ECOncrete: Born Global in Israel

Introduction

Marine biologist Dr. Ido Sella prepared to shut down the lab for the night and retreated to his office to prepare for a meeting tomorrow. It would be with his co-founder, fellow marine biologist Dr. Shimrit Perkol-Finkel about the future direction of their company ECOncrete (http://www.econcretetech.com). Both scientists founded the rising start-up in order to propose an ecologically friendly alternative to existing marine building materials, which they were able to accomplish with much success.

ECOncrete is a unique proprietary mixture of concrete that is ecologically friendly to marine life such as fish, crabs, and slugs as well as corals, and starfish that usually affix themselves to undersea environments. ECOncrete's product line consists of several types of building materials composed of the proprietary mixture. Each product has unique properties and a structural shape that encourage marine life to develop habitats along the building structure that serve to strengthen the structure over time.

At present, the company serves government and commercial customers intending to build coastal structures such as jetties, breakwaters, and canals. ECOncrete contracts with a concrete producer located within a close proximity to the project site, delivers specifications and instructions for production, and engages the manufacture of ECOncrete products to meet its clients' needs. While this flexible manufacturing model has been successful for ECOncrete to date, the team had recently begun considering an alternative business model for the company a few weeks prior.

One such model is a licensing arrangement under where ECOncrete would no longer manufacture the concrete and deliver it to their clients. The company would effectively become a technology company, licensing the rights to manufacture ECOncrete products out to partners while maintaining patent protected proprietary control over intellectual property. The shift in direction is significant for the small company and would mean a change in operations, growth strategy, and essentially the building of a very different type of organization. Ido knew that he and Shimrit would have a lot work to do before coming to an official decision.

This case was prepared by Joanna Ghazali and Karen Bender under the supervision of professor Gregory L. Stoller as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

Concrete

Concrete's qualities as a versatile, relatively cheap yet sturdy and easily shaped mixture of commonly found elements including sand, water, and limestone have secured it as the prevailing building material of choice dating back as early as 6500BC in the construction of a limitless range of structures.

The composition of the mixture that makes up concrete known as cement, depends on the requirements of its application – such as required strength, environmental exposure, and desired texture. Although hard and sturdy when dry in its final form, cement mixture is considered a perishable product – due to an exothermic chemical reaction that occurs when all ingredients are combined, and the product can become unusable in as little as 90 minutes.

Demand for concrete is growing each year (Exhibit 1), driven by the growth of the housing market, demand[1] for infrastructure as well as commercial construction (Exhibit 2). The National Ready Mixed Concrete Association estimates the value of ready mixed concrete produced at $30 billion.

The combination of this high demand as well as its perishable nature and have resulted in a geographically segmented industry, with concrete production facilities so great in number that most construction projects are no farther than a 90 minute drive from a concrete plant. In fact, there are an estimated 5,500 plants with over 55,000 mixer trucks making concrete deliveries in the United States[2]. Here, although the concrete industry is composed of businesses that range in size from small family owned businesses to large multi-national corporation, it is primarily is dominated by four (4) major players that collectively hold 67% of industry market share - LafargeHolcim Group (28.6%), Cemex SAB de CV (18.3%), HeidelbergCement AG (15%) and Texas Industries Inc (5.4%).

Coastal Use of Concrete

"Concrete is 70% of the entire coastal infrastructure in the world."
- Dr. Ido Sella

ECOncrete's value proposition lies in its alternative as a superior building material for use in coastal, marine structures. Concrete's versatility has lent to its long history of use in marine construction materials from jetties to sea walls to pilings, etc. While it has performed relatively well, its use in these marine environments and subsequent effects on marine life have not been studied until recently.

Concrete has been found to deteriorate[3] when used in proximity to sea water, as well as disrupt the ecological composition of the marine environment. Firstly, its submersion into salt water results in deterioration when salinated water absorbs into the porous concrete, and

[1] Collard-Wexler, Allan. "Demand Fluctuations in the Ready-Mix Concrete Industry." NYU Stern (2010)
[2] National Ready Mixed Concrete Association. US Ready Mixed Concrete Production through April 2016 http://www.nrmca.org/concrete/data.asp (accessed June 2016)
[3] The Constructor, Concrete in Seawater http://theconstructor.org/concrete/concrete-in-seawater/843/ (accessed June 2016)

electro-chemical reactions from the salt's contact with the reinforcing steel cause corrosion. This in turn causes expansion and pressure, which creates great fissures in the concrete, eventually splitting entirely along the reinforcing steel bars.

Biodeterioration also occurs, accelerating the process. Microbial colonization by organisms in the seawater that settle on concrete create a biofilm which in turn leads to the chemical deterioration of the concrete surface. The organisms are allowed to penetrate further into the structure as the sea water permeates the porous concrete. The biodeterioration is caused by organisms found in bacteria, fungi, algae and lichens, that lower the pH levels to as low as 1.5, and which makes the structure more attractive to more invasive microbes. It has been estimated that biodeterioration-related structural problems cost billions of dollars a year in infrastructure maintenance and repair.[4]

Despite is ill-suitability for coastal construction, nearly 70% of coastal infrastructures worldwide are made of concrete. Usage of conventional concrete for coastal construction causes severe stress on native marine life, causing loss of habitats, reduced biodiversity in addition to the dominance of invasive species.

ECOncrete

"The final product, which will be concrete, will be in line with all the requirements for marine construction, but will be a better substrate for the recruitment of biology.

So, for example, we showed that in New York we had a concrete that actually recruits oysters and can grow oysters. They accumulate this mass and this mass becomes an oyster reef or this mass becomes a coral reef. Those are organisms that can take calcium carbonate from the water and, and deposit it in a skeleton on substrate.

If you look at the concrete structures they [the oysters] are actually starting to cover them with calcium carbonates – they have encapsulated the concrete with a protective layer so there is actually a cost value for that – for reduced maintenance, increased durability of the structure. [As you] reduce erosion of the structure, you protect the rebar which is the steel that is sitting within the concrete."

- Dr. Ido Sella

Biogenic build-up on an undersea structure
Source: ECOncrete

[4] Wei, Shiping, Zhenglong Jiang, Hao Liu, Dongsheng Zhou, and Mauricio Sanchez-Silva. "Microbiologically Induced Deterioration of Concrete: A Review." Brazilian Journal of Microbiology Braz. J. Microbiol. 44.4 (2013): 1001-007. Web.

Dr. Ido and Dr. Shimrit together with their unique team of scientists, engineers, and designers work closely with policy makers, as well as marine and construction experts to design or retrofit structures to promote biological productivity and restore the fragile habitats and species native to coastal and marine environments. Although Dr. Ido and Dr. Shimrit have years of international experience in the field of artificial habitats, the company's products and processes are continually and professionally evaluated in their in-house laboratory run by concrete specialists and geologists.

ECOncrete offers ecological alternatives to conventional concrete by changing the composition of cement mixture, the surface texture of the concrete, and the macro design of the construction elements. The enterprise produces modular concrete units that can be arranged to form various structures including sea walls, breakwaters, and tide pools.

ECOncrete's attractiveness to marine life has structural advantages. The design of ECOncrete matrices support biogenic build-up - the calcium carbonate deposits produced by marine organisms like oysters, mussels, barnacles and corals that cover the surface, add volume and weight and contribute to the stability of the structure.

These calcium deposits build up and increase the strength and stability of coastal infrastructures by absorbing wave energy and protecting them from damages associated with harsh marine environments by coating the concrete surface, increasing the operational life span of the structure and reducing the need for periodic maintenance work.

ECOncrete adjusts the design and composition of the matrices to suit the local environment of the project, enhancing any structure ecologically either by integrating ECOncrete designs into new structures, or by retrofitting existing structures with modular ECOncrete units. Products include seawalls, armoring units, designed tide pools, marine mattresses, sinkers, bio active wall tiles, pile encapsulation for pile and pier retrofitting. At the core of the company, the research and development department creates unique solutions for the needs of any project.

Dr. Ido and Dr. Shimrit have found that the manufacturing cost of ECOncrete units is less than 7% more than the cost of manufacturing standard concrete, depending on the material availability. This cost however, is offset by cost savings in structural maintenance, as well as government incentives to support environmental policies.

Standard conventional concrete tetrapod (right) and ECOncrete tetrapod (left)
Source: ECOncrete

Use of the ECOncrete tetrapod units in a riprap designed to provide the biological niches that natural intertidal habitats offer. The composition and texture of the concrete supports the biological activity of oyster crabs, worms, and corals.
Source: ECOncrete

From the Shores of Israel

ECOncrete differs from the thousands of start-ups that owe their beginnings to Israel's unique environment of innovation in its global approach. Known as the "Startup Nation," Israel boasts the highest density of tech start-ups in the world; there are more Israeli companies on the technology oriented NASDAQ than any country outside the US. In fact, the number of companies on the NASDAQ that consider Israel home is greater than that of Europe, Japan, Korea and Chine combined. (http://freakonomics.com/2009/12/04/how-did-israel-become-start-up-nation). Its fragile geopolitical situation and innovation-friendly policies makes for an isolated market that many Israeli entrepreneurs have used as a test ground before launching globally.

A born-global[5] company from the start, ECOncrete quickly realized the importance of analyzing their technology in varied and far reaching environments and installed testing stations in the Red Sea, Mediterranean Sea, and the Atlantic Ocean along the East Coast of the US, including Savannah, Georgia, New York Harbor, the Florida Keys, as well as the Great Lakes. The set-up of such diverse testing environments early on in the venture represent the enterprise's vision in operating in coastal regions throughout the world.

The founders of ECOncrete realized that Israel alone was not a large enough market to sustain the enterprise and opted to develop its expertise in coastal environments throughout the globe, as one of its key competitive advantages.

Its first project was in 2010, where ECOncrete worked on the Jaffa Port conducting environmental enhancements to increase the population of juvenile fish and the installment of artificial intertidal rocky habitats. A year later in 2011, ECOncrete installed a biologically active concrete green wall in Tel Aviv.

Beyond the shores of Israel, ECOncrete's technologies are featured in two locations in the New York City Brooklyn Bridge Park, which is located along the East River and spans over two kilometers of the Brooklyn coastline. Constructed on an abandoned cargo and storage piers, the Park transforms the hostile environment into a flourishing recreation area while preserving and restoring natural habitats. ECOncrete's Ecological Pile Encapsulations were installed under Pier 6 and Tide Pools alongside Pier 4 beach.

As part of the "Living Breakwaters" project design in the Rebuild by Design Competition, an initiative of the President's Hurricane Sandy Rebuilding Task Force, work has begun to incorporate ECOncrete Ecological Armoring Units and Tide Pools along the southern shore of Staten Island to reduce the risks of flooding and storm damage and revive local ecology.[6]

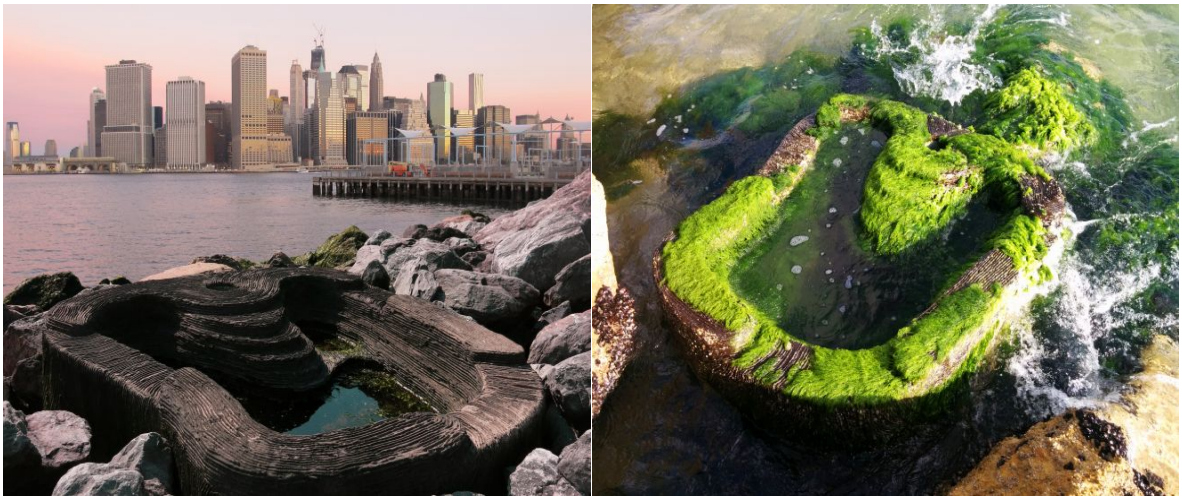
[5] Tanev, Stoyan. "Global From The Start: The Characteristics of Born-Global Firms in the Technology Center." Technology Innovation Management Review. N.p., Mar. 2012. Web. June 2016.
[6] ECOncrete website, Selected Projects (accessed June 2016)

Competitors

While there are few innovators in the concrete industry, there are a few competitors offering ecologically friendly coastal building materials.

The Reef Ball Foundation is a global nonprofit organization with the goals to rehabilitate ocean reef ecosystems and stabilize coastal waters with over 6,000 projects in 62 countries. Their primary product are "Reef Balls" – hollow concrete structures designed to last over 500 years with various holes and textures mimicking a natural reef in structure and water flow which enhance marine life. The foundation sells molds of different sizes, as well as permits the licensing and copying of the molds. The foundation also sells their proprietary additives to concrete. As Reef Balls do not include steel or iron as structural support, the likelihood of cement degradation due to corrosion and the expansion of structural elements is reduced. The hollow nature of the Reef Balls reduce the amount of production materials required and allow for easier transport and reduced transportation costs by inserting an inflatable into the hollow of the ball and towing it with a light vessel to the installation location.[7] Like ECOncrete, Reef Ball relies on local concrete production facilities to meet its demand.

Retail concrete protective coatings such as the epoxy produced by Pond Armor known as Pond Shield are able to provide some protection from water damage but are primarily used for smaller projects and home use such as residential water features like ponds, fountains and salt water tanks. Such coatings can be applied to concrete, stone, tile wood, metals including steel, aluminum, copper, cast iron, brass as well as rock, fiberglass, and other surfaces. However, long-term usage in industrial applications may not be a viable alternative for the construction of marine structures.



An ECOncrete Tidal Pool installed at Pier 4 of the Brooklyn Bridge Park when installed (right) and several months later (left).
Source: ECOncrete

[7] Reefball Foundation http://www.reefball.org/ (accessed June 2016)

Conventional Cement/Concrete Players

The largest player in the industry is LafargeHolcim Group (Lafarge) (http://www.lafargeholcim.com) with 27% market share having merged with Holcim, a Swiss-based global producer of cement and other building material with a major presence in the United States in 2015. The merged entity formed the largest producer of cement in the United States and globally.

The French giant operates in 58 countries and is present in North America under its subsidiary, Lafarge North America (LNA). LNA is the largest construction material supplier in North America, producing cement, ready-mix concrete, aggregates and a range of concrete products, including precast panels and beams, catch basins, manholes, water and sewer pipes, blocks and bricks. The subsidiary is a vertically integrated conglomerate that employs nearly 10,000 workers in about 900 Lafarge offices across the United States and Canada and operates ten (10) cement plants and two (2) grinding plants in the United States, along with seven (7) cement plants and two (2) grinding plants in Canada.

The second-largest player in the cement manufacturing industry is Mexico-based Cemex SAB de CV ("Cemex" http://www.cemex.com) with 23% market share. Cemex produces cement, aggregates and ready-to-mix concrete under the Cemex, AccuMix, Broco, and Rinker brands. Headquartered in northeastern Mexico, Cemex operates in in North America, South America, Europe, Asia and the Mediterranean. In 2015, the company employed 43,000 people and generated $12.7 billion in revenue across its three product segments. The company sells its products to residential, commercial, industrial and infrastructure sectors and has experienced strong revenue growth in the past 5 years, driven by increased demand for cement in the residential sector from an increase in housing starts, low levels of inventory by customers and low interest rates.

HeidelbergCement AG (HeidelbergCement http://www.heidelbergcement.com/en) is based in Germany and holds 17% market share. Its products include cement, aggregates, concrete and asphalt, and are sold in over 40 countries under the Lehigh Cement brand. In 2015, the company employed over 45,000 people and generated $15.0 billion across all its product lines. Its customers include construction companies for private residential, public and commercial construction.

> *"The manufacturers of cement do not compete directly with us. Some are manufacturers of ready-mix concrete, but (for the most part) cement is an ingredient of concrete. [We believe] our competitors are entities that can create concrete structures with ecological benefits, but until now, most do not provide structural performance.*
>
> *Some might provide solutions in specific structures, but none like ECOncrete, which are modular solutions for any number of applications"*
>
> – Dr. Ido Sella

Manufacturing or Licensing?

Presently operating under a variation of the manufacturing model, ECOncrete proposes its ecologically-friendly products for construction projects and upon winning the contract, sources for a concrete manufacturing plant close enough to the project to contract the production of ECOncrete products to the specifications needed by the client.

The arrangement allows for ECOncrete to keep its overhead low, and reduces the associated costs of having to undertake manufacturing in-house, including storage costs, cost of equipment and maintenance, and the risks of manufacturing defects, while providing the advantage of geographic flexibility. As Dr. Ido sees it:

> *"With the joint venture you share the risks but you share the revenue. And, it depends on how you do that. With a license, the licensees have most of the risk. But then, later on, you get a low percentage of the revenue. So it's just a game of risks, and property and, and your share in the final product in the end."*

The existing model allows ECOncrete to operate leanly. Dr. Ido and team are able to dedicate efforts towards promoting the brand globally, securing sales, and new innovations. Both accomplished scientists, Dr. Ido and Dr. Shimrit's desire to continue innovating was the seedling in pursuing a licensing model for the business. However, ECOncrete currently estimates that only 30% of their current income is from such licensing arrangements. The remaining 70% of business comes from contracted projects, which can have negative impacts on cash flow as marine construction projects of this nature can often experience significant delays or be sidelined completely. Dr. Ido recalls a recent experience:

> *"Someone was building a pier and heard about us and wanted to integrate our technology into his project. During the build and during the design for a breakwater, he's become our client. But, then we're project related. For example, one of the projects found metal in the soil so until they do a full survey of heavy metal they cannot proceed with construction. This means that our revenue instead of coming next year will come in 2 years. Because they have now 12 months of assessment. And it happened with a project that wasn't canceled but was delayed, which affected cash flow."*

As a technology company, ECOncrete would actively campaign for the use of ecologically friendly alternatives to marine construction materials by making the technology to the masses via a licensing model. The company would maintain ownership and control over its intellectual property and continue its research into the development of other ecological innovations.

There are several ways in which the technology could be licensed out, depending on the terms of the licensing agreements. These terms include how exclusive the usage of the technology may be, the purpose of which the technology might be used, the geography in which the licensee may market and sell products derived from the intellectual property, how long the license will be active, and the compensation structure of the agreement.[8] Royalties could be in the form of a specified annual fee, or a percentage of the project value, or a percentage derivative of the products manufactured, for example.

Currently ECOncrete is working with US firms under a licensing model, as Dr. Ido explains:

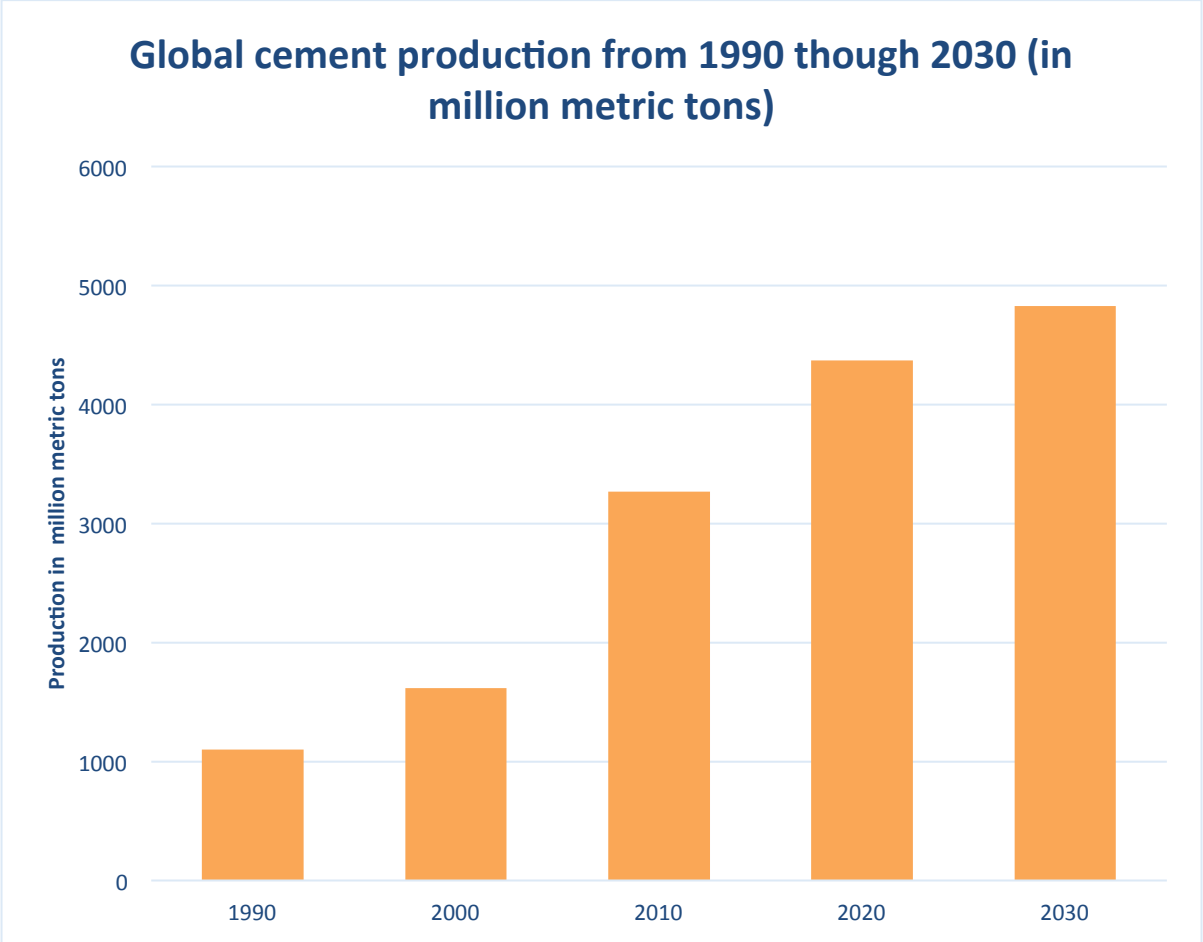
> *"Now we work with an entity in Washington State. They manufacture the units for us and market them here in the US for us. They get the forms - exactly the tools for creating the units - and they get powders for mixing within the mix – this is what makes the concrete unique."*

Among the other opportunities that could be sought include forging strategic partnerships with existing cement manufacturers such as LaFarge, Cemex and HeidelbergCement which might license ECOncrete technology to extend their own product lines and increase their appeal to clients that value green alternatives in construction. To date, three of the five largest world-wide cement producers have contacted Dr. Ido and his team, although the team has been reluctant to partner with these industry giants.

Going down this route would have significant implications towards the direction and form of ECOncrete as a company. In fact, one of the largest strategic issues facing ECOncrete is how to increase the company's ability to license their technology rather than rely on contracted projects for revenue.

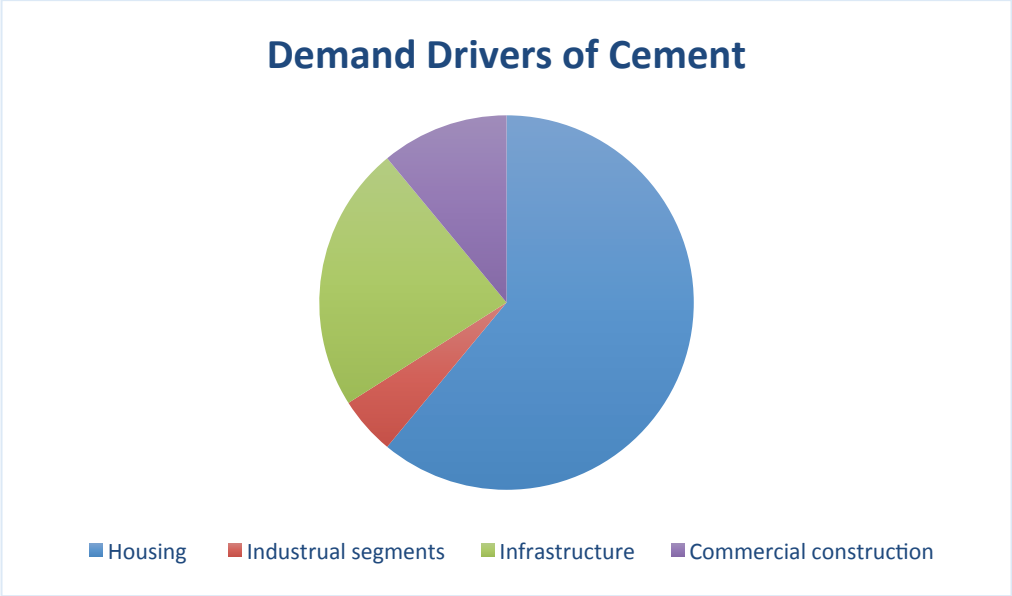
[8] Cayenne Consulting, Your IP Gives You Two Business Model Choices, March 2014 https://www.caycon.com/blog/2014/03/your-ip-gives-you-two-business-model-choices/ (Accessed June 2016)

EXHIBIT 1



Source: http://www.statista.com/statistics/373845/global-cement- production-forecast/

EXHIBIT 2



Source: Market Realist, PCA, Various Industry Sources

Study Questions

1. Should ECOncrete change its strategic direction or maintain operating under its existing manufacturing model? If so, what changes should be made? Do not feel limited to the alternative of pursuing a licensing model.

2. If ECOncrete should pursue a licensing model, what challenges will the enterprise face?

3. As a small start-up that operates in a global landscape, what characteristics or competitive advantages would secure ECOncrete's success?

4. What reasons might ECOncrete have for choosing to not partner with a larger cement manufacturer at this time? Do you agree with these reasons?

5. Is ECOncrete a born-global firm? Explain.

Request for Financials, *please*

The purpose of the financials is to help students roughly estimate a cost-benefit analysis of a more involved project based business model versus a technology licensing business model.

If ECOncrete could provide past financial statements such as Income Statements, Balance Sheets or Cashflow Statements, it would be much appreciated. (we can mask the numbers by altering them by a multiplier for confidentiality if you prefer), if not, we would appreciate:

Revenue

- Revenues for the past few financial years
- Milestone timeline of projects
- A short note on how projects are priced (how does ECOncrete charge its clients).
- If the technology is licensed out, how would ECOncrete charge its royalty/licensing fees (flat annual basis, per usage basis, per product units produced?)

Costs

- Operational costs for the past few financial years
- Components of costs of goods sold
- Top 5 largest expenditures (eg. Salary & wages, research & development, distribution costs, capital expenditures etc)
- How much does ECOncrete usually pay to the concrete contractors to manufacture the product and transport it to the project site?

Financing

- Timeline of how many rounds of financing ECOncrete has received (Series A, B, C, etc)