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Predicting the Diffusion of New Products

Will Apple Vision Pro, one of the hottest new product launches of 2024, succeed or fail? The Apple Vision Pro headset launched with much fanfare in June 2023. The mixed reality headset device, priced at \$3,499, offers consumers spatial computing, seamlessly blending digital content within a physical space. Vision Pro allows users to interact with different types of digital content (e.g., apps, photos, entertainment, gaming) in a way that feels like the content is physically present in their space. Proclaimed Apple's CEO Tim Cook during a launch event, "Today marks the beginning of a new era for computing. Just as the Mac introduced us to personal computing, and iPhone introduced us to mobile computing, Apple Vision Pro introduces us to spatial computing. Built upon decades of Apple innovation, Vision Pro is years ahead and unlike anything created before — with a revolutionary new input system and thousands of groundbreaking innovations. It unlocks incredible experiences for our users and exciting new opportunities for our developers."¹ During one weekend in January 2024 during its presale period, Apple sold 180,000 units.² Nevertheless, reviews were mixed and by mid-2024, sales were reportedly slowing.³ Time will tell whether the product will take off or crash and burn.

One job of product managers, marketers, strategic planners, and other corporate executives is to predict what the demand will be for a new product or service and how quickly the company can access that demand. This task is easier for certain classes of new products than for others. For new consumer packaged goods, for instance, one can look at past product rollouts, one can look at similar products currently in the marketplace, or one can run test markets — selling the product in a small section of the country to assess consumer acceptance. Quite often, for new products that represent incremental variations or improvements over existing products, marketers do a fairly good job of understanding

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how that product will be adopted in the marketplace. This is not to say that managers always get it right, as has been made clear in the cases of New Coke^a, Microsoft Zune^b and Quibi^c.

Contrast this with “new-to-the-world” products – products that represent great improvements over products currently in the marketplace or those that represent completely new classes of goods and services. For these types of products, consumers have either (1) no benchmark or (2) an inappropriate benchmark for understanding the product. Consider the telephone. When first introduced to the world, it was dismissed as a curiosity item, unlikely to replace the seemingly adequate telegraph. And, with the personal computer, it took consumers years to understand what it was and how it might affect their lives, and even then, it still only penetrated 30% of homes fifteen years after it was first developed.

For these new-to-the-world products, it is more difficult to predict the amount and rate of consumer acceptance (at least in the short run). This is not to say that firms do not try. Many firms develop predictions either in-house or by hiring consulting firms to do a demand assessment. The approach taken in these efforts often is one of adding up the pieces for a bottoms-up approach—for example, “We predict 10% adoption within Segment A, 25% adoption within Segment B, and so on.” Other times, managers start with top-down estimates of the total addressable market (TAM) and then make an educated guess as to the amount of market share the firm will be able to garner (e.g., 1% is often a popular but often faulty guess). These calculations are built on questionable assumptions about customer behavior and, as a result, unfortunately, produce demand predictions that are shaky at best.

The result is that sales estimates miss by many orders of magnitude. They are not off by 10% or 20%; they are off by factors of 10, 20, or even 100. As one colleague notes, “We’re not talking the difference between a single and a home run, we are talking about whether we are even in the right stadium.” Even the world’s most successful companies and their investors miss the mark when predicting whether a new product will be successful. Consider the human and financial resources put behind the development and launch of Google Glass^d and Meta’s Horizon Worlds and metaverse initiatives,^e which serve as cautionary tales for overambitious demand forecasts and return on investment calculations.

^a New Coke was a reformulation of Coca Cola’s flagship product. It was introduced in 1985, after blind taste tests showed it to be preferred to traditional Coke and to Pepsi. Consumer backlash was almost immediate, forcing Coca-Cola to reintroduce its traditional product as Coca-Cola Classic and to eventually drop New Coke in most markets.

^b Microsoft Zune was a portable media player designed to challenge Apple’s iPod. Positioned as cooler and more social than the iPod, Zune’s clunky appearance and brown hue kept its market share low. Quality issues and bugs and a lack of developer support contributed to Microsoft’s inability to support a thriving ecosystem to surround it. It was discontinued in 2011.

^c Founded and led by entertainment and technology titans Jeffrey Katzenberg and Meg Whitman, Quibi was a subscription streaming platform that delivered 10-minute “quick bites” of content to mobile devices. After raising \$1.75 billion in capital, the service shut down after 8 months in market due to its inability to attract paying subscribers. Critics blamed the paid model, citing the fact that consumers could get similar content for free on YouTube and Tik Tok.

^d Google Glass, smart eyeglasses that featured a display and camera in place of the lens, was introduced as a prototype for \$1,500 in 2013. Following an uproar about privacy concerns that led businesses and entertainment establishments to restrict their use, and health and safety concerns related to eye pain and distracted driving, Google Glass was discontinued before diffusing broadly. Those who wore them were labeled “Glassholes” and struggled to navigate the etiquette associated with wearing a hidden camera connected to a computer on one’s face in public.

^e After changing its name to Meta in 2021 to support its growing investment in the metaverse, a virtual reality-fueled vision for the future of the Internet, Facebook reported losses of \$24 billion in its Reality Labs division for 2021 and 2022. One of its initial forays into the metaverse, Horizon Worlds, was a free virtual reality world where users could engage in social activities and host events. Meta saw platform numbers drop to 200,000 monthly users (from 300,000 following the launch) as users criticized the incomplete environment that lacked social functionality, featured rudimentary graphics, and offered a glitchy user experience.

Where do these predictions go astray? Oftentimes, these methods grossly underestimate *how long* it will take for customer demand to materialize and *how widely* the innovation will spread through a population. We refer to this as *product diffusion*, the rate and breadth of adoption in a target market. The first step in predicting demand for new-to-the-world products is understanding the factors inherent in those products and their marketing strategies that will either encourage or hinder adoption among target customers. Which product characteristics and which marketing strategies will accelerate product purchase, usage, and repurchase, and which will act as friction points and/or roadblocks?

Over the next set of pages, you will see four innovative products that have been introduced to the marketplace. Ten years from now, some of these products may be well entrenched in our (or some customer segment's) daily lives. Others may be still struggling to gain customer acceptance. Still others may have long since disappeared, never having gained sufficient traction in the marketplace. Of course, it would be nice to predict demand for each of these products with some degree of reliability. As a first step, however, a marketer might settle for understanding what customer adoption and product diffusion might look like and how easy or difficult it will be to achieve. The goal of this exercise is to compare and contrast these four products to determine why one might diffuse rapidly and another not at all. What are the product characteristics and marketing strategies that make Product X a likely "star" and Product Y a likely "dog"?

Your job is to rank the four innovations in terms of how rapidly and broadly they will diffuse in the marketplace and analyze your ranking to identify those characteristics or conditions that account for those predictions (i.e., explain your decision rationale by generating theories about what makes new products successful and what makes them fail). Note that it is insufficient to say, "this product will never fly" or "this is a silly product." Rather, you need to dig down and determine *why* it will never fly or *why* it is a silly product. You should be able to identify a handful of factors that are helpful and harmful to diffusion that generalize across a broad class of products. Then, get to work. Your goal is to increase the likelihood of success of each product. What changes can you make to the product and its marketing strategies to increase the likelihood of acceptance and prompt faster and broader diffusion?

Shucks^f

John Hathaway opened a lobster shack in Maine called the Sea Star Grill. He wanted to offer his customers the authentic experience of eating a fresh Maine lobster, with the lobster crackers and bibs that were the necessary accoutrements for the messy process of "shucking" a whole lobster to remove the meat from its hard-shell body, tail, claws, and legs. Maine's restaurants were filled with diners tucking into fresh, whole lobsters with their hands and engaging in the messy work of getting to the meat. Eating lobsters was a theatrical event compared to a typical meal and New England tourists often included a lobster night on their travel itineraries. Diners chose their live lobster from the tank after watching it crawl around for a bit, put on their brightly colored plastic bib in anticipation, and then saw it show up on their dining table still in its shell minutes after it was boiled. Attacking it with their bare hands and the lobster crackers, diners poked and prodded the meat out of the shell with childlike abandon. With lobster juice running down their chins and their hands sticky from the shells, diners eating lobsters shared a communal experience unlike any other. Described Portland restaurant owner Debra Randall, "People love to put on the bib. They want the experience of cracking the lobster, of

^f This section uses excerpts from the Harvard Business School case authored by John T. Gourville entitled "Shucks," Harvard Business School Case #512-048 .

sitting by the water, of seeing the boats...It's the whole Maine experience...A lot of people say goodbye to the lobster. Some people kiss it."⁴

However, Hathaway soon realized that some of his customers simply wanted to eat their meals without all the work and mess. They wanted what Mainers called "a Lazy Man Lobster,"⁵ where the shell was already cracked for them and the meat was ready to be daintily and easily removed with a fork. Hathaway was in disbelief, "The customers, especially the tourists, didn't want the experience, they didn't want the ritual of eating a whole lobster. I was stunned."⁶ But, he likened it to eating other meats, "You don't buy a salmon with the head on it; you don't buy chicken with feathers on; and you don't buy a cow. But you still buy a live lobster."⁷ The idea of making lobster easier to eat intrigued him and his research turned up an interesting innovation in Louisiana:

This guy was using 'high pressure processing' or HPP to kill bacteria and thereby extend the shelf life of raw oysters. He placed live oysters in a large steel container, dropped the container into a tank filled with water, and cranked up the water pressure to very high levels. This instantly killed the oyster, along with any unwanted bacteria. As a side benefit, however, it loosened the oyster from its shell. I thought, 'why not lobsters?'⁸

Hathaway entered the lobster processing business to change the way chefs prepared lobsters. Noted the *Boston Globe* after observing the results of HPP on lobsters, "The lobster came out looking exactly as it had before it went in, only it was no longer alive. But inside the lobster, the change was dramatic: the pressure had forced the meat to detach from the exoskeleton, which meant that when the shell was cracked, the meat slid out whole, undamaged, but still raw." An uncooked lobster, naked of its shell but intact, opened up new preparations ideas and new eating experiences.

The Maine Lobster Industry

In 2022, Maine received about 98 million pounds of lobster worth \$389 million, with most of this volume caught between July and November, the height of the lobster-catching season.⁹ These lobsters were largely caught by self-employed Maine lobstermen. Lobstermen sold each day's catch to the owner of the local lobster wharf. There were about 200 wharves in Maine, each supplied by 10 to 50 lobstermen. The price paid to the lobstermen by the owners of the wharves depended on supply and demand. During the height of the season, the price per pound was typically between \$2.50 and \$3, and in winter, when supply was lower, the price increased between \$4 and \$5 per pound.¹⁰ The owners of the lobster wharves then sold either to live-lobster dealers (70% of volume) or to lobster processors (30% of volume) after taking a markup. There were about 30 live-lobster dealers in Maine. They graded lobsters for quality and size, selling the best and largest to higher-end restaurants and supermarkets (about 10% of what they bought). They sold another 60% to wholesalers who then sold to supermarkets, restaurants, and seafood markets. The remaining 30% was sold to lobster processors like Shucks.¹¹ The live-lobster dealers also took a markup before selling the lobsters to these channels.

There were five lobster processors in Maine and almost fifty in Canada. They processed lobsters for the market. Processed lobster came in several forms. Much of it was cooked by steaming and the meat was removed from the shell to be sold as fresh or frozen lobster meat. It was difficult to remove lobster meat from its shell without cooking it first. Sometimes the whole lobster was cooked and frozen intact in its shell, and sometimes the lobster tail was removed and frozen raw, with the rest of the body cooked and the meat removed. Processors sold these products to the food service industry (e.g., to cruise lines, restaurant chains), retailers (e.g., specialty seafood stores, supermarkets), or to processed food companies to be used as an ingredient.

There were different demands for lobster across individuals. A survey, conducted for the Maine Lobster Promotion Council of more than 800 U.S. adults, noted six distinct customer segments, ranging from “Lobster Traditionalists,” who enjoyed frequently eating lobster to “Moral Protesters,” who deeply disliked lobster (see **Exhibit 1**). Hathaway thought about these segments and realized that likes and dislikes were based on a cooking and eating practice that had changed little in the past 50 years.

Lobster Processing

High Pressure Processing (HPP) was initially developed to eliminate bacteria in foods. Hathaway found that a secondary benefit was that it could easily separate meat from shell. While this made it easier to eat a lobster, it also made it easier to cook a lobster; chefs could simply purchase the raw meat without the hassle of the shell. There were other benefits, according to Hathaway: “This opens the door for a wide variety of new recipes. Gently poached lobster, lobster ceviche, or lobster tartar are now real possibilities. At the very least we are not left to simply boil a lobster until it has the consistency of rubber.”¹² A Maine chef who was one of Hathaway’s early customers observed, “Steaming and boiling are aggressive ways to cook meat. But when you can cook lobster slowly, at 145 degrees, the difference is unbelievable. It’s tender instead of chewy...You get something that you could easily slice through with a butter knife.”¹³ Lastly, HPP made shipping more affordable since now only the raw meat instead of the entire lobster could be shipped, cutting down on the weight of the shipment.

Lobster processing was a commodity business and lobster yield was a key factor in driving profitability. Hathaway explained:

Our cost of goods sold for lobster meat can vary between \$11 per pound when yield is high, to \$14 per pound when yield is low. In turn, say we sell the lobster meat into the channel at \$16 to \$18 per pound. We make a nice margin when yield is high and a much smaller margin when yield is low. And, if we have to pay more than \$3.50 per pound [to buy live lobsters], margin also suffers. And all of this assumes we are running at full capacity. At less than full capacity, the numbers get worse.¹⁴

Hathaway and his COO, Charlie Langston, leased a 20,000 square foot commercial building in Maine and converted it into a lobster processing facility. With about \$1 million, they received saltwater tanks to keep the lobsters alive until they processed them, industrial freezers to store processed meat until it was shipped, and a used HPP machine, nicknamed “Big Mother Shucker”. Langston explained:

We only used HPP to process our lobsters. The final product took several forms, ranging from raw whole frozen lobsters at one end, to just the raw frozen shucked meat at the other end. In between, we had raw frozen tails, raw frozen stuffed lobster, and raw frozen split lobsters. We sold these products to several established seafood distributors at a \$1 to \$2 per pound price premium relative to traditionally processed lobster meat. They, in turn, sold the products...to cruise lines...and to restaurant chefs.¹⁵

Although HPP offered a more convenient form of lobster, not everyone fully understood that. There was one example of a potential end user, who seemed to have initially understood the process and the value of Shucks, but who later said, “If I were to order from you guys, could I get you to add one more step and cook the lobster before you ship it to me?”¹⁶ Hathaway wondered if he should wait for the market to catch up or accelerate adoption and if so, how. There was nothing proprietary about HPP lobster. Although, at the time, no one in the U.S. was using HPP on lobsters, a few HPP machines were starting to appear in Canada. How quickly could Shucks grow and how big could the business become?

Apex Ski Boots[§]

Apex developed an unconventional two-part ski boot system that was different from the traditional rigid one-piece ski boot that was commonly offered on the market. Apex created a warmer and softer walking boot that buckled into a stiff exoskeleton or chassis (see **Exhibit 2**); the boot could perform like a traditional ski boot but offered significantly more warmth and comfort on and off the slopes. It offered these benefits within a new design that looked significantly different from existing ski boots, with soft plush cushioning instead of the stiff performance plastic.

Comfort was a serious pain point in the ski boot industry and foot pain from boots was extremely common. Described one skier, “On every run, I knew I’d have to stop halfway down and unbuckle my boots, because I couldn’t feel my toes.”¹⁷ Boots were perceived by skiers to be critical to their performance because they were the direct connection between the body and the ski: the stiffer the boot, the more control a skier could have. The stiffness that was important for control produced uncomfortable wearing conditions. While boot pain was prevalent, most skiers seemed accustomed to this discomfort. This may have been due to the widely accepted view that performance and comfort could not go well together. As a former ski racer once explained, “I’m a hardcore, let-your-toenails-fall-off kind of skier. Skiers take pride in their pain.”¹⁸

The industry had used cushioned footbeds, orthotic inserts, and custom bootfitting as solutions for boot discomfort and these solutions often doubled the price of a ski boot. Ski shops and specialty stores made extra margins from these products and services and often earned their reputations based on the quality of their bootfitting. The Apex co-founders did not think this satisfactorily solved the problem. They formed Apex to solve the foot pain issue associated with conventional ski boots.

The company was convinced that the product had the potential to transform the industry. For example, customers such as Scott Lippman, who enjoyed skiing with his family, praised the Apex boots: “I was immediately sold.”¹⁹ Lippman disliked traditional stiff ski boots so much that he almost quit the sport. Discovering Apex helped him go back onto the slopes. Lippman, his wife, and his daughters all used Apex ski boots after finding the company’s online reviews²⁰.

The US Ski Industry

About 15 million people engaged in alpine skiing every year²¹, with approximately 40% of them skiing only one day that winter, and another 40% skiing two to eight days, and 20% skiing nine days or more. In the United States, there were about 475 ski resorts across 35 states.²²

There was a well-established wholesale distribution model for ski equipment: manufacturers sold to retailers, who then sold to consumers. Manufacturers and retailers could each expect to generate a 50% margin on ski equipment sales.²³ Between 1,500 and 2,000 specialty ski stores operated near mountain resorts or in nearby cities, offered high levels of specialized knowledge and service, and accounted for 81% of retail sales. The retail buyers were often the store owners themselves, who might also work in the shop. Specialty store associates were highly knowledgeable and typically had a significant amount of experience with the sport of skiing and the equipment they were selling. Many shared their own personal preferences and recommendations with customers, and they often had entrenched loyalties to certain brands and products. Large retail chains like REI sold an array of equipment for dozens of different sports and accounted for 5% of ski equipment sales. Retail buyers at

[§] This section uses excerpts from the Harvard Business School case authored by Kate Barasz and John T. Gourville entitled “Apex Ski Boots,” Harvard Business School Case 520-013.

corporate headquarters determined which brands and products would be carried and sales floor staff – a group that tended to be younger, hourly employees with high turnover and who lacked first-hand experience with the brands they were selling – sold the products to customers in the stores. Lastly, online retailers and channels such as Amazon, evo.com, backcountry.com, and the online sites of specialty stores and brands accounted for 14% of ski equipment sales. Some types of ski equipment were better suited for online purchase than others. For example, while skis, bindings, and poles could be ordered online based on size or specifications, boots were more likely to be tried on for fit and comfort before purchase due to their idiosyncrasies. Online retailers offered little sales support.

Many retailers carried products with mass appeal, and sales staff had considerable sway over which products were promoted and sold. Consequently, equipment manufacturers not only needed to convince retailers to purchase their equipment, but they also needed to get them excited about selling it. Therefore, significant resources were devoted to wooing retailers via “swag and spiff” campaigns (e.g., offering “swag” of free products, or “spiff” of monetary incentives).

The three largest ski boot manufacturers in the U.S. were Salomon, with 120,000 pairs of boots sold in the U.S. per year and a 21% market share, Dalbello, with 85,000 pairs and 15%, and Nordica, with 80,000 pairs, and 14%.²⁴ The top five competitors accounted for over 70% of sales and the top ten for over 95%.²⁵ All of these competitors were well-funded, global brands with partnerships with professional ski racers and ski instructors who wore and promoted their products.

Skiers were wealthier on average; it was estimated that more than 50% had household incomes that exceeded \$100,000 per year. About 60% of skiers were male.²⁶ While skiing frequency had remained stable over the past 10 years, some predicted that the industry was close to decline. It was projected that 50% of people who skied one day would never ski a second day that season. Cold weather, as well as uncomfortable and expensive equipment, generally discouraged people from participating. Aging and injuries also generally reduced the will and/or ability to ski.

In general, customers spent a considerable amount of time researching ski equipment before a purchase. For more expensive skis and boots, it was not uncommon for people to take at least a week to look for available options. Consumers went to brick-and-mortar stores to try equipment and interact with sales staff and relied on ski websites, online retailers, and ski magazines for feedback and reviews. Once they found a brand they liked, consumers usually stayed loyal to that brand. A poll showed that more than 60% of skiers strongly preferred specific brands of snow sports gear.²⁷ Finding the perfect customized boots mattered greatly to skiers. The cost of an average pair of ski boots was \$389, with high-end models retailing for more than \$500.²⁸ In contrast, a pair of Apex ski boots cost on average \$774.²⁹ Over the 4-8 years that skiers owned a pair, they adapted their boots to get the perfect fit, making boots less interchangeable than other ski equipment.

The Apex boot’s radical design attracted attention, with *Powder Magazine* referring to it as the “first real ski boot innovation in over fifteen years” and emphasizing that “it will be evident from first glance that it is steeped in value.”³⁰ Hanson and Neily followed the standard procedure to enter the well-established ski distribution network. Like its competitors, Apex hired a sales team and transported them to ski resorts. They reached out to specialty stores to convince them to offer a few pairs of their boots. They purchased a booth at the industry’s preeminent annual trade show in Denver, Colorado to create awareness.

Apex boots were optimal substitutes to conventional ski boots and could be used with all the same skis and bindings. Nonetheless, in retail channels, it was not uncommon for sales staff to steer away consumers from the Apex boot, even if they had never personally tried the boot. Bootfitter and specialty ski shop owner, Greg Dekdabrun, was one of Apex’s earliest retailers. He clarified:

We've found it's extremely important that the staff has tried the boot to make them better believers in the product. Then they have to spend time with the customer, asking lots of questions and understanding their needs. This just doesn't happen in many non-specialty ski shops. A sales associate might look at simple cues, like what the person is wearing, to figure out what their price range might be. Then they want to know what kind of skier the person is. If they're advanced, the assumption is that they care about performance and aren't as concerned about comfort.³¹

Apex tried to overcome the issue by offering sales associates incentives and \$50 cash bonus for every pair sold, but this did not significantly modify sales staff behavior. Some of them, who were hardcore skiers themselves, believed that the boots were designed for people who cared more about après-skiing (drinking and eating on the slopes after skiing) than skiing itself. In addition, others found issues with the product itself. Scott Russo, Vice President at Nordica USA, emphasized his doubts, "Apex boots look different -they're chunky- and skiing is an inherently aspirational sport. People just don't see these top performers skiing on Apex boots."³² Noted an Apex executive, "Our frustration is the disconnect between our customers, who love the boots, and dealers continually telling us to stay away... They look at our boot, and their initial response is, 'Well, if it's so comfortable, it can't perform.'"³³

Apex had a small team, and their marketing budget was limited to \$250,000, which was tiny compared to what competitive boot brands spent. What was the best way to achieve success? What could Apex do differently to appeal to a greater number of consumers?

Bo's Fine Foods Sliced Ketchup

Bo's Fine Foods started a Kickstarter campaign to launch its new product, Slice of Sauce, a no-mess slice of dried ketchup that would be an alternative to the regular ketchup sauce traditionally made from tomatoes, vinegar, sweeteners, and spices (see **Exhibit 3**). Unlike typical ketchup, which came in semi-liquid form in a multi-serve bottle or in individually sized sachet packets, it would not squirt, make a mess, and leave bread soggy. Each pack of Slice of Sauce would contain eight portable slices of ketchup, the perfect portion size for a sandwich or a burger. The inventor and CEO, Emily Williams, developed the product while experimenting with some of her family's recipes, passed down by her father, a restaurateur in Michigan³⁴. In a video promoting the Kickstarter campaign, Williams explained: "The slice is going to revolutionize the way that we sauce. But it's also all-natural, no preservatives. This flavor is the real deal."³⁵ Williams was inspired to create more manageable condiments that would be easily portable and could make eating a better and cleaner experience. Another advantage of Slice of Sauce was that the product did not need to be refrigerated and had a 12-month shelf life. Her ambition was to get the product into stores nationwide.

The Sauce and Condiment Industry

Major players in the \$30 billion sauces and condiments market included Conagra Brands Inc., General Mills Inc., The Kraft Heinz Company, and McCormick & Company Incorporated.³⁶ The ketchup market generated \$6 billion in revenue in the U.S., and was expected to grow annually by a CAGR of 2.4%.³⁷ Ketchup was a prevalent condiment that could be consumed with anything, as a topping for french fries and burgers, or as an ingredient in recipes such as meat loaf or beef stew. Consistency, texture, color, taste, and health profile were drivers of satisfaction for consumers.

Heinz was the ketchup brand that was most used by Americans. More than 197 million Americans used Heinz, compared to 84 million who used Hunt's, the second most popular ketchup brand.³⁸ Although Kraft Heinz had 70% of the share of the ketchup market,³⁹ and the company offered more

than twenty ketchup varieties to satisfy the changing tastes of consumers, younger generations often opted for healthier options and it would not be uncommon for them to choose trendy startup brands over heritage brands favored by their Baby Boomer parents.⁴⁰

Recent trends driving growth in the category included organic, low/no sugar, hot and spicy flavors, and innovations in sustainable and easier-to-pour packaging. Glass ketchup bottles were notorious for their agonizingly slow pours as captured in the classic Heinz advertisement set to the 1970's Carly Simon hit song "Anticipation". This often left consumers aggressively hitting the bottom of the bottle, which abruptly released a stream of ketchup too large for the application, or impatiently digging a knife into the narrow neck of the bottle to try to get a smaller portion out with less mess. While the category was ripe with innovations, a recent foray into colored ketchups served as a warning for those seeking to change this pantry staple. EZ-Squirt, a colored ketchup launched by Heinz was initially popular; the first year's forecasted demand was sold in just a few months following the launch,⁴¹ which was heavily promoted with advertising. EZ-Squirt featured the company's product in a Blastin' Green color and a squeezable plastic bottle that encouraged children to squirt the ketchup into designs on their plates or food. Awesome Orange, Totally Teal, Stellar Blue, Passion Pink and Funky Purple colors expanded the product line. The line extension was eventually discontinued due to a lack of traction.

Companies such as Kraft Heinz sold ketchup to grocery and other retailers who sold it to consumers for household use and maintained salesforces to sell to food service providers such as restaurants and companies such as Aramark and Sodexo, who provided cafeteria and restaurant services to universities, hospitals, and other businesses. Consumers purchased more than 80% of their ketchup in brick-and-mortar stores rather than online.⁴² Ketchup was also a condiment well stocked by quick-serve restaurants, such as McDonald's, Burger King, Wendy's, KFC, and others to enhance the flavor of their food. Consumers of these establishments often took several individual-sized packets upon checkout, unsure of how much they would need, which led to food waste.

Like Bo's Fine Foods, there were other companies that produced dried ketchup. For instance, a Los Angeles restaurant, Plan Check Kitchen + Bar, introduced the very similar "ketchup leather," which would prevent bread from becoming soggy. To create a "slice" of ketchup leather, the restaurant's chef mixed several ingredients such as tomato paste, spices, and garlic, in a blender, and dehydrated the mix completely. Afterwards, the ketchup leather could be cut into a few slices.⁴³

Although Slice of Sauce was not the first dried sauce initiative, it was the first with crowd funding⁴⁴. On Kickstarter, the brand had 677 backers, who pledged \$30,090 to help support the company and bring the product to life.⁴⁵ The company described their mission and goals on their Kickstarter page:

We set out to share our passion for healthy living and our love of food. We want to spread awareness that products with clean labels and ingredients with integrity can also be fun. We are deeply committed to leading the way in sustainable packaging and regenerative sourcing. Slice of Sauce began in our homes, but we're excited to bring it to the shelves of grocery stores everywhere. In addition, we hope Slice of Sauce will address a need for healthier alternatives in schools, hospitals, and the military.⁴⁶

The company highlighted that a part of the Kickstarter funding would go to manufacturing and production: "We've been working with a manufacturer in Brooklyn, New York, to produce our hand-made slices and we're ready to fulfill orders. We're confident that we can satisfy our backers, however, we encourage your early support in order to ensure timely deliveries." The remainder of the funding was expected to go to Kickstarter fees and shipping costs.

Slice of Sauce was featured on a *Shark Tank* episode (a reality show featuring startup founders pitching their new business ideas to angel investors). To describe the product, Williams compared slices of ketchup to the slices of packaged cheese commonly used in sandwiches. Unlike condiment packets that were often tough to open and could create a mess, especially with children, the slices of ketchup would be mess-free and easily transportable. When Barbara Corcoran, one of the *Shark Tank* investors, expressed concern that a standard bottle of ketchup would last longer and could be used for many more uses than the eight ketchup slices per package being sold by Slice of Sauce, Williams mentioned that she would strategically price Slice of Sauce as a premium product, at the retail price of \$5.99. The average price for a 14-ounce bottle of Heinz ketchup (23 one-tablespoon servings) on Amazon was \$3.19, while the same product could be purchased at grocery store Kroger for \$3.29.⁴⁷ Amazon also sold 150-count boxes of single serve Heinz ketchup packets for \$34.99.⁴⁸

Although it was an innovative product, could Slice of Sauce generate demand and revenue? An article in *The Atlantic*⁴⁹ questioned whether soggy burgers were truly an issue that needed fixing. Some were skeptical about this new way to consume ketchup; one Twitter user shared: “I just discovered something called a ketchup slice and it’s an absolute abomination. A crime. Just don’t do it. I don’t want a ketchup fruit roll-up or anything that resembles a processed slice of ketchup.”⁵⁰ However, there were also people who were eager to try the product. For example, another Twitter user expressed excitement: “I am so ready for a ketchup slice on my bacon and egg burger. My mouth is watering at the prospect.”⁵¹ Could sliced ketchup truly change the way we ate burgers and sandwiches?

John Deere Artificial Intelligent Software for Farming

Deere & Co., the largest agricultural equipment manufacturer, had spent decades investing billions of dollars⁵² to transform itself from an equipment provider to a technology provider. Moving from human piloted machines to autonomous machines, the company had transformed the practice of farming through automation, data collection and analysis. Proclaimed John May, Chairman and CEO of Deere, “We don’t create tech for tech’s sake. There’s purpose behind everything we do, so that our customers have the tools they need to tackle some of the world’s greatest challenges.”⁵³ The technology solutions were part of Deere’s mission to deliver precision agriculture: tools to monitor, manage, and optimize farming operations to reduce costs, manage resource allocation, and increase crop yields via automation, prediction science, and increased accuracy and efficiency.⁵⁴

Deere was now poised to launch its next big initiative: artificial intelligent (AI) software-as-a-service (SaaS) for farming that would collect data from the company’s 1.5 million technology-enabled pieces of equipment it had sold to its customers and transmit it back to the John Deere Operations Center in the cloud, where it could be stored and analyzed using AI-derived algorithms and machine learning techniques to predict and optimize crop performance across farms.

An early use case for the software was smart crop sprayers equipped with 36 cameras (see **Exhibit 4**), which detected, using computer vision technology, the difference between plants and weeds and directed the spray of herbicide to eliminate only the weeds. The efficacy of the software was enhanced by an ever-expanding collective database of photographs of all of the crops and weeds encountered by Deere’s sprayers in service in its customers’ fields, which was used to train the AI engine. Explained the company on its website, “Our machine learning platform is a collection of software applications that enables our equipment to learn and adapt. For example, for See & Spray Ultimate, specialized software manages images – collecting, ingesting, searching, curating, and labeling them – to ultimately deploy trained models back to the machine for use distinguishing weeds and plants in a multitude of varieties and conditions.”⁵⁵ The Deere Autonomous 8R tractor (see **Exhibit 4**) could “see”, “think”,

“work” and plow the field by itself, using its cameras, edge computing, artificial intelligence, and machine learning to allow farmers to focus on other tasks.⁵⁶

Deere had ambitious goals: in the short term, it aimed to connect 1.5 million existing customer machines farming 500 million acres to the Deere Operations Center, which would, as a result, successfully gather, save, and analyze farming data, including images from the fields.⁵⁷ Over the longer term, the company’s objective was to transform all of its equipment line into autonomous models equipped with data gathering capabilities.⁵⁸

The Agricultural Equipment Industry

About 2.5 million units of agricultural equipment were sold globally and sales were growing by 4% per year.⁵⁹ Deere held the largest share of the market, with a global share of 25%. CNH Industrial N.V. had a market share of almost 13%, followed by Kubota Corporation with a share of about 12%.⁶⁰

Deere made money primarily from equipment sales, but earned additional revenue streams from equipment repairs and sales of replacement parts. Deere faced criticism and mistrust from some of its customers who accused it of installing proprietary software on its equipment which precluded owners from repairing it themselves; instead, forcing them to use Deere’s more expensive repair services.⁶¹

Now, in addition to selling its agricultural equipment, which could cost as much as \$600,000 for a tractor,⁶² Deere would offer its AI software, so it could be downloaded and incorporated into existing or new agricultural equipment as a software-as-a-service (SaaS) in return for either a monthly fee or a per-acre fee based on usage. It was a chance to open up a new revenue stream for the company, but it was unusual to see subscription models in the agricultural industry. Analysts predicted that selling software subscriptions to farmers could generate higher gross profit margins (85%) than sales of equipment (25%).⁶³ Deere predicted that its software could generate 10% of revenues going forward.⁶⁴

Some of Deere’s competitors, including CNH Industrial and Bayer and Corteva Inc., had also started investing heavily in technology to build better agriculture systems that would not only reduce farmers’ costs in the long term with more efficient operations, but also forecast more precisely crop yields and profitability.⁶⁵ The larger companies had not been able to generate substantial profits from these investments yet, according to analysts, and startups had failed to gain traction as well.⁶⁶

Since the 1990’s, Deere had been leveraging technological advances to develop smarter machines, starting with the incorporation of GPS sensors on harvesting equipment to maximize crop yields.⁶⁷ A partnership with NASA’s Jet Propulsion Laboratory led to satellite-guided autopilot tractors. Explained Terry Pickett, a manager of the Advanced Engineering group at John Deere Intelligent Solutions Group, autonomous tractors saved significant costs, reducing expenses for fuel, operator labor, and machinery wear and tear. He explained, “Typically, when a tractor crisscrosses a field, the rows overlap by about 10 percent...This means a significant portion of the field receives double the necessary seed, fertilizer, and pesticide, and the job takes longer than necessary...Self-guidance had a big impact on the cost of the product farmers were producing, the amount, and often the quality.”⁶⁸ Self-guided systems like Deere’s were harvesting around a third of the farm acreage in the U.S. The self-driving tractors could plant seeds, harvest crops accurately, and could be controlled from farmers’ mobile phones⁶⁹. Deere’s chief technology officer, Jahmy Hindman, explained: “Without this self-driving technology, farming is incredibly exhausting mentally and physically. You’ll find some of the most advanced robotic machines are being used on the farm to feed the world.”⁷⁰

Detailed data had long been an important part of farming, and farmers relied heavily on almanacs and handwritten notes handed down through generations to help them make decisions on what and

how to plant and harvest their crops. Noted *Popular Science*, “When it comes to profitability, every data point can mean the difference between earnings and loss”⁷¹ in the financially unpredictable farming industry plagued by pests, weather events, and fluctuating commodity prices. Since the dawn of Deere’s smart machines, some farmers began using the John Deere Operations Center digital platform for their data management needs. Smart trackers on Deere equipment collected data and fed it into the platform where it could be stored and analyzed. Nebraska farmer Taylor Nelson, who used Deere’s AutoTrac guidance system on his 12,000-acre farm, noted the system’s ability to catch mistakes before they happened and to increase the efficiency of planting with less costly human resources. “You can use this technology to stick people in with less experience and still get optimal results,” he said, and calculated that he could plant twice the acreage per day with Deere’s digitally enabled system.⁷²

However, until now, a farmer’s data remained secure and private and allowed the farmer to restrict access to it from outsiders.⁷³ Farmers often viewed their farm’s data as intellectual capital.⁷⁴ However, shared data across farms was critical to the machine learning needed to fuel the AI software. Explained Chris Padwick, the Director of Computer Vision and Machine Learning at Deere’s Blue River Technology division, “In general, in all of our machine learning projects, we tried to embrace the idea that all data is good data...We might have sprayer data from See and Spray collected from cameras that can be useful to train the autonomous tractor. The autonomous tractor has different cameras, different geometry, and they can collect data with different kinds of modality and different sensors, but that data that’s collected from other projects can also be useful in that training.”⁷⁵

While some customers were already testing the new farming AI software, others were opposed and struggled with its expected costs that would put additional financial strain on their business models.⁷⁶ Others were concerned about data privacy. Walter Schweitzer, a farmer and president of the Montana Farmers Union, complained, “You’re losing control of the data, and the ownership of the tools.”⁷⁷ He worried that Deere would gain more power over farmers if it managed the data so critical to a farm’s success and the software used to analyze it.⁷⁸ Padwick was hopeful, “What I think is going to happen here is you’ll see some people are going to be really excited about the technology and adopting it, and then word of mouth in the coffee shops is going to spread...That’s how a lot of these products get sold, not by flashy marketing, presentations, or cool videos on YouTube; it’s coffee shop conversations. And if folks see that other farmers are starting to use the autonomous tractor and getting good value from it that will naturally drive adoption. Because really, it’s a trust network.”⁷⁹

“It’s easy to underestimate the amount of technology in the industries we serve,” noted Hindman. “Modern farms are very different from the farms of 10 years ago, 20 years ago, and 30 years ago. There are farms that are readily adopting technology that makes agriculture more efficient, more sustainable, and more profitable for growers. And they’re using high-end technology: computer vision, machine learning, [satellite] guidance, automation, and autonomy.”⁸⁰ Added Jorge Heraud, vice president, automation and autonomy, “Building on our 186-year-old roots as a world-class manufacturer, we are now set up to become a world-leading robotics and artificial intelligence company.”⁸¹

Exhibit 1 The Six Lobster Customer Segments

Convenient Lobster Lovers (28% of the population) The modern family, with two jobs, two incomes, and not a lot of spare time. They liked lobster in restaurants, but wanted home cooked meals that were quick and easy.

Young, Middle America (20%) Young professionals who were far from the coast. They did not have a lot of disposable income, but enjoyed trying new food. They had some experience with lobsters in restaurants.

Lobster Traditionalists (15%) New Englanders or wannabes. They were comfortable boiling whole live lobsters for small dinner parties and large family functions. They enjoyed the tradition associated with lobsters.

Food Adventurers (13%) Aging professionals with money to spend and a taste for good food. They enjoyed variety, especially when it came to seafood.

Moral Protesters (13%) Disliked all things lobster, including the look of them, the expense of them, and the way they were killed.

Been There/Done That (11%) They had tried it all and hated most of it. They now liked to stay within their comfort zone.

Source: John T. Gourville, "Shucks," Harvard Business School Case 512-048, 2012.

Exhibit 2 The Apex Ski Boot**Walking Boot****Chassis****Apex Ski Boot
(Walking Boot + Chassis)**

Source: Kate Barasz and John T. Gourville "Apex Ski Boots," Harvard Business School Case, No. 520-013.

Exhibit 3 “Slices” of Ketchup from Bo’s Fine Foods Kickstarter Campaign Page

Source: Bo’s Fine Foods Kickstarter Page, <https://www.kickstarter.com/projects/sliceofsauce/slice-of-saucetm>, accessed 07/07/2023.

Exhibit 4 Deere AI Tractors: See & Spray and Autonomous 8R (from top to bottom)



Source: Deere Corporate Website, <https://www.deere.com/en/sprayers/see-spray-ultimate/> and <https://www.deere.com/en/autonomous/>, accessed 07/07/2023.

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