roughly 5 years old and inflation may have led to increase in cost.

Building and Storage

The client will need a facility to house the equipment listed above. For the smaller sized equipment, a minimum of 4,928 square feet of space would be required. The estimated cost is $35 per square foot. [3][17]

Before and after oats are processed, they need to be stored. Storage unit sizes range from 5 to 15,000 tons and range in price from $75,077 to $261,807. The average cost per ton is $408 per ton. If the client were to use their own land, this would result in storage costs of $154,418.

Transportation

A common question in business is whether to do it yourself or outsource to a company already in the market. Thus far, there are substantial upfront capital costs, and hiring a grain transportation company to transport the oats from the farm to the mill would be less expensive and a more efficient use of capital resources. Relevant companies, some located in South Dakota, have an average base fee of $350 plus for the amount to be transported. The cost of transportation can be based on distance needed to travel or the amount of the grain in bushels. In the case of the client, we use the number of bushels because grain transportation companies that go by distance are unlikely to transport at such a small distance. There are roughly 60 bushels of oats in a ton leading to 22,740 bushels in total that need to be transported. This multiplied by the market price for transporting a bushel of oats, which is $0.19, gives us a total transportation cost of $4,670. If the client were to capture the whole market, while still farming themselves, the cost would be the same, as other producers will pay to transport their grain to the mill. [20]

Labor

Below is an estimate of the labor needed to operate and maintain the machines needed to process oats, which would not vary in terms of whether the small-level equipment is used. [10] These numbers are derived from industry research on oat milling facilities with the recommended operators per machine. The following numbers are based on running the equipment at 100% efficiency.

Note: The client could hire fewer people, but efficiency would be sacrificed. For example, the client could hire a machinist and an unskilled laborer costing them $27 an hour, $15 for the machinist, $12 for the unskilled labor. Within this hour of work, two-man hours of tasks are being done efficiently and to standards. Now instead, the client attempts to cut costs by hiring one laborer at $15 an hour to do both the job of the machinist and the unskilled laborer. Now, the machinist, who will only work for $15 an hour because of his skills, has to do the work of a machinist, which takes an hour, and the work of an unskilled laborer, which also takes an hour. The machinist will have to take two hours to do the work assigned and be paid $30 for his work, thus costing the client more money for the same amount of work.

Labor Costs

Position	Number in Position	Salary ($/hr)	Total Cost Per Hour
Plant Manager	1	$ 20	$ 20
Administrative Assistant	1	$ 10	$ 10
Technician Operator	8	$ 15	$ 120
Unskilled Workers	8	$ 12	$ 96
Janitor	1	$ 15	$ 15
Total	**19**		**$ 261**

Price

The average price received for selling processed oat flakes in the year 2022 is roughly $481 per ton. However, this can mainly be attributed to a massive price increase in oats in the past year and may not be sustainable. A more accurate and sustainable price would be $440 per ton. We will assume a 30% variance in the price of oats.

Cost of Food Sovereignty

Crop	Annual Cost per 10,000 (based on a population of 33,000)
Oats	(9,530)

Note: Parenthesis indicates a negative figure

Conclusion

South Dakota has a slightly saturated market for oats. The largest market for oats in the 150-mile radius surrounding the client, in South Dakota, is in commercial baked goods (estimated 800 tons of oats annually). However, many commercial bakeries do not source oats. Even when this radius was expanded to include grocery stores and breweries, the FERC found that this demand is already being met in South Dakota.

In all scenarios produced by the FERC, it was found that breakeven will never be reached due to substantial operating and capital costs. The FERC found that the client will never reach breakeven both before and after the depreciation model is considered.

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