# Technological Choice: California Wild Rice Processing Under Uncertain Demand*

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## Abstract

This study is concerned with technological choice under uncertain demand conditions. It begins with an overview of the California wild rice market. The wild rice product is described, the wild rice industry is review and wild rice market conditions are explored. The overview is followed by a discussion of wild rice processing. Technological choice and competitive strategy issues are reviewed and then a framework for choosing between two competing technologies is proposed.

The two competing technologies differ in their ability to store and process wild rice over a marketing year. The traditional technologies requires almost immediate processing of the harvested wild rice while the experimental technology allows harvested wild rice to be stored and processed over the course of the marketing year. Technological choice is explored using multiattribute utility analysis and two economic evaluations. The economic evaluations are payback period analysis and internal rate of return analysis given uncertain demand conditions. The experimental technology is shown to be the dominant technological choice under both multiattribute utility analysis and the economic analyses.

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# Contents

## Introduction

The California wild rice industry in 2001 is undergoing change. This change is being driven by increased wild rice production, changes in wild rice demand, and buyer concerns relative to product quality and food safety. These changes necessitate the need for the industry to evaluate its operational and marketing strategies. A major concern of the industry is how to meet the on-going changes while remaining profitable.

The major emphasis of this study to evaluate two of the technological choices that are available to meet those changes. The technologies are a traditional technology and newer experimental technology that has been conceptualized, but not as yet used by the industry. The traditional and experimental technologies use the same basic wild rice processing steps (see Figure #1). The traditional technology requires that immediately after the curing stage that the wild rice be either parched or parboiled to infuse the bran layer into the wild rice kernel and then further processed into black or scarified wild rice. The experimental technology allows the wild rice to be stored after the curing stage.

The technological choice begins with a multi-attribute analysis that compares the two technologies on the basis of certain selected characteristics. The technologies are then compare on the basis of their internal rates of return under three differing product demand scenarios The study begins with an broad overview of wild rice market characteristics.

The market overview is broad in nature reflecting limited public information available on wild rice demand. The market data that does exist tends to be highly aggregated as wild rice market data is often included in general statistics on specialty products or other rice products. The information provided in the report is based on the public information that was available and information provided by knowledgeable people in the California wild rice industry.

## Overview of the California Wild Rice Market

### *The Wild Rice Product*

Wild rice derives its name from the Native Americans harvesting the wild rice[1] by hand from lakes and streams in the wilds of Minnesota and Canada. Domestication of wild rice started in the 1950's and supplies have increased greatly in the past twenty-five years due to various technological advances. These advances include the invention of mechanical harvesters, the development of research and marketing associations, and the development of shatter resistant cultivars.

The growth of wild rice as a field crop coincided with the market expansion, which resulted in lower prices and a more consistent supply. "Wild rice is firmly established as a new cultivated crop and should continue to expand in production and usage as yield and production efficiency are improved" (Oelke, 1993). Markets for wild rice and wild rice products have expanded at a vigorous rate since 1978, especially during 1982 to 1984 when the demand increased 52%.

Commercial wild rice production started in California 25 years ago. Today, the California industry accounts for approximately 60% of world production. California production of wild rice takes place on about 20,000 acres in the Sacramento Valley, Fall River Valley, and Alturas area. Average yields are 12 hundredweight to the acre giving a total production of 24 million pounds of green wild rice[2] a year. This production is expected to increase dramatically in the near future due to the introduction of a new patented hybrid variety of wild rice that will increase yields to 30 hundredweight per acre thus increasing total production to 60 million pounds a year assuming acreage remains constant at 20,000 acres.

California processed wild rice wholesale prices have declined steadily over the past 10 years and currently average $1.50 a pound. This translates in to an $18,000,000 industry. If prices were to remain unchanged the future wholesale output value would be approximately valued at $45,000,000 (Hasbrook).

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[1] Wild rice is a grass cultivar and is not related genetically to either the japonica or indica rice species.

[2] The average conversion from green wild rice to processed final product is 51%. That is, one pound of green wild rice will process into approximately 0.51 pounds of processed wild rice products.

The continual growth of the California wild rice industry is dependent on its ability to develop innovative marketing and processing techniques to meet changing buyer expectations and to reduce price. California wild rice is generally harvested on a "green" basis during the months of July, August, September, and early October. Harvested rice is delivered to wild rice processing facilities at average moisture content of 35%. The green wild rice is cleaned, cured, parboiled, dried, and roasted to stable moisture content of 14%. The original green wild rice, after processing, results in a fairly constant set of finished products, which are classified by grade (Hasbrook).

The grades starting with A and progressing to C differ by length, weight and thickness. A is the longest, weighs the most, and has the greatest kernel thickness. Wild rice is sold in three forms at the processor level: black, scarified and pre-cooked. The "Black" wild rice form, in which the wild rice possesses a traditional black appearance, reflects the color of the black bran layer. This bran layer is extremely hard and requires a fairly long cooking time. Table #1 shows the input-output relations between green wild rice and finished wild rice products (Hasbrook).

**Table #1**
**Input-Output Relationship: Green Wild Rice to Finished Product**

| Harvested Green Wild Rice | | Finished Product Distribution | |
|---|---|---|---|
| Input = 100 Lbs | | 100 Lbs | |
| Outputs | | Grade A | 29 lbs |
| Dirt | 1 lb | Grade A- | 29 lbs |
| Handling Loss | 1 lb | Grade B | 28 lbs |
| Hulls | 33 lbs | Grade C | 6 lbs |
| Moisture Loss | 14 lbs | Brokens | |
| Finished Products | 51 lbs | Large | 6 lbs |
| | | Small | 2 lbs |

Cooking time for black wild rice varies in length from 55 minutes for A grades to 45 minutes for black B grade. This black product accounts for about 13.5% of all processed whole grain wild rice sold.

"Scarified" products are the result of a mechanical process of scratching the surface of the black bran layer, thereby allowing a more rapid water absorption during the cooking process. Scarified A, B and C grade wild rice are cooked from 30 minutes for A grades to 15 minutes for C grade. Scarified products account for 81% of the processed whole grain wild rice sales.

The third category of whole grain wild rice processed products is for "pre-cooked" products. This wild rice product has a cooking time of 5 and 10 minutes. This category of wild rice is for highly specialized convenience foods and food service accounts and represents 5.5% of the whole grain sales. Broken kernel wild rice is either blended into various whole grade wild rice products or utilized as an input to the production of rice cakes.

### *The Wild Rice Industry*

The marketing system for wild rice consists of five major groups: growers, buyers, processors, wholesalers, and retailers. Green wild rice is generally purchased at the harvest site. Buyers can be agents for value-added processor or wholesalers or are buying for their own wild rice processing operations. Wild rice processors typically process the green wild rice into finished wild rice products that are either sold in bulk to value-added processors or wholesalers or used in producing their own value-added products under their own labels. There are fifteen major processing plants in North America designed and used exclusively to process wild rice. They include four in Canada, eight in Minnesota, and three in California.

The value-added processors or wholesalers purchase wild rice from processors and then use it to produce branded wild rice blends or re-packages it for sell under their branded labels[3]. The marketing retailers sell branded packages of wild rice and wild rice blends while occasionally packaging and selling wild rice products under their own brand name.

### *Wild Rice Retail Demand*

The retail demand for wild rice and wild rice products is dependent on product price, consumer tastes and preferences and product information. The retail price for wild rice varies by its value-added characteristics. An average retail price for a pound of packaged wild rice is $5.00 and can be as high as $10.00 for some specialty blends. Blended wild

[3] Appendix A provides a table listing of wholesale and retail firms involved in wild rice marketing.

rice products would include those products that have special seasonings, dehydrated vegetables and/or other grains added to the wild rice.

Increased market demand for wild rice has been due in large part to the introduction of wild rice blends. Although the blends usually contain only 15% wild rice, they account for over two-thirds of the total sales of wild rice. Sales in the blend market have increased an average of 15% each year since 1961 when the first blend of wild rice, long-grain rice, and herbs was sold. Blended rice ranged from $1.75 - $4.75 per pound with a rough average of $2.79 per pound (Oelke et al).

The demand and price for wild rice and its blends can also reflect differences in consumer tastes and preferences. The demographics of the typical wild rice and wild rice blend consumers are some college education, in the 35-54 year old age group, and tend to be professional and managerial workers. These individuals tend to be in higher income groups, are well read, and enjoy cooking (Simmons Market Research).

Other factors that can influence the demand and price for wild rice products include: its perceived nutritional value, its storability, organic vs. non-organic production, and by production region.

The nutritional content of wild rice is an important benefit in relation to demand. The low fat, high protein content, and low sodium content, combined with strong yet acceptable flavor creates a strong demand in the health food market. Storability also affects the demand for wild rice. Wild rice can be stored for long periods of time when kept in an airtight container. Cooked, it will keep for 10-14 days refrigerated, or it can be frozen for up to six months.

*Organically grown* wild rice is specific market segment. There are USDA standards, which must be met in order to label wild rice as “organic”. These standards are primarily based on the type and use of pesticides and herbicides. Typically, organic does not exclude the use of pesticides or herbicides but the ones used are used in a minimal fashion and are generally classified as non-synthetic or are generally acceptable as safe. This is an important quality in the health food sector. Organic wild rice sells for a premium in the retail market. An average of $1.00 premium is given to the organically grown wild rice compared with the non-organic wild rice (Hasbrook).

*Regionally grown* wild rice also has value. Consumers purchase more pure wild rice in Minnesota than elsewhere due to a greater familiarity with this food (Oelke et al).

A rough breakdown of regional and organic wild rice is as follows:

- Canadian Lake Wild Rice (organic wild rice from the wild)
- Minnesota Lake Wild Rice (organic wild rice form the wild)
- Minnesota Cultivated Wild Rice (farm grown wild rice)
- California Cultivated Wild Rice (farm grown wild rice)

*Production technique* can also influence the demand for wild rice. Lake grown and hand harvested wild rice is perceived by consumers to be more "natural" than wild rice produced on farms. Lake grown wild rice is grown in the wild in the lakes of Minnesota and Canada and is hand harvested. Farm grown wild rice is a cultivated row crop that was introduced in the early 1970's. The cultivated wild rice has both a yield and cost of harvest advantage over lake grown wild rice. A price premium is given for the lake grown wild rice because it is considered more "natural ". Hand picked wild rice is found in Canada and Minnesota. It is illegal to mechanically harvest wild rice from lakes or rivers in Minnesota. An average premium of lake grown and hand picked wild rice is two dollars over the cultivated crop price (Hasbrook).

The demand for retail wild rice and wild rice products would appear to be fairly price responsive. There are a number of possible substitutes for wild rice and wild rice products. These would include other grain products and blends, white and brown rice and their associated mixes. The presence of these close substitutes would suggest the price point for wild rice and wild rice blends needs to be comparable to its close substitutes. Therefore, factors that would influence that price point need to be carefully considered. These would include wild rice production and processing costs, value-added costs including costs of blend ingredients, and marketing costs. Any substantial increase in these costs and consequent upward pressure on wild rice prices could have a major effect on the quantity of wild rice demanded.

***Exportation***

The export demand for wild rice has fluctuated recently. Table 2 shows the exports of wild rice from 1994 to 1999. Major importing countries of U.S. Wild Rice include Canada, The United Kingdom, Netherlands,

**Table #2 U.S. Exports of Wild Rice**

| Year | Quantity in Pounds |
|---|---|
| 1994 | 11,353,000 |
| 1995 | 7,415,000 |
| 1996 | 11,131,000 |
| 1997 | 13,831,000 |
| 1998 | 12,989,000 |
| 1999 | 12,676,000 |

Belgium, France, Germany, Switzerland, Spain, and Australia.

The outlook for the European Markets is bright. The European market has grown significantly in the past ten years from around a 1.5 million pound market to a market now estimated to exceed 4 million pounds annually. This growth has occurred due to two factors. First, steady and reliable exportable supplies have allowed/fostered increased promotional efforts by U.S. marketers and by development of distribution programs by European companies. Second, growth has come from a steady decrease in the delivered cost of wild rice to European ports of entry thus resulting in increased consumption.

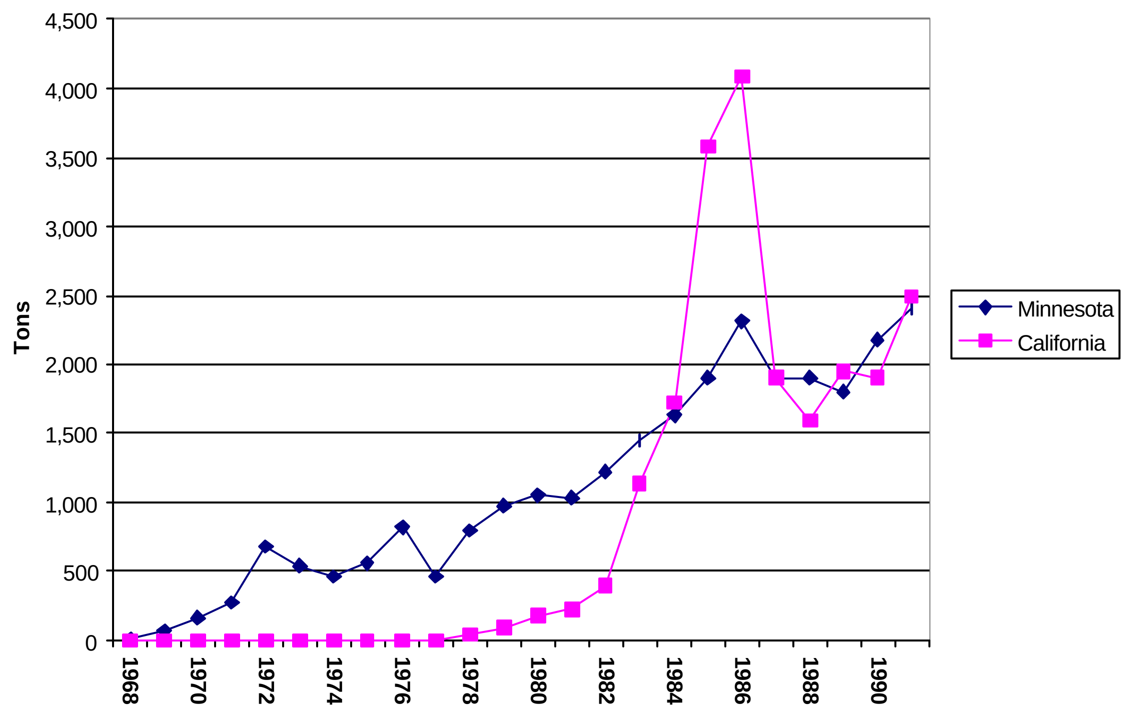
***Farm Level Demand and Processor Demand***

Chart #1 is based on production figures developed by Oelke et al. Published wild rice production numbers after 1990 were not available. Production in both California and Minnesota increased over the 1968-1990 time period with California becoming the leading producer. It is expected that over the next five years (2001-2005) that California production will continue to grow and Minnesota production will decline (Errecarte).

Farm level prices in the early 1970's averaged about $2.50 pound on a green wild rice basis. Wild rice production levels increased by 26% between 1982 and 1984 and more than doubled in 1985, and while there was increased market demand farm level prices dropped to an average of $0.90 to $1.00 per green wild rice pound. Production increases attributable to both expanded acreage and increased yields per acre have further reduced producer prices. Current California producer prices for wild rice average approximately $0.45 per pound of green rice. Minnesota producer prices remain somewhat higher primarily due to some of the unique characteristics of the Minnesota market discussed earlier. The difference between retail prices and producer prices has become wider over time. The increase in the retail-producer margin may be attributable to the increased value-added processing and marketing costs of both the wild rice processors and blended product manufacturers.

Processor prices have also declined over time. Processor level wild rice prices are variable and have fluctuated widely since the mid 1980's. In the past few years' wholesale prices have averaged $1.50 per finished product pound compared with a high of $5.15 in 1978.

**Chart #1**
**Wild Rice Production: 1968-1991**



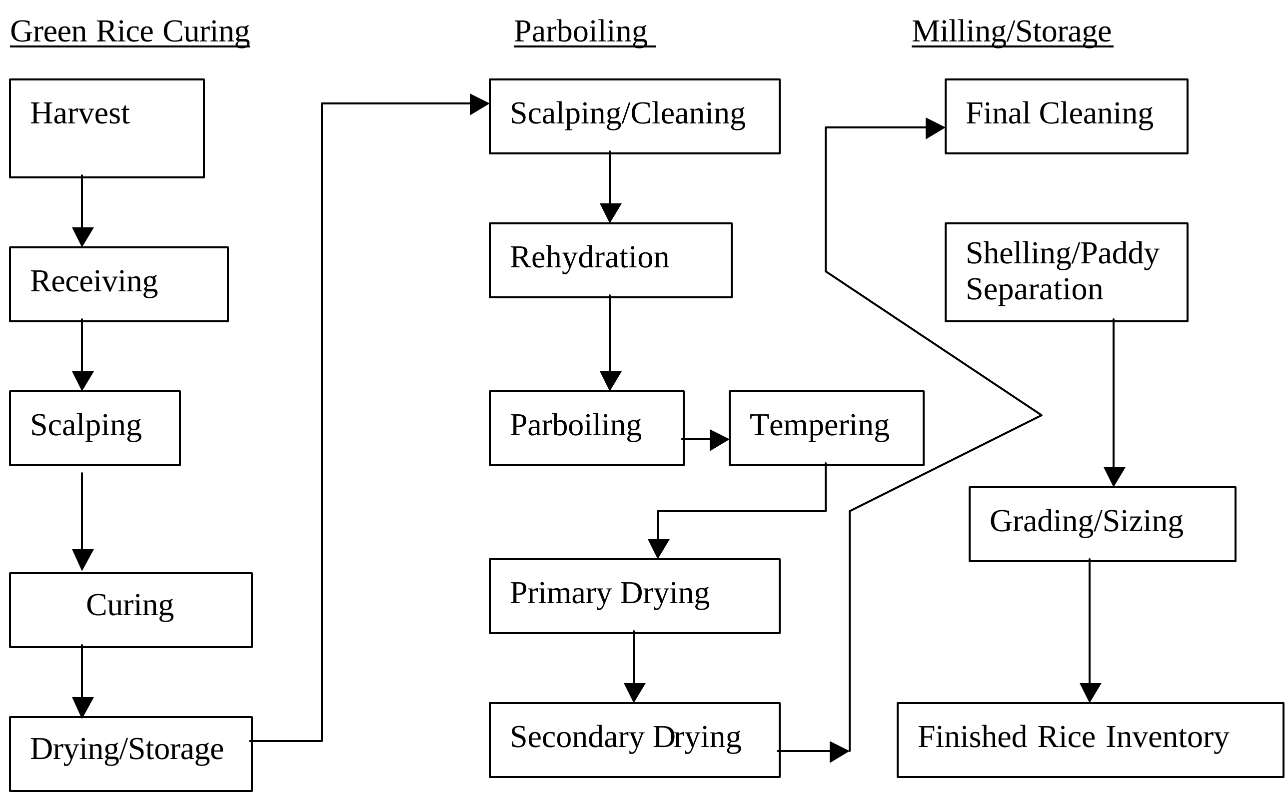

The downward pressure on wild rice processor's prices coupled with increased competitiveness in the industry and expectations of buyers with respect to changes in market demand, product quality control, and food safety concerns have heightened the need for wild rice processors to evaluate how to improve their processing technology to gain greater cost efficiencies, increased processing flexibility to meet changing demands, improve product quality control, and meet greater food safety standards. The next section of this report addresses these issues.

## Wild Rice Processing and Technological Choice

### *Wild Rice Processing*

Wild rice processing is composed of three main steps (Boedicker and Oelke). The initial step involves the handling of the fresh green rice. Once harvested, green wild rice is placed in long rows, ten inches deep, to allow the chlorophyll to dissipate from the plant. The rows are continuously turned to avoid heat damage. The wild rice is then transported to a processing facility. The wild rice is received into the facility where it is weighed and scalped. Scalping is the process of removing large foreign objects and field residues from the green wild rice. The wild rice is cured after the initial scalping process. Curing allows for some fermentation of the green rice to take place. The wild rice then undergoes drying and short-term storage period in preparation for the parboiling process. Before the rice can be parboiled, it must again be scalped and cleaned.

**Figure #1**
**Wild Rice Processing Flow Chart**



Parboiling is a process of rehydrating the wild rice and heating it under pressure. In a pressure cooker, the wild rice is baked for forty-five minutes in order to caramelize the starches in the rice. This carmelization process facilitates the unique wild rice cooking attributes. The tempering stage is where the rice is allowed to cool before it is dried. The wild rice is dried after the parboiling/tempering process to moisture content of fourteen percent.

The last of the processing sequences is to mill the wild rice. The first substantial step is the shelling and paddy separation process. In this step, the hull is rubbed off of the kernel to expose the black wild rice kernel. A hull separator separates the hulls from the wild rice kernels. The output of this stage is black wild rice. A decision that can be made at this point is whether to scarify the black wild rice or leave the wild rice in the black form. Scarification is the process of scratching the black wild rice kernels with a stone or sandpaper substance in order to scar the surface. As discussed above this process allows for faster cooking times then leaving the wild rice in the black form.

Most wild rice is processed on either a green wild rice or finished wild rice basis by major processing facilities in Minnesota, California, and Southern Canada (Walsh). Processing fees vary greatly as a result of the seasonal nature of wild rice processing, and as a result of the varying quantities of grain processed.

A processor using a green wild rice processing fee structure charges a set amount per pound of green wild rice processed by the plant. Wild rice processing fees based on a green rice system can be disadvantageous for the green rice producer since it gives the processor little incentive to maximize the quantity/quality of the finished wild rice. The result could be that processors are technically less efficient than they might be.

An alternative approach is for the processors to charge on a finished product basis. The processor is paid based on the end yield (quality and quantity) of finished wild rice. The processor can be disadvantaged by this fee structure. Finished product output can fluctuate greatly and if a lower output than expected occurs the processors will have reduced processing fees and suffer processing cost losses.

Economies of size also have a role in the fees charged by wild rice processors. Typically, plants that process in larger volumes are much more cost effective than the smaller plants, some of which process as few as one hundred pounds (Oelke).

Current California wild rice processing costs can fluctuate from 16 to 21 cents per pound on a green wild rice basis, or between 32 and 42 cents per pound on a finished wild rice basis.

Wild rice is harvested in California during July, August, September and the first half of October. The California wild rice processing plants have historically processed all of the production in about a 105-day period. This requires that individual processors make decisions regarding the mix of black and scarified products that will be processed in the same 105-day period.

The end result is that all processing costs are incurred in a 105-day period, the finished goods inventory must be maintained over the rest of the marketing year resulting in high finished goods inventory costs, product quality control problems, and there are limitations in the flexibility of adjusting the product mix for changing market conditions over the course of the marketing year. These issues has resulted in an effort to develop a wild rice processing technology that would allow for greater product mix flexibility, the ability to spread-out processing costs, to increase product quality control, and reduce finished goods inventory costs.

### *Technological Choice and Competitive Strategy*

The choice of any given technology is strongly linked to the competitive strategy a firm is adopting. The idea of competitive strategy is perhaps most closely associated with Michael E. Porter (1980). Porter expresses this concept as follows: “Essentially, developing a competitive strategy is developing a broad formula for how a business is going to compete, what its goals should be, and what policies it needs to carry out those goals.” Competitiveness is defined as the ability to get customers to choose your product or services over competing alternatives on a sustainable basis.

Sustainability is the key word here. For example, a firm may be able to gain a short-term advantage by using corporate assets to subsidize its prices. However, this is rarely a sustainable position and long term can lead to less than satisfactory firm performance. A sustainable advantage is one that allows for continual long-tem firm profitability.

Porter maintains that that there are three generic competitive strategies. They are: low-cost leadership, product differentiation, and focus. Focus is further divided into cost focus or product differentiation focus. Low-cost leadership corresponds to a potential low-price competitive advantage. Differentiation refers to uniqueness of product or service as perceived by the customer when comparing the alternatives. The focus strategy is one based on a specific geographical area, market, or product segment.

A basic assumption of research effort was that given the competitiveness of the wild rice processing sector and "commodity nature" of the product that a differentiation strategy was not realistic. That is, price is a primary determinate of the competitiveness of the individual firms in the industry. That is not to say that other factors are not important, rather at this time no basis of sustainable product differentiation exists.

However, the successful low cost competitor should not ignore the differentiating advantages in pursuit of its low costs. If quality, availability, customer service, or other factors valued by customers fall below a threshold level of acceptability held by customers, then a low-cost competitor may sink to a lower category of discount or low-quality competition. Therefore, it is necessary under a low-cost competitive strategy to ensure customer service parity if not greater than customer service parity with its competitors.

Technological choice is dependent on the choice of competitive strategy. Technology is defined as " a way to do something." There are almost always alternative technologies available to do something. There are new and old, labor-intensive and capital intensive, and unknown technologies yet to be developed. Technological choice must also be based on linkages in the firm's activities and recognition of the interactions among these activities. A further complication of technological choice is the recognition that new technologies may have the promise of enhancing firm performance by providing better products, better customer service then do existing technologies.

The following section of this paper explores technological choice in the California wild rice industry. Two basic assumptions are made: 1) that product demand cannot be perfectly forecast and that the competitive strategy is one of low-cost leadership. Low-cost leadership refers to not just processing costs, but in all operations aspects of the firm including overhead costs, inventory costs, economies of scale, and learning curve efficiencies. As mentioned above, within the context of low-cost leadership is the ability to maintain at least service parity with competitors in maintaining existing differentiating factors.

### *Technological Choice Using Multiattribute Analysis*

This section and the next develop a methodology for choosing between two wild rice processing technologies and explore the economic consequences of the processing technology that is chosen. Two technologies are compared: a traditional technology and an experimental technology.

Both technologies have the same basic processes as described above: green rice handling and curing, parboiling, and milling. The primary difference between the two occurs at the end of the green rice handling and curing process

The tradition technology allows for only short-term storage of green rice. The cured green rice is then taken out of storage, cleaned and rehydrated, parboiled, milled, left black or scarified, and stored in finished good inventory in approximately a 105-day period.

The experimental technology allows for the cured green rice to be stored and processed across the marketing year. This allows for parboiling and milling to be done throughout the marketing year. More importantly, it allows for just-in-time decision making as to whether to scarify the black product. Thus, the experimental technology allows for more flexibility in inventory control, product quality control, and market decision-making than does the traditional technology.

Although there are obvious benefits to this experimental technology there are risks inherent in the adoption of any new technology. For example, there is a least some probability that the technology simply will not work or will not perform at a level of technical and/or managerial efficiency sufficient to gain the cost, quality control, and product mix flexibility benefits.

The technological choice more appropriately needs to be done by precisely specifying the factors that affect the choice, by allowing trade-offs among the factors, and then choosing an alternative that offers the best balance. Technological choice is a strategic decision and like many strategic decisions of vertical integration, major capacity expansion, or entry into new businesses decision-makers should go beyond cost and investment analyses to consider broad strategic issues and perplexing administration problems that are very hard to quantify. Thus, technological choice needs to take into consideration a number of factors not simply the capital and operational costs of adopting a specific technology.

Multiattribute Utility Analysis (MUA)[4] is useful for any decision in which multiple factors are important, no alternative is clearly best on all factors, and some factors are difficult to quantify. Several business decisions have these characteristics: plant location, decisions to vertically integrate, what and whether to negotiate, and technological choice.

The development of a MUA model requires the following: 1) define attributes of value for the technologies; 2) assess the performance of the technological choices on each attribute; 3) determining trade-offs across attributes, and 4) calculating overall values.

The attributes values need to comprehensive or broad enough to account for most of what is important in evaluating the technologies, to highlight the differences among the technologies, to reflect separate, non-overlapping values to avoid double counting, and to be independent of each other. The key attributes are arranged into a hierarchy showing their logical relationships. Each of the key attributes can be further subdivided into component attributes.

Assessment of each of the attributes requires that a ranking or rating scale be created. These scales can be either standard unit (e.g. dollars for costs) or relative such as the perceived degree of technological risk of adoption. These assessments are then transformed into 0-to-100 point scales for standardization. The determination of the trade-offs across attributes can be done by obtaining a set of weights that represent the decision-maker's judgment about the relative importance of the attributes. The last modeling activity is to calculate a weighted-average score for each candidate by working up the hierarchy.

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[4] A comprehensive treatment of multiattribute utility analysis is provided by Ralph L. Keeney and Howard Raiffa in *Decisions with Multiple Objectives: Preferences and Value-Trade-Offs* [New York: Wiley, 1976]

A MUA model was constructed using input from the management group at SunWest Foods. SunWest is a rice and specialty food products company located in Davis, CA. The results[5] of that model are presented in Tables #3 and #4.

The six key attributes selected by the management group in term of their relative importance in making a wild rice processing technological choice were: product quality, demand flexibility, technological risk, inventory carrying cost, barriers-to-entry, and project costs.

**Table #3**
**Multi-Attribute Analysis**

Weights and Attributes Affecting Choice

| **.40 Product Quality** | **.20 Demand Flexibility** | **.15 Technology Risk** | **.10 Inventory Carrying Costs** | **.10 Barrier-to-Entry** | **.05 Project Costs** |
|---|---|---|---|---|---|
| .40 Microbiological Safety<br>.30 Uniformity<br>.15 Post Harvest Handling<br>.10 Appearance<br>.05 Smell | | .50 Rice Curing Process<br>.20 Foreign Material Contamination<br>.20 Product Quality Control<br>.10 Capacity Bottlenecks | .50 Cured Paddy Inventory<br>.50 Finished Product Inventory | .60 Working Capital<br>.30 Market Barriers<br>.10 Investment Barriers | .60 Operating Costs<br>.30 Lead Time<br>.10 Investment Cost |

It is interesting to note the order of relative importance placed on each of the six attributes. Three of the six attributes (product quality, technological risk, and barriers-to-entry) do not lend themselves well to quantification yet make up 65% of the attribute value weights. Product quality aspects are deemed the greatest importance. Demand flexibility ranks second as an important choice attribute. This suggests that it and product quality are thought to be important differentiating factors for a low cost producer strategy.

Project costs were assigned the lowest weight indicating that whatever cost differences may exist between technological choices they are deemed to be least

[5] The input provided by the company's management should be viewed as general in nature and used to represent the useful of this type of modeling technique.

important when compared to other decision attributes. The inventory cost attribute is weighted toward the cost of storing the green wild rice prior to parboiling. That green wild rice inventory cost has a higher weight than finished inventory value would indicate that there is more risk in storing green wild rice than the processed wild rice products. This risk would include product degradation and further moisture losses. The barrier-to-entry attribute has to do with the value a high capital cost technology has in potentially securing a strategic low cost producer sustainable competitive advantage. Table #4 shows the technology scoring values that were assigned to each attribute for the traditional and experimental technologies.

**Table #4**

**Technology Scoring Values**

| **Traditional Technology Scoring Values** | |
|---|---|
| Product Quality | (.40) (0) + (.30)(0) + .15(0) + (.10)(0) + (.05)(0) = 0 |
| Demand Flexibility | (100) (0) = 0 |
| Technology Risk | (.50)(100) + (.20)(100) = 70 |
| Inventory Carrying Costs | (.50)(100) = 50 |
| Barriers-to-Entry | (.60)(50) = 30 |
| Project Costs | (.30)(100) + (.10)(100) = 40 |
| Overall Value | (.40)(0) + (.20)(0) + (.15)(70) + (.10)(50) + (.10)(40) + (.05)(40) = 21.5 |

| **Experimental Technology Scoring Values** | |
|---|---|
| Product Quality | (.40) (100) + (.30)(100) + .15(100) + (.10)(100) + (.05)(100) = 100 |
| Demand Flexibility | (1.00) (100) = 100 |
| Technology Risk | (.20)(100) + (.10)(100) = 30 |
| Inventory Carrying Costs | (.50)(100) = 50 |
| Barriers-to-Entry | (.60)(50) + (.30)(100) + (.10)(100) = 70 |
| Project Costs | (.60)(100) = 60 |
| Overall Value | (.40)(100) + (.20)(100) + (.15)(30) + (.10)(50) + (.10)(70) + (.05)(60) = 79.5 |

The technological scoring values are computed by multiplying the sub-attribute weights shown in Table #3 by their assigned scale number (0-100). For example, the product quality score for the traditional technology is calculated by multiplying 0.40 (the sub-attribute weight for microbiological safety) times the scale number assigned to it by the management group. For this particular sub-attribute, the scale number is zero. This means that it was totally inferior to the experimental technology. Note that the same 0.40 is multiplied by 100 for the experimental technology. The rest of the calculations follow the above.

The overall scoring value for each technology is calculated by multiplying the attribute value by the respective sub-attribute score and summing across all attributes. The overall value for the traditional technology is 21.5. The technology with the highest score is deemed the dominant (choice) technology.

The dominant MUA choice is the experimental technology, which is not surprising given the weights placed on product quality and demand flexibility as differentiating factors and the relatively low weight placed on technological risk. This would indicate the management group thinks that the operational and management risks associated with the experimental technology are relatively low when compared to its cost and differentiation attribute values.

***Economic Evaluations of the Technological Choice***

Three economic evaluations of the technological choice are presented. The first evaluates economies-of-size between construction of an experimental technology 8,000,000-pound wild rice processing plant and a 10,000,000-pound plant. The second is temporal breakeven analysis. The third analysis is a set of three internal rates of returns calculations based on changing product demand assumptions.

Table #5 presents fixed and variable cost comparisons[6] between a 10,000,000-pound traditional technology plant, and an 8,000,000-pound and 10,000,000-pound experimental technology plant. The 10,000,000-pound experimental technology plant has a slightly higher, $0.01, average total cost than the traditional technology. This is due to higher capital and depreciation costs than the traditional technology.

Figure 2 shows the average fixed cost curve associated with the 8,000,000-pound and 10,000,000-pound plants. The average fixed cost curve comparisons indicate that at every level of processing up to its capacity the 8,000,000-pound plant has lower average fixed cost of processing.

The 10,000,000-plant would require a throughput of 9,250,000-pounds of product or 92% of its capacity before achieving the same average fixed cost that the 8,000,000-pound plant would at full capacity. The average fixed cost of processing becomes lower

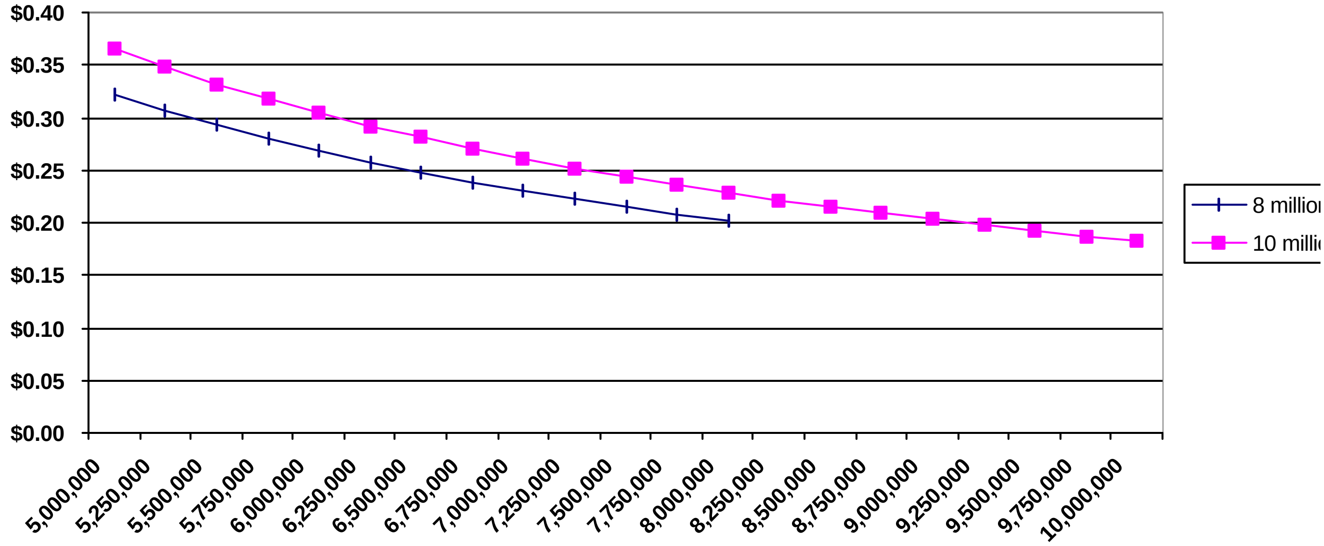
[6] The costs should be viewed as general estimates and not definitive numbers. The economic analysis that is based on these numbers must therefore be taken in the same light. The cost estimates are based on conversations with SunWest Foods staff. A more detailed breakdown of the fixed and variable costs developed for this study are contained in Appendix B to this report

for the 10,000,000-pound plant than that achievable by the 8,000,000-pound plant when more than 9,250,000 pounds of green rice are processed. Thus, based on fixed costs and increased flexibility to meet increasing demand the 10,000,000-pound plant would be the preferable option given that the increased capital cost would not act as a constraint.

**Table #5**
**Cost Comparison: Traditional Technology and Experimental Technology**

| | Plant Capacity (lbs) | | |
|---|---|---|---|
| | Traditional Technology | Experimental Technology | |
| Capacity<br>Cured Green Rice Throughput in pounds | 10,000,000 | 8,000,000 | 10,000,000 |
| | | | |
| 1. Variable Costs | | | |
| Direct Labor | $402,000 | $400,000 | $402,000 |
| Supplies | $1,500 | $1,500 | $1,500 |
| Repairs | $30,000 | $30,000 | $30,000 |
| Electrical Costs | $54,000 | $45,000 | $54,000 |
| Total Variable Cost | $487,500 | $476,500 | $488,000 |
| Average Variable Cost (lb.) | $0.05 | $0.06 | $0.05 |
| | | | |
| 2. Fixed Costs | | | |
| Operations Management | $237,000 | $237,000 | $237,000 |
| General Management | $100,000 | $100,000 | $100,000 |
| Taxes | $52,000 | $41,300 | $52,000 |
| Capital Cost | $213,000 | $188,000 | $237,000 |
| Miscellaneous Expenses | $50,000 | $60,000 | $60,000 |
| Depreciation | $724,000 | $648,000 | $804,000 |
| Total Fixed Cost | $1,376,000 | $1,274,300 | $1,490,000 |
| Average Fixed Cost (lb.) | $0.14 | $0.16 | $0.15 |
| | | | |
| Total Cost | $1,863,500 | $1,750,800 | $1,978,000 |
| Average Total Cost | $0.19 | $0.22 | $0.20 |

**Figure #2**
**Average Fixed Cost Curves**




The second analysis looks at the breakeven time associated with a 10,000,000-pound traditional plant and 10,000,000-pound experimental plant. The payback period is defined as the time when green rice procurement cost, curing cost and processing costs have been paid for by wild rice sales revenues.

The difference in the two technologies is that the tradition technology requires that all of the above costs be accrued in a 105-day period while the experimental technology accrues procurement and curing cost in a 105-period but processing costs are spreads across the marketing year. Procurement cost for both plants is based on a $0.45 per pound green rice cost. This results in a $4,500,000 total cost for procurement. Curing cost (including green rice handling costs) is based on a $0.03 cent per pound figure. This results in a $300,000 total curing cost. The processing cost for both technologies is approximately $0.17 per pound and results in $1,700,000 in total processing costs.

Thus, for the traditional technology $6,440,000 is expended in a 105-day period. The experimental technology requires expenditure of $4,800,000 in a 105-day period and allows for the $1,700,000 processing costs to be spread out over the marketing year.

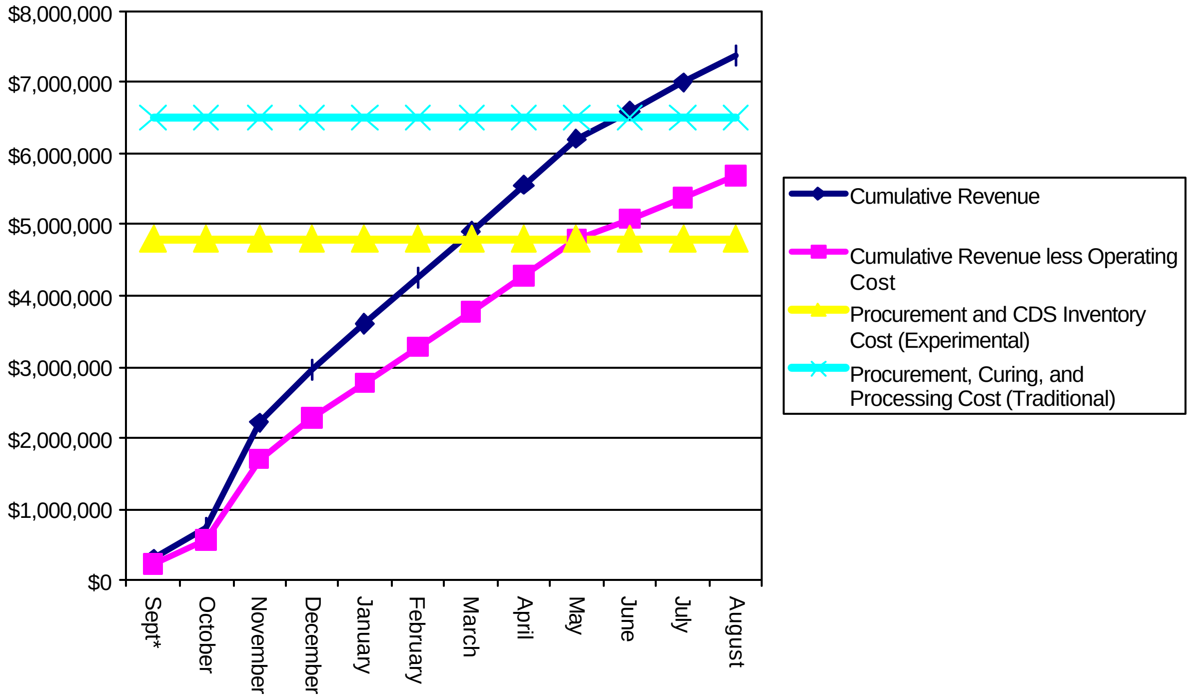
Table #6 shows a "best guess" forecast of the demand for the finished wild rice products by month over the marketing year and the consequent gross revenues by month.

**Table #6**
**Best-Guess Forecast (Pounds per Month)**

| | | | Monthly Demand and Revenue | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | Grade A Black | Grade A- Black | Grade A- Scarified | Grade B- Scarified | Grade B- Black | Grade C- Scarified | Large Brokens | Small Brokens | Total demand (final product) | | | |
| Sept | 19,160 | 40,000 | 59,160 | 45,720 | 11,400 | 12,240 | 12,240 | 4,080 | 204,000 | | | |
| October | 28,740 | 60,000 | 88,740 | 68,580 | 17,100 | 18,360 | 18,360 | 6,120 | 306,000 | | | |
| November | 95,800 | 200,000 | 295,800 | 228,600 | 57,000 | 61,200 | 61,200 | 20,400 | 1,020,000 | | | |
| December | 47,900 | 100,000 | 147,900 | 114,300 | 28,500 | 30,600 | 30,600 | 10,200 | 510,000 | | | |
| January | 42,152 | 88,000 | 130,152 | 100,584 | 25,080 | 26,928 | 26,928 | 8,976 | 448,800 | | | |
| February | 42,152 | 88,000 | 130,152 | 100,584 | 25,080 | 26,928 | 26,928 | 8,976 | 448,800 | | | |
| March | 42,152 | 88,000 | 130,152 | 100,584 | 2,5080 | 26,928 | 26,928 | 8,976 | 448,800 | | | |
| April | 42,152 | 88,000 | 130,152 | 100,584 | 25,080 | 26,928 | 26,928 | 8,976 | 448,800 | | | |
| May | 42,152 | 88,000 | 130,152 | 100,584 | 25,080 | 26,928 | 26,928 | 8,976 | 448,800 | | | |
| June | 25,578.6 | 53,400 | 78,979 | 61,036 | 15,219 | 16,340 | 16,340 | 5,447 | 272,340 | | | |
| July | 25,530.7 | 53,300 | 78,831 | 60,922 | 15,191 | 16,310 | 16,310 | 5,437 | 271,830 | | | |
| August | 25,530.7 | 53,300 | 78,831 | 60,922 | 15,191 | 16,310 | 16,310 | 5,437 | 271830 | | | |
| Total | 479,000 | 1,000,000 | 1,479,000 | 1,143,000 | 285,000 | 306,000 | 306,000 | 102,000 | 5,100,000 | | | |
| | | | | | | | | | | | | |
| Price/Lb. | $1.50 | $1.50 | $1.50 | $1.50 | $1.50 | $1.40 | $1.00 | $0.75 | | | | |
| | | | | | | | | | | | | |
| Month | Sept | October | November | December | January | February | March | April | May | June | July | August |
| Gross Revenue | $295,596 | $443,394 | $1,477,980 | $738,990 | $650,311 | $650,311 | $650,311 | $650,311 | $650,311 | $394,621 | $393,882 | $393,882 |
| Total Gross Revenue = | $7,389,900 | | | | | | | | | | | |

Figure #3 is based on revenue data provided by Table #6. Figure #3 shows the approximate time when cumulative revenues will cover the costs. The gross revenue line for the traditional technology crosses the total procurement, curing and processing costs line in June of the marketing year while the cumulative revenue less operating cost line for the experimental technology cross the procurement and curing cost line in May. This suggests that the experimental technology will allow for net profitability to begin early for the experimental wild rice plant than it would for a traditional wild rice processing plant. The earlier profitability favors the experimental plant as the choice technology.

**Figure #3**
**Marketing Year Breakeven Period for Traditional and Experimental Technologies**




The third analysis focuses on the internal rate of return (IRR) of the technological choice under uncertain demand scenarios. The first IRR calculations are based on the "best-guess" product demand forecast provided in Table 6. Table 7 provides the information used to calculate the IRR on both technologies. The primary difference between the two technologies is the expenditure of processing costs in either a 105-day period or over the marketing year. An additional cost is calculated. That cost is the cost of money for the processing plant operations. Both technologies incur upfront procurement and curing costs; however, the traditional plant incurs all processing costs in the initial 105-period of operations.

It is assumed that both types of plants borrow operating capital and that capital is paid back out of the operating revenues over the course of the marketing year. The operating capital interest rate is assumed to be 8% on the unpaid portion of the operating capital. Conversely, if the plants have their operating capital supplied from firm retained earnings than the 8% is assumed to be the opportunity cost of that capital. The IRR's are calculated based on a 15-year investment period.

**Table #7**
**Traditional and Experimental Technology Investment Rates of Return: Best-Guess Demand**

| | Net Revenue | Gross Revenue | Procurement Cost | Curing Cost | Processing Cost | Operating Capital Cost (Opportunity Cost) | Technology Investment Cost |
|---|---|---|---|---|---|---|---|
| Before Tax: Experimental Technology | $759,700 | $7,389,900 | $4,500,000.00 | $300,000 | $1,700,000 | $130,200 | $4,733,000 |
| | | | | | | | |
| Before Tax: Traditional Technology | $704,847 | $7,389,900 | $4,500,000 | $300,000.00 | $1,700,000 | $185,053 | $4,496,350 |
| | | | | | | | |
| | IRR | | | | | | |
| Experimental Technology | 14.11% | | | | | | |
| | | | | | | | |
| Traditional Technology | 13.65% | | | | | | |

Table #7 suggests there is no significant difference between the internal rates of return on the two technologies. Two factors are affecting the slight 0.5% difference in the two IRR's. The first is the difference in the operating capital cost and the second is the difference in initial investment of the two technologies. If the investment cost of the two technologies were the same the IRR's would be 14.11% and 12.69% respectively. If the tradition technology were to have an investment cost that was 90% of the experimental technologies rather than the 95% shown above then the IRR's would be 14.11% and 14.7% respectively. Thus, based on previously stated assumptions and IRR calculations there is not a major financial advantage to either technology. This result would seem to be consistent with the results of the multiattribute utility analysis. The investment cost weight was assigned a 10% value (the lowest) in the project cost value which itself received the lowest value weight of 5%.

***Internal Rate of Return and Uncertain Demand***

The next two tables show the impact of uncertain demand on the internal rate of return for the technological choices. Uncertain demand means that there exists a certain probability that the best-guess forecast will be in error. It will be assumed that the error is 20% of the best guess forecast. That is, there will be 20% more Black A and Black B product demanded than processed. The demand estimate error must be on the black product since once wild rice is scarified it cannot be returned to the original black form. However, if the demand for scarified product were under estimated then the black product could be re-milled to the scarified form.

**Table #8**
**Effect of Uncertain Demand on Internal Rate of Return: Type 1 Error**

| Products | Best-Guess Forecast | Actual Demand (20% Forecast Error) | Sales Based on Forecast Error | Market Price | Outside Purchase Price | Outside Purchase Cost | Lost Sales Revenue |
|---|---|---|---|---|---|---|---|
| Grade A Black | 479,000 | 574,800 | 479,000 | $1.50 | $1.75 | $167,650 | $143,700 |
| Grade A Scarified | 1,000,000 | 904,200 | 904,200 | $1.50 | | | |
| Grade A- Scarified | 1,479,000 | 1,479,000 | 1,479,000 | $1.50 | | | |
| Grade B-Scarified | 1,143,000 | 1,086,000 | 1,086,000 | $1.50 | | | |
| Grade B-Black | 285,000 | 342,000 | 285,000 | $1.50 | $1.75 | $99,750 | $85,500 |
| Grade C-Scarified | 306,000 | 306,000 | 306,000 | $1.40 | | | |
| Large Brokens | 306,000 | 306,000 | 306,000 | $1.00 | | | |
| Small Brokens | 102,000 | 102,000 | 102,000 | $0.75 | | | |
| Total | 5,100,000 | 5,100,000 | 4,947,200 | | | $267,400 | $229,200 |
| Total Revenue = | $7,389,900 | $7,389,900 | $7,160,700 | | | | |
| Total Revenue Less Outside Purchase Cost = | | $7,122,500 | $0 | | IRR = | 6% | |
| Total Procurement, Curing, and Processing Cost = | | $6,685,000 | $6,685,000 | | | | |
| Net Revenue Traditional Technology with Forecast Error = | | $437,500 | $475,700 | | | | |

Table #8 is the result of the Type 1 uncertainty in demand error. The Type 1 uncertain demand error is the situation where the best-guess forecast is processed and then during the marketing year additional Black A and B product are demanded. The firm has two options. The first is to not make the sale and the second is to purchase Black A and B wild rice from another firm for re-sale. If the sale is not made then lost revenues result and excess scarified product is placed into carry-over inventory.

The additional cost of purchasing outside wild rice is assumed to be $0.25 cents above the firm's sales price. Comparison of the two options suggests that the preferable economic option under the Type 1 uncertainty demand error is forego the sales. This results in a reduction of total revenues from $7,389,900 to $7,160,700. Subtracting out the total procurement, curing, and processing costs results in net revenue of $475,700. This net revenue based on a 15 year investment period results in a 6% IRR. This is a very conservative and somewhat improbable scenario. It is highly unlikely that the firm would not adjust future year's "best-guess" forecasts if the Type 1 error were being made. However, it does provide an IRR range from worst to best forecasts.

Thus, the traditional technology can have an IRR range of 13.65% to 6%, when there is a 20% probability that the best-guess forecast will be a Type 1 error. The experimental technology avoids this Type 1 uncertainty demand error since the processing is done just in time to meet the actual demand. The IRR advantage to the experimental technology increases substantially given the assumption of a Type 1 situation occurring.

Table #9 shows the results of the Type 2 uncertainty demand error. This error occurs when a firm recognizes that its best-guess forecast is likely in error. The firm attempts to allow for the error by processing more Black A and Black B product that it's best-guess forecast. The firm can then re-process the Black product to scarified product if it discovers that is best-guess forecast was more accurate than believed. This strategy is somewhat constrained in that, historically, out of every 100 pounds of green the finished product yield has been 29% A and 28% B.

There are two disadvantages to the strategy. The first is that re-milling black wild rice to scarified products is not a one-to-one process. A pound of re-milled black product on average will give an output of 0.9 pounds of scarified product and 0.1 pound broken products. Second, there is a cost to re-mill the product. This re-milling cost is approximated to be $0.10 per pound of black rice. It can be observed that a Type 2 uncertainty demand forecast error is preferable to a Type 1 uncertainty demand forecast error.

This analysis is based on re-milling enough black rice to return it to its best-guess forecast figure. This is a conservative view since it is possible that only a portion of the black product will actually be re-milled. That is, there will be something greater than a 0% forecast error, but something less than a 20% forecast error.

**Table #9**
**Effect of Uncertain Demand on Internal Rate of Return: Type 2 Error**

| Products | Best-Guess Forecast | 20% Forecast Error | Product Availability after Re-Milling | Outside Scarified Rice Purchases | Outside Purchase Price (Net of Sales Price) | Market Price |
|---|---|---|---|---|---|---|
| Grade A Black | 479,000 | 574,800 | 479,000 | | | $1.50 |
| Grade A Scarified | 1,000,000 | 904,200 | 990,420 | 9,580 | $1.75 | $1.50 |
| Grade A- Scarified | 1,479,000 | 1,479,000 | 1,479,000 | | | $1.50 |
| Grade B-Scarified | 1,143,000 | 1,086,000 | 1,137,300 | 5,700 | $1.75 | $1.50 |
| Grade B-Black | 285,000 | 342,000 | 285,000 | | | $1.50 |
| Grade C-Scarified | 306,000 | 306,000 | 306,000 | | | $1.40 |
| Large Brokens | 306,000 | 306,000 | 317,460 | | | $1.00 |
| Small Brokens | 102,000 | 102,000 | 105,820 | | | $0.75 |
| Total | 5,100,000 | 5,100,000 | 5,100,000 | 15,280 | | |
| | | | | | | |
| Total Revenue = | $ 7,389,900 | | $ 7,404,225 | $7,381,305.0 | | |
| | | | | | | |
| Re-Milling Cost per lb = | $0.10 | | $15,280 | $15,280 | | |
| | | | | | | |
| Outside Rice Cost = | | | $26,740 | $0 | | |
| | | | | | | |
| Total Revenue less Re-Milling Cost and Outside Rice Purchases = | | | $7,362,205 | $7,366,025 | | |
| | | | | | | |
| Procurement, Curing, and Processing Costs = | | | $6,685,000 | $6,685,000 | | |
| | | | | | | |
| Net Revenue = | | | $677,205 | $681,025 | | |
| | | | | | | |
| IRR = | | | 12.48% | 12.59% | | |

The costs of re-milling and purchasing outside rice to meet product demand are less costly under this option than processing wild rice to the best-guess forecast and purchasing outside rice to meet existing demand. Two IRRs for the Type 2 error are shown. The first is with outside rice purchases and the second is without outside purchases. The two IRR's are quite close. Both IRR's for this strategy are less then had the best-guess forecast been correct, but significantly less variable than the 6% to 13.6% range for the Type 1 error strategy. Thus, it would appear that dominant marketing strategy would be to use a Type 2 error strategy if a traditional technology were to be the technological choice. A major advantage of the experimental technology is that its demand flexibility ability allows both Type 1 and Type 2 uncertain demand forecast errors to be avoided

## Conclusions

This study has evaluated wild rice processing technological choice under demand uncertainty. The California wild rice industry is growing and the pressure to meet increasingly critical customer demands is increasing with that growth. The industry is under pressure to reduce costs and increase product quality.

Two technologies were studied to evaluate their potential for meeting those customer demands while providing a sustainable competitive advantage. A low cost strategy is chosen as the strategic choice since their exists a large degree of substitutability between individual firm's wild rice products and between wild rice and other types of specialty grain products. The strategic choice of low cost must be accompanied by differentiating factors, which must be comparable or greater than those supplied by competing firms.

The technological choice was first evaluated using a multiattribute utility analysis. The analysis indicates that for one of the firm's in the California wild rice industry that factors such as product quality, demand flexibility, technological risk, inventory carrying costs, barrier-to-entry considerations, and project costs are important choice variables. The first two factors, product quality and demand flexibility carry the majority of the value weight in the technological choice decision.

The multattribute utility analysis was followed by a financial analysis of the technology investment. IRR's were calculated for a best-guess demand forecast and two forecasts where the probability of forecast error was taken into account. Although the experimental technology has higher IRR's for all three analyses the only significant difference occurs under the Type 1 error where the firm processes to the best guess forecast and the meets changes in black wild rice demand by purchasing wild rice form competing wild rice processors.

The dominant processing strategy when using traditional technology to process wild rice would be a Type 2 strategy where the expected forecast error is included in the processing decisions. More black wild rice would be proceed than the best-guess forecast and if needed it would be re-milled into scarified rice. This has the dual advantage of increasing the IRR over the Type 1 error and reducing the need to purchase wild rice from other processors. That reduction in outside purchases may also reduce the need to provide outside processors competitive knowledge.

The IRR results and the multiattribute utility analysis would appear to support the choice of the experimental technology. The avoidance of the Type 1 and Type 2 demand forecast errors would also strongly favor the experimental technology as the choice technology. Thus, in light of the multiattribute utility analysis where the values on technological risk and projects costs were significantly less than those on product quality and demand flexibility it would appear that the experimental technology is the dominant technological choice.

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## List of Tables

## List of Figures

# Appendix A
# Wild Rice Wholesalers and Retailers

## Wild Rice Wholesalers and Retailers

| Manufacturer | City | Product Name/Brand | Ingredient Content List | W/R Rank | Food Type P or M |
|---|---|---|---|---|---|
| | | | | | |
| **Trader Joe's** | So. Pasadena CA 91031 | *Trader Joe's* Wild Rice | All | | -- |
| | | TJ Cal Rice Trilogy | CA Wild Rice | 4 | M |
| | | TJ Basmati Rice Medley | Wild Rice | 2 | M |
| | | TJ Wild & Basmati Rice Pilaf | Wild Rice | 2 | M |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| **Uncle Ben's Inc.** | Box 1732, Houston TX 77251 | *Uncle Ben®s* Long Grain & Wild Rice | Wild Rice | 2 | |
| | | *Uncle Ben's* Long Grain & Wild Rice Fast Cook Recipe | Precooked Wild Rice | 3 | M |
| | | *Uncle Ben's* Long Grain & Wild Rice Original Recipe & Fast Cook | $21.60/12bx/case | 3 | M |
| | | | | | |
| **Conagra** Consumer Affairs 1-800-323-9980 | Dept H-W, PO Box 3768 Omaha Neb 68103-0768 http://www.healthychoice.com | *Healthy Choice Soups* Turkey w/White & Wild Rice (canned) | Wild Rice | 10 | P |
| | | | | | |
| **Campbell Soup Co.** | Camden NJ 08103-1701 1-800-257-8443 www.chunky.com | *Campbell's* Healthy Request Hearth Chicken Rice w/White & Wild Rice (canned) | Wild Rice | 11 | P |
| | | *Campbell's Chunky Soup*-Savory Chicken w/White & Wild Rice | Cooked Wild Rice | 9 | P |
| | | *Campbell's Chunky Soup* Beef w/White & Wild Rice (canned) | Cooked Wild Rice | 7 | P |
| | | | | | |

| Manufacturer | City | Product Name/Brand | Ingredient List | **Wild Rice** Rank | Food Type P or M |
|---|---|---|---|---|---|
| | | | | | |
| **Near East Food Prop.** | Chicago IL 1-800-822-7423 | N.W. Long Grain & Wild Rice Pilaf Mix | Wild Rice | 2 | M |
| | | *Near East* ®Mediterranean Chicken & Wild Rice | | 3 | M |
| | | | | | |
| **Sun West Organics** | Davis CA | *SunWest* Organic Wild Wild Rice | Wild Rice | 1 | -- |
| | | Organic Wild Mix (Wild & Short Grain Wild Rice) | Organic Wild Rice | 2 | M |
| | | Organic Pilaf Wild & Long Grain White Rice w/Herbs | Organic Wild Rice | 2 | M |
| **The Hain Food Group** Uniondale NY | Hain Consumer Affairs 255 W. Carob St., Compton CA 90220 | *Hain*® Wild Rice Soup (canned) | Wild Rice | 6 | P (canned) |
| **Nature's Best** Pat Devious, Mrtg. | Puente Street, Brea, CA | "store brand" Organic Brown Basmati & Wild Rice Blend (in bin) | Wild Rice | 2 | -- |
| Randy Lindberg, CEO | | Wild Rice MacDouhall's (in bin) | Wild Rice | 1 | -- |
| | | | | | |
| | | | | | |
| | | | | | |
| **New Frontiers Natural Foods** / Private Label | Arizona | *New Frontiers Natural Wild Rice* - Cereal – | Wild Rice | 1 | -- |
| | | *New Frontiers* Organic Wild Rice | Wild Rice | 1 | -- |
| | | | | | |
| | | | | | |
| | | | | | |

| Manufacturer | City | Product Name/Brand | Ingredient Content List | W/R Rank | Food Type Prepared=P Mix=M or Microwave=MW |
|---|---|---|---|---|---|
| **Lundberg Family Farms** | Box 369, Richvale CA 95974-0369 | ***Lundberg® Wild Blend*** | Wild Rice Bits | 3 | M |
| | | ***Lundberg Country Wild*** | | 0 | |
| | | | | | |
| **Fantastic Foods Inc.** 707-778-7801 | Petaluma CA | Four Grain Rice Pilaf | | 4 | M |
| ***Gibbs Wild Rice*** 1-800-824-4932 (CA) | Box 277, Deer River, MN 56636 | ***Gibbs Wild Rice Organic*** ***Total Prdts: 12 – 8 with wild rice*** | 100% Wild Rice | | |
| ***Fall River Wild Rice Mills*** | 41577 Osprey Drive, Fall River Mills, CA 96028 | Fall River Wild Rice | 100% Wild Rice | | |
| **HyTop**-Packed for Federation Group | Arlington Heights IL | Hy-Top® Long Grain & Wild Rice w/Herb Seasonings | Wild Rice | 3 | M |
| **Golden Grain Co.** Box 049003, Chicago 60604-9003 | Pleasanton CA Rice A Roni | Rice-A-Roni® - 2 products Long Grain & Wild Rice Original | Wild Rice | 2 | M |
| | | | | | |
| ***General Mills*** | Minneapolis MN 1-800-847-FARM | *Farmhouse*® Long Grain & Wild Rice w/Traditional Herbs/Herbs & Butter | | 2 | M |
| | | *Farmhouse* Long Grain & Wild Rice Traditional Herbs & Seasonings | Wild Rice | 2 | M |
| | | *Farmhouse* Brown & Wild Rice | | 2 | M |
| | | | | | |
| | | | | | |
| | | | | | |

| Manufacturer | City | Product Name/Brand | Ingredient Content List | W/R Rank | Food Type P or M |
|---|---|---|---|---|---|
| **Riviana Foods Inc** (713) 529-3251<br><br>Fax: (713) 529-1661 | 2777 Allen Parkway, 15th Floor, Houston, TX 77019 | 4 product brand lines: Mahatma®, Carolina Rice®, Success®, & Water Maid® | | | |
| | P.O. Box 2636, Houston, TX 77252 | Mahatma® Long Grain and Wild rice mix, | Lg Rice, iron supple., WR | 3 | M |
| | | Success® Brown & Wild Mix | Brown rice, wild rice | 2 | M |
| | | Carolina® LG & WR | Rice. Wild rice, & spices | 2 | M |
| | | Water Maid® – no WR prdts found | | | |
| **Ankeny Lakes WR Co.** | Marketed by FamilyFarms Direct.Com | Wild Rice Galore 3 – 8 oz bx $20.95 | | 1 | |
| | Herb Lake Landing, Manitoba | Wild Rice Blend 5 – 1 lb bags $20.00 | | | |
| | | Northwest Blend WR 5 lbs. $21.00 | | | |
| | | 5 – 1000 lbs 50 lb bags $3.60-3.20/lb | Bulk wild rice | 1 | |
| **Riceland Foods Inc.** | Stuttgart, Arkansas | Seasoned LG & WR 6 – 36 oz bx | Rice, wild rice, onion, garlic, spices | 2 | M |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

# Appendix B

## Wild Rice Processing Plant Construction, Fixed, and Variable Costs

## Wild Rice Processing Plant Construction and Fixed Costs

**Construction Costs**
Plant Size (Green Rice Pounds)

| **Land at $8,000 per Acre** | 8 million | 10 million | Dry Down Capacity |
|---|---|---|---|
| 2 Acres | | | $16,000 |
| 3 Acres | $24,000 | | |
| 4 Acres | | $32,000 | |
| **Total Land Cost** | $40,000 | $48,000 | |
| **Land Improvements at $20,000/acre** | $60,000 | $80,000 | |
| **Buildings at $50 per sq ft** | $600,000 | $800,000 | |
| **Paddy Dry-Down Bins** | | | $250,000 |
| **Equipment** | $2,500,000 | $3,125,000 | |
| **Installation and Electrical** | $500,000 | $625,000 | $50,000 |
| **Preliminary Engineering** | $35,000 | $35,000 | |
| **Engineering** | $20,000 | $20,000 | $20,000 |
| **TOTAL** | $3,755,000 | $4,733,000 | $320,000 |

**Annual Fixed Costs**
Plant Size (Green Rice Pounds))

| | 8,000,000 | 10,000,000 |
|---|---|---|
| **Operations Management** | $50,000 | $50,000 |
| **Quality Assurance** | $50,000 | $50,000 |
| **Mechanical Maintenance** | $52,000 | $52,000 |
| **Electrical Maintenance** | $35,000 | $35,000 |
| **Inventory Control and Accounting** | $50,000 | $50,000 |
| **General Management** | $100,000 | $100,000 |
| **Total** | $337,000 | $337,000 |
| **Property Taxes at 1.1% of Total Plant Value** | $41,305 | $52,063 |
| **Capital Costs at 10%** | $187,750 | $236,650 |
| **Depreciation, (straight-line)** | | |
| Equipment at 5 years | $611,000 | $761,000 |
| Buildings at 30 years | $20,000 | $26,667 |
| Dry-Down Bins at 15 years | $16,667 | $16,667 |
| **Total Management, Taxes, Capital, and Depreciations Costs** | $1,213,722 | $1,430,046 |
| Miscellaneous Fixed Expenses | $60,000 | $60,000 |
| **Total Fixed Costs** | $1,273,722 | $1,490,046 |

## Annual Variable Costs

Plant Size
(Green Rice: Million of Pounds)

| | 8,000,000 | 10,000,000 |
|---|---|---|
| **Direct Labor** | | |
| Unloading | $60,480 | $60,480 |
| Weighing | $30,240 | $30,240 |
| Curing | $60,480 | $60,480 |
| Parboiling | $40,320 | $40,320 |
| Cleaning/Grading/Milling | $40,320 | $40,320 |
| Sanitation | $60,480 | $60,480 |
| Loading Out | $30,240 | $30,240 |
| Quality Control | $70,560 | $70,560 |
| **Total Direct Labor** | $393,120 | $393,120 |
| **Sanitation Supplies** | $1,500 | $1,500 |
| **Equipment and Repair** | $30,000 | $30,000 |
| **Electrical Costs** | $45,000 | $54,000 |
| **Weighing-In** | $4,000 | $5,000 |
| **Weighing-Out** | $3,200 | $4,000 |
| | | |
| Variable Cost -Curing | $151,200 | $151,200 |
| Variable Cost-Processing | $325,620 | $336,420 |
| **Total Variable Costs** | $476,820 | $487,620 |