

Case Study

Artificial Intelligence: Stitch Fix

A Blue Ocean Retailer in the AI World

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This case was written by Mélanie Pipino, Research Associate of the INSEAD Blue Ocean Strategy Institute, under the supervision of W. Chan Kim and Renée Mauborgne, Professors of Strategy at INSEAD. It is intended to be used as a basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

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Whether you are a shopaholic, a need-based shopper or totally disinterested by retail shopping, you will need to shop for clothing. Everyone must.

In 2018, the U.S. apparel market was valued at approximately US \$340 billion, U.S. dollars,¹ which makes it the largest in the world. Stores have always been the primary source of sales in the U.S. Apparel industry, but while most shopping is still done in brick-and-mortar retailers, online sales had grown faster than brick-and-mortar sales and “Apparel, Footwear and Accessories” is now the largest U.S. e-commerce category.²

When you experience brick-and-mortar shopping, you can see and touch products as well as take items home immediately. But in-store shopping is time-consuming and inconvenient: go there, park your car, enter crowded shops, try on clothes in tiny rooms with questionable privacy, get limited choice that is typically far more expensive than online and have limited opening hours and long check-out lines. These pain points have propelled the Apparel and Accessories e-commerce revenues to US\$103 billion in 2018 – rising to an expected \$145 billion by 2023.³

Low price and convenience⁴ rank highest among the reasons why customers choose to shop online versus in stores and most online stores focus on low prices, fast delivery and easy returns. However, online shopping for clothes has its downsides as well. Because of the tremendous choice, online shopping has become time-consuming and confusing. Customers have countless websites and an endless number of pages. This overwhelming selection of apparel, shoes and accessories, coupled with a lack of professional advice and the impossibility to assess quality and how an item actually fits before buying can make the online shopping experience difficult and frustrating, especially when customers do not know which style suits them. What used to be extremely convenient in the first place has become tricky.

Stich Fix: Reinventing the E-commerce Retail Experience

"Spending a day at the mall, or devoting hours of time to sifting through millions of products online is time consuming, overwhelming and neither effective nor enjoyable. I knew there had to be another way."

Katrina Lake, CEO of Stich Fix

Stich Fix, a San Francisco-based e-commerce company, is a personal styling service that chooses clothing for shoppers using a combination of artificial intelligence (AI) and professional stylists and sends a personalized box of apparel based on the customer's sizes and preferences. In 2017, founder Katrina Lake, named by Forbes as one of America's wealthiest self-made

1 Apparel - United States | Statista Market Forecast. (n.d.). Retrieved from <https://www.statista.com/outlook/90000000/109/apparel/united-states>

2 Garcia, K. (2019, February 11). The State of US Apparel Shopping in Five Charts. Retrieved February 25, 2019, from <https://www.emarketer.com/content/the-state-of-us-apparel-shopping-in-five-charts>

3 U.S. online apparel and fashion market size 2022. (n.d.). Retrieved from <https://www.statista.com/statistics/278890/us-apparel-and-accessories-retail-e-commerce-revenue/>

4 Total Retail 2015: Retailers and the Age of Disruption. (2015, February). Retrieved February 2019, from <https://www.pwc.com/sg/en/publications/assets/total-retail-2015.pdf>

women,⁵ was one of the few women to lead an IPO and at 34, Lake was the youngest. That year less than 8% of IPOs were led by women; since 2000 the percentage has never exceeded 13%.⁶

The Stitch Fix adventure started in 2010, as part of a class project, when Katrina Lake tested the concept, formerly known as Rack Habit, in her apartment, while finishing an MBA at Harvard Business School.

Lake had a lifelong love of clothing; retail fascinated her. But she couldn't help noticing that retail, an age-old industry, never changed. She just kept thinking about how technology could be leveraged to change the value you are able to provide to people and, in doing so, create a fundamentally different and superior experience to buyers. Lake had watched industry leader Blockbuster quickly succumb to Netflix, a company that leveraged technology to create a leap in buyer value which set it apart and was irresistible to people. In 2009, Netflix pivoted from mailing disks to streaming videos, creating an entirely new experience. Customers could not only stream a rich array of movies but also amazing original series like *Crown*, *House of Cards*, and *Orange is the New Black*, anytime, anywhere, anyway without leaving the comfort of their home, a new value proposition. In contrast, retail may as well have been selling 1970s leisure suits. There were so many inefficiencies. Online clothing stores just basically digitalized the physical stores, creating more selection but removing the ability to try and buy immediately. This was not a new value proposition. How would technology possibly change that, Lake wondered?

Lake thought about her sister, a personal shopper in New York City who helped women find the right clothes to match their attitude, body type and sense of style, and wanted to extend that privileged experience to women everywhere. But she knew that only the wealthy and the in-the-know would go for a personal shopper, such as Michelle Obama who is famous for always looking great thanks to the personal shopper she uses. Lake also recognized that people don't have time anymore and widely enjoy the convenience of online shopping, hence explaining its enormous growth. She wondered how to combine the best of online retail stores – the large selection and the ability to shop from anywhere, anytime – with the ultimate tailored experience of personal shoppers. Doing that, she reasoned, would offer a leap in value and open up a new market. But Lake's reasoning didn't stop there. At the same time, in her personal life, Lake had joined a community-supported weekly fruit and vegetable subscription where customers received seasonal produces directly from local farmers. Because these boxes depend on what the farmer harvested, customers don't know in advance what it would contain. They only know that it will be fresh and in season, so likely delicious. Lake loved the surprise factor and that it would push her to try new fruits and vegetables she had never tried before. Then the idea came up: why not do that with clothing too?

Making It Happen

To make this work, she knew technology would be a key enabler. Was there a way to combine the human element of a personal shopper with AI doing the early matching so a business could be built that not only would customers love but would importantly also be economically scalable?

5 O'Connor, C. (2017, November 30). Stitch Fix Stock Surge Puts CEO Katrina Lake Among America's Richest Self-Made Women. Retrieved from <https://www.forbes.com/sites/clareoconnor/2017/11/29/stitch-fix-stock-surge-puts-ceo-katrina-lake-among-americas-richest-self-made-women/#6be4f8e830f9>

6 Rey, J. D. (2017, November 17). Women in tech see today's Stitch Fix IPO as a milestone. Retrieved from <https://www.vox.com/2017/11/17/16668888/stitch-fix-ipo-katrina-lake-women-tech-female-founders>

Here's how she set out to make that happen. Initially, customers would fill out a Survey Monkey questionnaire to describe their style profile and preferences which Lake would store in an Excel spreadsheet.⁷ Once done, Lake had to go and buy clothes that matched these preferences using her own funds, and hand deliver the clothes to her customers. Buyers would pay by check for what they wanted to keep and return the unwanted items. Lake wasn't making any money: she was selling clothes at cost. But she was gathering data to pitch the business to investors. And women seemed to love it.

As the number of orders increased, Lake needed funds to grow her company. In February 2011, financial help came from Steve Anderson and his one-man venture capital firm, Baseline Ventures. Anderson is famous for massive returns from early investments in Instagram and Twitter. Anderson invested \$750,000 in the company, buying 28.1% of Stitch Fix (shares that are worth about \$500 million as of April 2018). He was also offered a seat on the Board. The capital enabled Lake to officially launch Stitch Fix in February 2011.⁸

Four months later, Stitch Fix moved to a small office in San Francisco and launched its website. At that time, all five employees helped with packing and shipping boxes of clothing every Monday.⁹ They celebrated their 100th order in June 2011.¹⁰

Lake initially relied on word-of-mouth to grow Stitch Fix. She had no marketing budget and didn't hire a dedicated marketer until June 2013.¹¹ In an interview with CNN, she explained: "All of our growth was organic. It was just people telling other people."¹² This strategy worked: Stitch Fix was adopted right from its start by fashion bloggers and the influential 'mommyblogger' sphere (which in 2010 exceeded 4 million American women).¹³ ¹⁴ Hundreds of women shared their exciting Stitch Fix experience with selfies detailing what they received and asking followers what should be kept or what should be returned. They were quickly hooked on the service by the surprise effect Stitch Fix delivers. And it was a win-win: blogging increased Stitch Fix's brand awareness while the bloggers saw much more engagement with a Stitch Fix blog post than any other topic.¹⁵

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- 7 Berman, N. (2018, December 18). 20 Things You Didn't Know About Stitch Fix. Retrieved January 11, 2019, from <https://moneyinc.com/stitch-fix/>
 - 8 Taylor, C. (2013, February 28). Stitch Fix Gets \$4.75M Series A to Scale Out Its Tech-Enabled Personal Shopping Service. Retrieved April 18, 2019, from <https://techcrunch.com/2013/02/28/stitch-fix-funding-series-a/>
 - 9 Lien, T. (2017, June 18). Stitch Fix founder built one of the few successful e-commerce subscription services. Retrieved January 14, 2019, from <https://www.seattletimes.com/business/stitch-fix-founder-built-one-of-the-few-successful-e-commerce-subscription-services/>
 - 10 One Fix at a Time: How Stitch Fix Got Its Start. (2017, December 10). Retrieved April 18, 2019, from <https://www.stitchfix.com/women/blog/inside-stitchfix/how-stitch-fix-started/>
 - 11 DeAmicis, C. (2013, December 26). Confessions of a Stitch Fix addict: The key to subscription e-commerce. Retrieved February 24, 2019, from <https://pando.com/2013/12/26/confessions-of-a-stitchfix-addict/>
 - 12 "There haven't been a lot of founder CEOs that look like me," L. (n.d.). How Stitch Fix CEO Katrina Lake turned a business school project into a \$3 billion company. Retrieved from <https://money.cnn.com/2018/07/31/news/stitch-fix-founder-ceo-katrina-lake-interview/index.html>
 - 13 Casserly, M. (2013, May 06). Stitch Fix CEO Bets on Styling Mommy and Brags Record Growth In 2013. Retrieved February 18, 2019, from <https://www.forbes.com/sites/meghancasserly/2013/05/06/stitch-fix-ceo-bets-on-styling-mommy-and-brags-record-growth-in-2013/#52ba7a8748ba>
 - 14 Joshi, P. (2011, March 14). Advertisers Seek to Harness the Power of the Mom Blogger. Retrieved April 18, 2019, from <https://www.nytimes.com/2011/03/15/business/media/15adco.html>
 - 15 Casserly, M. (2013, May 06). Stitch Fix CEO Bets on Styling Mommy and Brags Record Growth In 2013. Retrieved February 18, 2019, from <https://www.forbes.com/sites/meghancasserly/2013/05/06/stitch-fix-ceo-bets-on-styling-mommy-and-brags-record-growth-in-2013/#52ba7a8748ba>

To surround herself with experienced people, in 2012 Lake hired Mike Smith, former COO of the then \$5 billion Walmart.com as Chief Operating Officer and former data scientist at Netflix, Eric Colson, as Chief Algorithms Officer. By February 2013, Stitch Fix had more than 10,000 customers,¹⁶ and in Q3 2013, revenue was 2.5 times higher than in Q3 2012.¹⁷

Funding the Future

To face the growing demand – a two-year wait list at one point¹⁸ – Lake needed expansion capital. But raising money was one of the most challenging tasks for Lake¹⁹ as venture capitalists didn't buy into the concept of Stitch Fix. During her pitches, Lake would come with a box of clothes and a personalized card from the stylist in her hands to show what Stitch Fix was about. But there was an emotional disconnect from investors. One of them told her: "I think you're amazing, but I have to pick one or two board seats a year where I feel really passionate about the business, and I don't think I can be passionate about women's dresses and retail." Others thought the company was too small²⁰ and they didn't like the hourly-paid human stylists at a time when everything is about automation and apps, and they didn't like that Stitch Fix took ownership of inventory, which they considered capital-intensive and risky, preferring instead to buy on consignment. But Lake believed that owning all the inventory was the key to deeply understand each item and turn it into a structured data, with the help of the merchandize team that takes detailed information on each item. And this data was crucial for Stitch Fix as it allows the company to better understand what people want and therefore turn over inventory faster than many traditional retailers do: six times a year for Stitch Fix, against four times a year for a department store.²¹

After facing repeated refusals from venture capitalists, Anderson, the initial investor, invested \$4.75M in a Series A funding round with two other venture capitalists in February 2013. The capital infusion enabled Stitch Fix to continue growing.^{22 23}

Using its expansion funding, Stitch Fix opened warehouses to manage inventory and grew to 49 employees. By October 2013, its customer base and revenue grew five times and its staff had grown to nearly 200.²⁴ To meet the demand, Lake needed to raise capital again, but this time it was easier

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- 16 Taylor, C. (2013, February 28). Stitch Fix Gets \$4.75M Series A to Scale Out Its Tech-Enabled Personal Shopping Service. Retrieved April 18, 2019, from <https://techcrunch.com/2013/02/28/stitch-fix-funding-series-a/>
 - 17 Casserly, M. (2013, May 06). Stitch Fix CEO Bets on Styling Mommy and Brags Record Growth In 2013. Retrieved February 18, 2019, from <https://www.forbes.com/sites/meghancasserly/2013/05/06/stitch-fix-ceo-bets-on-styling-mommy-and-brags-record-growth-in-2013/#52ba7a8748ba>
 - 18 Lien, T. (2017, June 18). Stitch Fix founder built one of the few successful e-commerce subscription services. Retrieved January 14, 2019, from <https://www.seattletimes.com/business/stitch-fix-founder-built-one-of-the-few-successful-e-commerce-subscription-services/>
 - 19 Forbes, M. (2018, August 09). How Stitch Fix's Katrina Lake Built A \$3 Billion Business. Retrieved March 14, 2019, from <https://www.forbes.com/sites/moiraforbes/2018/08/09/katrina-lake-billion-dollar-business/#1a36c495727f>
 - 20 Turner, C. (2019, March 20). Why We Need More Women Investing in Women-Owned Businesses. Retrieved April 18, 2019, from <https://www.myasbn.com/small-business/finance/why-we-need-more-women-investing-in-women-owned-businesses/>
 - 21 Smiley, L. (2019, February 19). Stitch Fix's radical data-driven way to sell clothes—\$1.2 billion last year—is reinventing retail. Retrieved April 18, 2019, from <https://www.fastcompany.com/90298900/stitch-fix-most-innovative-companies-2019>
 - 22 Rudolph, H. W. (2018, March 16). Get That Life: How I Founded an Online Personal Shopping Company. Retrieved April 18, 2019, from <https://www.cosmopolitan.com/career/a59033/katrina-lake-stitch-fix-get-that-life/>
 - 23 List of Stitch Fix's 6 Funding Rounds totaling \$122.4M. (n.d.). Retrieved February 2019, from https://www.crunchbase.com/search/funding_rounds/field/organizations/funding_total/stitch-fix
 - 24 Taylor, C. (2013, October 17). Stitch Fix, The Online Personal Shopping Startup, Sews Up \$12 Million Series B Led by Benchmark. Retrieved December 15, 2018, from <https://techcrunch.com/2013/10/17/stitch-fix-funding-series-b/>

thanks to the results of the company. Benchmark Capital led the next funding round, investing \$12M in October 2013 and \$25M in June 2014 in exchange for 26% of the company. Legendary venture capitalist Bill Gurley joined the board of directors.^{25 26}

In addition to raising capital, Lake also brought in some heavyweight recruits including former Gap and Walmart executives Marka Hansen and John Fleming as board members. Three new executives joined the company, former Nike executive Lisa Bougie as Chief Merchandising Officer, Jennifer Olson, an e-commerce expert who had formed a high-profile alliance with Crate and Barrel joined as CMO, and Stella & Dot's Meredith Dunn as VP of Styling.²⁷

Fast forward to May 2017, Stitch Fix brand awareness was 41% among US women age 21-65 with incomes over \$50K, up from 28% just six months prior.²⁸ In November 2017, Stitch Fix went public at an initial public offering price of \$15 per share, with just \$42 million in venture capital funding, making Lake, at the age of 34, the youngest female ever to launch an IPO.^{29 30} A photo of Lake standing at the Nasdaq podium with her then 14-month-old son on her hip went viral on social media. Lake became a model for women, and especially working mothers.³¹

One year later, Stitch Fix shares more than doubled to a market capitalization of more than \$4.3 billion.³² In February 2019, the company had more than 6,600 employees,³³ with a majority females both within the board and the workforce^{34 35}, including over 3,900 stylists³⁶ – mostly part-time employees who work from home – over 1,500 warehouse employees spread across their 5 warehouses,³⁷ 200 client experience employees, 95 engineers and 100 data scientists.³⁸ In short, it was a company founded and led by a woman, with one of the largest female management and workforces in the AI space, if not across almost all industries.

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- 25 Schleifer, T. (2017, October 19). Here are the big winners from Stitch Fix's IPO. Retrieved April 18, 2019, from <https://www.recode.net/2017/10/19/16505274/stitch-fix-ipo-winners-benchmark-baseline-katrina-lake-lightspeed>
 - 26 Bill Gurley is a general partner at Benchmark Capital, a Silicon Valley venture capital firm. He is listed consistently on the Forbes Midas List and is considered one of technology's top dealmakers.
 - 27 Taylor, C. (2013, October 17). Stitch Fix, The Online Personal Shopping Startup, Sews Up \$12 Million Series B Led by Benchmark. Retrieved December 15, 2018, from <https://techcrunch.com/2013/10/17/stitch-fix-funding-series-b/>
 - 28 Is Stitch Fix's IPO The Latest E-Commerce Dud or Is Its Styling Algorithm A Game-Changer? (2017, November 17). Retrieved January 23, 2019, from <https://www.cbinsights.com/research/stitchfix-valuation/>
 - 29 Chen, C. (2019, April 17). The evolution of Stitch Fix: From a Harvard student's apartment to a \$2 billion company. Retrieved April 18, 2019, from <https://www.businessinsider.com/stitch-fix-personal-styling-overview?IR=T>
 - 30 Katrina Lake. (n.d.). Retrieved from <https://www.forbes.com/profile/katrina-lake/#62e058e85fe9>
 - 31 "There haven't been a lot of founder CEOs that look like me, ". L. (n.d.). How Stitch Fix CEO Katrina Lake turned a business school project into a \$3 billion company. Retrieved from <https://money.cnn.com/2018/07/31/news/stitch-fix-founder-ceo-katrina-lake-interview/index.html>
 - 32 Bond, S. (2018, October 02). Stitch Fix to launch online clothing services in the UK. Retrieved February 12, 2019, from <https://www.ft.com/content/19afc8be-c5b4-11e8-8167-bea19d5dd52e>
 - 33 Stitch Fix Fact Sheet. (2019, February 1). Retrieved from https://newsroom.stitchfix.com/wp-content/uploads/2019/02/StitchFix_FactSheet-19-02-19.pdf
 - 34 <https://fortune.com/worlds-greatest-leaders/2019/katrina-lake>
 - 35 86% of Stitch Fix employees are women. Steinmetz, K. (2018, May 03). Stitch Fix CEO Katrina Lake on Why Gender Matters. Retrieved from <https://time.com/5263874/katrina-lake-stitch-fix-interview/>
 - 36 Stitch Fix FAQ. (2016, September 1). Retrieved from https://newsroom.stitchfix.com/wp-content/uploads/2016/09/StitchFix_FAQ-9.pdf
 - 37 Berman, N. (2018, December 18). 20 Things You Didn't Know About Stitch Fix. Retrieved January 11, 2019, from <https://moneyinc.com/stitch-fix/>
 - 38 Steinmetz, K. (2018, May 03). Why Stitch Fix CEO Katrina Lake Stands Out in Silicon Valley. Retrieved April 18, 2019, from <http://time.com/5264160/stitch-fix-has-one-of-silicon-valleys-few-female-ceos/>

The Stitch Fix Experience

"The concept has always been personalization. There are millions and millions of products out there. You can look at eBay and Amazon. You can look at every product on the planet but trying to figure out which one is best for you is really the challenge."

Katrina Lake, CEO of Stich Fix

In the crowded and rapidly changing retail industry, competitors attempt to differentiate themselves through low price and fast shipping. Stitch Fix by contrast differentiated itself through personalization and an element of surprise. Using a mix of AI and human stylists, Stitch Fix helps millions of women, men and children find clothes they really like. More than that, they get to try and often find new things they like but wouldn't have picked for themselves, in their budget (prices range from \$25 an item, up to \$600), and that fits them perfectly. People lead busy lives and Stitch Fix adds utility by saving time; customers needn't spend hours in stores or browsing hundreds of pages on the web. Thanks to its algorithms, Stitch Fix can deliver personalization at scale.

Now, let's see how it works. First, the customer takes 10 minutes to fill in his/her style profile, that can be updated any time later. Each client provides over 90 data points³⁹ including size, fit and price criteria, as well as how often s/he dresses for certain occasions or which parts of his or her body the client likes to flaunt or cover up. Customers are also invited to share their social media profiles, such as Pinterest, so stylists, and AI, can learn their tastes.

Once the style profile is complete, customers have the option to set up automatic deliveries, ranging from every two weeks to once a quarter. Stitch Fix is not an ongoing subscription service and deliveries can be adjusted or stopped at any time; this flexibility is an additional convenience factor for the users who don't feel trapped with a subscription. Customers are asked to pay a non-refundable \$20 "stylist" fee for each shipment – called a "Fix". The fee is applied as a credit toward any merchandise the customer keeps – encouraging clients to purchase items – plus a 25% discount is given for those who purchase everything in the box, which is a major incentive to buy all five items as it can be cheaper to keep everything than sending back one item. This also saves the company mailing cost and the burden of cleaning and checking all returns. Once the customer tries on the five items at home, s/he has three days to decide whether to keep or send back items. Returns are easy: simply slip the items into the prepaid mailing envelope and drop it into any USPS mailbox.

Despite the success, Stitch Fix continued to innovate. In December 2017, it launched Style Pass as an alternative to the \$20 styling fee per Fix. Style Pass is a \$49 fee that allows 12 months of free styling which is then credited to the next item purchased. Customers feel like they are getting a bargain, so they are more likely to order more Fixes, and Stitch Fix keeps their users more active and engaged, decreasing their churn rate.

Advanced algorithms (see Appendix A), even able to anticipate buying and repurchasing needs, combined with thousands of human stylists, ensure that customers receive clothing they will love and want to keep. Shipment requests are processed by an algorithm that calculates which warehouse is best suited to fulfil the Fix, based on location, inventory, and customer preferences. To process the customers' preferences, which are written answers, Stitch Fix uses the Natural

39 Quarterly Results. (n.d.). Retrieved from <https://investors.stitchfix.com/quarterly-results>

Language Processing (NLP), a sub-field of AI that enables computers to understand human languages. Orders are then routed to the styling algorithm. First, the algorithm removes from the inventory list all clothing either already sent to the client (purchased and returned items) or marked 'undesirable' by the client. Then the machines identify items likely to delight customers. Each item is subject to 100-150 data points (colour, material, length, etc.). This data, coupled with algorithms and customer feedback, allows Stitch Fix to calculate a probability score of purchase for each item.

Moreover, Stitch Fix has photographic data on all its inventory that trained Artificial Neural Networks⁴⁰ turn into vector descriptions. As 46% of Stitch Fix customers have a dedicated Pinterest board with clothing inspirations,⁴¹ these trained Artificial Neural Networks also turn Pinterest inspirations into vector descriptions and then calculate the similarities to optimize the selection.

Once done, the shipment request is routed to a stylist. Even the choice of the stylist depends on an algorithm. To be associated with a particular customer, a score is calculated based on the availability of the stylist, but also on a previous relationship between a stylist and the customer (based on previous orders) and the affinities between the customer's style preferences and those of the stylist. Once determined, the Stitch Fix stylist selects five items (clothes, shoes and accessories) from the list produced by the algorithm by reviewing customer preferences in the style profile. Finally, a warehouse worker scans and collects each item successively, collecting one item after another, just like a personal shopper would do. Because Stitch Fix is constantly growing, its engineers developed warehouse maps and an algorithm to optimize the routes workers take; this reduces time and error.⁴²

On the scheduled date, customers receive their Fix without knowing what is inside, which adds a little "surprise" factor. In addition to the five tailor-picked items, the customer finds a Style Card for each item in the box that gives styling advice (what to wear with each item, how to mix it with the proper shoes...etc.) and a little personalized note from the stylist explaining why s/he picked certain items based on the customer's profile recommendations. The customer decides what to keep – knowing that there is a 25% discount where everything is kept – and what to return. They are also asked for online feedback, identifying what s/he liked or disliked, to help plan future Fixes. Customers can invite friends by sharing a referral link; they receive a \$25 credit for every friend who orders their first Fix.

In February 2018, Stitch Fix went a step further and launched a new service, *Extras*, that allows shoppers to add extra products to their Fix such as underwear and socks from either top brands or Stitch Fix private label *Everyday*. It's a great way to up-sell essential products and discourages

40 Artificial Neural Networks are one of the main tools used in machine learning. As the "neural" part of their name suggests, they are brain-inspired systems which are intended to replicate the way that we humans learn. Neural networks consist of input and output layers, as well as (in most cases) a hidden layer consisting of units that transform the input into something that the output layer can use. They are excellent tools for finding patterns which are far too complex or numerous for a human programmer to extract and teach the machine to recognize.

What is an artificial neural network? Here's everything you need to know. (2019, January 06). Retrieved from <https://www.digitaltrends.com/cool-tech/what-is-an-artificial-neural-network/>

41 Faguer, L. (2017, May 22). Comment Stitch Fix exploite le pouvoir des algorithmes ? Retrieved April 18, 2019, from <http://customer-insight-consulting.com/22691/>

42 Clark, J. (2017, August 31). The curious connection between warehouse maps, movie recommendations, and structural biology. Retrieved April 18, 2019, from <https://multithreaded.stitchfix.com/blog/2017/08/31/warehouse-layouts/>

customers from visiting other stores to buy these undergarments, where they could be tempted to buy other clothes. These little “Extras” increase the activity and the brand loyalty of Stitch Fix.

Over time, Stitch Fix learns more about client preferences via detailed data on both the merchandise they keep and return. The more customers use Stich Fix the smarter it gets. Over 85% of the shipments result in direct client feedback.⁴³ This feedback helps Stich Fix not only improve personalization for customers but, also, with wholesalers and designers. Stich Fix shares its findings with vendors to better determine, in real time, what items will sell well, and which are less likely to be successful. The items available are all based on recommendations that emerge from customer surveys, Pinterest boards and personal notes to stylists. Information gathered is then used by algorithms, written by data scientists, to select the best items for the customers.

Scaling Fast But Not Too Fast

Launched as a women’s-only service, Stich Fix now serves men, kids, petite, maternity, and plus size, but the largest portion of the company’s revenue is still from women’s apparel. By gradually expanding into newer categories, Stich Fix is targeting the entire family through every step of their life (work clothes when starting a new job), men’s clothing, maternity clothing, kids clothing, etc.). In 2016, 39% of Stich Fix customers bought most of their clothing from Stich Fix, up from 30% in 2015.⁴⁴

Stich Fix scales up fast, but Lake knows the key to sustainable growth sometimes requires slowing down. She wants to grow but refuses to expand at the cost of a poor customer experience. Lake paces Stich Fix growth. Handling returns, making sure that every item is in perfect condition, and developing new product lines (men, kids, plus size...etc.) requires a lot of work. To thrive and grow, Stich Fix does not hesitate to pull the brake, typically via the use of waiting lists. For instance, the algorithm once made a bad prediction about a forthcoming trend. What did Stich Fix do? Instead of sending out suboptimal clothing, then suffering a high return rate and dissatisfied customers, Stich Fix donated unfashionable clothing, explained the problem, and asked their customers to wait. What could have been a disaster ended up boosting customers’ trust. As the business grew, they put potential customers on waiting lists rather than sign up people they could not adequately service.

Stich Fix achieved profitability in 2014, three years after its launch. Revenue grew from \$73 million in 2014 to \$1.2 billion for 2018.^{45 46} As of March 2019, it had 3 million active customers, year-over-year growth of 20%.⁴⁷ Stich Fix works with more than 1000 fashion brands⁴⁸ and also has its own

43 United States Securities and Exchange Commission Washington, D.C. 20549 Form S-1 Registration Statement. (2017, October 19). Retrieved April 18, 2019, from

<https://www.sec.gov/Archives/edgar/data/1576942/000119312517313629/d400510ds1.htm>

44 Faguer, L. (2017, May 22). Comment Stich Fix exploite le pouvoir des algorithmes ? Retrieved April 18, 2019, from <http://customer-insight consulting.com/22691/>

45 Understanding Stich Fix: Finding the Perfect Fit. (2017, November 13). Retrieved February 24, 2019, from <https://www.goodwatercap.com/thesis/understanding-stitch-fix>

46 Pearce, D. (2018, October 01). Stich Fix Announces Fourth Quarter and Full Fiscal Year 2018 Financial Results. Retrieved February 20, 2019, from <https://investors.stitchfix.com/news-releases/news-release-details/stitch-fix-announces-fourth-quarter-and-full-fiscal-year-2018>

47 Stich Fix. (2019, March). Retrieved April 2019, from <https://investors.stitchfix.com/static-files/2b398694-f553-4586-b763-e942617e4dbf>

48 Quarterly Results. (n.d.). Retrieved from <https://investors.stitchfix.com/quarterly-results>

brands, which represented 20 percent of revenue in 2017. Gross margins increased from 35% in 2014 to 45.1% in 2017,^{49 50} thanks to the launch of higher margin private label brands designed by and for Stitch Fix exclusively, based on customer feedback. In 2019, Lake was named among Fast Company's Most Creative People in Business.⁵¹

Profits and sales are important but keeping customers engaged is vital for any online seller. Style Pass and Extras increase the retention and usage rate. To gather more customer data, which improves the algorithms ability to understand a customer's personal style, Chris Moody designed a feature in 2017 called *Style Shuffle*, available on the Stitch Fix app since March 2018. This addictive like/dislike quiz allows customers to rate a set of clothing images each day while encouraging them to visit the app more often. With more than 75% of customers using the feature, Style Shuffle boosts Fix requests and keeps customers engaged.

Another way that Stitch Fix found to keep its customers engaged is social media. Stitch Fix understood the value of its customers' social media accounts, especially Pinterest boards which focus on visual inspiration, particularly clothing. With Pinterest, Stitch Fix created an ecosystem of customers. A search for "Stitch Fix" on Pinterest brings up dozens of pages of boards with hundreds of pins in each board. There are even tutorials on YouTube about how to create the perfect Pinterest board for your Stitch Fix stylist and over 12,000 videos of people unboxing their Fix, some of them with over 130,000 views.

The algorithm allows Stitch Fix to learn about customer preferences and body types, and Stitch Fix gets to know who its customers really are with their Pinterest boards. Stitch Fix's own Pinterest account has over one million followers. They have so many followers because, unlike other retailers, Stitch Fix is not selling what they post on Pinterest; these are style inspirations, not advertisements.

Besides word-of-mouth of women loving the service and telling their friends, and bloggers talking about it, Stitch Fix recently invested heavily in marketing efforts, using TV campaigns to attract new customers. In 2018, Stitch Fix spent \$102.1 million on advertising, a 45% increase over 2017 and quadruple their 2016 advertising spend. In February 2019, Stitch Fix showed their new campaign to the US press, generating 60 million reactions on Twitter.⁵²

Stitch Fix is endlessly growing and expanded into the UK in May 2019.⁵³ That said, in July 2018, Stitch Fix saw the first attempt by Amazon to jump into the blue ocean Stitch Fix had created: *Prime Wardrobe*. This "try before you buy" shopping service was free and available from the Amazon website to all Prime Members. Customers could select as many as eight items that they want to try. Then they have seven days to decide what they want to return or keep before their credit card is charged. Returns are easy with the included prepaid return label and a resealable packaging. Because customers have to select their items themselves, apart from the fact that they have seven days to decide what to keep before their credit card is charged, there was not much

49 Understanding Stitch Fix: Finding the Perfect Fit. (2017, November 13). Retrieved February 24, 2019, from <https://www.goodwatercap.com/thesis/understanding-stitch-fix>

50 <https://www.bloomberg.com/opinion/articles/2019-01-03/stitch-fix-s-success-story-is-underappreciated>

51 <https://www.fastcompany.com/90298900/stitch-fix-most-innovative-companies-2019>

52 Pasquarelli, A. (2019, February 25). AdAge. Retrieved February 26, 2019, from <http://www.adageindia.in/marketing/cmo-strategy/stitch-fix-debuts-new-brand-campaign-on-oscars-night/articleshow/68144799.cms>

53 Jacobs, E. (2019, May 10). Would you let this woman choose your clothes? Retrieved from <https://www.ft.com/content/a7a6d328-7172-11e9-bbfb-5c68069fbd15>

difference with a usual Amazon shopping experience. That is probably why the service never took off: According to a 2018 Gartner survey among 1,500 Prime Members, only 3% used Prime Wardrobe.⁵⁴

But in July 2019, Amazon seriously targeted Stitch Fix with their new service “Personal Shopper,” by Prime Wardrobe. With Personal Shopper, customers receive monthly curated clothing boxes of eight items, similar to Stitch Fix. Prime Members begin by filling in a survey detailing their measurements, style, and budget. This survey is then analysed by a mix of stylists and AI to select items that their customers will like. Customers can preview the items before shipping and indicate which they want to receive and which they don’t like and should be changed. Personal Shopper is available exclusively for Prime members and costs \$4.99 per month. Besides the cheap price, Amazon offers a large selection of brands and free & easy returns. Amazon already has over 100 million Amazon Prime Members in the US, and the female members are all potential customers.

Despite the fact that Stitch Fix exceeded all stock market expectations, in July 2019 the stock price dropped on the news of Amazon.⁵⁵ However, analysts still recommend investing in Stitch Fix. They believe that the retail sector is so massive that Amazon’s new service will not steal customers away from Stitch Fix and that it can even make Stitch Fix’s offer more appealing.

In the meantime, on September 12, 2019, in an attempt to lengthen widen and deepen its blue ocean and build barriers to imitation, Stitch Fix acquired the technology and intellectual property from Finery, another female-led company. Finery extracts shopping receipts from email and creates a virtual wardrobe from it. Suddenly, customers can have a picture of everything they bought. Finery comes up with recommendations for mixing the pants you just bought with a top in your closet for a great Friday night outfit. It also reminds you about the return deadline, while monitoring for potential price adjustments of items you saw online but did not yet purchase. While it remains to be seen how Stitch Fix will use this technology, we could imagine that it will allow them to offer more mixing and matching combos for women so they know how to use the clothes that they have, whether they purchased them on Stitch Fix, or elsewhere.

Questions

1. Katrina Lake raised \$42 million and struggled to find investors to back Stitch Fix. Meanwhile, the male-run apparel retailing start-ups such as Fanatics, The Hut Group and Wish raised on average over \$2 billion in funding. What role do you think gender played in this disparity? How could Lake have more effectively tackled this issue?
2. Lake looked across three industries to create her new market space: retail, personal stylists, and subscription boxes. What did she take from those three industries and what did she leave behind?
3. From the buyer’s perspective, what are the unique ways which Stitch Fix offered a leap in value beyond other retailers (brick-and-mortar and online)? What do you think will be the likely impact

⁵⁴ Chen, Cathaleen. “Is the Stitch Fix Model the Future of Amazon Fashion?” The Business of Fashion. The Business of Fashion, July 31, 2019. <https://www.businessoffashion.com/articles/news-analysis/amazon-personal-shopper-stylist-stitch-fix>

⁵⁵ Equity, S. F. C. L. (2019, September 5). Stitch Fix: Unreasonably Beaten Down. Retrieved from <https://seekingalpha.com/article/4289711-stitch-fix-unreasonably-beaten>

of Amazon? What advice, if any, would you give to Lake concerning Amazon's "personal shopper" offering?

4. Will Stitch Fix's recent purchase of Finery IP help to act as a barrier to imitation and extend its blue ocean, especially against Amazon? With the understanding of what Finery does, how can you imagine Stitch Fix could use this to really add value for customers?
5. If you look at Stitch Fix's profit proposition, what do you see as key challenges to growing revenue and profits and protecting the blue ocean it created?

Appendix A

The Algorithms Tour

Unlike Facebook or Google that closely guard their algorithms and keep them secret, Stitch Fix created an interactive tour aiming at sharing how some of the diverse applications of artificial intelligence at Stitch Fix work. On top of the algorithms already described in the case study (warehouse assignment algorithm, intelligent logistics and the machines performing a variety of algorithms to produce rank-ordered lists of the inventory), AI is deeply engrained in everything that Stitch Fix does: in recommendation systems, in human-based computation⁵⁶ resource management, inventory management, algorithmic fashion design and many other areas.

Client' "States"

To anticipate the needs of their customers, Stitch Fix has to know the "state" of each client at each point in time (new client? Did they use a referral link? Are they going through a new phase in life, etc.) – as they will likely have different shipment cadences, different desires for email contact, etc. Stitch Fix keeps track of every touchpoint with each client—every item sent, feedback given, and every email – using this data to understand clients' states and related needs. They can detect changes in state and consider possible triggers. Once the state is defined, they can develop state transition matrices and Markov chain⁵⁷ models that allow them to study system-level effects, and most notably to anticipate future demand, as inventory is often bought months before it arrives at the warehouses.

Inventory Management

Stitch Fix must anticipate its clients' needs to have enough of the right resources in place at the right time. To do so, it uses system dynamics⁵⁸ to purchase and maintain adequate inventory availability for stylists while minimizing the sum of ordering costs; meet future demand, allocate inventory appropriately to different warehouses, and occasionally donate old inventory to make room for new styles.

New Style Development

Volumetric challenges are not the only considerations with inventory replacement. Stitch Fix also want to purchase and develop new clothing in ways that continually improve its inventory, helping their stylists give greater delight to a broad client base. Designing new styles for their Stitch Fix exclusive brands provides a great opportunity to tailor new designs for particular client segments that tend to be underserved by other brands. Stitch Fix approaches this with inspiration from genetic algorithms⁵⁹ that use recombination and mutation along with a fitness measure—the same mechanism used by mother nature in evolution by natural selection. The first step is to think of each style as a set of attributes ("genes"). Then consider the vast set

56 Human-based computation is a computer science technique in which a machine performs its function by outsourcing certain steps to humans.

57 A Markov chain is a stochastic model describing a sequence of possible events in which the probability of each event depends only on the state attained in the previous event.

58 System Dynamics is a tool to investigate and model complex dynamic problems in terms of stocks (the accumulation of things), flows (the motion of things) and feedback loops at any level of aggregation. System Dynamics is now one of the most commonly used forms of computer simulation for dealing with many faceted problems. The objective of this method is to find the conditions under which a system under study will evolve and in what direction. The tools used are models that represent symbolically the reality of the system. It aims at considering the interrelationships between the components of an organization or environment rather than looking at each component in isolation.
<http://www.foresight-platform.eu/community/forlearn/how-to-do-foresight/methods/gaming-simulation-and-models/system-dynamics/>

59 Genetic Algorithm (GA) represents a subset of Ignite Machine Learning APIs. GA is a method of solving optimization problems by simulating the process of biological evolution. GAs are excellent for searching through large and complex data sets for an optimal solution. Real world applications of GAs include automotive design, computer gaming, robotics, investments, traffic/shipment routing and more.
<https://apacheignite.readme.io/docs/genetic-algorithms>

of styles this way and consider the client feedback ("fitness") available for each of them. Now consider creating new styles by recombining attributes from existing styles and mutating them slightly. Note that the number of possible combinations is very large ($\prod k_i$). In the next step, they deviate from a canonical genetic algorithm: instead of simply selecting based on fitness and then unleashing random recombinations and mutations as the next generation of styles, they are somewhat pickier about what makes it into their inventory. They first develop a model of how well a given set of attributes is likely to suit the target clients. They then use this model to highlight a variety of attribute-sets that they think have a high probability of being loved. Then they work with their human designers to vet and refine this collection, and ultimately to produce the next generation of styles. These new styles get produced and are made available to the styling algorithm, then on to delighted customers, and the cycle of evolution continues.

Data Platform

The Data Platform team provides the data and compute infrastructure—along with a collection of internal SaaS products—that allow the data scientists to effectively and efficiently carry out analysis, write their algorithms, and put them into production. The platform nicely encapsulates properties like data distribution, parallelization, auto-scaling, failover, etc. This allows the data scientists to focus mostly on the *science* aspect yet still enjoy the benefits of a scalable system. Engineers focusing on building platforms that enable data scientists to carry algorithm development all the way from concept to production.

Source: A majority of the text in Appendix A is taken verbatim from: <https://algorithms-tour.stitchfix.com>