Customer Confusion: Product Overlap, Ambiguous Needs, and Information Overload. An examination of corporate mental models for derivative product creation and their impact on customers

by

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Submitted to the System Design and Management Program in Partial Fulfillment of the Requirements for the Degree of

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Abstract

Companies in highly competitive industries often develop incremental products to meet diverse customer needs or to gain share from competitors. However, in order to help customers to choose between derivatives, companies also present more detailed product specifications or features to their customers, resulting in customer confusion. We categorized customer confusion into three facets: product overlap, ambiguous needs, and information overload and discussed each confusion in three case studies. This thesis presents a theory of mental models for companies facing this issue, and uses three case studies to examine the issue: Groceries (Trader Joe’s), Wearable Devices (Fitbit), and Semiconductor (Texas Instruments).

We conclude that product ambiguity is the dominant type of customer confusion in the grocery retail industry. Trader Joe’s has adopted the no sale strategy to mitigate this effect. We identify information overload as the most significant concern in wearable devices from the Fitbit case, where online user reviews supplement specification information. Finally, we find that contextual ambiguity is a huge problem for the customers in the semiconductor industry. Several strategies such as customer support and enhanced web content are identified to reduce this ambiguity.

We propose three system diagrams showing how company strategies affect customer confusion regarding different levels of product knowledge and ability to acquire new knowledge. The diagrams shed light on how sales support could intervene effectively, based on the customer type and confusion type.

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1 Introduction

As revenue grows, many companies have invested their resources in expanding their product portfolios to sustain the momentum of revenue growth. There are two ways that the company can expand their product portfolios. One way is to grow organically by developing incremental or innovative products based on the company’s core strength. Another way is to grow inorganically by mergers and acquisitions.

Two common external causes of product expansion are by customer needs and competitions. For example, Lays released different flavors of chips to cater to the consumer in different regions. On the other hand, the prevalence of BB (beauty balms) cream in the US since 2011 is due to competition. The all-in-one formula was first booming in South Korea and then spread quickly throughout Asia. The competition has driven almost all the cosmetic brands in releasing their own BB cream products as opposed to the traditional foundations, featuring their unique technology and secret formula. By keeping the products aligned with the trend or the state-of-the-art technology, companies can maintain share in the competitive market.

Many companies leverage expanding product offerings as a company strategy. Harvard Business School Professor Clay Christensen asserted that 30,000 new consumer products are launched yearly. However, studies have found that there is a disparity between the number of new products and the growth of revenue within a firm. According to a report from BCG (Pichler, Dawe, & Edquist, 2014), new products introduced annually from 2002 to 2011 grew by 60%; however, the company’s sales grew just merely by 2.8 per year.

How could revenue growth be stagnant, despite increasing product launches? Joan Schneider and Julie Hall assert that the biggest problem that resulted in developing a failed product is lack of preparation, where companies put too much emphasis on design and manufacture and were late in putting efforts in marketing. While implementing new technology in the product helps companies to differentiate from competitors, failing to understand the target market and user behavior, and tie the technology to customer needs often cause a new product to fail. For example, the Instant Pot is a successful cookware product which integrates Bluetooth in the device. Since the slow cooking process can take up hours, the remote controlling feature can add value to the customers. On the other hand, adding the Bluetooth feature on the espresso machine, such as the Nespresso Prodigio machine, may not add as much value to the customers since it usually takes less than 30 seconds to make a coffee, and people are more willing to wait next to the espresso and drink it right away.

Many companies tend to set business strategies from a top-down approach in order to align with the company vision and goal. If the strategy works and predicts the customer behavior successfully, it aligns with the company’s goal, and the company would keep adopting the strategy, reinforcing the positive feedback loop of company improvement. However, a failure mode occurs when there’s no timely feedback on the customer behavior feeding into the company’s decision making processes, and when the overuse of the strategy causes customer behavior to become unpredictable.

Failing to understand customer needs and launch the product to the right market is a common failure mode in developing a new product. Another failure mode caused by developing incremental products, however, is less discussed in the literature. Segmentation is a common

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marketing strategy to help a company grow revenue by more precisely addressing customer needs, and it will produce various products that target different customers. However, over-segmentation has its side effect—it will offer too many options for customers to choose, lose customer interest, and eventually lose sales. In the competitive market where the time-to-market is essential in gaining the market share, companies often adopt the strategy to alter the existing design slightly and launch the product as fast as possible. The similarities and overlap of the previous and current generation of products also cause the customer to generate fatigue in the decision making processes, affecting the quality of their decisions. As the customers’ decision-making processes become a random variable, the marketing strategies to expand the product portfolios is less likely to work as efficiently as planned.

It is a collective mindset for companies to adopt product expansion as a strategy to accelerate revenue growth. However, as the loop reinforces, the customer will encounter confusion by facing too many options with too many product feature similarities. The confusion makes customer behavior unpredictable, decreasing the efficacy in executing the strategy.

This study aims to study the mental models across three different industries: retail, consumer electronics, and the semiconductor industry in developing incremental products and presenting their product specifications and features to customers. Customer confusion caused by information overload, product overlap, and ambiguous needs will be discussed in each case study. Besides, the strategies each company apply to cope with customer confusion are being discussed and analyzed respectively. Lastly, a system diagram will be used to illustrate the interaction between company strategy and customer confusion.
2 Literature Review

2.1 Product Specifications and Consumer Behavior

Product specification is not only necessary in the product design and development process within a firm but also crucial in presenting to the customers. A product would require good translations from customer needs to specifications. A complex system, especially, would require designers and engineers to list the specifications down to the sub-layers for better engineering management (Crawley, Cameron, & Selva, 2015). The more detailed the specifications are during the product development, the better management and control of the project would be. However, the same detailed level of product specifications does not usually present to the customers or consumers. Instead, there is much research studying consumer behaviors with different presentations of product specifications, hoping to find out the best strategy in product specification marketing.

Research has found that product specifications can influence consumers’ choices, although they may necessarily influence consumers’ likings. Better product specifications can lead customers to choose the product option even though the product itself does not provide better user experience (Hsee, Yang, Gu, & Chen, 2008). In light of the significance of product specifications in influencing customers choices, many companies have turned their product competitions into specification competitions.

2.1.1 Choice Overload

As of the market environment today, people are facing ever-increasing options of choices in their daily lives. While people embrace the autonomy of making their personal choices, researchers have been arguing that an overabundance of choices, however, would generate an adverse effect on the consumers. Negative effects such as the decrease in the motivation to choose (or even make a choice at all), or reduction of the satisfaction of choice were discussed in several studies. Professor Iyengar argues that more choices can be demotivating when there are superfluous choices. By conducting three experiences, they found that people are more likely to purchase when being presented with six choices than 24 or 30 choices (Iyengar & Lepper, 2000). Also, people presented with fewer choices are likely to be more satisfied with their choices. One of the studies (Iyengar & Lepper, 2000) was conducted at the entrance of a grocery store where consumers have to choose among six options of jams or a more extensive assortment of 24 options for consumers to taste before purchasing. The result showed that although more people were approaching the tasting table with 24 options of choices, only 3% of the crowd purchased the jam presented on the table. On the contrary, although the tasting table with fewer choices attracted fewer people to stop by, 30% of the people who dropped by purchased the jam presented on the table. The experiment showed that more choices could decrease consumers motivations to make a purchase decision.

Schwartz (2004) elaborated “the paradox of choices” and mentioned that as the number of choices increases, people tend to feel more powerful due to the liberations and autonomy that choices bring. However, when the number of choices grows, and the negatives escalates to the point of overload, choices no longer liberate people.

As there was a substantial amount of research each stating the positive and negative consequences of having a variety of choices, the choice overload hypothesis was later brought out by Mr. Scheibehenne through quantitatively analysis of the mega-data from previous literature, either showing positive or adverse effects. The research suggested that there should
be other moderators than the number of choices which affect consumers decision-making processes and outcomes (Scheibehenne, Greifeneder, & Todd, 2010). The study mentioned that information overload is one of the moderators that plays a role in consumer purchasing behavior.

Information overload, a term that was defined by Bertram Gross (1964) in “The managing of organizations.” It is generally used as a term to describe the difficulty in understanding an issue or making effective decisions when there is too much information.

“Information overload occurs when the amount of input to a system exceeds its processing capacity. Decision makers have fairly limited cognitive processing capacity. Consequently, when information overload occurs, it is likely that a reduction in decision quality will occur.” (Toffler, 1990)

Previous literature has defined the formula of information overload as the product of the number of the assortment and the number of attribute of the option (Jacoby, Speller, & Kohn, 2006). Moreover, the choice overload is merely a subset of the information overload. That is, the number and the level of attributes are as significant, if not more, as the number of choices in influencing consumers decision-making experiences.

Research has looked into the effect of the number of the attributes and the level distribution of attributes on the consumers (Lee & Lee, 2004). They found that the number of attributes and the level distributions of the attributions can be good indicators of the information overload effect on the consumers, whereas the count of the alternative (number of choices) does not necessarily lead to the same prediction in choice quality. Also, the study found that when the attribute levels were equally distributed, subjects were less confident in their choices, while increasing the number of attributes resulted in more confusion, less satisfaction, and less confidence. Also, the choice set with more alternatives or attributes may have less information to process if the attributes distribute unevenly.

2.1.2 Consumer Confusion

To further study the context, the cause and the consequences of consumer confusion, many researchers have focused on different dimensions. Matzler et al. (2011) consolidated the findings from previous literature and defined three types of consumer confusions:

(1) Similarity Confusion
“a lack of understanding and potential alteration of a consumer’s choice or an incorrect brand evaluation caused by the perceived physical similarity of products or services.”

(2) Overload Confusion
“a lack of understanding caused by the consumer being confronted with an overly information rich environment that cannot be processed in the time available to fully understand, and be confident in, the purchase environment.”

(3) Unclarity Confusion
“[…] may not be aware of what attributes they should be looking for, the level they require, or how one attribute influences another attribute.”
While previous literature has been focusing on the confusion caused by **information overload** (including the factor of the number of choices, number of attributes, and the level distribution of the attributes), researchers started to look into the confusion caused by brand similarity and ambiguity of the product information.

### 2.1.3 Product Ambiguity

The concept of tolerance of ambiguity was first brought out by Frenkel-Brunswik (1948). The definitions and measures of tolerance ambiguity have been evolving ever since. In cognitive psychology, tolerance of ambiguity is concerned with the degree to which people can restrain their need for a perfect, clear view of the environment (Matzler et al., 2011). In this case, consumer confusion due to ambiguity occurs when the uncertainty and the error of the product exceed one’s tolerance of ambiguity.

While studies have found the negative consequences of product unclarity, such as the decrease in consumer attractions, reduction of the satisfaction after the purchase, other researchers have found the ambiguity in product information can be utilized as a business strategy to increase the product margin. One study suggested that higher level of ambiguity in the product quality can result in companies generating more profits by charging a price premium compared with lower ambiguity given that the customers show predisposition in a brand (Yoo & Sarin, 2018). There was also research studying the psychological construct of how ambiguity in decision ambiguity favors the competition of the incumbent product strategically (Muthukrishnan, 2002). The study suggested that while the incumbent company can use the ambiguity to get a higher premium, the incumbent company, however, should try to reduce the ambiguity to gain the market share. Therefore, it is crucial to promote information transparency while not generating consumer confusions; in other words, there’s a need for creating proper ambiguity in product specifications to help consumers in navigating the product options and make the choices easier to weigh.

### 2.2 Consumer Confusion Reduction Techniques

**Interactive decision aids**

Several information technologies have been developed to empower the decision-making process of consumers (Walter, Battiston, & Schweitzer, 2008). Along with the explosive growth of e-commerce and the number of people who use interactive media, interactive online shopping interfaces have been sophisticatedly developed. The interactivity features online are therefore designed to fill the gap in which customers are not in contact with a physical product and cannot evaluate the usability of the product directly. Furthermore, the interactivity helps users in the decision-making process by aiding the users to improve the decision quality and to minimize the efforts in choosing. Human interactivity and machine interactivity are two decision aid methods (Häubl & Trifts, 2003).

A two-stage process was being proposed to reach to consumer purchase decisions (Bettman & Johnson, 1988). First, a consumer would screen a large assortment of products, and select a subset of more promising options without examining into details. Secondly, a consumer would evaluate and compare the subgroups in more information based on the critical attributes and make a purchase decision.
The concept of interactivity is to aid humans in two-stage decision-making processes (Häubl & Trifts, 2003). Several interactivity tools were developed to help human in decision-making processes. For example, a Recommendation Agent (RA) is a tool to help consumers screen the initial alternatives from the enormous selections of products online. Secondly, a Comparison Matrix (CM) is used to help consumers to organize the options by evaluating the options based on the essential attributes. The use of interactivity in the online shopping environment will help to fill the gaps where representatives are not presented to guide the consumers in making the proper decisions.
3 Objectives

3.1 Company Strategy vs. Consumer Behavior

In what we will assert as the "traditional business mindset," companies setup strategy based on specific mental models to achieve goals or align with the vision of the company. And if the approach is later proved to be successful, the company will continue adopting the strategy to reinforce the positive outcomes. The schematics of the model is shown in Fig 3.1a.

However, we will postulate that the traditional model assumes that the customers behave as predicted, specifically that incremental new products will continue to attract new customer segments, and will not cause adverse effects to existing segments (Fig 3.1b). Companies sometimes make assumptions that the strategy will keep addressing customer needs, but in fact, they are neglecting the side effect of the strategy. That is, without tracking the customer behavior in a timely fashion, the company will only be able to evaluate the performance of the strategy after the unpredicted customer behavior has harmed the company's goal. And often the time delay makes it too late for the company to make any modification of the strategy to secure the company from failure (Fig 3.1c).

Over the past two decades, user experience (UX) research has become a buzzword in the industry. The study has defined three facets for UX in understanding the users' interaction with the technology. However, Hassenzahl & Tractinsky summarized the UX as the consequences of users internal state, the characteristics of the designed system, and the context (Hassenzahl & Tractinsky, 2011).

The development of user research can be traced back to early 20th in the industrial design to improve manufacture efficiency and to make human labor more efficient in operating the machines. Frederick Winslow Taylor, regarded as the father of scientific management, summarized the efficiency techniques in his book "The Principles of Scientific Management" in 1911. The studies of the human-machine interface were later applied in airplane cockpit designs. Nowadays, due to the advance in ubiquitous computing and Web design, the user experience has shifted from usability engineering to multiple aspects of metrics. Donald Norman, a cognitive scientist, first coined the term "user experience design" in his book, The Design of Everyday Things," during his work at Apple.

“I invented the term because I thought human interface and usability were too narrow. I wanted to cover all aspects of the person's experience with the system including industrial design graphics, the interface, the physical interaction and the manual. Since then the term has spread widely, so much so that it is starting to lose its meaning.”

(Donald Norman, 1988)

Since then, user experience design (UXD) has become a popular search in the job market in tech companies, and the need for the user experience designers are growing dramatically. A report in 2016 (Mind the Gap: A Report on the UK’s Technology Skills Landscape) recorded a 289 percent increase in requests for UX interviews. It is currently well-known by the companies to do user research before launching a product, especially in the Web page or App designs.

Nowadays in the consumer market, given the availability of mass customers data accessible online, it is common to conduct consumer behavior research during the product development process to address carefully to customer needs (van Kleef, van Trijp, & Luning, 2005).
experience design has established the new framework in e-commerce given the nature of a large amount of accessible consumer data. In other industries, however, where the customer/consumer data cannot be retrieved and analyzed timely, it is more challenging to capture the unpredicted customers' behavior and adjust the company strategy in real time.

3.2 Mindset of Developing Incremental Products in Different Market Structures

Economists have characterized four types of primary market structures: perfect competition, monopolistic competition, oligopoly, and Monopoly (Chamberlin, 1949). In this research, we hypothesized that different types of market structures entail mental models in product development, influencing the representations of product specifications to the customers and therefore changing the behavior of the customers.

In order to sustain the revenue growth of a company, expanding the product portfolios has been commonly utilized as a strategy to enhance the company competitiveness. Product portfolios expansion can be realized by the internal new product investment or external acquisition. By continually developing products that can fulfill customers’ needs, not only can the revenue growth of the company sustains but companies can build long-term customer loyalty and trust. On the other hand, keeping the new products competitive in the market would prevent the customers from shifting to its competitors. Also, new products would help the company to tap into new markets by merely altering small parts of the product design. In other cases for products that own high share in the market, there may not be room for the margin to be
optimized. However, by slightly altering the design of the product, the company may make the product profitable again.

In the perfect competition market structure, the products in the markets are considered to be homogenous, and customers have no particular preferences. Especially in the scenario where product design incorporates more customer involvement, incremental innovation is likely to take place. Ideally, the incremental products are supposed to help the company to attract more customer segments to enhance sales. However, the increased number of options would result in consumer confusion such as information overload, product similarities (Matzler et al., 2011). In other cases, when companies try to emphasize on the incremental specifications, customers might get confused with the key attributes of the products, resulting in “unclarity”—the third type of confusion defined by Kurt et al., 2011.

Figure 3.2 Mental models of the company mapping to the customer behavior in perfect/monopolistic competition

When customers experience the confusion that exceeds the acceptance level, they will adopt the confusion-reducing strategy (CRS) to release the cognitive strain (Mitchell and Vassilios, 1999). This study has defined six categories of strategy that customers adopt when facing confusion: 1) do nothing; 2) postpone/abandon the purchase; 3) clarify the buying goals; 4) seek additional information; 5) narrow down the set of alternatives; 6) share/delegate the purchase. Therefore, the moments where customers slow down the purchasing process can signal the customer confusion.

Research has proposed several techniques such as eye tracking, mouse tracking, video recording, and data analytics to measure customer behavior. For example, UserTesting.com helped StubHub to increase the conversion rate by 2.6% by identifying the customer confusion in the purchasing process. They figured out that the critical link that brings the customers to the purchasing page was buried in an ambiguous link, causing buyers not getting to the purchase page quickly and easily. The link was therefore changed to an eye-catching “go button,” enabling easier purchasing processing, increasing the conversion rate.

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2 http://info.usertesting.com/rs/usertesting/images/UserTesting_StubHub_Case_Study.pdf
On the other side of the competitiveness spectrum, we have monopoly/oligopoly. In this scenario, the monopoly would leave more ambiguity in product specification presentations to reserve a price premium. Research has found that higher ambiguity in product quality can result in companies generating more profits by charging a price premium compared with lower ambiguity when customers show predisposition in a brand (Muthukrishnan, 2002). However, if the ambiguity level has reached the point beyond customer tolerance, the customer gets confused and becomes less willing to shift to new products, resulting in profit loss.

For our case studies, we’re going to focus on competitive markets (perfect/monopolistic competition), because we think those are the most interesting subset where customers experience a combination of three types of confusion. Competition forces the customer to face more than one choice. And competition makes companies setup different strategies in presenting their product attributes, to deal with customer noises. Moreover, competition exerts confusion on the consumer by showing the similarities of the product attributes. While the monopoly market structure usually saves customers from decision fatigue and product overlap by being the only choice, more insights can gain from analyzing the dynamics between company strategy, the context of the market and the consumer behavior.
3.3 Objectives and Hypotheses

This study will discuss the company goal, the mental model of the company in developing and presenting their incremental products in the competitive markets, and the expected customer behavior in response to the product representations. In particular, we will look into one of the most important goals of the company—accelerating revenue growth and how the company uses developing incremental products as a strategy to attract more customers and eventually gain more revenue. In an ideal business model, the positive impact, which is the revenue growth, in this case, will keep happening annually if the loop reinforces. However, if the strategy is overused, take over segmentation for example, the unexpected customer behavior such as customer confusion will cause the loss in customer attraction, decreasing company revenue instead.

To elaborate on the model that we propose in Figure 3.4, we use three case studies in three different industries: retail, consumer electronics, and semiconductor industry to analyze the context, the company goal, the incremental product strategy, the competition, and the customer behavior. We will also investigate the customer confusion in each industry by defining three types of customer confusion: product overlap (product similarities within a company and across brands), information overload (excess number of choices and attributes), and ambiguous needs (product, process or contextual unclarity; or not knowing the critical attributes to evaluate product choices). We will also discuss the company strategies in dealing with customer confusion.

![Company Mindset](image)

Hypothesis 1:

We hypothesize that the three industries are subject to three different types of confusions defined in the literature and this paper: product overlap, information overload, and ambiguous needs. We assumed that consumers shopping in a grocery retailer would be most likely to experience confusion caused by product overlap. In cases where consumers purchase an electronics product online, they are more prone to face confusion resulted from information overload. Lastly, customers in the B2B business model often experience confusion due to the ambiguity of the purchasing context.
Hypothesis 2:

If hypothesis 1 is correct, different strategies are applied in various industries in dealing with customer confusion:

In the grocery retail industry where product overlap is the most significant problems, companies often differentiate from competitors via high quality or organic product offerings.

In the consumer electronics industry, where the purchasing process happen in e-commerce, some companies adopt the one-product strategy or present fewer specifications online to prevent customers from information overload.

B2B companies, where several decision makers are involved in the purchase process, rely on sales representatives to communicate to the customers, ensuring that customers make easier decisions by reducing the ambiguous needs of the decision-making processes.

Hypothesis 3:

There is little literature that discusses customer confusion in B2B companies. However, B2B companies often fail to grasp how confused their customers are. Relative to consumer electronics or retail companies, B2B companies often get slower feedback from customer behavior. Some factors in the slow mechanism include multiple decision makers, the ambiguity of the purchasing process, complexity of the decision, longer product cycle to evaluate the success.
4 Trader Joe’s

4.1 Company Overview

Trader Joe’s is a privately held American grocery chain store opened by the founder Joe Coulombe in 1967. The first store opened in Pasadena, California. By October 2017, there were 474 locations across 43 states in the United States.

As analysts mentioned, “Millenials and boomers alike are focusing on more healthy eating choices and creatively prepared meals,” fresh-format grocery stores (stores that emphasize on perishables and offer center-store assortments that differ from other traditional retailers³) such as Whole Foods and Trader Joe’s are growing drastically while the conventional supermarkets are decreasing in sales. In the eMarketer report in 2018 (Figure 4.1), fresh-format grocery stores are predicted to grow at 6.0% (CAGR) from 2017 to 2022, whereas the traditional supermarkets are stagnant in growth (0.5%). Also, e-commerce has disrupted the industry and exacerbated the decline of sales in conventional supermarkets.

![Figure 4.1 Grocery stores sales and store count change by category](https://www.emarketer.com/Chart/US-Grocery-Store-Sales-CAGR-by-Retailer-Type-2017-2022/221558)

³ https://www.fmi.org/our-research/supermarket-facts

Trader Joe’s operates in an average store size of 15,000 square feet, which is only one-third the size of the average traditional grocery chain store. However, it achieved twice the sales per square foot than Whole Foods (Figure 4.2). In terms of pricing, both grocery chains own private labels, providing the customer with lower-budget selections. However, Whole Foods still creates the image as a more expensive choice in comparison with Trader Joe’s and has been owning the nickname “Whole Paycheck.” A study has shown that Whole Foods cost about one dollar more than Trader Joe’s in general on the same item.\(^5\)

Table 4.1 Trader Joe’s company overview in comparison with Whole Foods

<table>
<thead>
<tr>
<th></th>
<th>Avg. SKUs</th>
<th>Revenue (p.s.f)</th>
<th>Store Size (s.f.)</th>
<th>Revenue (2017)</th>
<th>Company Mission</th>
<th>No. of Stores</th>
<th>Private-Label Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trader Joe’s</td>
<td>4000</td>
<td>$1,734(^6)</td>
<td>15,000</td>
<td>$13.3B</td>
<td>Fun, individual pride, company spirit, best food, product information</td>
<td>474 (2017)</td>
<td>80%(^7)</td>
</tr>
<tr>
<td>Whole Foods</td>
<td>7000-20,000(^9)</td>
<td>$930(^6)</td>
<td>38,000-50,000(^2); 40,000(^9)</td>
<td>$16.03B(^10)</td>
<td>People and planet, Organic/natural, high quality</td>
<td>500 (2019)(^11)</td>
<td>50% (non-perishable at 365 stores)(^12)</td>
</tr>
</tbody>
</table>

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\(^7\) https://www.businessinsider.com/trader-joes-sells-affordable-goods
\(^8\) https://www.supermarketnews.com/retail-financial/whole-foods-shelves-365-store-concept
\(^11\) https://www.supermarketnews.com/retail-financial/whole-foods-set-open-500th-store
\(^12\) https://www.supermarketnews.com/sponsored-content/next-wave-private-label
In 2015, reports showed that Trader Joe’s had $13.3B in revenue. As a privately-held company, not many details regarding the company strategy and financial status were published. However, marketers have been very interested in analyzing the business model and comparing with other traditional grocery retailers. Many have attributed the success to its unique customer experience, eco-friendly and healthy image, and inexpensive products.

4.2 Company Image

Trader Joe’s is known for its image as inexpensive grocery shopping by cutting out the middle man in the supply chain. You can find $0.95 for five bananas in Trader Joe’s compared with $1.05 at Whole Foods. Eighty percent of the products are privately labeled. Also, the company refutes the exclusive discount strategy by promoting the concept “best price, every store, every day.”

"Sale is a four-letter word to us. We have low prices, every day. NO coupons. NO membership cards. NO discounts. NO glitzy promotions or couponing wars at our stores. We offer the best everyday values, every day.” – Excerpt from Trader Joe’s website

Trader Joe’s also ties their image with animal protection and eco-friendly visions. On February 12, 2016, Trader Joe’s has announced their plan to implement all the supply chain to source “cage-free” eggs throughout the United States by 2025. The plan was first based on customer feedback back in 2005, and since then, Trader Joe’s has been increasing the ratio of the “cage-free” eggs to “conventional” eggs. The example shows that Trader Joe’s not only takes customers' feedback directly into an action plan but also linked the company vision to the environment.

Sustainability is also a focus in the corporate strategy, and Trader Joe’s implement the vision through the packaging framework. By minimizing the amount of packaging and sourcing renewable and eco-friendly package materials, Trader Joe’s have eliminated one million pounds of plastic from the store.

Besides, Trader Joe’s sees itself as a neighborhood grocery store by fostering a healthy and friendly community. Featuring different themes of graffiti specialized for each location and friendly crews wearing Hawaiian T-shirt, Trader Joe’s offers a unique shopping experience that blends well the neighborhood, which is different from other grocery chains.

4.3 Customer Feedback

One of the critical differentiators that Trader Joe’s has compared with other traditional retailers is the efforts and methods in learning customer feedback. As a customer-centric company, Trader Joe’s learns directly from the voice of customers via the captains and crews of the store. In this case, Trader Joe’s can timely alter the products it carries to cater the shoppers to generate a personalized experience.

According to the US Multichannel Retailer Customer Experience in 2018, Trader Joe’s ranked No.1 and was the entrant in the Top 10 list. Eighty-seven percent of the customers indicated that the shopping experience is easy while not owning an e-commerce presence. Trader Joe’s

also delivers 69 positive experience for each negative one, which is the highest among the 287 brands.

### 4.4 Consumer Confusion

Below, we evaluate Trader Joe’s strategy and products with respect to the three types of confusion defined in this study.

**Information overload**

| Table 4.2 Comparison of SKUs, revenue per square feet, store size and SKUs per square feet among Trader Joe’s, Whole Foods, and Walmart |
|---|---|---|---|
| | Avg. SKUs | Revenue (p.s.f.) | Store Size (s.f.) | SKUs/s.f. |
| Trader Joe’s | 4000 | $1,734⁶ | 15,000 | 0.27 |
| Whole Foods | 7000-20,000¹⁴ | $930⁶ | 38,000-50,000⁷; 40,000¹⁵ | 0.18-0.4 |
| Walmart | 30,000-40,000¹⁶ | $319¹⁷ | 58,000 | 0.60 |

To relate the store metrics such as SKUs and store size to information overload, we divide the average SKUs of Trader Joe’s, Whole Foods and Walmart by the store size. The calculation gives us the average SKUs per square feet, indicating the number of choices (SKUs) that customers face within a unit area (Table 4.2). Trader Joe’s has a 0.27 SKUs/s.f., which is less than half of Walmart (0.6). Since Whole Foods varies in store sizes, small Whole Foods format has the lowest SKUs/s.f. at 0.18, whereas larger Whole Foods format has slightly higher SKUs/s.f. (0.4). Despite having the largest SKUs per square feet among the three, Walmart generates the least revenue per square feet. In this case, we think that more choices do not result in more customer attractions and more sales of the company. Instead, more choices may lead to more customer confusion than fewer choices provided to the customers in a given area.

Studies have attributed the success of Trader Joe’s to the simplicity and variety it provides to the customer shopping experience¹⁸. Having, in general, less than six options to choose from for any given category, compared with 15 items in traditional grocery stores, Trader Joe’s enables customers to make quick and easy decisions. By Trader Joe’s reduces the number of choices per category, Trader Joe’s carries a broader variety of product, featuring products from all over the world. In sum, Trader Joe’s provides customers with simple but fun shopping experiences.

Also, by not implementing the discount or sales strategies of traditional grocery stores, Trader Joe’s ensures customers that they are buying at the best price at any time and any location.

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¹⁴ https://www.supermarketnews.com/retail-financial/whole-foods-shelves-365-store-concept
¹⁷ https://www.forbes.com/sites/greatspeculations/2019/02/13/walmart-should-benefit-from-higher-comparable-sales-in-fiscal-2019/#6f114e066e0c
simplicity reduces the mental efforts for the customers in seeking for the sales items to optimize the budget. Besides, the crews in Trader Joe’s are trained to support customers proactively, along with the smaller store footprint, the customers are less likely to get lost during the shopping process. In sum, customers in Trader Joe’s are less prone to experience information overload since it offers a more straightforward way for customers to make decisions.

**Ambiguous needs**

Private label brands have been adopted in grocery stores to offer a lower-end selection for the customers. Companies use private label strategies to offer a best/better/good selection of products. However, the traditional grocery stores often offer a discount on their premium brand products, making the price matching the lower-end private brand product. In this case, customers get confused with the real quality of the supposed premium offering. The unclarity in the value proposition and the trade-off between price often confuse the customers in making their purchase decisions.

Several new private label brands, however, have been adding value to the customers rather than merely providing the price incentives. For example, Kroger’s high-end brands such as HemisFares international food features are introduced to compete with premium brands in both quality and price. Whole Foods private label brand 365 provides the customer with a cheaper option while emphasizing on the quality and the source of the ingredients.

Trader Joe’s owns the highest percentage (80%) of private label products among the grocery chains, compared with 30% at Walmart. By carrying a high percentage of private brand products, Trader Joe’s largely eliminates the customer perceptions that national brands are associated with better quality than private brands. Also, by not implementing a sale strategy, it can prevent confusion associated with price vs. quality.

Besides, Trader Joe’s provides a tasting table for customers to make decisions based on real experiences which otherwise customers can only make decisions by simply reading the labels on the package. Along with the trend of healthy diets in recent years, customers have been paying attention to the source and ingredient of the food. Moreover, the customer service and tasting table of Trader Joe’s generate an environment for customers in learning more details about the food they are going to purchase. Trader Joe’s mission statement mentioned, “The mission of Trader Joe's is to give our customers the best food and beverage values that they can find anywhere and to provide them with the information required to make informed buying decisions.” Trader Joe’s aims to provide customers with the product information to help customers make easier decisions through the unique storytelling in the package. Instead of associating the product with brands, the package leads customers to understand the ingredients of the products at a single glance as well as to learn the origin of the food. With more knowledge of the product content, customers can make easier decisions by assessing what product match their needs rather than choosing between brands.

**Product Overlap**

19 [https://storebrands.com/minimize-consumer-confusion](https://storebrands.com/minimize-consumer-confusion)
Traditional supermarkets carry a large assortment of brands of similar products, and it is easy to find similarities in product design and packaging among different brands. In traditional grocery stores, customers differentiate similar products with brand names. On the other hand, Trader Joe’s offers customers unique and proprietary products that they cannot find elsewhere. Unlike national brands focusing on establishing brand images, Trader Joe’s private labels are packaged with appealing narratives or storytelling about these products. The differences from other national brands prevent customers from being trapped in confusion caused by product similarities, and especially, the uniqueness attracts the customers seeking for innovated diet experiences.

Table 4.3 Comparison of customer confusion: Trader Joe’s, Whole Foods and Walmart

<table>
<thead>
<tr>
<th></th>
<th>Product Overlap</th>
<th>Information Overload</th>
<th>Ambiguous needs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trader Joe’s</strong></td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>▪ Featuring diverse products from all over the world</td>
<td>▪ Smaller SKUs/s.f.</td>
<td>▪ High percentage of private label products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Easy-to-navigate store format</td>
<td>▪ No sale strategy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Smaller store footprint</td>
<td>▪ Tasting Table</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Product information displayed on the package</td>
</tr>
<tr>
<td><strong>Walmart</strong></td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>▪ Carry multiple brands for a single product category</td>
<td>▪ High SKUs/s.f.</td>
<td>▪ Lowest percentage of private label brands</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Large store footprint</td>
<td>▪ Confusion of the value proposition with private-label products if the discount strategy is incoherent</td>
</tr>
<tr>
<td><strong>Whole Foods</strong></td>
<td>Medium</td>
<td>Low to Medium</td>
<td>Low to Medium</td>
</tr>
<tr>
<td></td>
<td>▪ Featuring natural and organic products</td>
<td>▪ Smaller footprint stores have lower SKUs/s.f., whereas larger footprint store have slightly higher SKUs/s.f.</td>
<td>▪ Private label “365 everyday” features lower price with high quality</td>
</tr>
</tbody>
</table>

4.5 Discussion
The grocery retailer industry is a highly competitive industry where all three facets of confusion: product overlap, information overload, and ambiguous needs occur. Even though many business reviews have analyzed Trader Joe's strategy in providing fewer options for the customers to prevent information overload, we think that Trader Joe's considers ambiguous
needs (product ambiguity) as an unsolved problem in the grocery retail industry. Consequently, Trader Joe's developed a unique strategy in dealing with this type of customer confusion by coherent private label strategy and product information representation. Both Whole Foods and Trader Joe's have revolutionized the traditional industries by offering fewer options in smaller store footprint. To seek differentiation in the highly competitive market, Whole Foods emphasizes on natural, organic, and high-quality products; Trader Joe's, on the other hand, features diversity, low budget, good-quality products.

In this case study, we summarize some of the strategies that Trader Joe's uses to eliminate customer confusion as below:

1. Fewer options (information overload), more varieties (product overlap)
2. Coherent pricing strategy (ambiguous needs)
3. Tasting table (ambiguous needs)
4. Product storytelling on the package (ambiguous needs)

The full-service sales and marketing agency, Acosta, have revealed that shrinking format and returning to premiumization due to the fading economic recession and enhanced preferences for quality, health, and convenience over price\(^20\). Based on the assumption of the predictions, Trader Joe's has been educating the customers with the ingredients and stories of their products and provide convenience for the customers with customer-centric service. The smaller store size and the smaller number of SKU enables customers to purchase with more convenience and prevent customers from getting lost in the vast assortment of products; the fun shopping experience helps Trader Joe's in developing customer loyalty.

\(^{20}\) https://www.acosta.com/
5  Fitbit

5.1  Company Overview

Fitbit, a wearable devices company founded in 2007 in San Francisco, was once the pioneer of the fitness trackers. It was the leader in the fitness technology to measure the number of steps walked or climbed, heart-rate monitoring and algorithm to assess the quality of sleep. Since 2007, Fitbit has been expanding its product offering by increasing the number of features to match personal fitness metrics on the devices. In terms of applications, Fitbit has expanded the primary market from zip-based devices to fitness trackers, to wristband trackers, to smartwatches. Figure 5.1 shows the family tree of Fitbit products in chronological order, clustered with three device types: smartwatch, wristband, and clip. Fitbit has so far launched 23 wearable products, with nine products active on Fitbit’s official website. Fitbit generally launches new products in every product family every year. As the new products replace the old products, Fitbit usually only displays the most current products the website, although customers can still purchase the older generations from other channels (Amazon, eBay, etc.) However, if there’s a popular product in which the new generation cannot cover some of the features or market needs, the product remains on the website. For example, despite the launch of Inspire HR, Alta HR is now still active for two years on the official website due to the smaller form factor, longer battery life (7 hours vs. 5 hours) and the feature of elevation tracking which has been embraced by the market. Alta, however, has been replaced by Inspire. General speaking, Fitbit products maintain in the market for one to two years depending on the market needs.

Figure 5.1  Fitbit product family tree (same color indicates the same roots of product families), products highlighted in red are currently active products on the official website (May, 2019)

Fitbit had a 71% market share in 2011 in the wearable devices sector. However, their market share currently has decreased to <10% due to fierce competitions from Apple Watch (in the smartwatch sector) and Mi Band (in the wristband sector). Some other players such as Garmin, Samsung, and Huawei have also entered the market, making it harder for Fitbit to gain back the market-leading position. According to the IDC global quarterly report in December 2018, Fitbit’s market share declined, and the shipment decreased from 22.2M unit (2016) to 15.4M
unit (2017). On the other hand, Apple Watch shipment grew by 54% in 3Q18 compared with 2Q18\textsuperscript{21}, while Xiaomi grew 90.9%.

5.2 Revenue Summary

Fitbit reached its top revenue in 2016; however, the revenue decreased drastically (25%) in the following year despite the slight increase in the average selling price per device. According to the annual report from Fitbit, the company goal in 2018 was to tap into the smartwatch market and increase the average price per device by selling more high-end products, such as Ionic. However, the device shipment did not increase as expected due to the competition from Apple Watch series 4. In 2019, the company adjusted its strategy to diversify the market by offering multiple product offerings to increase the shipment, expecting a slight decrease in the average price per device.

![Fitbit Annual Revenue and Device Shipment](image)

**Figure 5.2** Fitbit Annual Revenue and shipment (from 2010 to 2019), and the average price per device (2019 revenue is based on estimation)

5.3 New Products

Fitbit has been expanding its product portfolio by launching new products annually. New products from the same product line integrate improved or enhanced features and specifications. The addition of a product line targeted the demand from other market sectors. For example, the launch of Surge in 2015 was Fitbit’s entry into the smartwatch market, and the product line is the highest-end product line that Fitbit offers with GPS integrated. Two years later, Fitbit added

\textsuperscript{21} IDC worldwide quarterly wearables tracker, December 3, 2018
incremental features such as swim-proof, SPO2 sensors that measure blood oxygen level, and female health check and released Iconic. Therefore, Fitbit stopped selling Surge on the official website started in 2017. Inspire HR, launched in early 2019, are the next generation of the Alta HR. Alta HR has a slightly larger display with slightly higher weight, although both devices are considered as lightweight trackers. In addition to the slight change in the design, Alta HR offers better water resistance, integrated connected GPS, and added incremental features such as female health, guided breathing, manual start/stopping of activities. The Alta/Inspire product family targets the lower-end customers of the tracker sector.

Fitbit reached its highest revenue in 2016 with three new products released to the market in the same year, accounting for 70% of the total revenue by year-end. In 2017, Fitbit launched three new products as well; however, the revenue contribution from the new products was only 31%, showing that the improvement and innovation were not strong enough to attract the consumers. According to the analyst\textsuperscript{22}, 2017 was a year where the wearable devices split into smartwatch and wristbands by the vendors. At the same year, Fitbit released Ionic, a flagship device in Fitbit’s product portfolio, however, wasn’t able to compete over Apple Watch 3 in terms of specifications with its proprietary OS or offer enough pricing incentives. On the other hand, Alta HR wasn’t cheap enough to compete with Mi band in the wristband sector. In 2018, Versa, a true smartwatch, was launched to replace Blaze and help the company grow from the fitness business into the health care business, Fitbit CEO, James Park said in 2018. The three new products released in 2018 contributed slightly more in the total revenue (57%), suggesting the improved impact of new product strategy by launching the right products to target the customer segments.

To halt the drastic decrease in revenue since 2017, Fitbit adopted different product strategies. In 2018, Fitbit was foreseeing the market moving from tracker-based products to smartwatches. The company’s mission focused on selling smartwatches to increase the average dollar per device. Given the smaller audience of Ionic, Versa was launched in 2018 as a solution to address the mainstream smartwatch market. “Fitbit Versa is that this is our true mainstream device from a feature set, design and price perspective. This is a device for us to use as a means to gain a significant market share,” said the CEO in 2018 at an interview with TechCrunch. However, the major share of the smartwatch was taken by Apple Watch, and the strategy did not work as effectively as expected. In 2019, Fitbit adjusted its strategy to diversify its product offerings, meaning not pursuing the increase of average dollar per device, but to offer a set of options targeting from high-end to low-end consumers. By covering different segments of customers using the combinations of new products, Fitbit aimed to increase the revenue in 2019. Fitbit is estimated to launch five products in 2019. In addition to Versa light, Ace 2, Inspire and Inspire HR, reports have been predicting that at the end of 2019 Charge 4 will release to the market.

\textsuperscript{22} https://www.fool.com/investing/2018/03/14/things-go-from-bad-to-worse-for-fitbit.aspx
Figure 5.3 Fitbit number of new products and annual revenue (2009-2019)

5.4 Product Portfolio Strategy

One product strategy vs. multiple product strategy

One of the main factors that caused Fitbit to decline in sales in 2017 is the competition. Both Apple and Xiaomi applied the one-product per year strategy to capture the market share, targeting the smartwatch and the tracker market respectively. Apple used the branding power to outcompete Fitbit, while Xiaomi attached to the lower end market with an aggressive pricing strategy.

Fitbit outlined their mission to emphasize health and fitness, cross-platform compatibility, a connected community of users, and enable longer battery life, which is a critical attribute in evaluating the performance of wearable devices. The company has been adding incremental features on devices. Fitbit now has 30 features presenting to consumers online. However, the abundant features did not increase their competitiveness in the market. In Apple Watch and Series 3 and Fitbit Versa comparison from Wareable, "if you're looking for the most mature wearable on the market right now, the Apple Watch's density in features and strong design make it tough to look past," the analyst mentions. It shows that despite the 30+ features which Fitbit have been addressing on the website, Apple Watch is more well-known for its strength in the features.
In the press release in March 2019, Fitbit has mentioned delivering high quality and affordable wearable products to people of all ages and all activity levels. Therefore they have announced four new products in early 2019: Fitbit Versa Lite, Fitbit Inspire HR, Fitbit Inspire, and Fitbit ACE2. Fitbit hopes to grow the community and provide the user with personalized service on the platform.

5.5 Customer Confusion

To reach broader customer profiles, Fitbit currently uses nine active products on the website to address the needs of various markets. Three of the mainstream products are smartwatches, while the other four products are fitness trackers. As there are 30+ features mentioned on the Fitbit website, customers are likely to be overwhelmed by the number of attributes or features to compare among nine product offerings to make the best decision. After reading all those 30 features, customers are not likely to have the capacity to memorize all the previous features and make comparison cognitively. If customers consider pricing, they have to evaluate and make trade-offs between cost and usability while making their decisions, where information overload is likely to happen.

Besides, the listed features can cause unclarity to the customers in that they don’t know what matters to them, and without personal experience, they couldn’t grasp how the features map to the benefits. Without being educated of why they need the features, customers may find the features irrelevant despite a long list of features.

One strategy that Fitbit utilizes to minimize information overload on the customers and help them find the best products for them is by the “Take the quiz” feature on the website. The three-question quiz will indicate the customers what the best option is for each person. Instead of having a list of 30 features to select from, the quiz asks the customers to choose three features among ten choices which they value most. The quiz can be finished within one minute.

Complimentary to the website, user reviews and recommendations of wearable products among Fitbit product lines are easily found online. More educated customers may click into the reviews and read the pros and cons of each product to select the best options for them.

TechRadar newsletter reviews all the Fitbit available devices (ten products in total) and published—Best Fitbit 2019: which is right for you. It summarizes each product with two pros and two cons, with catchy and easily understood phrases23. The online review is now very crucial in e-commerce since it’s not sufficient to merely look into the company’s website. Customers now are influenced by the experiences of other users and would like to know what are some potential disadvantage they will encounter in using the products.

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23 https://www.techradar.com/news/wearables/best-fitbit-which-is-right-for-you-1322700
Table 5.1 Comparison of customer confusion in wearable devices among Apple, Fitbit and Xiaomi

<table>
<thead>
<tr>
<th></th>
<th>Product Overlap (within company)</th>
<th>Information Overload</th>
<th>Ambiguous needs (Product ambiguity)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apple</strong></td>
<td>Low</td>
<td>Low</td>
<td>Medium to high</td>
</tr>
<tr>
<td></td>
<td>- 4 incremental products</td>
<td>- One product choice</td>
<td>- Detailed specifications and features not easily found on the website</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Summarize to 5 key benefits (Apple Watch 4)</td>
<td>- Provide benefits rather than features/specs</td>
</tr>
<tr>
<td><strong>Fitbit</strong></td>
<td>High</td>
<td>Medium to High</td>
<td>Low to Medium</td>
</tr>
<tr>
<td></td>
<td>- Smartwatch: 6 incremental products</td>
<td>- 9 benefits mentioned in Versa</td>
<td>- Detailed features listed and being compared across products</td>
</tr>
<tr>
<td></td>
<td>- Tracker (wristband): 13 incremental products</td>
<td>- Around 30 features presented on the website per device</td>
<td>- Provide benefits, features and specs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fitbit uses “Quiz” to help customer identify best choice among multiple products</td>
<td></td>
</tr>
<tr>
<td><strong>Xiaomi</strong></td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>- 3 incremental products (Mi Band 4 release in 2019)</td>
<td>- One product choice</td>
<td>- Simple specs and features on the Website since the devices are less complex</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 6 key features displayed (Mi Band 3)</td>
<td>- Provide features</td>
</tr>
</tbody>
</table>

5.6 Discussion

For this case study on Fitbit, we think the primary type of confusion customers are facing is the **information overload**, in which customer feel confused in choosing among the products that Fitbit offers. Also, customers will face confusion caused by unclarity for which attributes benefit them most because they may have no previous experiences in using the features. However, both Apple and Fitbit represent benefits of the devices rather than the features firstly, trying to convince customers of “why” they use the device rather than “what” is on the device. Apple does not reveal too many details of features or specifications on the website, whereas Fitbit addresses the 30+ features to the customer, which may cause **information overload**.

Table 5.1 shows different types of confusion customers face when purchasing the wearable devices from Apple, Fitbit, and Xiaomi from their websites. The diversifying customer strategy that Fitbit is using will lead to customer confusion by increasing the number of options for
customers. On the other hand, the one product strategy that Apple and Xiaomi use, although targeting a merely specific category of customers, will eliminate the customer confusion of **information overload** by offering one choice rather than nine choices. Also, the customer’s tolerance for product feature ambiguity may be higher if there’s only one product option. For example, Apple Watch did not reveal too many feature details on the website, but it still brings far more customer tractions than Fitbit. By keeping the ambiguity of the product features and specifications, Apple can prevent from imposing **information overload** to the customers and keep the price premium by leveraging ambiguity.

On the other hand, if there are more options to select from a company with different combinations of feature sets, customers would desire to learn more about each feature for them to choose the right feature set. Consequently, the company will present more details of the features and specifications on the website, and therefore **information overload** is likely to happen.

However, a user interface with a quiz can help customers choose from multiple product options, and online review articles can reduce **information overload**. Due to the advance of the Internet, customers can easily access the information regarding consumer electronics by browsing the Internet. Customers can often educate themselves with product knowledge, to learn the key metrics of the electronics, and to compare and purchase. More educated customers can, therefore, reduce the **product ambiguity** and help the customer make higher-quality decisions.

As regard to product similarities across brands, since the customer expectation for wearable devices has been shifting since Fitbit first launched the tracker at 2009 and there are fewer players in the market, the top players are trying to find their niche to gain the market share. Therefore, there is less confusion from similarity across different brands.

In sum, we conclude that **information overload** is the most important type of confusion that customers may face in the Fitbit case. Since Fitbit has developed multiple product families to target different customer segments, more product information is required to be shown to the customers to help customers to make quicker decisions with ease. An optimization between minimizing **information overload** and presenting the proper amount of information is thus crucial to create user an easy and smooth purchasing experience.
6 Texas Instruments

The semiconductor industry requires the company to continually develop new products so that the chips they provide can support the launch of the customers’ project schedule but also the performance requirements. The product development cycle can range from 6 months to 2 or more years depending on the application of the customer. For example, a new power converter IC has been released every year to match the release-to-market schedule of customers’ laptop products. On the other hand, it may take more than two years for a company to develop a digital signal processor (DSP) for an automotive Tier 1 company.

6.1 Company Overview

Texas Instruments (TI) is one of the leading companies in the semiconductor industry, possessing the broadest product portfolios compared with its competitors such as Analog Devices, NXP Semiconductors, STMicroelectronics, Maxim Integrated. Although the wireless products formed 18% of revenue in 2012, TI announced to exit the personal mobile market by stopping the investment in OMAP, a system-on-a-chip solution (SOC) product line for the mobile phones and tablets, foreseeing the design of the SOC may be taken away by their large customers. Instead, TI aimed to shift focus from integrating digital, analog, and RF signal processing onto a chip to specializing in embedded processors, seeking to invest in the applications with longer life cycles. In 2018, the analog and embedded processor ICs had generated more than 90% of the total revenue of the company, among which the analog IC accounted for 68% of the total revenue. According to the IC insights report in 2018, TI had the highest market share in the analog IC (18%).

During the past six months, TI has launched 187 new products, representing 1.06% of the current total products. Despite having a vast product portfolio to manage, TI still deems the broad portfolio of differentiated analog and embedded processor products as its advantage according to their 2018 annual report.

Due to the diversity of TI’s products, TI faces different competitors in different product categories. One of TI’s competitor in the analog IC is Analog Devices (ADI), which also has diverse categories of products and ranked No. 2 in the Analog IC market share (8%). ADI launched 73 new products in the past six months. Table 5.1 captures the product information from the websites of TI and ADI. In 2018, TI generated $15.8B of revenue, which was around 2.5 times of ADI’s revenue ($6.2B); likewise, the number of new products that TI launched in the past six months (187) is 2.5 times more than ADI (73).

| Table 6.1 Revenue and number of new products comparison between ADI and TI |
|-----------------------------|-------------------|--------|---------|---------|---------|
| Company                   | 2018 Revenue ($)B | # of New Products during the past (Mar. 2019) |
|                           |                   | 2 week | 1 month | 3 month | 6 month |
| Analog Devices            | 6.2               | 6      | 9       | 27      | 73      |
| Texas Instruments         | 15.8              | 4      | 9       | 82      | 187     |

Note: Data extracted from company website
6.2 Mental Model in New Product Development for Server Boards

Although the semiconductor industry is a highly customer-centric industry, the product development cycle time is not merely determined by their customers; instead, it involves several stakeholders. Take the product development of power chips in the server boards for example. TI developed chips to provide power to the server boards that are designed by the Original Design Manufacturing (ODM) customers such as Quanta, Wistron, and Inventec. The mainstream server boards are utilizing the core chip and the architecture that Intel develops, and the power chips that TI produces support the CPU, DDR, and system power. The server boards are then provided to the end customers such as data centers or the brand-name enterprise server companies such as HP, or Dell. However, unlike Intel, TI is not the only supplier that has the technology to provide the power solution for the server board. Several players such as Infineon, Intersil, and Fairchild have been investing resources to gain share in the server market due to the growth of data centers and cloud computing.

Figure 6.1 Interactions of stakeholders in developing new core and power solution chips for enterprise and datacenter servers

Figure 6.2 Timeline of core chip & power chip product development for Intel Purley server boards
Figure 6.1 illustrates the interactions between each stakeholder during the development of a server board. The processes can be simplified into the following six steps:

(1) Core chip provider and End customer:

Intel works closely with their end customers (datacenters, OEMs) in understanding the future needs of the server systems to define the specifications of the chip.

(2) Core chip provider and Other power chip solution provider:

Due to the partnership, Intel cooperates with different chip providers, including IC vendors for power, interface, embedded processors, to generate a reference design for their proposed platform. The ODM customers will further use the reference design in designing their projects.

(3) End customer and Customer:

The end customer (OEMs, datacenters) starts discussing with the customer (ODMs) on their requirements on the server boards and the schedule. The project will then officially kick-off in the customer side. R&D engineers start to design the server boards and contact various chip vendors.

(4) Power solution chip provider and Customer:

Without any released-to-market products to support customers design, power solution chip providers work with the customers to design their chips on the customer projects and optimize the quality and performance of the chips via several validation builds. The chip provider usually undergoes an average of 3-5 tape-outs, the point at which the graphics of the photomask being sent to the fabrication facility, to optimize the circuit design.

(5) Core chip provider and Customer:

The R&D engineers in the customer company would maintain contact with the core chip provider (Intel) to get updated requirements of the architecture and feedback on potential issues on the suggested design.

(6) Customer and End customer:

The test result of each validation build from the customer is presented to the end customer for reference, making sure that the specifications meet their expectations.

Facing fierce competition in the market, power solution chip providers adopt several strategies to strengthen the link in the stakeholder diagram and to win the market share. Some strategies include:

**Early engagement with core chip provider (Intel) to be on the reference design**

Since leveraging the reference design requires the least effort for the R&D of the customers to design a server board, having the chips on the reference design increases the chance that the customer adopts the power solution chip on the project. It also reduces the efforts of the sales engineers to persuade the customers to select their solutions. However,
it requires the power solution provider to engage early with Intel for the cooperation. Therefore, usually, the chips with a more market-dominant product are more likely to be selected in the reference design for the next generation. For example, Infineon’s power solution was widely adopted on the VR12.5 server boards on the previous generation Grantley platform. Therefore, Intel chose Infineon’s power solution as the Purley Neon City reference design, one of the earliest Purley reference design released by Intel.

**Optimize the product through each customer design validation**

For both the incumbent provider that is on the design of the previous server board and the newcomer, it is very crucial to utilize the chances of customer validation build to enhance their IC performance on the server system. As the power performance being the top concerns in the server boards design, it’s essential that the providers prove the best performance during each validation. The decision makers on the customer side would use the result of the performance as an indicator of whether to adopt the power solution when their product releases to market.

**Influencing the end customer**

In some of the cases, the end customer owns more decision power of the server board than the customers. For example, they may obtain a better deal with the power solution chip provider and assign the vendor directly. In this case, it is more crucial for the power solution provider to work directly with either the OEM or the datacenters to address influence on their decision-making processes.

In 2013, Intel launched its core chip solution for Grantley platform, as the standard architecture for efficient to optimized performance server boards, and defined the next generations platform as Purley server. With a product cycle of four years, Intel Purley platform was launched in the second quarter in 2017. Using Skylake CPU and Lewisburg PCH, Intel has defined new power specifications (VR13) to support the power system in the Purley platform.

Figure 6.2 shows the timeline of the chip provider and the customer (or the server board manufacturers). The chip providers started the product design before the customer started their pilot project. Once Intel defined the VR13 power specifications, the power solution providers, such as TI, Infineon, Intersil, and Fairchild began to developing their chips to meet the power specifications and working with Intel to be chosen in the reference design. As soon as the Intel reference design for Purley server, code name Neon City released, the customer started to design and build the server boards. Meanwhile, the power solution chip providers had to develop prototypes based on both Intel VR13 requirements and customer needs, reviewed the circuit and layout design of the server boards, and ensured their samples being delivered to customers manufacture sites before each validation stage.

Typical ODMs undergo three validation processes: engineering validation test (EVT), design validation test (DVT), and production validation test (PVT) before mass production (MP). Therefore, the power solution chip providers had to utilize each build to validate their performance on the server board system, to fix the potential bugs or to optimize the performance to outcompete competitors. So the customer would provide the test boards to their end customers for double verification.
Often, the customers would request the power solution chip providers launch their chips before the MP of their projects. In this case, they could ensure that the end product delivered to the end customers were using the mature, and stable products with guarantee. Also, TI launched the VR13 power solution in the fourth quarter of 2016, prior to the launch of Intel core chip in mid 2017.

6.3 Focus on Industrial and Automotive Markets

The product development cycle of power chips for server boards is highly driven by several ODM customers, and the product development cycle is 3-4 years. Customers designing next-generation server boards or server platforms with different architecture will force IC vendors to develop new chips accordingly. From 2014 to 2018, a steady 6% to 7% of TI total revenue came from the enterprise customers, mostly are server board manufacturers.

Considering long term profitability and stability, TI strategizes to diversify the applications of the customer base and invest in market segments with longer product life cycles, considering there are more intrinsically diverse applications in the industrial markets. In the annual goal of 2013, the CEO, Rich Templeton announced to shift the focus to industrial and automotive markets, which accounted for 37% of the revenue in 2013. In 2018, the revenue of industrial and automotive combined has reached 56% of TI total revenue (Figure 6.4).

With a diversity of applications and less pressure in launching new products to the market, the industrial or automotive customers often select the solutions from the existing product portfolios. Also, industrial and automotive customers are less price and time sensitive compared to consumer customers. Therefore, industry and automotive customers do not often drive IC vendors to tailor an IC with specific functionalities or to meet a certain price point.
6.4 Digital Marketing in the Semiconductor Industry

How can the customers choose from a broad product portfolio? Moreover, how did TI capture opportunities among the diversified customers following the growth of the industrial and automotive market?

The prevalence of the Internet has changed how the customers access information, and accordingly, it has changed the way semiconductor companies market and sell their products. Customers in the semiconductor industry, like the consumers, are turning to the easy-to-access way when they search for a new product. According to the Design Engineer and Supplier Interface Study in 2014 on the design engineers, 56% of the design knowledge comes from online resources. Also, CEB research has found that 57% of the purchase process has been done before sales engagement thanks to the Internet. It is therefore crucial for the companies to generate a library of technical information, optimize the digital marketing content and establish strategies to reach out and monitor the 57% of the process and to guide the customers in the individual-search process.

| Industry/trade magazines – digital | New technologies 21 | New product information 16 | "How-to" design information 8 | Industry news 31 |
| Industry/trade magazines – print | 17 | 15 | 8 | 24 |
| Search engines – general | 12 | 11 | 16 | 9 |
| Conferences – in person | 9 | 11 | 5 | 4 |
| Face-to-face meetings with suppliers | 8< | 11 | 6 | 2 |
| Industry/trade websites | 7 | 5 | 6 | 9 |
| Vendor websites | 6 | 11 | 15 | 2 |
| Distributor websites | 5 | 9 | 5 | 4 |
| Search engines – industry-specific | 5 | 4 | 5 | 4 |
| Your peers | 3 | 2 | 13 | 3 |
| Conferences – virtual | 3 | 2 | 3 | 3 |
| Webcasts | 2 | 1< | 5 | 1 |
| Social media | 2 | 1 | 1 | 2 |
| Videos | 1 | 0 | 4 | 1 |
| **ONLINE TOTALS** | **43%** | **46%** | **56%** | **36%** |

Figure 6.4 Methods and resources distribution of information access of design engineers

From semiconductor company’s view, focusing in digital marketing, such as enriching and organizing the Web content and optimizing search engine will help companies to reach out to the diversified customers without sending sales representatives for a door-to-door visit. Meanwhile, it requires less application-specific training for the salesperson to communicate with the customers. Therefore, semiconductor companies have been shifting the battlefield from physical customers visits to the Internet. Some semiconductor companies recruit their digital marketing teams and update the contents; while some other companies choose to work with 3rd parties. For example, Fairchild Semiconductor, a pioneer in transistor and integrated circuit manufacturing has been working with the Mx Group to improve Website conversion.

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6.5 Web Tools to Guide Selling

To use Web page as a method to guide customers in the decision-making processes before the engagement of sales engineers, Texas Instruments has developed several Web tools to support the R&D engineers in different stages of the design process.

(1) Starting to design a brand-new application

At the very early stage of the design process, either before or after the project kick-off in the customer’s company, R&D engineers are likely to be asked by the procurement team to roughly estimate the BOM cost of the project and evaluate the feasibility of the project. In this case, engineers start to research the components relevant to the design. Usually, engineers face ambiguity resulted from the lack of details in system requirements, the technical knowledge, and previous experiences in designing the new application (if the project is not an extension of the previous designs). These factors generate customer confusion caused by ambiguous needs.

Furthermore, there may be tens of chips with different functionalities to select. Customers usually face information overload for a large number of attributes to consider within a huge IC selection pool. In most of the cases, the customer will firstly search the products that have been used previously from the company’s system to eliminate the efforts of documentation and logistics. On the other hand, using a previously-used product may enhance their confidence level of the product. Engineers may sometimes face the pressure from the sourcing team to select the chips that are in the solution pool so that the procurement team can negotiate a better price with the vendor by increasing the purchase volume.

To cope with customer confusion and guide customers in the product research stage, TI offers Web tools to browse products from the application’s view. Customers can search the reference design of various applications, from personal electronics to automotive, where TI has already picked and recommended the product for the customer. The reference design will eliminate the cognitive load that the customer may experience when choosing multiple products with various functionalities, decreasing the effect of information overload. Also, every reference design comes with the design guide, giving more details of the system knowledge that the customer may lack to design their projects. The additional information fills the technical gap of the customers, reducing the confusion caused by system and knowledge related unclarity.

At this early design stage, TI has more influential power in the customer design, since the schematics have not been fixed. If the customers obtain the proper product information, chances that they purchase the product increase. Also, it’s even more likely to sell more than merely one product on the customer’s application since the reference design provides a total solution by using the combination of different TI products.

(2) Finding a product for the current design

When customers are developing incremental features on their projects, they often leverage the schematics from the previous design and make slight changes or additions. This stage occurs in the middle stage of the design process, and customers would seek for chips dedicated to specific functionality and meet particular system requirements. However, customers usually face information overload generated by a large number of choices online.
As the requirement or the purpose of the chip is clear, it is essential for TI and other IC companies to make clear hierarchy search and categorization of ICs, so that customers can easily search the product themselves through browsing the Web.

Also, given the critical product specifications are already known by the customers, TI provides selector tools that enable the customer to filter the specifications that are critical to them and find the exact match.

At this stage, TI still has high influential power to phase in the product in the customer’s design. However, there may be fewer chances to sell other chips to the project and change other designs on the schematics that were already fixed in the previous project.

(3) Finding a replacement for an existing product

More often than not, the customer tries to find a substitute for a chip they are using for several reasons: 1) the pressure from the procurement team due to pricing issues, 2) the previous validation test proved that the chip could not work on the system, or 3) requires a 2nd source of the chip for sourcing purpose. It usually happens in the late stage of the design, when the schematics have already been fixed (or almost fixed), even sometimes during the PVT (last validation test). In this case, the customer usually has the least flexibility to undergo any design change.

R&D engineers may go online to search from a large pool of ICs and find a lot of similar products, in which they encounter the confusion from information overload and product overlap.

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Customer confusion</th>
<th>Engineer familiarity with the product</th>
<th>Web tools</th>
<th>Design stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting to design a brand new application</td>
<td>Ambiguity, Information overload</td>
<td>Usually Low</td>
<td>Reference design by applications</td>
<td>Early</td>
</tr>
<tr>
<td>Finding a product for the current project</td>
<td>Information overload</td>
<td>Mid/High</td>
<td>Product search by product category, product selector/filter tool</td>
<td>Mid</td>
</tr>
<tr>
<td>Finding a replacement for an existing chip</td>
<td>Product overlap, Information overload</td>
<td>High</td>
<td>Cross-reference search</td>
<td>Late</td>
</tr>
</tbody>
</table>

TI developed the competitor cross-reference search tool that enables customers to enter the part number of the IC that the customer wants to replace and the result would come out with a suggested TI product indicating the level of similarity between the two products. Customers can know the degree of similarity between the two products without reading thoroughly in each
The search tool can not only save the efforts of the customers in browsing from a massive data library, but also enable customers to make quick decisions in the late stage of their design.

Even though the customers have the technical understanding of the products, it’s not sufficient enough for the customer to make a purchase decision. Lacking previous experiences in using the product in their project or trust in the brand are some reasons why customers don’t usually make a purchase right away. In this case, many semiconductor companies offer design and simulation tools to give the customers a picture of how the chip will operate in the system. For example, WENBENCH is an ease-of-use design tool to help customers to create custom circuits. It was initially designed by National Semiconductor which was later acquired by TI in 2011.

To enhance the customers’ confidence level in using the product, semiconductor companies usually lead the customer to order the EVM or samples via the website after the customer chooses a specific product to browse. With the hands-on experiences in designing the chip, the customers have committed time and efforts to learn about the technical details of the chip. As long as the EVM test result shows the feasibility in customers’ use case, the trust increases, and therefore the chance of purchase also increases.

Both the and design tools and EVM/sample request tool help to reduce the ambiguity-related confusion by gaining customer trust with the brand and empowering customers with the technical knowledge to design their products.

6.6 Discussion

In this case study, we think that the main problem that customer faces is ambiguous needs. The ambiguity comes from process unclarity, product unclarity, or contextual unclarity. Even though R&D engineers are the people in charge of searching a new product, they face process ambiguity since they are not the only decision maker of the purchasing procedure, while procurement, supply chain management team and their supervisors may have more power in the decision-making processes.

Another type of ambiguity that customer often face is the product unclarity. The product ambiguity is the unclarity of the product requirements that occur initially in the design phase, sometimes due to the confidentiality of the project. The unclarity will cause further confusion to the customers when choosing the right component for the design. Without knowing the system requirements, customers were unable to find the best product that meet the needs.

The ambiguity confusion causes customers to make lower quality decisions. Therefore, one of the jobs for a salesperson in the semiconductor industry, TI, for example, is to assist the customers in the decision-making processes by finding the critical decision makers and engage with customers and end customers to ensure the product specifications meet the system requirements. In sum, customer support helps the customers to make easier decisions and expedite the decision-making process.

Having strong product position in the semiconductor industry, TI is not shy in having a head-to-head comparison with competitors and makes efforts in educating the customers to be more knowledgeable by the training videos, free design tools, and frequent seminars, believing nowadays R&D engineers are doing more self-training online to enhance their technical skills.
TI also releases the datasheet of most of the products, make it downloadable on the website, while some of the vendors only provide datasheet when being contacted.

Releasing all the product information online generates transparency of the products but meanwhile imposes *information overload* on the customers. Companies may be able to learn from customer activity on the website to identify whether the customers need more or fewer details in enabling them to make decisions. For example, a customer that downloaded several datasheets may suggest having less tolerance in ambiguity; and more detailed product information would help the type of customers in making decisions. On the other hand, customers using the cross-reference tool on the website can be identified as the customers who prefer fewer details to make decisions. However, it is only with the combined support of the sales engineer that a company can truly understand the proper level of product details to be shown to each customer. However, in general, by assuming that educating the customers with the Web contents can cultivate more knowledgeable customers, and knowledgeable customers are less prone to experience *information overload*, TI aims to inform the customers with rich Web content.

As the semiconductor industry is a highly competitive market, similar products can easily be found across competitors, causing customer confusion. Although some companies still thrive on making differentiated products to provide more values to the customers, often the product uniqueness is not perceivable or not having as much attraction to the customers. In this case, the customer support and the brand image impact a great deal in the customer decision-making process. Some factors include the quality of technical support for customers, relationship and negotiation with the procurement team, and the supply stability. The customer ecosystem is how companies differentiate from each other despite the high similarity products.
7 Discussion

Hypothesis 1: Customers in different industries face different types of confusion. We assumed that the main problem in grocery retailers is product overlap, in consumer electronics is information overload, and the semiconductor industry is ambiguous needs.

In previous chapters, we have discussed three types of customer confusion in each case, along with the comparison with competitors. We found that Trader Joe’s identified the ambiguous needs as a significant problem in the grocery retail industry and established a unique strategy in coping with this type of confusion. Although information overload is a typical customer problem during purchase, many other companies, such Whole Foods, are solving the issues by offering fewer SKUs for the customers to choose from and a smaller store footprint to enable easier navigation.

The Fitbit case suggests that more product offerings, though targeting a diversified customer base, can cause customer confusion by information overload. Fitbit presents 30+ features on the website to the customers for a single device, with nine available products on the website. Compared with Apple and Xiaomi, which only have one mainstream product on the site with no more than six benefits or features to convey to the customers. Customers that choose products from Fitbit’s website need more time and cognitive resources in evaluating the options.

In the Texas Instruments case, the most significant problem that customers face is the confusion from the process and product unclarity. Multiple decision makers are usually involved in the process, and system requirements are needed for selecting the right product for the design. The complexity of the decision-making process often hinders customers from making an easy decision.

Hypothesis 2:

We hypothesize companies in different industries adopt different strategies in coping with the largest confusion problem identified in Hypothesis 1. In the grocery retail industry where product overlap is the most substantial problem, companies often differentiate from competitors via high quality or organic product offerings. In the consumer electronics industry, where the purchasing process is mostly done in e-commerce, some companies adopt a one-product strategy or present fewer specifications online to prevent customers from information overload. B2B companies, where several decision makers are involved in the purchase process, rely on sales representatives to communicate to the customers, ensuring that customers make easier decisions by reducing the ambiguity of the decision-making processes.

From the case studies, we figured out all three domains of confusion defined in this study occur in each case. Figure 7.1, 7.2, 7.3 summarize the cause of each confusion type mapping to the relative strategies the company adapt to eliminate the effect.
In the highly competitive grocery retailer industry, customers face brand similarities and information overload for a large assortment of choices. Moreover, the incoherent discount strategies often make the customer confused about the quality of the products they are purchasing. Trader Joe’s prevent the customers from experiencing the confusion by reducing the number of choices and the size of the store but enhancing the diversity and uniqueness of the product which customers may not be able to find elsewhere. Without discount strategies, customers make easier decisions by focusing on seeking the best quality products than the occasionally on-sale products to optimize their budget. The strategy decreases the cognitive load of the customers in making purchasing decisions, enabling customers to make easier decisions without taking price into the complicated evaluation process. Also, the non-sale strategy allows customers to focus more on the ingredient and the origin of the product, and therefore being able to figure out themselves what the key attributes they care most in each decision process.

Figure 7.1 Trader Joe’s mental models resulting in customer confusion and company strategies in reducing customer confusion (*indicates the most important problem identified in the case study)
In the Fitbit case, we concluded that **information overload** and ambiguity are experienced more by the customers than **product overlap**. The wearable technology has a shorter development history than other mobile electronics for the popularity started around 2002 when Bluetooth headset released. Since then, they have only been several players in the market with the changing customer expectations on wearable devices. Therefore, the key players are trying to find differentiation from other competitors in terms of value proposition, and the confusion of **product overlap** is not as severe as that in the grocery retail industry. Fitbit differentiates itself by the platform and community strategy and diversifying the customers base, along with the product strength in battery life.

The strategies to differentiate with competitors cause customer confusion: The diversifying strategy, however, may cause customer confusion in having more than one choice to evaluate. With that, Fitbit helps customer to determine the best product for them by taking a simple three-question quiz online. On the other hand, by increasing the health and fitness software features, customers may find it challenging to identify which matters to them most without using the device in person. This feature unclarity makes the customer confused in the purchasing process. Thanks to the rich product evaluation articles over the Internet, customers can try to reduce the product unclarity based on other user experiences. In this case, user experience and review play a significant role in customer purchasing behavior, and Fitbit and other companies who generate the most revenue from e-commerce should ensure the online review align with their company strategies.
In the third B2B case of Texas Instruments, with high competitions and more extended development of the semiconductor industry, high similarity of products can be easily found across companies. Top players often differentiate themselves with higher quality or with a better cost structure. With the product strength, TI is very transparent in a head-to-head comparison with competitors assuming customers are educated enough to make a fair and right judgment. While the abundant product offerings and detailed specifications are published online which may bombard customers with too much information, TI released online tools, reference designs, training videos to help customers choose the right products.

Another differentiation strategy that TI uses to outcompete other companies is by offering reliable customer support of the customer eco-system and making communications in a feedback loop to reduce the ambiguity that customers may face during the decision-making process. In this case, where decision makers involve multiple stakeholders, customers are most likely suffering confusion from contextual ambiguity. The customer support from the vendor helps customers in resolving the process and product specifications oriented unclarities and therefore helping customers in making easier decisions.

Customers from the three case studies face confusion from all the three domains: **product overlap**, **information overload**, and **product ambiguity**. Moreover, the three companies applied different strategies in eliminating customer confusion. However, one similarity that we found in those cases is reducing product noise by providing more product information to customers.

In three of the cases, we found that Texas Instruments are assuming customers are becoming more knowledgeable and Trader Joe’s targets the customers that are willing to learn about a variety of products, and they both make efforts in educating the customers with more product knowledge. A study has indicated that product noise reduces the sensitivity of consumers to
small differences in product attributes (Gabaix et al., 2004). With a strong product offering and more knowledgeable customers, companies with high quality and low production cost can ensure that the customers perceive and value their quality or performance of the product over competitors. Meanwhile, educated customers are less likely to experience confusion caused by unclarity and information overload. In the Fitbit case, if the customers find the feature descriptions on the company Website are not sufficient, they will usually go through technology/product review articles to fill the knowledge gap. By filling the technical or product knowledge gap, customers can become less confused even if there are multiple options to evaluate.

Also, we observed that companies having a broader product portfolio are more likely to present more detailed product information on the website. The mental model of the company assumes that more product choices provided to the customers may lower customers’ tolerance in ambiguity, and therefore, more product information will help customers in evaluating the options. In Fitbit’s case, more product offerings cause Fitbit to represent more detailed product information on the website, whereas the competitors (Apple and Xiaomi) do not need to present detailed specifications to facilitate customers in the decision-making processes. Despite having a large product portfolio, Texas Instruments provides downloadable datasheets, comprehensive features, and specifications for each product.
Figure 7.4 System diagram of customer confusion and company strategies for a) Type A: customers with prerequisite product knowledge, b) Type B: self-learning customers without prerequisite knowledge, and c) Type C: customers without prerequisite knowledge and are less willing to acquire new knowledge.

We built a system diagram to show how the three types of confusion relate to company strategies (Figure 7.4) based on the case studies from Fitbit and Texas Instruments. We found that in a competitive market, companies often first focus on dealing with customer confusion caused by product overlap. To differentiate from competitors to gain share in the market, some companies develop more products to target multiple customer segmentations (Fitbit). Some companies differentiate themselves with more better-quality products (Texas Instruments). As the number of product increases within the company, companies often present more details (including features and specifications) of their product offerings so that customers can make purchase decisions.

Type A customers: customers with prerequisite product knowledge or experienced customers

In an ideal condition where the customers are more knowledgeable or more willing to be educated, the detailed information will help customers self-learn and understand what attributes matter most, further reducing the unclarity. With knowing what attributes matter to them most, the educated customers are less likely to experience information overload (Figure 7.4 a).

Type B customers: self-learning customers without prerequisite product knowledge

However, not all the customers have the prerequisite knowledge to understand what attributes are essential to them. For those customers with less product or contextual knowledge, they may often find being bombarded by the excessive amount of information, experiencing a higher level of information overload. In this condition, a new company strategy needs to be applied to alter the internal mechanism. For example, even though a first-time smartwatch user doesn’t have previous experiences in having one, third-party review articles online can help them get a quick summary of pros and cons of a selection of Fitbit products. The customers can learn quickly within a paragraph the key attributes and the level of attributes for a smartwatch. As the product ambiguity reduces, the level of information overload decreases. Another strategy that companies often use is to turn the Type B customers to Type A by putting relevant technical contents on the website. Customers can also learn critical attributes of the product by learning the fundamental principles of the product.
However, the online training materials, if excessive, may cause side effect like information overload. Some companies, especially B2B companies like Texas Instruments, provide sales support to customers so that they can help customers in identifying their key concerns mapping to the proper products for them, reducing the information overload.

Type C customers: customers without prerequisite knowledge and are less willing to acquire new knowledge

The third type of customers defined in the study is the customers who don’t have the product knowledge required for product evaluation and are, for some reasons, less willing to acquire more knowledge. Some of the reasons for the reluctance of learning the technical or product knowledge can be time pressure and too high barrier in catching up the technical information. For example, when facing a project deadline, an R&D engineer may not have the resource to select a solution from an unfamiliar pool of chips by self-learning. Therefore, in this scenario, sales or technical support directly from the company will be very crucial in decreasing the information overload for the customers.

Hypothesis 3:

In hypothesis 3, we assumed that B2B companies often fail to grasp how confused their customers are, compared with other industries such as consumer electronics and grocery retail industry for the longer product development cycle. Retailers like Trader Joe’s can use the unit product sold as a metric of customer attraction and make a change on the shelf products from time to time to best meet customer needs. Consumer electronics companies that rely mostly on e-commerce can analyze user behavior on the website as an indicator of customer attraction. From the case study of Texas Instruments, we found that customer attraction or purchase behavior cannot be easily analyzed due to the complexity of the decision-making processes. That is, the decision is not only determined by the person who searches for the product (usually the R&D engineers), but also by the procurement team. Also, the purchase cannot complete through the website but rather, through distributors in most of the cases. The ambiguity of the purchasing process made it difficult to create a feedback loop from customer behavior to the product information that the company presents.

However, as a leader in the semiconductor industry, Texas Instruments, and other companies as well, provide customer support to the customers while keeping track of the customer decision making processes. By maintaining the customer relationship and timely checking on customer projects, TI can learn the feedback from the customers whenever there is any confusion from the customers. In this case, whether or not the company can resolve customer confusion in time depends on 1) the relationship with the customer and 2) how closely the company or sales representative follows customer projects.

In sum, whether B2B companies capture how confused their customers rely on whether a strong customer support eco-system surrounds the customers. However, the feedback from the customer support can be more accurate than the other two industries: consumer electronics and retailer, since direct customer interview is more accurate and specific than using the data as an inference for customer confusion.
8 Conclusions

Companies often use product portfolio expansion as a strategy to meet the customer needs and gain share in the market. However, companies often overlook the side effects on customers when applying the new product strategy. As the number of product increases, customers encounter information that causes confusion, which affects their decision-making processes. In this study, we discussed company strategies in developing and presenting incremental products in the competitive market and the corresponding customer confusion by analyzing three cases from three different industries—retail, consumer electronics, and semiconductor. We chose Trader Joe’s, Fitbit, and Texas Instruments in the study for they are among the top five players in their industries respectively.

We defined three types of customer confusion—**product overlap, information overload, and ambiguous needs** in our study and analyzed how the company mental models map to each type of confusion.

We think that ambiguity caused by product unclarity is a common problem in grocery retailers, where traditional grocery stores often use incoherent “on sale” strategy that confuses customer perception of the quality of national brands and private brands. Instead, Trader Joe’s solves the problem and increases simplicity in the purchasing experience by carrying more than 80% of private-labeled products and applying the “no-sale” strategy. Another strategy that Trader Joe’s uses to reduce the **product ambiguity** is by emphasizing the origin and ingredients in the package and advertisements.

For consumer electronics, which has the highest online sales in U.S. e-commerce according to a report from eMarketer, we conclude that **information overload** is the most significant problem from Fitbit’s case. With a company strategy to diversify the customer base, the number of products increases each year, making it more difficult for customers to make decisions compared to Apple and Xiaomi, which launch only one new product per year. Fitbit solves the problem by using three-questions quiz online to help the customers find out the right product for them.

In the semiconductor industry, customer confusion is rooted mainly from the complexity of the decision-making process. Some factors for the contextual ambiguity are multiple decision makers, unclarity in the purchase process, unclarity in the system specifications and requirements by end customers. Texas Instruments provides rich web content from reference design guide, product introduction to cross-reference tools to help customers fill in the technology gap to choose and design the right product for their projects. More importantly, TI focuses on sales and technical support in solving the ambiguity, both product and process-related, so that customers can make faster and easier decisions.

From the case studies, we propose three system diagrams of company strategies in relations to three types of confusion by defining three types of customers. Customers are segmented based on their product knowledge or experience and the willingness to acquire new knowledge.

Generally speaking, in a competitive market in which the product cycle is less than two years, companies often want to seek differentiation with other products in the markets to reduce

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customer confusion in the perception of **product similarity**. Therefore, more products options with incremental features are developed, resulting in more features and specifications presented to the customers. More product information generates **information overload** meanwhile decreases ambiguity. However, different types of customers experience a different level of confusion. That is, experienced customers (Type A) are less likely to feel overwhelmed by a larger number of options and attributes (**information overload**) and understand which attributes matters to them most (**ambiguous needs**). Assuming all the customers are Type A customers, presenting more detailed features and specifications generates an overall positive impact in the decision-making process because of the reduction of ambiguity.

However, Type B: self-learning customers without prerequisite product knowledge and Type C: customers without prerequisite knowledge and are less willing to acquire new knowledge are playing essential roles in a business model. Some companies publish more educational information to help the customer gain technical knowledge and understand the critical attributes in choosing a particular product. For example, Texas Instruments host technology day occasionally to educate customers the fundamentals of how different motors work so that customers can choose a proper motor controller with the knowledge. Similar contents are posted on the website and are accessible through the Internet. A person who had never had a smartwatch before may read the online review article to learn the pros and cons of each watch in the market in a short period. By filling the technical gap for the product evaluation, customers know the key attributes or how to evaluate the product, and consequently, the more knowledgeable customers are less likely to experience **information overload**. Also, direct customer support helps customer to decrease the **information overload** further. Some companies, such as Texas Instruments, have been trying to train the Type B customers to Type A, minimizing the customer confusion and increasing the quality of customer decisions.

Type C customers require the most direct sales and technical support from a company since they do not have the resources (technical ability or time) to acquire new information to make easier decisions. Sales representatives can help them in identifying the best product with the minimum resources they need. Despite that the sales support may be merely assistive for Type A and Type B customers, it can enable customers to make faster decisions and get close feedback from customers with human interaction. Therefore, the quality and efficiency of customer support are crucial in the context where the decision-making processes are complex, involving multiple stakeholders. While big data and machine learning may provide some insights into customer behavior, the importance of sales support in B2B is significant, and companies should address customer support in making company strategies.

We have identified several strategies that companies apply to reduce customer confusion in the competitive market successfully. Future work may include research on how to define metrics and identify each type of customers based on massive customer activity data. Customer activities on the website may serve as the data source in identifying different types of customer defined in this research. By segmenting customers into different categories, automatically generating alert to a sales representative when unsolvable customer confusion is detected, the salesperson can optimize their resource distribution and provide the customer support more effectively based on the understanding of customer behaviors. Seamless integration of data in customer support can help companies to deploy their sales resources effectively.
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