EXTRACTING MINERALS FROM THE GREAT SALT LAKE: GREAT FIND OR GREAT FRAUD?

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ABSTRACT

Nutritional minerals have been sourced from the Great Salt Lake (GSL) and provided to domestic and international markets since 1969. Endorheic properties of the lake leading to high mineral concentrations, in conjunction with the vastness of the lake, set the GSL apart as the most logical location for nutritional mineral extraction in the world. In spite of the vast abundance of mineral-based resources, only three companies possess water rights with accompanying food-grade mineral extraction claims[1]; Mineral Resources International, Inc. (MRI), Trace Minerals Research, LLC (TMR), and Salt Lake Minerals Co., LLC (SLM). Significant barriers to entry exist regarding capital requirements, operational liabilities and the acquisition of adequate production technologies. These barriers prevent market entry for actors other than those already established within this market. In addition to external barriers preventing market entry, this market is also characterized by vastly dissimilar business models amongst the sourcing entities. Only MRI implements a traditional solar-evaporation technology when transforming raw GSL water into a concentrated mineral form. The other organizations boast a technology superior to solar-evaporation. Inter-business production method analysis reveals enormous quantitative distinctions regarding concentrated mineral product. In spite of this quantitative distinction, all three entities are successful in marketing product. In-depth analysis suggests that TMR and SLM purchase non-food-grade product from a GSL source and market the product as food-grade in an effort to compete against the industry pioneer MRI. Consumers lack the ability to differentiate between food-grade and non-food-grade product. Additionally, no mechanism is in place requiring that GSL harvesters selling product marketed as food-grade – actually produce to a level suitable for human consumption.

[1] Food-grade refers to a quality measurement of product. Food-grade product is approved by the FDA for human consumption. In contrast, non-food-grade product, while containing nutritional content, is not suitable for human consumption. Both food-grade and non-food-grade production practices take place on the GSL.

INTRODUCTION

The market for nutritional minerals is characterized by a steady and growing demand coupled with a finite number of actors supplying product to market. Unique factors of size and salinity support the Great Salt Lake (GSL) as a very logical sourcing option for nutritional minerals. In fact, the aggregate demand for nutritional mineral products worldwide relies heavily on the supply of minerals housed in the GSL. In light of the growing demand for nutritional minerals, a traditional market would experience a surge of additional market participants, causing the supply of the product to increase, pushing the price of the product downward – ultimately driving economic profit towards zero. Under conditions of perfect competition the growing demand for nutritional minerals would be met by supply-side response factors. The GSL market for nutritional minerals does not, however, meet the requirements of a traditional "perfect-competition" model.

Barriers to entry prevent market participation for entities interested in sourcing nutritional minerals from the GSL. In fact, market entry barriers are substantial enough that supplying GSL nutritional minerals is most likely limited to the few organizations already sourcing from the lake. While it is possible for an organization with enough resources to overcome these barriers, the lack of successful attempts in the last 30-years suggests a continued dearth of market participants. Among the existing suppliers, each entity attempts to meet the market demand according to various methods. Distinctions among entities currently supplying nutritional minerals to market exist in regards to both sourcing practices and production technologies. Business model specifics comparing the actors within this market unveil the unique practices of these organizations. This article explores the market for GSL

nutritional minerals, examining the factors that prevent market participation, and the way in which each supply participant seeks to satisfy the market demand for these nutritional minerals.

The remainder of the article is organized as follows: Section 2 examines the GSL in terms of salinity and size, and compares the market for non-food-grade minerals to the market for food-grade minerals. This is accomplished using traditional supply/demand arguments in accordance with historical growth rates. Section 3 discusses the history of GSL sourcing entities. Section 4 examines market-entry barriers, analyzing the entry process chronologically in accordance with requirements that need to be met by any interested entity. Section 5 considers differing business practices among the currently established industry-sourcing entities. Section 6 considers the future of the nutritional mineral industry reflecting on the unique economic structure of the market, existing barriers to entry, the history of entities within the market, and critical business practices of the existing entities. Closing remarks conclude this section.

1. THE GREAT SALT LAKE

The Great Salt Lake (GSL) stands as an endorheic[2] body of water uniquely situated in the desert-region of northwest Utah. This shallow lake, lying within a bowl-like basin between the Wasatch Range on the east and the Great Salt Lake Desert on the west, is the largest salt lake in the Western Hemisphere.[3] Now only a fraction of its prehistoric size, the GSL occupies around 2,500 square miles. Fed by a consistent flow of water from Bear, Jordan, Ogden and

[2] This term refers to a closed drainage basin that retains water and allows no outflow to other bodies of water. In other words, the body of water is considered terminal.

[3] Historically, this lake is thought to have occupied nearly 20,000 square miles in areas now known as California, Idaho, Nevada, and Utah.

Weber rivers, more than one million tons of mineral deposits are added to the terminal lake each year. In recent years, mineral-free water evaporation from the lake exceeds the total amount of water flowing into the lake, causing a gradual shoreline recession and an ever-increasing rate of mineral concentration.

The salinity of the GSL can be as high as 270 parts per thousand (ppt.), compared with an average of 35 ppt. for the majority of the world's oceans. Consequent to the concentration of minerals in the GSL, salt levels are far too high to support fish and the vast majority of other aquatic species. Although the GSL is not resource-rich in fish – it is, however, resource abundant in regards to sodium chloride, potassium and sodium sulfates, magnesium, elemental chloride, magnesium chloride brine, brine shrimp, brine shrimp eggs, and dozens of trace minerals. Each of these resources is directly tied to an external market and can be extracted from the lake following traditional market practices.

The extraction of minerals from the GSL can be divided into distinctive categories involving non-consumptive mineral products and consumptive mineral products. Critical demand and supply realities in regards to minerals sourced from the GSL make the academic study of nutritional, food-grade minerals, instead of non-consumptive minerals, the focus of this study. A summary of market conditions for both mineral markets is provided in Table 1.

2.1 NON-CONSUMABLE MINERALS

The demand for non-consumables sourced from the GSL is relatively stable, experiencing an occasional positive fluctuation following innovations that link the source mineral to a new application. Additionally, as countries develop, as measured by their ability to

purchase (income), the demand for non-consumable minerals is positively influenced. The demand for these products consequently rises overtime at a gradual rate – experiencing

TABLE 1 – DEMAND AND SUPPLY TRENDS

	NON-CONSUMPTIVE MINERALS	CONSUMPTIVE MINERALS
DEMAND	Stable. Increasing gradually with income/development parameters, and new product applications.	Steady growth. Increasing rapidly in accordance with health benefit discoveries.
SUPPLY	Abundant. Can be produced in thousands of locations around the world.	Restricted. The Great Salt Lake has extreme advantages in production because of the size of the lake and high salinity levels.

periodic exogenous shocks. As the demand does rise, the supply-side of the market quickly responds – compensating for the increased demand and creating a stable and competitive price in the market. Supply-side stability established within the global market for non-consumable minerals is easily accomplished subsequent to the vast supply of sodium chloride, magnesium chloride, and potassium sulfate. These minerals are extracted from thousands of locations around the world where they exist ubiquitously.

A better understanding of what these minerals are used for in everyday applications will make this argument more clear. Various non-consumptive products are produced following the extraction of sodium chloride, magnesium chloride, and potassium sulfate which contribute to consumer utility in a myriad of ways. Sodium chloride is converted into products such as water-softeners, livestock salt-licks, and ice-melt pellets. Magnesium chloride is often used in the

production of magnesium metal, chlorine gas, and as a dust suppressant. Potassium sulfate is most often converted into a commercial-grade fertilizer, or used in glass manufacturing processes. As people find more applications for these minerals, the demand will grow. This demand can be satisfied, however, by any of the thousands of suppliers that have the ability to produce these products.

Sodium chloride is amply produced through a process of halite[4], and can be extracted following natural evaporation processes which occur throughout numerous bodies of ocean water, brine wells, and lakes with high levels of salinity. More than 200 million metric tons of sodium chloride was produced primarily by the United States, China, Germany, India and Canada in 2005 alone; less than one percent of which was sourced from the GSL.

Magnesium chloride is typically extracted from seawater, brines, and sea-beds. The majority of magnesium chloride mining that takes place in the United States concentrates on the central portion of the states where residual deposits were left as the oceans receded during the last period of the Paleozoic Era.[5] The production of magnesium chloride is not unique to the GSL. In fact, any country with access to the ocean can produce magnesium chloride.

Potassium sulfate, also known as sulfate of potash, is found in salt mines around the world, located in nearly every country. The demand for potassium sulfate has historically increased at an annual rate of 1.8% (2000 – 2008), and is expected to continue at this slow rate.In 2002 the demand for potassium sulfate by the United States alone was 960 thousand short tons. While Great Salt Lake Minerals Corporation, a Utah based company, produced 600 thousand short tons helping to satiate domestic demand, the shortfall of production was met by

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[4] Halite refers to mineral deposits that occur following evaporative processes occurring in bodies of water.
[5] The Paleozoic spanned from roughly 540 to 250 million years ago.

other domestic and international suppliers. As the demand continues to rise at a predictable rate, worldwide suppliers will adjust production accordingly.

2.3 NUTRITIONAL MINERALS

In contrast to the low growth rates regarding demand, and the abundance of suppliers within the market for non-consumables, the market for nutritional minerals is experiencing steady growth, and is limited by natural comparative advantage properties to primarily being sourced from the GSL. The growth experienced within this market in conjunction with the natural GSL advantages in supplying this product to market underscores the importance of understanding this market.

Among the large bodies of saltwater, the GSL is the most concentrated hypersaline source of nutritional minerals in the world. The extraction of nutritional minerals from saltwater bodies with less concentration would prove too costly to produce product that would be competitive with nutritional minerals extracted from the GSL. In fact, sourcing alternatives to the GSL all prove inferior in either size, or mineral concentration. The GSL, standing as the fourth largest hypersaline lake in the world, is only surpassed in size by the Caspian Sea, Aral Sea, and Lake Balkhash.

While these four sources of water all stand as larger saltwater bodies each has salinity levels much less concentrated. More precisely, the highest salinity level among the larger bodies of water stands at a mere 12 ppt. The GSL has recorded salinity levels as high as 270 ppt. In addition to the unique salinity concentrations of the GSL, this body of water is also the only hypersaline body of water to be located in the Western Hemisphere. Arguments of geography, however, pale in comparison to arguments of both size and salinity. The GSL is far superior to all other bodies of water when examining the influence of size and salinity.

The Dead Sea lying between Jordan and Israel in the Eastern hemisphere is the only lake that has greater mineral concentrations than the GSL – at levels of 300 ppt. Although mineral mining does take place in the Dead Sea, this lake is only sixteen percent the size of the GSL. More precisely, the size of the Dead Sea is 394 square miles compared to the GSL which boasts 2,500 square miles. Arguments identifying the GSL as the most logical choice for nutritional mineral extraction in the world need to be examined in juxtaposition to the steady growth experienced in this market.

The demand for nutritional minerals is increasing at impressive rates worldwide. In 2008, the industry of health supplement stores involved more than 10,000 retailing companies with combined annual revenues of $6 billion in the United States alone. While sales during this year grew by 12%, this figure represented the lowest growth rate experienced by the organic industry throughout the past decade; most certainly a result of the ensuing recession. Increasing demand can occur subsequent to changes in expectations, the number of buyers in the market, and adjusting preferences.

Expectations about future incomes and the price of nutritional mineral products are unlikely to have changed to a significant degree. In fact, throughout the recession, as people's expectations about income were decreasing, demand within this market was still growing. Additionally, because this market does not historically exhibit falling prices, it is also unlikely that expectations about future prices have led to increased demand. The number of buyers has most certainly changed in a positive direction. The base of domestic and international customers is rapidly expanding – contributing to the increased demand for nutritional minerals. Ultimately, however, demand within this market is primarily influenced by changing preferences. Preferences for market goods are altered according to data-gathering and interpreting processes, and in accordance with new goods becoming available. A circular

interaction between buyers and suppliers exists, where suppliers inform buyers about the positive health ramifications associated with the consumption of their product, and buyers inform suppliers of their current health needs. The information-age and globalization have forever changed the way markets function.

Producers are more likely to fund research verifying their product has positive health ramifications when the study can reach a mass-audience at a near instantaneous rate. The information-age now allows anyone with a health concern to do online research and explore the best method of ameliorating their physical ailment. Globalization allows anyone in the world with sufficient resources to shop-around for the best product, and order in the comfort of their home or office. It is likely that the combination of consumers becoming more health-conscious, the availability of information about the effects of products, and the simultaneous mass-marketing campaigns within this industry have led to an ever-increasing rate of demand stimulus. Of the aforementioned contributing factors, the growth of the nutritional mineral industry is most dominantly tied to studies that validate linkages between the consumption of these minerals and health benefits. New health benefits regarding nutritional minerals sourced from the GSL are discovered monthly.

These discoveries are published in academic journals and health magazines throughout the developed world. In spite of the fact that scientific processes are rigorously emphasized while testing for correlations between specific nutritional minerals and health benefits, the FDA is slow to accept nutritional minerals as capable of altering health – subsequent to a definitional classification which doesn't identify nutritional minerals as either a "food or drug". In an effort to adhere to FDA regulations, companies specializing in nutritional minerals use specific verbiage colloquial within the industry. Specific phrases such as "supports", "helps to compensate for", and "designed to" are used instead of phrases such as "increases", "reduces",

and "promotes". Eighty-six known elements are sourced from the GSL and successfully marketed both domestically and internationally as capable of ameliorating a host of health problems.[6]

In spite of nutritional minerals not having an FDA "stamp-of-approval", buyers continue to stock their cabinets with products composed of nutritional minerals – with a belief that the structure-function claims will ameliorate one or more of their health status predicaments. Buyers routinely return to purchase more of a similar product, following a period of trial and success with their health-seeking purchase. Research evidence suggests that nutritional minerals sourced from the GSL have positive implications for myriad of health conditions. Some of the structure function claims involve improving conditions of metabolic syndrome, heart health, conditions of obesity, brain development, bone loss, bone health, weight gain, mental health and mood, immune-support, bone mineral health, eye health, blood sugar balance, hydration, fatigue, gastrointestinal function, colorectal function, cardiovascular function, and menopause.[7] It is likely that with increased correlations between various nutritional minerals and factors of health that this industry will continue to grow at double-digit rates.

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[6]Elements touted for their nutritional value sourced from the GSL include: aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, bromide, cadmium, calcium, carbonate, cerium, cesium, chloride, chromium, cobalt, copper, dysprosium, erbium, europium, fluoride, gadolinium, gallium, germanium, gold, hafnium, holmium, hydrogen, indium, iodine, iridium, iron, krypton, lanthanum, lead, lithium, lutetium, magnesium, manganese, mercury, molybdenum, neodymium, nickel, niobium, nitrogen, osmium, oxygen, palladium, phosphate, phosphorus, platinum, potassium, praseodymium, rhenium, rhodium, rubidium, ruthenium, samarium, scandium, selenium, silicon, silver, sodium, strontium, sulfate, sulfur, tantalum, tellurium, terbium, thallium, thorium, thulium, tin, titanium, tungsten, uranium, vanadium, xenon, ytterbium, yttrium, zinc, and zirconium.

[7] These claims are not made by all of the operating entities.

2. GSL SOURCING ENTITIES

The GSL is owned by the government of the state of Utah. Organizations wishing to source from the GSL are therefore required to first apply with the Utah Department of Natural Resources. If the application is accepted, organizations then pay land-use rental fees, and royalties contingent upon the tonnage of minerals extracted from the GSL, or for nutritional minerals according to an established percentage of end-product sales. Royalty percentages are stated in code R652-20-, currently establishing royalty percentages for phosphate, potash and other associated minerals at a value of 5%. Organizations with established contracts prior to the enactment of code R652-20- are exempt from the standard royalty, and are instead subject to previously agreed upon contract stipulations. In addition to meeting the requirements for the Utah Department of Natural Resources, organizations wishing to source from the GSL must also obtain the necessary water rights from the Utah Division of Water Rights prior to extraction.

Subsequent to publically accessible historical documents within both of the stated departments, the process of verifying land-use rental fees, royalties, water rights, and the subsequent identification of GSL sourcing entities that legally extract from the GSL is easily accomplished. Distinguishing further, to identify which of these companies target nutritional minerals, has been determined by contacting representatives from each of these companies and specifically verifying the nature of company-specific sourcing.

Records from the Utah Department of Natural Resources identify seven GSL sourcing companies and one sourcing individual (2009). The Utah Division of Water Rights echoes the natural resource record – indicating sourcing practices among the listed organizations. Among the sourcing entities – Great Salt Lake Minerals (a Compass Minerals company), US

Magnesium, Morton Salt, Cargill Salt, and William Colman – all exclusively source minerals that are non-consumptive in nature. Trace Minerals Research, LLC., Salt Lake Minerals, LLC, and North Shore Limited Partnership, however, have all stated both – a history of, and future intention to source nutritional minerals from the GSL. Having eliminated the other organizations as possible entities that source nutritional minerals from the GSL, attention is now focused on the remaining three entities.[8]

The Anderson Family, predecessors to the current establishment known as MRI, has been extracting nutritional minerals from the GSL since 1968. The founders of MRI, Hartley and Gaye Anderson, were the first to convert minerals and trace minerals from the GSL into food-grade mineral products. These products have been sold to domestic markets since 1969, and international markets since 1974. On the international stage, which serves as the focus of MRI sales and marketing campaigns, product promotion is successful in the countries of Europe, Asia, Southeast Asia and the Pacific, Africa, and North America.

Ultimately, all existing companies with rights to source nutritional minerals from the GSL have historical roots with the original company. North Shore Limited Partnership exists as the harvesting intermediary for Mineral Resources International (MRI). North Shore Limited Partnership's ownership is divided amongst the Andersons and Frank Shepherd; the owner of Marine Minerals.

In April of 1996, the owners of MRI created an auxiliary LLC to serve as a specialization company with specific purpose of distributing product domestically. Trace Mineral Research, LLC (TMR), initially created to distribute MRI product in the U.S. domestic market, was sold

[8] Company-specific claims regarding the sourcing of nutritional minerals from the GSL was confirmed by phone interviews with organizational leaders from each individual entity, and by further verifying the production of product with the claims each company made about production.

in April 1999 following a stock purchase agreement between the two companies. The two companies continued doing business together, with MRI being the exclusive mineral supplier to TMR and TMR being MRI's exclusive distributor to the U.S.A. health food store market for another seven years until 2006, when the contractual arrangements between the two companies ended.

TMR now operates independent from MRI, selling to more than 3,500 health food stores in the U.S. alone.[9] TMR advertises product longevity as having been established in 1969, thirty years prior to the stock purchase agreement between the two companies. Not surprisingly, MRI is at odds with TMR boasting product history from a period prior to their establishment as a separate entity. Conflicts between these two companies are continually expressed in numerous legal actions, making the fact that both entities are located a stones-throw from each other a difficult reality for each organization.

In addition to MRI and TMR sourcing nutritional minerals from the GSL, another company known as Salt Lake Minerals (SLM) also shares in the market for nutritional minerals. SLM is the newest operating entity within this market, having been established in 2006. This company directs most of its attention to international markets, with a specific focus on Asia. The history of SLM is similar to that of TMR, in that the founders were previous employees of MRI. MRI is in current litigious battles with both TMR and SLM in regards to alleged agreement violations that were made while the current owners of these organizations were employees of MRI. In spite of the pervasive legal battles that continue to exist between these companies, each company is nonetheless successful in establishing itself within the market and continues to distribute product to a myriad of buyers around the globe. The market for

[9] This statement was made by Ryan Fisher, the general manager of Trace Minerals Research on August 12th, 2009.

nutritional minerals sourced from the GSL is, however, limited to the stated suppliers. Notwithstanding the ensuing battles between the established entities, market conditions portray a promising and bright future to the already-established players. Market conditions may eventually entice additional participants to enter the game.

4. BARRIERS TO ENTRY

Having recognized the nutritional mineral market as being limited in regards to active participants, it is now critical to consider what factors prevent others from competing within this market. Why are there so few GSL nutritional-mineral market participants? In the absence of market-entry barriers, additional entities realize profit potential, and begin competing – ultimately leading to a traditional "competitive-market" structure, wherein market participants compete for profit. The absence of additional market participation strongly suggests that barriers exist which prevent additional entities from entering the market and capturing the profit potential inherent therein.

When barriers prevent market participants from entry into a market, participants already established often price-gouge and produce at levels below those determined in a perfectly competitive market. When a market is limited to one supplier, price is determined by the supplier and is set at a point that maximizes profit. In a perfectly competitive market price is simply a function of market determined demand and supply. Absent any competition, prices would rise from a point determined by the demand and supply in the market – to a point where profits are maximized. Competition does, however, exist in this market – suggesting that market forces drive the price towards a competitive equilibrium. While the price of product is subject to competitive forces within this market, entry into this market is extremely limited by

various barriers. These barriers give advantage to the entities already operating within the market.

No individual or company has successfully sourced[10] nutritional minerals from the GSL without having acquired the original and proprietary sourcing methods established by the pioneering company. A proper understanding of market entry prevention needs to consider various barriers from the perspective of a start-up company having desires to source and sell nutritional minerals from the GSL.

4.1 ECONOMIC BARRIERS

Analyzing economic barriers to entry is a process that needs to take place from the perspective of an entity seeking market entry. A significant barrier within one or more areas can prove major enough that potential entrants into the market can be deterred by the existing obstruction. If a foreknowledge of the market-entry barrier exists, it is likely that any entity with intent to enter the market would theoretically overcome the barrier before attempting to enter as a market participant; or realize that entry is not feasible, and therefore not attempt to enter. It is not always the case, however, that market barriers are clearly delineated beforehand. Market participation may commence with no initial knowledge of barrier existence. In this case, the lack of barrier transparency may drive competitors out of the market after they have already attempted to establish themselves within the market. Whether or not barriers are clearly visible beforehand or not, it is evident that GSL market participation is extremely limited – and that therefore, barriers to entry in this market do exist.

[10] I consider "success" in this case to reflect a minimum of 2-years end-product sales from the sourced minerals. Although there have been attempts at market entry, none have successfully met the 2-year mark from the date of establishment.

Economic barriers primarily involve arguments of capital and technology. Within a standard profit equation, profit is equivalent to total revenue minus total cost. Total revenue is a function of price multiplied by quantity. Entities with influence over the price, as is the case here, set the price of product at a point that maximizes profit. Total cost is a function of waged-labor, and capital payments. Entities considering market entry compare a projected total revenue figure to total costs of production. Profit potentials are directly tied to the cost of capital. The cost of capital is, in part, a function of the technology inherent in the production process. If projected total revenue is below total costs in the long run, then organizations will not seek to participate within the market. An organization without the technological know-how may only be able to produce at a high-cost, and would therefore not be able to compete with entities already established. It is important, therefore, to consider both capital requirements and technology. Economic barriers are directly tied to both capital and technology – stressing the importance of examining each of these categories in detail.

An organizational entity wishing to operate within the GSL nutritional mineral industry needs to first consider economic barriers in regards to capital requirements. Capital requirements within this market are relevant regarding the obtainment of water rights, payment of application fees, water right fees, point-of-diversion transfer costs, operational liability costs, and royalty payments. Individually, none of these prove costly enough to warrant a "barrier-to-entry" claim. Together, however, barriers to entry in the form of capital stock are significant enough to prevent most entities from competing. Each of these will now be considered in an effort to divulge the magnitude of each economic argument within the market-entry argument.

Initially, conducting business on the GSL requires a $40 state application fee, specifically identified by the state as a "filing" charge. In conjunction with this fee, entities

interested in extracting minerals from a government-owned parcel of land must compete with others that have similar intentions. In fact, upon submitting an application for mineral extraction, a bonus-bid is submitted with a minimum bid of $1 per acre. The state division then advertises for competing bids by placing the parcel in an auction called a simultaneous offering. Entities are then allowed a period of time (typically 60 days) to enter a bid for the same parcel. All the bids are opened simultaneously and the highest bidder is awarded the application for the subject parcel, after the bid-period is closed.

Entities interested in sourcing nutritional minerals from the GSL can easily access publically available information regarding the submission of similar requests. Given the short list of interested sourcing entities, it is likely that entities submit bonus bids that are near the minimum required levels. The financial burden in regards to the application process necessary in sourcing nutritional minerals from the GSL cannot, even by the most stringent standards, be considered an economic barrier to entry.

Most of the available land surrounding the waters of the GSL sits dormant – never being applied for or receiving bids from any organization or person.[11] At the current rate of utilization it is likely that a surplus of land will exist far into the future. While the availability of land poses no immediate barrier to entry, it is important to note that if applications for the use of land on the GSL continue to be approved (even at a slow rate); state land applications will eventually be limited – inducing barriers to entry on an argument of geography alone. Given the current rate of application submission and the availability of land, land supply restrictions are several hundred years away. It can therefore be surmised that barriers to entry in regards to the availability of land on the GSL are very small.

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[11] The North end of the GSL is the most mineral-rich area of the lake. Accordingly, this area is where organizations source nutritional minerals; whether food-grade or non-food-grade.

Water rights, classified as "real property" in Utah, are bought and sold much like real estate. A water right is specifically a right to the "*use*" of water based on quantity, source, nature of use, point of diversion, and physically putting the water to beneficial use. In order to source nutritional minerals from the GSL, it is obviously necessary to divert water – which requires the prior obtainment of a water right. In order to obtain a water right it is first necessary to file an application with the State Engineer. After the application is reviewed regarding the water's proposed development specifics, a legal notice is prepared and advertised for 14 days in local newspapers. Following this period of time, an additional 20 days of wait time are required – allowing anyone to protest the water right claim. If no disputes are filed, the State Engineer reviews the application, potential revising or applying conditions to the application. The approval process takes a minimum of three months. If disputes arise, the process could take much longer. While the water-right disputation system is in place for entities seeking to source from the GSL, it is rare that claims are filed. The majority of water right claims are processed within a period of two weeks. In addition to time constraints, water right claims are also subject to fees based on the quantity of water diverted. Water right fee schedules indicate that the most expensive rate (relevant when applying for 11,500 or more acre feet) is a mere $1,000. The process of obtaining water rights, therefore, requires a maximum of $1,000 and up to three months of wait time for the processing of paperwork. From a perspective of economic barriers, the process of obtaining water rights is fairly simplistic and does not create any significant obstruction.

The GSL is considerably shallow – contributing to vast annual variations in the shoreline. As the lake recedes (as it has done for the past several years), it becomes necessary to move water a substantial distance to a location where it can be processed. The process of moving water from the point of diversion to a place where it can either be transported or placed

in evaporation ponds requires pressurized pumps and canal tubing. While this process can be annoying and cumbersome, it is hardly expensive. A simple pump moving 8,000 gallons of water an hour, with tubing stretching several thousand feet might set an organization back a few thousand dollars.[12] So far, economic barriers have not proven significant enough to prevent small organizations from entering the market and competing. Consideration of operational liability costs changes this reality.

Operational liability costs include liability insurance, business income insurance, building and property insurance, automobile insurance, legal costs of forming an organization and obtaining trademarks and/or patents, building licenses, consulting costs, advertising and marketing expenditures, the provision of security, and the cost of producing product at food-grade quality. While a degree of variance exists regarding business-specific choices for each of these liability costs, even a bare-minimum aggregation presents a substantial barrier to entry.[13]

While a number of these operational costs are standard within any industry, producing product to a point that is considered food-grade sets this industry apart. Various accreditations and certifications authenticate product at a "food-grade" or supplement grade standard. Specifically, a food-grade mineral harvester typically targets the acquisition of such certifications including but not limited to cGMP (current Good Manufacturing Practices) certification, GRAS (Generally Recognized as Safe), Ames Assay and Mouse Lymphoma, Halal, Kosher, Vegetarian, and Anti-Doping. The provision of GRAS alone typically requires an initial $200,000 or more. Ongoing GMP compliance requires an average of $50,000-$100,000

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[12] It is important to consider that if the lake continues to recede, the expenses incurred at this point of business start-up may continue to escalate to a point where, it may one-day, be considered a barrier to entry. That day is not yet here. Although MRI moves water nearly 5 miles (2010), the cost does not amount to more than a few thousand dollars.

[13] Specific quantitative data obtained from all 3 organizational structures of study and verified (where possible) with the appropriate entities.

each year. The maintenance of an in-house lab and quality department to comply with these quality standards can also be very costly requiring the hiring of highly trained personnel, the purchase of expensive lab equipment, and supplies for the use of that equipment. Aggregately, the above operational costs present a significant barrier to entry.

TMR is GMP certified with NPA. SLM claims to be GMP compliant, but has never been certified. MRI is GMP certified with NSF. Each of these companies goes to a different length to guaranteeing that product is produced at "food-grade", and accordingly, incurs varying degrees of financial burden. A company not obtaining NSF certification would avoid the burden of paying for this certification. Subsequent to the fact that it is not required to have this certification, two of the three companies have opted not to obtain it. For companies not incurring these costs, operational liability decreases dramatically – decreasing the significance of entry barriers. TMR, SLM and MRI all produce product to a point that profits are realized. The decision to invest in an action that authenticates product produced as food-grade needs to weight the benefits of this action against the costs of gaining the accreditation. For two of the three companies – the decision was made against obtaining accreditation.

Next, it is important to consider the payment of royalties as a potential barrier. Royalties are paid to the state based on arrangements made between the state and specific business entities prior to the enactment of The Comprehensive Management Plan (CMP) for the Great Salt Lake (November, 1999), or based on a percentage of end-product sales. Whether companies began sourcing before 1999 when royalty rates were formally set or not, companies are now paying a standard rate of 5% to the state. While this may seem like a barrier to successfully operating a business (especially in the beginning), it is important to consider that if an entity is not able to produce product to a point where it is acceptable to sell in market, they are not responsible for paying any royalties to the State. Additionally, all three businesses

claiming to source nutritional minerals from the Great Salt Lake have found ways to reduce royalty payments, in some cases to insignificance.

Royalty agreements establish a percentage of end-product sales that must be paid to the State by each sourcing entity. It is possible for sourcing organizations, however, to avoid a significant portion of the payment responsibility. One way in which organizations accomplish this is by setting up two distinct organizations. The first organization possesses the royalty arrangement with the state. This organizational entity produces some raw ingredient, (or multiple raw ingredients), which it sells to the second organization. The first organization pays a royalty to the state based on the value of the raw ingredient. The second organization, purchasing product from the first, then transform the raw ingredient(s) into marketable products and markets these products to consumers. Considering that raw ingredients are only one input into the production process – it is evident that end-product sale prices are much higher than the mere cost of raw ingredients. It is optimal, therefore, for sourcing organizations to structure business in such a way that they avoid paying royalties on value-added products beyond the raw-ingredient stage. This practice is standard among GSL sourcing entities. Accordingly, it is evident that royalty payments do not significantly prevent entities from sourcing from the GSL. Organizations are, however, required to pay a minimum royalty of $5,000 to the State at the beginning of each year – regardless of the sourcing quantity or successful sale of product. Neither the $5,000 royalty requirement, nor the payment of royalties on raw product, however, constitutes a significant barrier to entry.

While capital requirements have been considered in regards to water rights, point-of-diversion transfer costs, operational liability costs, royalty payments and application and water right fees, only operational liability costs have proved significant in terms of economic barriers to entry within this market. There is, however, another area tied directly to arguments of

capital investment that has not yet been considered. After extracting minerals from the GSL, and before selling these nutritional minerals in the market, it is necessary to "transform" the minerals. The transformation process of minerals from their original state (raw GSL water) to food grade nutritional minerals requires first, a foundational technology and second, the successful application of the technology. While production-specific capital is a critical part of the production process, it cannot be separated from an argument of technology. Importantly, the technological process involved in transforming raw GSL water into food-grade nutritional minerals critically hinges on the existence and proper utilization of capital inputs.

Capital requirements, in conjunction with the accompanying technology, pose a significant enough barrier to entry within this industry that other business entities have not been successful at entering and competing with the established entities. When questioned about the extent of capital required to implement an operation based on solar-evaporation technology, MRI estimates that holding ponds alone will require more than $300,000.[14] While this amount is significant, the acquisition of holding ponds alone would hardly constitute an operable production process. It is likely that capital requirement in the realm of $500,000 or more would be required for a start-up operation – one much smaller than MRI's existing operation.

Possession of sufficient capital resources – absent the technological know-how – would not prove sufficient in the production process. Accordingly, while capital requirements stand as a significant barrier in their own right, an organization with the financial means to provide this capital would also need to acquire production-specific knowledge. Understandably, both capital and technology stand as interrelated and oppositional barriers to successful market entry.

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[14] This figure is based on conversations with MRI owners in October, 2009.

While TMR and SLM do not have solar-evaporation ponds, subsequent to the fact that they do not practice solar-evaporation, owners of both companies estimate that capital requirements for each of their organizations trump those of MRI.[15] While the specific technological practice for both companies is considered proprietary, and therefore not specifically discussed, the interplay between capital requirements and technology are undoubtedly similar to that discussed under the auspices of MRI.

Entry barriers discussed thus far highlight capital requirements and operational liability as the most significant barriers to entry within this market. In spite of the fact that varying production methodologies exist, neither practice takes place without a significant degree of capital. Additionally, meeting capital requirements alone does not facilitate a successful production practice. Capital must stand in tandem to an accompanying technology. Without both factors, no organization will successfully compete against the established entities within this market.

Following from the preceding discussion in regards to market-entry barriers three things become apparent. First, barriers to entry within this industry are focused within areas of capital requirements and operational liability. Second, entities desiring to enter this market need to find a way of overcoming both of these barriers. Finally, although distinctions exist in regards to production methodologies, overcoming barriers in regards to capital and operations is a necessary, but not sufficient, condition. In addition to meeting fairly significant capital and operational requirements, an organization wishing to compete within this industry needs to successfully implement a production technology.

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[15] Owners of TMR and SLM both have historical ties with MRI, having previously been a part of MRI's organization. It is likely that their statements regarding capital requirements for their current companies are compared to what they know of MRI – from a period when they were affiliated with the organization. Data obtained by author in interviews with Owners from both organizations in 2009.

5. BUSINESS PRACTICES

After noting barriers that make it difficult to compete with existing entities inside this market, it is important to note that business practices among the three entities possessing rights to source nutritional minerals from the GSL greatly vary. More precisely, the practice of solar-evaporation is practiced by MRI. TMR and SLM claim a production technology that is superior to solar-evaporation. It is critical to understand more about both solar-evaporation and the technological process that is used as an alternative to solar-evaporation.

As the process of solar-evaporation commences, GSL water is directed to a series of holding ponds – using natural sunlight and heat to evaporate stocks of water until reaching a predetermined degree of concentration. Solar-evaporation technology requires a series of holding ponds, an intricate knowledge of minerals, and a technical management of concentrated deposits. While the oft-cited "solar" claim stimulates a near-immediate response dismissing any *unique* technology as a part of the process, various techniques and time-acquired knowledge continue to lead to improvements within the production process. It is evident, therefore, that solar-evaporation as a technology involves a complex system that is not easily mastered.

The Andersons started extracting minerals from the GSL, in the late 1960s. They later established the solar evaporation technology bordering the historic high water line of the GSL. In spite of the fact that various conditions of the lake have presented barriers to the production process over the past 40-years, the process has been refined and developed to a heightened degree of efficiency. The current process of solar-evaporation transforms a range of 50 to over 200 gallons of raw GSL water into 1 gallon of concentrated minerals over the course two years. The original evaporative ponds are still being operated by the Andersons. After transforming raw GSL water into concentrated brine, MRI transports the minerals to a location in Ogden,

Utah – where an additional process of refinement and packaging takes place before the nutritional minerals are sold in market.

Neither TMR nor SLM possess holding ponds near the GSL, nor do they claim to.[16] In spite of not having evaporative ponds near GSL water, both organizations have legal water rights, with various points of diversion around the north-bed of the lake.[17] TMR currently purchases minerals from SLM. While each organization possesses the legal rights to source GSL water in raw form, TMR and SLM rely solely on one extraction site – holding in reserve the unused point of extraction. Both of these companies claim a shared production methodology that is technologically superior to "rudimentary" solar-practices implemented by their competitor. While TMR and SLM exist as distinct business entities – the actual line of separation between these organizations is not clear. Ultimately, both TMR and SLM utilize the same production technology, limiting an understanding of production technology within this industry to two methods.

The specifics of the "new" technology implemented collectively by TMR and SLM (hereafter NEW), are proprietary in nature and are not necessary to divulge when considering business-practice distinctions between the operating entities. The owners of TMR and SLM both have an understanding of MRI production practices, having been previously employed by the founding organization. Considering the knowledge these companies have regarding solar-evaporation practices, decisions have been made to implement the NEW technology into the production process. Under the premise of rationality, it is likely that the implementation of the

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[16] Initially, claims were made by TMR regarding solar evaporation ponds. Upon continued research, TMR reigned their previous story and purported that the original claim was made in an effort to protect their technology.

[17] Operations exist in both Little Valley Harbor and Rozel near the GSL. These locations exist nearly 40 miles from each other – each providing a potential water-sourcing location. When investigation for this analysis initially commenced, TMR had active water right contracts with the State. Upon completing the report, it became apparent that TMR no longer qualified for water rights from the GSL subsequent to nonuse practices.

NEW technology by TMR and SLM comes at a relative or absolute business advantage. In an effort to understand this advantage it is necessary to discuss known distinctions between solar-evaporation and the NEW technology.

The most obvious distinction between solar-evaporation and the NEW technology is in regards to the geographic location where processing takes place. Solar-evaporation necessarily takes place near the GSL.[18] The NEW technology utilizes a production process that is away from the GSL. Moving raw GSL water comes at a considerable cost. In fact, it is the occurrence of this cost that will help to illuminate technological distinctions between solar-evaporation and the NEW technology.

MRI, implementing solar-evaporation practices, transports minerals to a processing center after the process of evaporation has occurred. More exactly, an initial volume of as high as 200 raw GSL gallons concentrates to a mere 1 gallon of its initial volume before being shipped to processing centers. TMR and SLM transport raw GSL water away from the lake, to a processing center, before being able to utilize whatever method is used to concentrate minerals. Giving the NEW technology the benefit of the doubt, this analysis will assume that the conversion process of minerals inherent in this technology is a "perfect" process. Although a typical process of concentration involves a loss of crystals – a perfect system could in theory have a 10-to-1 ratio. According to this logic, before the NEW technology can be utilized, TMR and SLM would incur a cost of transporting a volume of water 10 times the amount that MRI incurs when shipping minerals post-concentration. In order for the NEW technology to have a financial benefit over solar-evaporation the costs incurred in transporting raw GSL water to

[18] If this wasn't the case, the organization practicing solar evaporation would incur a substantial cost in transporting water away from the lake – only to evaporate in a different location.

processing plants would have to be made up by a process of production that is vastly more efficient.

MRI's main production plant exists in Ogden, Utah. Trucks shipping concentrated brine from MRI's North Shore operation on the GSL to the Ogden processing plant drive 71 miles one-way. The trip involves a mixture of paved roads and dirt paths. Trucks are filled to capacity, housing 1,000 gallons of brine at the North Shore location, shipped to the Ogden plant, emptied, cleaned, and returned full with clean water for the crews working on-site. At a minimum, each trip involves direct labor and gasoline costs. Trucks used by MRI average 6.2 miles per gallon throughout the duration of the journey. Accordingly, when considering the journey of 142 round-trip miles – using the December 2009 average gasoline price in Utah ($2.61) – a single trip would cost a minimum of $60 in gas alone. This accountability mechanism ignores the cost of labor, maintenance on the transporting vehicle, and econometric data suggesting that gas prices are rising. As gas prices do continue to rise, it will become more expensive to transport minerals – whether in raw or concentrated form. While $60 a trip may seem substantial, when compared to the 1,000 gallons of concentrated brine – this cost can easily be absorbed in the price of the product sold at market.

Before TMR and SLM can benefit from the use of the NEW technology, it is first necessary to transport raw GSL water to a processing plant. TMR has a processing plant that is very near the MRI processing plant in Ogden, Utah – and a second plant in Logan, Utah. SLM has a processing plant in Ogden, Utah. In an effort to simplify the analysis, the plant location in Logan (an additional 25 miles from Brigham City[19]) will be ignored for the time

[19] Brigham City is a midpoint in the necessary travel between the GSL and the Ogden plants. Any minerals brought to the Logan plant would necessarily incur transportation costs inherent in the 25 mile trip from Brigham City to Logan, and then the 48 miles from Logan to Ogden.

being. It is not clear what proportion of minerals goes to which plant, so we will assume that all minerals go to the nearest plant. Transportation particulars are very similar for TMR and SLM when compared to the realities discussed with MRI. More specifically, vehicles used to transport minerals are alike, paths traveled from the processing plant to the GSL are near-identical, and the gas prices paid for transport are the same between organizational entities.

Contrary to the similarities that exist in regards to the transportation process between MRI and companies that have the NEW technology, there are stark differences. Specifically, when TMR or SLM bring water from the GSL to their processing plant they are shipping raw GSL water. Reflecting on the fact that an initial 10 gallons of raw GSL water eventually becomes 1 gallon of concentrated brine, companies transporting GSL water in raw form, do so at a decisive financial disadvantage. By comparison, MRI ships 1,000 gallons of concentrated brine at a transportation cost of $60; an amount that only procures 1,000 gallons of raw GSL water for TMR and SLM. After the NEW technology is implemented in regards to the raw GSL water, the entity implementing the NEW technology is left with a residual concentration of 100 gallons of concentrated brine. More precisely, every gallon of concentrated brine that MRI possesses for use in various product applications has a built-in transportation cost of $.06. By the same method of calculation, each gallon of concentrated brine that TMR and SLM have to use in their product applications comes at a financial transportation cost of $.60. Having minimized the distance traveled by ignoring the processing plant further away, it is very likely that concentrated product incurs a transportation cost that is greater than the stated $.60 per gallon. Additionally, TMR and SLM would have to incur a considerable increase in labor costs in order to transport raw GSL water to a degree that could compete with MRI. While labor costs are not computed in this analysis, they will most certainly exacerbate the disadvantage that these two companies experience.

In addition to vast distinctions regarding transportation costs, the magnitude of GSL water reliance is immensely different for the technology-divided entities. MRI estimates 50 trips each year, delivering on average 50,000 gallons of concentrated brine to their processing plant throughout the calendar year.[20] In sharp contrast to the enormity of volume that MRI processes, TMR and SLM together share annual proceeds amounting to between 12,000 and 15,000 gallons of raw, unprocessed water.[21] Transforming 15,000 gallons[22] of raw GSL water into concentrated mineral brine decreases the volume to a mere 1,500 gallons. Comparing the scale of concentrated brine available in product application between MRI and the other two companies – a staggering reality becomes evident. TMR and SLM boast a superior technological process converting raw GSL water into concentrated brine, but only end up producing one tenth of the volume of concentrated minerals as their competitor.

5.1 EXPLANATION EXPLORATION

While a typical industry limited to three supply participants is normally characterized by similar market practices and market-shares among actors; it is evident that this market is not. In order to explain the distinctions in business model practices it is necessary to consider various possibilities. Perhaps TMR and SLM are focusing short-run strategies on research and development. Or perhaps the organizations not practicing solar-evaporation are implementing strategies of product diversification, or specializing in a specific niche-market. Maybe TMR and SLM source the majority of their minerals from a site other than the GSL. Perhaps the NEW

[20] This assumes that each trip involves the transport of minerals to full capacity. The assumption of maximum capacity is made for every company in universal application.
[21] Interviews with Mitch Shaw confirm that between 12-15 trips take place each year. Each trip averages 1,000 gallons of raw GSL water. Variance in the number of trips taken is explained by traditional fluctuations in demand, supply and weather. November, 2009.
[22] This assumes the high-stated value.

technology is concentrating raw GSL water at a rate that MRI isn't. Consideration should also be given to the possibility that TMR and SLM purchase the majority of their product downstream from MRI, act as an unauthorized intermediary, and sell altered or watered-down product at market. Finally, it is also a possibility that these companies could be purchasing non-food-grade product from an industrial source, selling it as though it were food-grade. Each of these possibilities is now considered in turn.

First, it is possible that TMR and SLM are perfecting the NEW technology, and not focusing on producing to a cost-minimizing point. It is likely that the implementation of the NEW technology does not require massive amounts of raw GSL water, but rather time to perfect the process. While this is indeed a possibility, it should be noted that the process of technology development is expensive (both in terms of direct and opportunity costs) and can only maintain momentum to a point of exhausting financial and capital stocks. It is now four years past the point that TMR stopped sourcing from MRI and five years beyond the establishment of SLM. Neither of these organizations have practiced solar-evaporation, or sourced in quantities larger than those stated since their inception. Understandably, therefore, it is very unlikely that research and development alone are continuing to carry either of these organizations forward.

Another alternative explanation could rest on distinctions in modeled-approaches of specialization. If a company's business model targets the production of a specialized product, it is possible to outperform larger, more volume-concentrated organizations. More precisely, by satisfying a unique demand an organization can successfully compete in the market. Contrary to this logic, however, TMR and SLM market over 100 differentiated products. The majority of these products are in direct competition with products sold by MRI. It is therefore unlikely that an argument of specialization has relevance in explaining away the distinction.

Continuing the process of business-distinction discovery, it may be possible to explain the finite amount of GSL concentrated brine by exploring the possibility of product differentiation or diversification. An organization wishing to distinguish their product from others previously established within a market needs to characteristically establish features of their product that stand superior to the existing products in the market. This reality can be accomplished by simply targeting a unique niche-market. While this business model is successful in many market applications, approaches taken by TMR and SLM do not attempt to set-apart their product as unique or heterogeneous. Products marketed by TMR and SLM are similar in nature to those marketed by MRI when comparing product labels. In fact, it is obvious when observing product lines from each company, that even product names were chosen in an effort to reflect homogeneity and substitutability properties.

Similar product labels created separately by each operating entity, credit the GSL as the source of their minerals. While it is entirely possible that TMR and SLM product labels accurately reflect the GSL as the source for nutritional minerals, vast distinctions in the amount of minerals processed between the solar-evaporation entity (MRI) and entities' practicing the NEW technology (TMR and SLM) requires an explanation. Product differentiation or diversification realities do not, therefore, explain the enormous distinctions that exist in regards to the available nutritional-mineral product volume.

Having considered arguments of product specialization, diversification, differentiation, and possible focus on research and development – a viable explanation of the dearth of nutritional minerals by both organizations practicing the NEW technology is still lacking. While some combination of the above stated possibilities most often explains physical distinctions between market competitors – it is in this case, still necessary to continue considering other possible explanations.

TMR and SLM are successful in marketing GSL minerals to various suppliers around the world. If sourcing were more equally represented by each of the sourcing companies this would not be a surprising reality. Contrary to this reality, however, both TMR and MRI source a finite fraction of the nutritional minerals that MRI sources. Perhaps the reality explaining this distinction is more rudimentary than advanced business-comparison models can detect. In order to get at the root of this distinction it is necessary to consider that the NEW technology concentrates raw GSL water at a more efficient rate than that established by solar-evaporation practices. It is also very likely that TMR and SLM source the majority of their minerals from somewhere other than where they have mentioned. This could be satisfied by either purchasing product downstream from another supplier, or by purchasing product from a non-food-grade supplier and presenting the product as food-grade.

Both TMR and SLM advertise product via website portals. These websites provide statements about sourcing practices. Specifically, SLM states: "Our unique trace minerals are similar to those found in the sea, but because they are extracted from the Great Salt Lake, an Inland Sea, evaporating and concentrating over hundreds of thousands of years, they are many more times as concentrated as those found in the Pacific Ocean."[23] Similarly, TMR states: "Trace Minerals Research (TMR) helps rebalance the body by reversing the effects of the water cycle. Instead of relying on the soil to provide all the minerals and trace elements we need, we headed to the shores of the Great Salt Lake. Our extensive offering of products provides a wealth of mineral essentials formulated to address specific health concerns. By cultivating our

[23] This statement is found at: http://saltlakeminerals.com/

shores, we help restore the human body's need for a balanced spectrum of minerals and trace elements."[24]

In addition to the claims that both TMR and SLM source from the GSL, it is important to note official documents verifying specific minerals that are unique to GSL waters. More precisely, SLM has performed mineral testing with an accredited laboratory which verifies not only a plethora of minerals from aluminum to zirconium, but does so in unique quantity combinations – suggesting GSL mineral origination.[25] The argument of TMR mineral sourcing echoes that of SLM subsequent to the fact that they currently source product from this supplier. In addition to third party verification of the quality and source of minerals, owners from these companies were willing to provide a sample of raw GSL water for additional testing. While the accuracy with which statements can be made regarding GSL-sourcing practices for these two business entities can never be complete, it is highly likely that they do, indeed, sell product that is sourced from the waters of the GSL. In the instance that these companies do not source from the GSL, presenting a "face" that purports GSL sourcing practices would come at a substantial cost – jeopardizing the future of their enterprises. It is, however, likely given the volumes extracted by both of these companies that the minerals are either purchased downstream or from a non-food-grade, industrial supplier.

It is important to first consider, however, the possibility that the NEW technology concentrates raw GSL water in a manner that is superior to solar-evaporation methods. While this argument naturally follows from the purpose and intention of technological innovation, the minerals existing in a gallon of raw GSL water are not lost by means of solar-evaporation. No

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[24] This statement found at: http://www.traceminerals.com/

[25] These tests were performed by Advanced Laboratories, Inc. Mineral results can be obtained at: http://saltlakeminerals.com/analysis.pdf or by requesting the results directly from the laboratory.

matter the mechanism that concentrates a gallon of raw GSL water, the quantity of minerals will inevitably be the same. It is therefore not appropriate to associate a technology that replaces solar-evaporation with an ability to increase the quantity of nutritional minerals following any concentration process. It is possible, however, that the process of evaporation is sped up. While this would substantially decrease the time-related costs inherent in a solar-evaporation process, it does not explain away the fact that an infinitesimal amount of GSL water is sourced by these companies. Minerals do not grow in volume – limiting the sourcing companies to an amount of minerals sourced directly from the lake – after concentration takes place.

If mechanisms are used by TMR and SLM to speed up the process of evaporation, the fact remains that they only have one tenth of the volume that their competitor has to sell in market. While it could be argued that they gain product to sell at market much quicker, it is a far-stretch to assume that this time-effect would lend to any competitive advantage, absent any ground for volume comparison. It is also likely that any attempt to speed up the process of concentration would come at a cost regarding quality.

Finally, it is necessary to consider the possibility that the "NEW" technology does not exist, but is instead used to explain the absence of solar-evaporation practices by both TMR and SLM. While there is certainly room for continued discovery, previous arguments have suggested that product sold by TMR and SLM are, indeed, GSL-authentic. This reality, however, does not stand alone. It is also argued that the quantity of raw GSL water extracted by both entities not practicing solar-evaporation, is by no means sufficient in quantity to compete against the established industry-pioneer; MRI.

We are, therefore, left with a perplexing puzzle. TMR and SLM are able to compete with MRI, possess product that appears to be GSL-authentic, and source product in quantities

that when compared to MRI are infinitesimal. How is it then that both these organizations are able to compete? In order for competition to take place, given the reality that product is from the GSL, and that they are not sourcing raw GSL water to a degree of any magnitude, it is important to consider the possibility that they purchase product from another GSL supplier. While this is certainly not a new practice in the business world, when it occurs – it should take place according to established and approved structural arrangements.

It is very likely given the arguments discussed that TMR and SLM purchase product from one of two measures; either downstream from a food-grade producer (MRI), or from a non-food-grade producer. Assuming that these companies obtain product downstream from MRI, they would either have to focus on a value-added production process, or sell the product watered down in order to achieve any profit margin on the product sold. TMR and SLM would need to structurally distinguish their product and acquire marginal gains in the selling process if purchasing the product downstream. This could be accomplished by adding various compounds to the original mineral mixture, selling the product in niche markets, or by watering down the mineral content.

Changing the product to meet specific target-group needs establishes the product as heterogeneous – and has a strong supporting theoretic premise within traditional market practice. It is also possible that the product is watered-down and sold at a price competitive with MRI's similarly-named products. In spite of this possibility, sourcing downstream from MRI does not provide a feasible explanation. The composition of TMR and SLM product has the same specific gravity as the product sold by MRI. This means that the composition is very similar in nature to the product sold by MRI. No value added or watering-down process is taking place. Subsequent to the fact that the product can be considered homogeneous, purchasing product downstream from MRI would not prove financial beneficial for either

organization. In order for it to be beneficial, the specific gravity of the product would need to be different, showing either value-added, or a process of dilution in order for this theory to bear out.

How then do these companies remain competitive with the industry pioneer? Various explanations have been considered. Each has been dismissed on academic grounds. The most likely option to the perplexing problem remains. Purchasing product from a non-food-grade source would prove a substantial advantage financially. While this is not ethical, it is very likely that this practice is taking place. The production process involved in obtaining food-grade product is many times more costly than product that is non-food-grade. In addition to the production process, meeting specific standards becomes expensive for a food-grade producer to meet.

TMR and SLM likely purchase product from a non-food-grade harvester and present the product as an alternative to MRI's product. Non-food-grade product is much less expensive than food-grade product. Accordingly, product sold by these companies would not only be competitive, but would capture the attention of customers and eventually the bulk of the market share. If these companies present product as being equivalent to food-grade product and offer the product at a lower price than the food-grade producer – the market would be quickly inundated with non-food-grade product. Consumers lack the ability to verify that the product is of a certain quality – and, hence, rely on their experience with product previously purchased. Neither TMR nor SLM are NSF certified, and SLM only claims GMP compliance without even NPA authentication. Selling product at food-grade prices without incurring the cost of producing to food-grade would give both of these companies a decisive advantage – *until caught*.

This explanation is most likely in tandem with what is actually occurring within this industry. While the consequences of consuming non-food-grade product are vast, instituting a

minimum amount of monitoring within this market would remedy the problem. Organizations selling product that is advertised as "food-grade" should be required to maintain certifications that verify claims. While this comes at an expense to the business organization, it ensures that practices such as exist within this market do not take place. If each organization is required to pay these expenses – no organization is put at a disadvantage. Ultimately, competition among entities already sourcing from the GSL, and the safety of consumers would both be accomplished by requiring monitoring practices. Without monitoring, the wealth of nutritious minerals available for consumption within the waters of the GSL will be replaced by non-food-grade minerals intended for non-consumptive purposes.

6. CONCLUSION

The market for nutritional minerals is uniquely characterized. The Great Salt Lake stands as a body of water uniquely situated for nutritional mineral extraction based on natural factors of size and salinity. While nutritional mineral extraction practices have been taking place since the late 1960s, limited suppliers are active within this industry. Capital requirements and operational liability costs coupled with the requisite technological process inherent in the production process stand as significant barriers preventing additional business entities from entering this market. Among the three active supply participants within this market, each has its roots with the originating supply company – and therefore possesses knowledge of food-grade, solar-evaporation technology. Notwithstanding this fact, only Mineral Resources International (MRI) continues to use solar-evaporation in the production process. Each of these sourcing entities is successful in marketing product, and subsequently owns a portion of the market share. While each entity shares in the market, a comparison of

business models practices among the active entities reveals a significant distinction regarding the magnitude of minerals produced.

MRI processes nearly 50,000 gallons of concentrated minerals annually. Trace Minerals Research, Inc. (TMR) together with Salt Lake Minerals (SLM) only produces around 1,500 gallons of concentrated minerals annually. Analysis considering possible explanations to account for business entity distinctions suggests that TMR and SLM most likely purchase non-food-grade product from a GSL source and sell this product as food-grade.

Demand for nutritional minerals will likely continue to increase globally over the next several decades. The nutrition-rich waters of the GSL are capable of satisfying this demand. It is highly likely that MRI is the only GSL sourcing entity that sells food-grade product. Notwithstanding this reality, both TMR and SLM have successfully marketed product as quality-homogeneous to product produced by MRI. An inability on the part of customers to assess the quality of product, in conjunction with an absent quality control production requirement within this industry permits the supply of low-quality, non-food-grade product to enter this market; a market oriented around human consumption.

Ultimately, for business entities recognizing the expanding market for nutritional minerals – the GSL is underscored as a “great find”. The magnitude of barriers to entry within this market, however, will prevent the vast majority of organizations from becoming market participants. Entities already competing within the industry respond to unique incentives particular to their individual circumstances. For both entities competing against the pioneering organization, incentives have most likely induced behavior that, at best – could be characterized as “fraudulent”.

Although Great Salt Lake itself is far too salty to really support complex organisms other than brine shrimp within its depths, there is still a rich and strange history of people trying to populate the lake with various types of aquatic life nevertheless. In the 1800s there were numerous attempts to stock the lake with sea life such as oysters, eels, and crabs, yet all of these attempts failed as none of them could survive the extreme salinity levels and temperature fluctuations here.Â Whales are not the only unusual out of place animals reported from the lake. The areas surrounding Great Salt Lake have produced reports of camels roaming around, probably the descendants of escaped animals used by the military for use in the harsh desert conditions in the early 1800s. Table of contents. Innovation-Based Development of the Mineral Resources Sector: Challenges and Prospects â€“ Litvinenko (Ed.) Â© 2019 Taylor & Francis Group, London, ISBN 978-0-367-07726-6. Preface.Â Primary growth zoning and oscillatory zoning of Iceland spar from the Razlom deposit (Siberia, Russia) M.N. Logunova, J. GÃ¶tze, M.A. Ivanov & G. Heide. Attribution of paleontological collections is a step towards improving biostratigraphy of the Ordovician deposits of Baltoscandia M. Tsinkoburova, D. Bezgodova & I. Lobanova. The state estimates that the Great Salt Lakeâ€™s ecosystem has a $1.32 billion economic effect. It is a home or major resting place for more than 250 species of birds. Salt and other minerals are mined from the lake and used for fertilizer, melting snow on roadways and other products. Its waters are credited with helping produce dry, powdery snow that attracts skiers worldwide to the nearby mountains.Â Lawmakers on Thursday took a quick tour of a storage area at a factory that harvests the eggs and visited a plant that extracts minerals from the lake. Joe Havasi of Compass Minerals said the company had to extend its canals that pull brine from the water by about 2 miles because the shoreline has receded by 6 miles. ADVERTISEMENT. Great Salt Lake, the shrunken remnant of prehistoric Lake Bonneville, has no outlet. Dis-solved salts accumulate in the lake by evapora-tion. Salinity south of the causeway has ranged from 6 percent to 27 percent over a period of 22 years (2 to 7 times saltier than the ocean). The high salinity supports a mineral industry that extracts about 2 million tons of salt from the lake each year. The aquatic ecosystem consists of more than 30 species of organisms. Harvest of its best-known species, the brine shrimp, annually supplies millions of pounds of food for the aquaculture industry worldwide.