Title: Applying Scientific Discoveries to Consumable Products

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Abstract: This paper will use strategic frameworks to help a new biopolymer start-up diversify into new markets and technologies. The start-up, Bolt Threads, has developed a way to bio-engineer spider silk outside of the organisms themselves. While Bolt Threads already has decided its primary market will be clothing and textiles, my capstone team has been commissioned to search out secondary and tertiary market possibilities for Bolt Threads. Through brainstorming and initial weeding the remainder of the project has been focused on gathering and parsing through industry and product information to discern the attractiveness of each market and industry.

While the capstone project includes 5 products (fishing line, condoms, nail polish, hair product and medical sutures) in total this paper will focus solely on the industries that I am researching, medical sutures and fishing line. It will do an in depth look into the structure and incentives within each industry and then it will compare possible product strategies. It will finish with a recommendation, between the two industries, of which product Bolt Threads should invest into.

Introduction: As a new start-up time and resources are of the highest importance. Coming into business with one line and product is consuming as is, but what if you select the wrong industry? Betting on the wrong horse could be a waste of years of valid and ground breaking scientific research.

While brainstorming and narrowing selection have already occurred the purpose of this paper is to investigate between two industries, which poses the greatest potential for the highest profits, medical sutures or fishing line.

By the end of this paper you will see that fishing line is the ideal industry for Bolt Threads to enter. The fishing line market is full of noise from undifferentiated products, where a product with real differentiation could come in and significantly disrupt. The medical suture market is a generally attractive market but is unattractive for Bolt Threads due to the barriers to entry, namely the long FDA regulatory approval process, though surgeon adoption and lack of

frustration also pose significant barriers domestically and internationally where the FDA seal of approval is less important.

Literary Review: The majority of my literary review has been focused on the articles explaining the industries being researched as well as some articles from class about the different strategic frameworks that I analyze the industries through. I used Porter's 5 forces for analysis of the external factors, and use a variant of the resource based view of the firm (VRIO) and Core Competencies to do a brief analysis of the internal capabilities of the company, which culminate into the strengths of the firm. I then combine the two models in a strategy-SWOT and apply the delta model to arrive at the possible strategies for each industry.

How will the point be proved: While I will use articles to form the basis for the strategic review a lot of my information will come directly from an industry insider, Pat Ferguson. Not only is he the current president of RP Medical, the only suture manufacturer on the West Coast. He was also the president of the now defunct Bioline Company, the only manufacturer of biodegradable fishing line. The company had been sold and the product line driven into the ground. In addition to the primary research provided by Pat secondary research will include trade articles, press releases and industry evaluations.

In the end the point is proven by how realistic each strategy is considering the market and Bolt Threads' core competencies. This includes a standardized scale. Additionally, a human scale and "feeling" test has also be applied.

Bolt Threads

Who are they?

David Breslauer, Ethan Mirsky and Dan Widmaier founded Bolt Threads back in 2010. Each of the founders has deep backgrounds in biotechnology and has been researching a solution to produce protein microfibers with properties similar to spider silk. Dan and Ethan have researched how to replicate proteins outside of the donor organism while David has focused his research on spinning the proteins into fibers.[i] Dan and Ethan started their research while studying at UCSF while David studied at UC Berkley. The three were united to take their research to the next level with David using the proteins that Dan and Ethan engineered to form complete spider-like silks.

In Addition to the founders, Bolt Threads has built a team of researchers and business personnel in order to make this startup a success. The main campus is headquartered in San Francisco, with a product development office in Portland, headed by Chief Marketing Officer Sue Levin. Bolt Threads has connected with venture capitalists that have further connected Bolt Threads with resources to develop a commercial product.

What do they do?

Venture capital can be a blessing for researchers, but those behind the money are generally keen to get a return on their investment. Those funding Bolt Threads connected the team early on with Sue Levin, former CEO and founder of Lucy apparel. With Sue's experience and connections in the athletic and apparel industries and the fiber's high performance characteristics it seemed like a natural progression to move into the athletic and apparel industries.

An additional reason to move into textiles was to protect itself against it direct competitors. Bolt Threads is not the only firm engineering silk fibers. However, the founders are adamant that

they are the only ones who can produce at a scale and cost that makes them competition for traditional silks. Most of Bolt Threads' history has been refining the process and proving that proteins fibers can be engineered. However, in the last 6 months the company has been focused on scaling up its now proven process.

How do they do it?

Much of Bolt Threads process is confidential under a signed NDA. However, the general process can be known to anyone willing to do a Google search. Many spider silk DNA sequences have already been mapped. Scientists like Dan and Ethan have been inserting these sequences into a variety of living organisms. Bacteria, like E. Coli, are used by many groups due to their quick life cycles. This enables the researchers to quickly check their work and make corrections to perfect the next batch. Some researchers have even inserted the sequence into goat's mammary glades. When the goats are milked the proteins can be separated into goat and spider proteins.

The problem with the above processes is that they are not scalable. E. Coli mutates too aggressively to reliably produce the right proteins generation after generation and goats take years to develop, leaving the formula untested for years. Bolt Thread's process does not differ too much, but the differences do allow it to be scalable. This trade secret may prove to be the secret to Bolt's success. Once the proteins have been engineered the fibers are spun in a way far different then how spiders work. While spiders must spin silk at room temperature scientists have the benefit of removing that parameter. For many years the process of spinning silk seemed as far fetched as producing the proteins, but now it's a matter of using the right manufacturing method.

Why do they do it?

For eons mankind has searched for better materials, from animal skins to linens, wools, silks and cotton. The quest has always focused on higher performance, either keeping warmer, producing cheaper or having a better feel. In the 19th century synthetics were discovered. While these possessed new characteristics, such as stretch, strength and softness they have continually lacked the warmth and feel of natural fibers. The quest for the ideal fiber has stretched into the 21st century.

Spider silk has long been known to be strong and stretchy and possess a number of other ideal thread characteristics. A few times it has been meticulously milked and woven together with extraordinary results. However, It has never been produced on a mass scale due to the uncooperative nature of spiders, when kept together in any quantity they will eat one another. However, recent technology developments and research has allowed Bolt Threads to replicate the silk process outside of spiders, creating a new “super-silk” product with a variety of scalable attributes.

What differentiates them?

Using Jay Barney’s variation on the Resource Based View of the firm the VRIO[ii] model is useful to analyze the distinct advantages of the firm. While the V, R and I all represent the same values the O stands for organization. The VRI will not equal a strong competitive advantage if the organization does not exploit these activities. The key activities of Bolt Threads are examined in a table below.

Table 1

Activity	Description	V	R	I	O	Implication
Logistics	Movement in and out of resources from suppliers and to customers	Y	N	-	-	Parity
Operations	The actual processes that are used to produce the proteins and fibers	Y	Y	Y	Y	Competitive Advantage
Marketing	The team and activities used to develop go to market strategy and sales	Y	Y	N	-	Temporary Advantage
Firm Structure	The organization of management and roles	Y	N	-	-	Parity
Technology	The research developed by the organization	Y	Y	Y	N	Possible Advantage
Resource MGMT	How Bolt Threads manages its resources as well as it's ability to access funding	Y	Y	Y	N	Possible Advantage

While Table 1 is not a wholly scientific exercise due the subjectivity of the responses adding the core competency test can add a needed level of clarity. A core competency has 3 requirements.[iii]

1. Provide access to a variety of markets
2. Makes a significant contribution to the perceived value of the firm
3. Costly to imitate by competitors

It may be too early to definitively say that none of Porter's Value Chain activities represent a disadvantage for Bolt Threads. That will become obvious as soon as the firm starts full-scale production. However, using the VRIO model we can at least check to see which of the activities are core competencies. The three activities that will be costliest to imitate are the firm's technology, resource management and operations. These three activities are examined in further detail below.

Technology – Bolt Threads technology is the result of many years of scientific research. The quest for engineered spider silk goes back to at least the 1960's.[iv] Since this time

many have researched but few have actually attained a fiber comparable to spider silk, Bolt Threads has at least 5 competitors,[v] each at varying levels of performance. The first and last requirements of a core competency are well established. The ability to spin spider-like silk proteins into fiber is indeed rare and extremely costly to imitate, especially to the quality the Bolt Threads produces.

However, the contribution to the perceived value of the firm is still uncertain. Having spent the past 10 weeks researching applications for spider silk it is actually surprising how few of these industries are frustrated in a way that these fibers are uniquely capable of filling. Even the two industries examined later in this paper exhibit low frustration. Despite the low frustration these industries do have blue ocean space for a better, stronger more flexible fiber. These blue oceans are what could allow Bolt Threads to exploit the technology it has developed. Until that happens it is not conclusive that technology is a core competency.

Resource Management – Bolt Threads resources are extremely important, and the management of these is equally important. Not only has Bolt Threads proven an ability to appeal to venture capital funds, but these funds have been prudently used to hire talent and further the development of an expensive product without breaking the bank. These resources can provide the means to enter a variety of markets, as the expertise of the hired talent is diverse and deep while money greases many rough market entries. Indeed it is not easy or cheap to imitate these resources. The ability to attract investors and hire experienced talent is not something many firms have the ability to do.

Much like with technology it remains to be seen if Bolt Threads' resources and their management will contribute to the perceived value of the firm. Once Bolt Threads is making and selling products and/or raw material then it can be shown that this is a core competency. Though once the firms is producing rather than scaling and researching it

will need to manage a new set of resources. So in all, it remains to be seen if resource management can be a core competency of Bolt Threads and lead to a long-term competitive advantage.

Operations – While very similar, and dependent, upon Bolt Threads' technology operations differs in the execution of the technology. Because Operations is in many ways Bolt Threads' technology, the above analysis can transfer to this section. That analysis established an ability to enter a variety of markets and the barrier of cost to imitation, but left open the contribution to perceived value.

The difference between Operations and Technology is that the operations provide the value to the technology. The method chosen for growth of the engineered protein is different than its competitors. This difference as alluded to above is a trade secret but is what allows the company to produce at scale. It is arguable that this activity is the same as technology. However, technology more specifically refers to what the company has researched, while operations are a set of decisions on how to execute that technology. Where Technology must wait for profitability to prove that it is/has been a core competency Operations can be seen as a core competency now.

Industry Analyses

While the above analysis focused on the internal capabilities and competencies of Bolt Threads the following analysis will focus on the external markets that Bolt Threads stands to enter. This analysis utilizes Porter's Five Forces, and acts as a tool to examine the industries that Bolt Threads looks to enter. This will be used in conjunction with Bolt Threads selection criteria to select the ideal industry to enter. This analysis will also help form the threats and opportunities of a SWOT analysis later in the strategy section.

Fishing Line

Fishing line is the part of the fishing gear that separates the fishing pole from the bait. Essentially it extends the reach of the fisherman to extend to the other side of the pond, or down to the bottom of the ocean. There are three types of fishing line and each is used to essentially engineer where the line will break, should the line break.

The line is the strongest, and thickest portion of the setup. It is what winds on the reel and creates the greatest amount of reach. It is also the least desirable place for a break. It may be colored for better visibility when trawling. The leader is the second part of the setup and is often tapered down to the bait. Many setups only include the line and the leader, so often the leader does need to include qualities that allow it to be used close to the fish. Often the leader is translucent and is generally much thinner than the line. These qualities help it to disappear in the water so that fish don't get spooked. Both the line and the leader are without stretch so that movements in the pole or bait are transferred back through to each other, though this is not always the case.

The tippet is most frequently employed in fly-fishing, and is the most common part of the set-up to break of be cut off. Tippets are desired to be flexible but not so strong. If any part of the set-up is desired to be environmentally friendly and decompose, the tippet would be that product.

How fierce is rivalry?

Due to the fragmentation of brands and manufacturers (grouped together because Bolt Threads would be competing against both) the rivalry is very low in this industry. The fishing line industry is made up of many brands and even more manufacturers. A quick amazon.com search reveals at least 17 brands each with between 50 and 100 separate products. A search on alibaba.com reveals nearly 3000 fishing line manufacturers.[vi] Complicating rivalry further many large and small brands are owned by the same parent company and many rival brands source from the

same foreign suppliers. While this means that the level of actual differentiation is very low these brands are masterful at using marketing to differentiate their offerings.

Fishing line is generally seen as an add-on accessory, with margins to match. Brands are more apt to compete on rods or other high priced fishing products. Brands will white-label fishing line to round out their product line and exploit the high margins in a “razor and blades” business model. While some specialty regional brands produce their own differentiated line, like biodegradable line. However, large plastics manufacturers, who specialize in a wide variety of filament-based plastics, manufacture the majority of brand’s fishing line over seas. [vii] This adds to the lack of rivalry as the brands are not so much invested in what the fishing line is, but more in that they are selling it.

How high are the barriers to entry?

The barriers for this industry are generally low, especially if you have a product in a related industry like fishing tackle. Fishing line has very low actual differentiation, as seen on Alibaba.com there are nearly 3000 fishing line suppliers.[viii] Each of these suppliers ranges between $5m - $50m per year and has there business spread across North America, Europe and Asia nearly evenly. Most manufacture a range of filament-based products, such as string trimmer line, and package the same material differently for the separate industries it sells in. For a new brand to enter the fishing line market it would only need to buy the line and a label to put on it, then it could sell it as its own line product.

This however does lead to the two barriers for entry into the market, distribution and customer perception.

- **Distribution** – There are a plethora of fishing outlets in the United States and abroad. While many brands are sold at big box stores like Cabela’s or Wal-Mart some brands are more localized to regional or sole-proprietor tackle shops. This makes it easier to enter

the fishing line market when your brand is already in the channel with a related product. Product line extensions are generally much easier than establishing an entirely new distribution channel for an unknown brand.

- **Customer Perception –** While there is not necessarily a lot of brand loyalty for end users there is a lot of noise to overcome in the fishing line department. As each line within the material categories is very undifferentiated the existing brands have developed deep perceived differentiation. This is evidenced by the actions of the end users. A fish can be caught with nearly anything on the end of a string, however, an entire market now exists because these customers have been convinced that xyz change will improve the chance of their catching a fish.[ix]

  To overcome these perceptions requires that a brand actually deliver on differentiated benefits, or develop packaging and marketing that induces trial and rely on a good fishing experience to cement further adoption.[x] While any brand can come out with a fishing line product and most can secure distribution establishing the brand as a staple in the tackle box is the biggest hurdle to being successful.

What is the threat from substitutes?

There are two ways to look at substitutes. The first is as the function of line in catching a fish. The second is as a product being the material chosen for that line.

- **Catching Fish –** The most common substitutes for catching fish with a line and pole are nets and spears. The threat of substitution from these means is very low. These activities are seen as separate from fishing. Fishermen have internalized the idea of fishing and them being fishermen very deeply, so it is unlikely that a rival sport would sway them away from using a line and pole.[xi]
- **Material –** There are three principle materials used for fishing line – Nylon (monofilament), Fluorocarbon and Ultra High Molecular Weight Polyethylene (UHMWP),

each is a nearly perfect substitute for the other. However, branding has made these materials very differentiated materials. The threat from each material, especially is a new material is being launched, is substantial. In fact the braided market (fluorocarbon and UHMWP) is currently anticipated to grow at 4-5% whereas the industry as a whole is only anticipating 1% growth, signifying that Nylon is anticipated to shrink, having share taken from it.

While a fishing line need not be sensitive to the threat outside the industry within the industry a rival material may supplant a line product.

How much power do suppliers have?

Suppliers do not have very much power in this market. As was mentioned previously there are as many as 3000 suppliers of fishing line around the world. If a dispute arises with one supplier the brand could just as easily move to the next supplier. Another common threat from suppliers is forward integration, this as well is low for this market. The reason this is low is due to the diverse portfolio of industries that each of the manufacturers sells to.[xii] Fishing line is merely one of many products that is produced by the manufacturers and the resources required to brand and distribute that product are not worth the manufacturers' time.

Although suppliers do not show significant power in this industry they are instrumental influencers. The innovation does not come from the brands, it comes from innovations in plastics technology from the manufacturers. These manufacturers innovations are the fodder that brands utilize in their attempts to differentiate their products. Without these activities from the manufacturer the market would be more likely to stagnate.

How much power do customers have?

The threat from customers is high. Customers for this industry are not seen as the end-user, but rather the retailers that distribute the brands. Big box retailers have the most power, but it

remains the same for local retailers as well. This is because each either accepts or rejects your offering, each can easily backwards integrate and each controls your POP marketing.

- **Power to reject your offering –** There are many different brands in the market place, each with basically the same product offering. Amazon.com carries nearly 50 different brands each with 50-200 products. If any retailer decides to pull a product line there are many more gladly willing to take that shelf space.
- **Backwards integration –** As mentioned earlier one of the barriers to entry is distribution. As a retailers that is already solved. If the retailers already has any equity built into their brand introducing a new product is as easy as ordering product and labels, and any 3PL could put those together to be directly delivered to retail locations. Many retailers, such as Cabela's, already have their own white label fishing line brands. A product line extension would be even easier for a retailer of this type. Greatly increasing shelf space competition.
- **POP Marketing –** A large part of differentiating and selling fishing line product comes down to how your product is displayed to the customer. Retailers have nearly exclusive control over this end-user experience. Additionally, sales people may be specifically trained to sell certain products over others

Medical Sutures

How fierce is rivalry?

Rivalry within the medical sutures market is moderately low. In the United States the market is mostly divided between two companies, Ethicon (a division of Johnson & Johnson) and Covidien (formerly owned by Tyco International). Ethicon has a 70% market share,[xiii] while Covidien has around 20% market share.[xiv] The remaining 10% is divided up by a large number

of innovative players building a market large enough to entice the behemoths to purchase the new product line.

An important consideration for this market is that medical sutures are not the only products that representatives from these companies sell. Ethicon developed a very strong market share in the 1950-1970's from having more sterile sutures than any competitors and has maintained those relationships with scale and maintaining as good or better quality than competitors. This has kept rivalry in medical sutures very low. The rivals take what deals they can, but fight battles with each other in other product lines and industries.

Internationally rivalry is slightly higher. Though it is not high due to a larger number of competitors in emerging markets. Ethicon, Covidien and B. Braunson still make up the majority of the international market, however sutures are more commoditized globally. Alibaba.com shows more than 1000 separate manufacturers of medical sutures throughout the world. While many of these suppliers are big or growing companies none have a significant presence in the United States.[xv]

One last factor that plays a role in suppressing rivalry is a barrier to entry that will be discussed later. In the United States the FDA regulations for medical sutures are extremely strict. Not only is it expensive and time consuming to bring a suture to market, but once a suture has been brought to market it must be used in the specific use case defined by the application. Any changes that are made must reapply for recertification, which is additionally an expensive and time consuming process.[xvi] Due to this process the large firms are less likely to chase other products in the market. Thus reducing rivalry.

How high are the barriers to entry?

As was just mentioned the barriers to entry in this industry are extremely high. Not only are they currently high, but also they are ever rising. Pat Ferguson, President of RP Medical, said that if

he had not gotten into this industry 5 years ago, when he did, he would not have been able to enter the market now. The barriers in this industry are distribution, FDA regulations and surgeon preference.

- **Distribution –** Due to the market being dominated by Ethicon distribution is also dominated by Ethicon. Johnson & Johnson has a large workforce that is able to develop personal relationship with each hospital and in some cases surgeons that it sells to. There are no big wins in this industry because of its strong relationship base selling culture. To succeed a product would need to visit and develop a relationship with each hospital, clinic and surgeon it wants using its products.
- **FDA approval process –** Even for a product that is building off of an existing approved product the approval process is slow and expensive. Products that go inside the human body are heavily regulated and must prove efficacy across the board to be approved. Forms are expensive, clinical trials are expensive, and having the capital to burn through while you wait is expensive.
- **Surgeon preference –** Much like fishing line surgeons use what they like, often for no other reason than that they are used to it. While some surgeries do require a specific suture that has been approved if a surgeon has the ability to choose it will choose the one that it has used previously, even if the suture is inferior.[xvii]

What is the threat of substitutes?

Threat of substitutes in this market is high. While in the above fishing line industry threat from other forms of fishing was low and material substitute threats were high it is reversed in this industry.

- **Forms of wound closure** – While in 2011 more than 100 million wounds were sealed shut not all of these were sewn with medical sutures. Additionally, innovations in minimally invasive surgeries are avoiding the requirement for stitches all together.

Surgeries are growing due to the aging population and medical innovation being able to cure problems previously accepted. However, in the United States the market for medical sutures is only anticipated to grow at 1%. [xviii] The main determinant to the threat from substitutes will continue to be what will produce the best results? In some cases that will be a medical suture, however, in others medical glues or cut avoidance will provide the best results.

- **Material substitutes** – While the threat of one suture material substituting for another is much lower than it is in the fishing industry the threat is still moderate. FDA regulations and surgeon reluctance to try new materials do keep the threat at bay. However, there are many applications where one type of suture is equally substitutable for another.

How much power do suppliers have?

In the United States the brands themselves act as the manufacturers as well. So within the United States raw materials suppliers of plastics and solvents, as well as protein based materials, are the supplier. Their power is low. While raw materials suppliers do have a large customer base to select from outside of the medical suture industry within the industry there are few players within the industry to sell to. Further reducing power is that there are many raw materials suppliers to choose from, and Ethicon need not source from one supplier.

The threat of forward integration is nearly non-existent. The raw materials apply to a wide range of industries and medical suture represent a small slice of their portfolio. Not only is the industry a fraction of what they do but also special knowledge is required to transform the raw material into a product. That coupled with the high barrier of FDA approval create a very low likelihood of entry.

Internationally, there are many more companies that sell sutures as more of a commodity. These too have low power, as they do not have the distribution network setup. Additionally, with

the large number of them the brands that they sell into have the ability to switch easily between suppliers.

How much power do customers have?

Customers generally have low bargaining power in this industry. This is due to the inability to backwards integrate and the shear scale of Ethicon in bargain price and delivery. However, one consideration for bargaining power is that sutures are unlikely to be the only thing that a hospital or clinic is purchasing from the firm. In the case of Johnson & Johnson it is likely that a consumable like sutures could be used as a bargaining chip when discussing pricing for multi-million dollar machinery. While this would not be the case with a pure-play medical sutures supplier it is the case for many international and national companies.

Industry Selection Criteria

An extremely important assumption for selecting between industries is that Bolt Threads is capable of making a compelling fiber for the industry. Going into the specifications of what those attributes would be is beyond the scope of this paper. However, Bolt Threads core competency is the ability to shift and flex the properties of the fiber to match the application. With the wide catalogue of documented proteins the assumption is that Bolt Threads can produce whatever type of fiber it would like. This may or may not actually be the case.

The following criteria are used to guide Bolt Threads to which industry it should design a fiber for. While one part of the analysis should be, “how hard will it be for Bolt Threads to produce the ideal fiber?” This is not focused on because once the protein components are decided upon it is the same for Bolt Threads to produce one fiber as it is any other. So only the following four criteria will be used to guide Bolt Threads to industry/product selection: Market Potential, Market Structure, Frustration, and Barriers to Entry.

The numbers next to each section heading is the percentage that this is attractive for Bolt Threads. A comment is also given to specifically call out why each criterion is rated at its particular percentage.

Fishing Line -75%

This market is not a perfect 100% fit for Bolt Threads. However, given Bolt Threads capabilities and the structure of the market this seems like an area where Bolt Threads could have an easy win. This of course assumes that it is not too consuming to develop a fiber with the ideal characteristics.

Market Potential – 50%

The fishing market is divided largely by freshwater and saltwater fishing. The products are divided along these lines as well. Freshwater fishing represents nearly 75% of all fishing within the United States. While freshwater fishing is relatively well distributed across the US with the population saltwater fishing is obviously concentrated on the coasts. Three states represent nearly 25% of the total fishing market: Florida – 11%, Texas – 8% and California – 7%. Notably, these states do comprise the largest chunk of the continental United States, however, there are key markets within these states, Los Angeles, San Diego, Miami and Galveston, which provide the majority of the fishing population.[xi]

Margins in this industry are more than 50%, as these are accessories that traditionally have high margins.[vii] This market is nearly $500m/per year or $1.5b globally. This market is additionally expected to grow at about 2-3%, with braided line growing at an even higher 4-5% rate.[xix] These factors combine to create an attractive market. Though this is not possible without some work. Some additional concerns in this market are adoption and distribution. These are the factors that keep this from being a more attractive industry and will be discussed further under barriers to entry.

Market Structure – 100%

The market structure in this industry is very attractive for Bolt Threads to enter. As mentioned in the industry section it is comprised of many brands and even many more suppliers. Notably, larger conglomerates own many of these brands. However, even though a large firm will own many separate brands these are not consolidated but are run separately.[xii]

This is a large market with many brands and products already within it. Another product could easily enter without disrupting the status quo. On that same point another brand could enter and not be successful because the brand will not stand out. This should not be an issue for Bolt Threads as it has a product that can substantially differentiate itself, not only in strength but also with environmental friendliness.[vii]

In 2009, RP Medical developed a brand named Bioline here in Portland. The brand differentiated by being biodegradable, an uncommon trait within fishing line. This was seen as valuable because fishing line is frequently discarded in wilderness. Many fishermen are eco-conscious and the brand generated a large amount of buzz. The brand was sold in 2012, and ruined, but even still any Google search on environmental line still reveals the extensive buzz generated back in 2009. Fishermen are very “tech conscious” and generally “eco-concious” and are always looking for products that fill these aspirations.[ix]

A brand with the right differentiating factors can exploit this loose market structure to do exceptionally well. This market is giving a very attractive rating because Bolt Threads has the tools at its disposal to create a valuable and differentiated offering. There is space for another product and Bolt Threads is a product that can stand out in all of the noise.

Frustration – 25%

Currently this market has low frustration. The market is saturated with messaging trying to differentiate products. While fishermen are actively looking for products that fill their aspirational

tech and eco desires these are hobbies and not strong needs. Additionally, products in this market have not changed radically in the past 50 years creating a strong status quo. An instance of this is in tying fishing knots. While with many fibers tying an overhand knot is sufficient to hold, however, these products are stiff and require special knots. Even with these special knots the fibers often come undone. To compensate when a fiber is more difficult to knot the knot is usually change rather than the material. Frustration is not noted because it is just accepted as a cost to using the stronger material.

While a market that appears unfrustrated is generally a sign of an unattractive market there is still frustration that Bolt Threads could tap and solve. Essentially what Bolt Threads will have to do is create frustration with its offering. If the Bolt Threads product is sufficiently superior to the current offerings in areas such as flexibility, “feel” and strength then the market will become frustrated and change.

While it is likely that Bolt Threads can do this to some level this criteria is not rated higher due to the uncertainty of changing the markets perception. Much like surgeons use what they know despite a better product being available fishermen too may continue to use inferior products due to habit. Habit can be one of the more difficult things to change within the market.

Barriers to Entry – 50%

The barriers to entry are discussed above in the industry section. Distribution and customer perception will be extremely difficult to overcome. Bolt Threads will need to have a strong value proposition to convert users. An additional consideration for Bolt Threads will be how it distributes its product. If Bolt Threads acts as a white producer then distribution and marketing will be the responsibility of whichever brands it partners with. Having a big innovation with an actual differentiation would both be very big selling points to any brand.

This criterion is rated at 50% attractive because there are some real barriers to entry that could derail a successful product. However, tempering that is the possibilities for introduction that help mitigate those barriers. Additionally, while adoption is difficult to secure for most fishing products fishermen are very apt to try new products.[ix] With high trial rates a product that actually improves the fishermen's skill or experience should catch on quickly. The additional buzz from an innovative product should also drive trail and adoption.

Medical Sutures – 25%

While there are aspects of the market that are very attractive, overall it is very unattractive. The structure and barriers to entry are high and difficult to over come. However, with the right parties interested, and capitalized, this is an industry where a Bolt Threads fiber would fit in very well. That is one reason that this market was pursued initially. However, without an invested partner this market is generally just not worth Bolt Threads' time.

Market Potential – 50%

In 2012 the global market was a $4.7b industry with CAGR growth of 4%. Recently, the market size in the US has been estimated at $1.6b with slight 1% expected growth. [xviii] For those already within the suture market it is an attractive industry, especially with the growth internationally. The global growth is largely due to the growth of emerging markets. In those markets surgeries are growing as income and health benefits rise. Additionally, there is an increasing awareness of procedures, which also drives the number of surgeries requiring sutures internationally.

For Bolt Threads' the considerations are time to market, probability of success and space to be successful. The last two considerations are what really drive the positive side of the rating. Bolt Threads should be able to produce a very effective suture that is differentiated from the current offerings. This market has also shown sufficient space for another product. While Ethicon does

command a substantial market share they do not do any innovation in house, but rather when a promising innovation arises Ethicon will purchase it. This would work well for Bolt Threads, who does not want to be cumbered by marketing and distribution but rather wants to be a material supplier.

Time to market is what really hurts this market's potential for Bolt Threads. FDA regulations require extensive testing before a new product from engineered sources could be approved. Additionally, Bolt Threads would require much more time to make sure that the relevant properties are appropriate for the human, or animal body. Further exacerbating time to market is the capital required for that. It would take some time for Bot Threads to partner and established the required capital for testing, both internally and clinical. This is all of course before the filing costs to the FDA.

Market Structure – 25%

As mentioned in the industry analysis large multi-national companies that specialize in medical devices characterize this market. These firms not only the have the feet on the ground, but also have the power to bargain with customers. Competing with these presents challenges that only scale and money can solve.

The reason that this is rated at 25% rather than 0% is the knowledge that these companies are very keen to purchase innovation. Despite this it is still a huge risk to develop a product that cannot be distributed without the blessing of a much bigger company. However, the only way to obtain that blessing is demonstrate the efficacy of the product in the market. To begin Bolt Threads will need a development partner that would allow the innovation to be sold to a larger firm.

Frustration – 25%

This market is characterized by surgeons who are satisfied with the products that they currently have. There are many innovations that may be better than what surgeons are currently using, however trial and adoption are incredibly low in this industry.[ix] Unlike the fishing industry this market will be much more difficult to create a frustration.

Through netnographic research, however, a strong frustration and opportunity has presented itself. Medical students have a difficult time finding sutures that they can use to practice with. Many medical students complained on forums of being unable to acquire practice sutures. This is an interesting opportunity for Bolt Threads, because these young proto-surgeons have not yet developed their preferences and are more likely to try new things.

A low rating in frustration is specifically due to the low frustration of current surgeons. The rating would be 0% without the frustration and growing population of medical students. Medical students are expected to grow 18% over the next few years.[xx] If Bolt Threads could affectively reach this population it could lock them into a preference that would be lucrative for years to come.

Barriers to entry – 0%

As has been mentioned several times previously the barriers to entry are why this market is not attractive. While some of these barriers are capable of being overcome through strategic placing and partnerships they are guaranteed as an entry point. Additionally, the FDA approval process presents a double barrier. Not only is it expensive and time consuming for Bolt Threads to enter the suture market but also the barriers for Bolt Threads competitors will be lower.

If Bolt Threads is able to get its engineered protein fibers approved for use inside the body then other competitors will be able to piggyback off of those same approvals for an easier entry into the market. It goes the same for partnerships and medical student adoption. If Bolt Threads is

able to prove efficacy to a partner a competitor would only need to say that it is similar enough to Bolt Threads to also be considered. Competitors can like wise approach medical students. The catch-22 of entry into this market makes it very prohibitive.

Table 2

	Market Potential	Market Structure	Frustration	Barriers to entry	Overall
Fishing Line	50%	100%	25%	50%	75%
Medical Sutures	50%	25%	25%	0%	25%

Strategies

Strategy SWOT

A strategy SWOT is a tool that takes a traditional SWOT analysis and adds actionable strategies within to drive at how strengths can overcome threats. The most difficult area to develop strategies within is overcoming weaknesses to mitigate threats, while the easiest strategies are using strengths to capitalize on opportunities.[xxi]

Strengths and weaknesses were taken from the section about Bolt Threads and its activities and competencies. The opportunities and threats were taken from the industry analysis on fishing line and medical sutures.

Table 3

		Bolt Threads	
		Strengths	Weakness
Fishing Line		1. OPERATIONS 2. TECHNOLOGY 3. RESOURCE MANAGEMENT	1. UNPROVEN IN MARKET 2. UNPROVEN SCALE
Opportunities	1. DOMESTIC GROWTH 2. CONSOLIDATED MARKETS 3. FRAGMENTED MARKET	(2,1) Use technology to capture domestic growth (1,3) Partner with popular brand to deliver new product to market	(1,2) Work with firm which owns many brands to test and utilize market knowledge to deliver best product
Threats	1. MARKETING NOISE 2. DISTRIBUTION 3. DIFFERNTIATION	(1,1) Use buzz from innovative operations to overcome noise (2,2) Use new tech to differentiate offering in the market.	(2,2) Start with small scale and build up market slowly to secure dist. Relationships and scale of line
Medical Sutures			
Opportunities	1. INTERNATIONAL GROWTH 2. MED STUDENT GROWTH 3. INNOVATION HUNGRY FIRMS	(2,3) Impress firms with technology to gain dev. Partner (3,3) Use resources to market to med schools and sell direct to students to develop following	(1,1) Prove in smaller international market before coming to play in US (2,2) Start with medical students then see if can scale up to more businesses
Threats	1. FDA REGULATION 2. GIANT FIRMS 3. GROWTH IN SUBSTITUTES	(1,1) Navigate FDA reg. through rapid prototyping (2,3) Partner with giant firm for distribution (2,3) develop substitute product	(1,1) Prove in market by acquiring FDA approval (1,2) Get stamp of approval from partner firm.

Now that many strategies have been parsed out through the S-SWOT we can apply the delta model and combine several above strategies into a simplified delta strategy.[xxii]

Strategy for Fishing Line

The recommended strategy for Fishing Line is a best product strategy. The fishing line industry already has many offerings that produce a lot of marketing noise. For Bolt Threads fiber to stand out and gain adoption it will have to present a significant value to customers. However, because

it is a new material it will likely generate a significant amount of buzz, thus further increasing trial.

Strategy for Medical Sutures

The best strategy for medical sutures is a customer lock-in strategy. Surgeons have already shown that they will continue to use what they know even in the presence of a better method. Connecting with medical students before they have developed a preference for any specific type of suture will lock them in to the feel and capabilities of Bolt Threads' suture. The additional benefit of targeting medical students is that a suture can still be sold to them for practice even before it has been approved the FDA. This has two benefits, first, while small the sales will help mitigate the costs of development and clinical trials, and second, a following can be developed right away. By developing a following right away years of adoption will not be required once the suture is available to the market. Thus enabling Bolt Threads a few years advantage over its rivals.

Conclusion

The conclusion from the above analyses is that Bolt Threads should pursue the fishing line market over the medical suture market. While there are strategies that would work for both markets, and both markets do have openings in them for additional products. However, the primary criteria for market selection were laid out and for Bolt Threads the fishing line market, while smaller with more brands and noise, will have a quicker time to market and better disruption potential.

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