

Identifying the Gap between Consumers with Down Syndrome and Apparel Brands

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Abstract—The current adaptive clothing brands are limited in numbers and specific categories. This study explores clothing challenges for children with Down syndrome and factors that influence their perception of adaptive clothing brands. Another aim of this study was to explore brands' challenges in the adaptive business and factors that influence their perceptions towards the adaptive market. In order to determine the market barriers affecting adaptive target market needs, we applied Technology Acceptance Model. After interviewing and surveying parents/caregivers having children with Down syndrome and current adaptive brands, the results found education as the significant gap in the adaptive clothing market yet to be overcome. Based on the finding, several recommendations were suggested to improve the current barriers in the adaptive clothing market.

Keywords—Adaptive fashion, disability, functional clothing, clothing needs assessment, Down syndrome, clothing challenge.

I. INTRODUCTION

CLOTHING challenges related to fit, function, and style affect every population to a varied extent. Clothing is considered one of the basic human needs [1]–[4]. For many people, the ability to independently choose dress is of key importance; however, for individuals with disabilities, clothing options may be quite limited [3], [5], [6]. Adaptive clothing that is especially designed for individuals with disabilities, is an alternative option [7], [8]. Historically, the main purpose of adaptive clothing is to “allow individuals to achieve aesthetically normative style of dress while still incorporate functional elements that facilitate independence in activities of daily living” [7]. Such dresses sometimes lack aesthetic and expressive considerations [1] since they have function-driven designs, and therefore, sometimes result in unintentional stigmatization. Although, individuals with disabilities may get the option purchasing custom tailored clothing, it may be cost prohibitive [9].

A secondary clothing limitation is the lack of adaptive clothing awareness and education for individuals with disabilities [10], [11]. This may occur due to the lack of user’s awareness or adaptive clothing brands may not be adequately informed of market needs, resulting in frustration on both ends [3], [9], [12].

There is a growing demand [13] for adaptive clothing. The global market for adaptive clothing is expected to reach \$400 billion by 2026 [14]. A few apparel companies have been working on filling-up this gap and offering clothing from a

universal design perspective that would suit individuals of all ability [8]. Moreover, a few brands have created adaptive clothing lines for some specific groups of populations [13]. The lack of focus may be attributed to the fact that manufacturing adaptive clothing requires changes in the conventional production system, increasing costs and production time [15].

Previous studies on clothing related challenges for individuals with disabilities have identified some physical limitations of the users, apparel needs and barriers, and/or proposed related design solutions [1], [2], [10], [16]. However, there are some limited evidence-based knowledge that addresses clothing and dressing related challenges for children with disabilities, specifically children with Down syndrome [6].

Down syndrome or, Trisomy 21, is one of the most common congenital disabilities [17]. Individuals born with Down syndrome experience developmental delays and intellectual disabilities which may affect activities of daily living, such as the independent dressing task [18], [19].

Due to the lived experience and potential atypical body shape of children with Down syndrome (compared to their typical peers), mass market children’s clothing may not adequately address comfort, fit, aesthetic preferences, ease of use, and/or accessibility. Lack of appropriate clothing options may frustrate caregivers as well as arbitrarily constrain the child’s personal expression [20]. Moreover, adaptive clothing for children is often difficult to find, limited in selection, and more expensive, when compared to typical children’s clothing [6].

Recently, the global fashion industry has started addressing body diversity within the population (Mass market brands, such as Target™ and Tommy Hilfiger™), have begun to offer adaptive clothing collections, with options available in children sizes [21]. Other small brands, such as Abilitree™, Special Kids Company™, and Independence Day Adaptive™ exclusively offer adaptive clothing for children, but on a small production scale due to the companies’ size [22]. To date, there is no apparel company focused on end-users with Down syndrome except NBZ Apparel but it has closed since 2020 (NBZ Apparel International 2019).

In this study, we investigated the clothing preferences and challenges for children with disabilities (specifically Down syndrome) and their family caregivers. We also explored adaptive clothing brand awareness from the perspective of both this target population and the adaptive apparel brands.

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II. THEORETICAL FRAMEWORK

In the field of fashion and apparel, The Technology Acceptance Model (TAM) has been used in previous studies to contextualize consumer attitude towards online co-design processes [23], wearable technology applications [24], and enhanced retailing technology [25] etc. Davis [26] developed the TAM and suggested that an individual's attitude towards a new system (technology) is dependent on two variables: (1) *perceived ease* and (2) *perceived usefulness*. Perceived ease is defined as the degree of believed effort to use the technology, whereas perceived usefulness is defined as the degree of believed benefit of using the technology [26]. There are several external factors that may have direct or indirect influence on consumer's perceptions/attitudes/decision to use new technology (Fig. 1) [27].

In this study, we apply TAM to the adaptive clothing market to explore and understand the perceptions and attitudes

of both the target adaptive clothing consumer and the adaptive clothing brand (Fig. 2). Also, our research aims to identify the perceptions and attitudes towards adaptive clothing from the target consumer and brand.

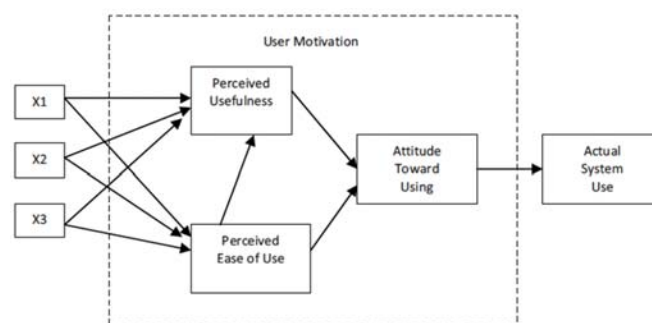


Fig. 1 Original TAM Model [26]

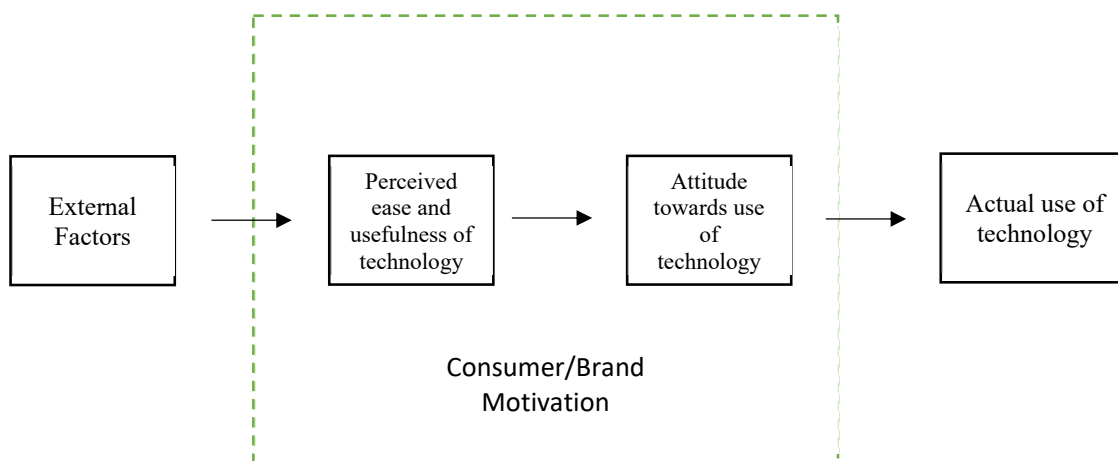


Fig. 2 Extended TAM Model

III. METHOD

Survey

General information about dressing and clothing issues for the target population (consumers only) was collected using an online survey of 49 people. Survey questions were related to “functional challenges in clothing”, participant’s “everyday go to brands”, difficulties “finding the right size/fit” and “preferred style”. Survey contained ten open and closed-ended questions.

The survey was distributed via Qualtrics™ to the National Down Syndrome Society [28] which has more than 300 local organizations across the United States. Survey data were coded using qualitative analysis coding software NVivo.

Interview

Based on the survey results, we framed a questionnaire for in-depth interviews with the target population (consumers only). The interview was aimed at identifying the child’s dressing and clothing related challenges, and the caregiver’s perceptions/preferences regarding commercial clothing options. Interview questions were related to- “complaint

reasons from child regarding size, fit and function of the clothing”, “child’s favourite designs”, “comfortable fabric choice” “importance of clothing in social participation”. This sample population was recruited from National Down Syndrome Society.

Another questionnaire was framed to understand the adaptive brand's perception of adaptive clothing. The goal of the brand's one-on-one interviews was to identify their most important issues/challenges in the adaptive clothing industry to achieve customer satisfaction in adaptive clothing purchase. All the Interview questions were semi-structured, open-ended. Interview questions were related to brand’s- “motivation”, “perception about target consumers”, their “challenges to meet consumers’ expectations”, current approaches to “solve business challenges and meeting market demand. LinkedIn was used for initial adaptive brands search and as the participant recruitment medium

Data Analysis

Recorded interviews and survey data were analysed following the principles of Grounded Theory [29] in four iterative phases. First, as recommended by [29], [30], raw data

were transferred and transcribed into descriptive themes using NVivo software [29]–[32]. Second, in the axial coding phase, the descriptive themes were contextualized into a theme-based setting [33], [34]. Third, as proposed by [29] in the selective coding phase, a core category was created contextualizing themes to broader concepts of a theory [35], [36]. The data were generated, analysed and compared across two or more coders.

IV. RESULTS AND ANALYSIS

In the online survey participants answered questions related to their child’s clothing preferences and challenges in ADL. Table I shows the demographic results of the survey participants.

TABLE I
DEMOGRAPHIC CHARACTERISTICS (F = FEMALE, M = MALE)

Age Groups (Years)	Diagnosis	Participants	F	M	Not Answered
8-14	Down syndrome	28			
5-7	Down syndrome	9	25	20	4
2-5	Down syndrome	5			
0-2	Down syndrome	3			

Survey questions included describing clothing-related challenges and clothing preferences for children with Down syndrome and/or their caregivers. Data indicated clothing as a key issue with the majority of the participants. For example, a typical shirt sleeve is longer than needed and does not fit the arm length of children with Down syndrome. As a result, children in this population need assistance in rolling up or altering the sleeves, which can be a burden for the families. Within the topic of clothing challenges, clothing fit was the most frequently reported clothing challenge by the respondents, with the Cohen’s Kappa coefficient = 98.04% agreement between raters (Table II).

TABLE II
NUMBER OF SURVEY RESPONDENTS FOR CATEGORY

Clothing Challenge	Number of Times Respondents Reporting
Fit Issues	52
Caregiver assisted dressing	27
Physical Limitations	26
Sensory Sensitivity Issues	19
Stylistic Challenges	4
Clothing Cost Issues	3
Clothing Issues Related to Devices	2

Participants described their clothing preferences among current commercial mass-market children’s wear. Data indicated that participants look for comfortable and cost-effective clothing options that provide various styles and ease in donning on and off. For example, participants frequently purchase leggings for comfort, due to soft fabric construction, elastic waists, and relatively low cost. Within the topic of product category, leggings were the most frequently reported clothing preference by the respondents, with the Cohen’s Kappa coefficient = 92.48% agreement between raters (Table III).

TABLE III
NUMBER OF SURVEY RESPONDENTS FOR CATEGORY

Clothing Preferences	Number of Times Respondents Reporting
Different Fashion Style	36
Sensory Friendly Material	39
Breathability	14
Easy to put on and off	13
Low cost	13
Easy to use fasteners	9
Size and Fit	7
Age-Appropriate Style	3

Participants described their current alternative solutions for finding clothing that fits their child. Data suggest that caregivers try to find easy to use fasteners and loose fit in clothes thereby facilitating the dressing task. Within the topic of alternative solutions, an alternative to mass-marketed fasteners and purchasing loose clothing were significantly reported by the respondents with the Cohen’s Kappa coefficient = 99.76% agreement between raters.

Family Interviews

Interviews were conducted via Zoom™, an online video conference platform, using a semi-structured interview format. Questions were used as conversation prompts in order to explore the concepts of clothing related issues and preferences for families of children with Down syndrome. Descriptive and axial coding determined conversation topics (Table IV).

TABLE IV
NUMBER OF TIMES RESPONDENTS REFERRED TO EACH OF THE MAJOR THEMES CODED FROM INTERVIEWS

Major Topic Themes	Number of Respondent References
Clothing Preferences	135
Clothing Challenges	137
Alternative Approaches	28
Recommendation for Brands	45

Selective coding themes from the interviews categorized the respondents’ general discussion of the child’s clothing related challenges, categorized by clothing pain points and alternative solutions for the adaptive market.

For the specific theme of “clothing preferences and challenges,” participants reported limited availability of a range of styles, size related difficulties, functional attribute related issue are mostly reported. For example, participants reported:

“There’s so much variety in height, weight, do you know, body shape, all of that, so it’s hard to find something that works for everybody”

For the specific theme of “Alternative Approaches,” purchasing available clothing from store and adapting them are respondent’s major alternative approaches to meet child’s clothing requirements. For example, participants reported:

“I typically I just work with what I have at the store”

Brand Interviews

Interviews were conducted via Zoom™, an online video conference platform, using a semi-structured interview format. Questions were used as conversation prompts in order to

explore the concepts of adaptive clothing related challenges and advantages in the business. As with the family interviews, descriptive and axial coding determined conversation topics (Table V).

TABLE V
NUMBER OF TIMES BRAND RESPONDENTS REFERRED TO EACH OF THE MAJOR THEMES CODED FROM INTERVIEWS

Major Topic Themes	Number of Respondent References
Business Motivation	9
Business Challenges	96
Advantages	19
Future Prospects	21

Selective coding themes from the interviews categorized the respondents' general discussion of adaptive clothing related challenges, categorized by clothing pain points and alternative solutions.

For the specific theme of "Business Challenges," expensive production, marketing challenge, designers struggle in solving fit issues are reported by majority of the respondents. For example, participants reported:

"Financially, to have a specific line of clothing just for Down syndrome just doesn't work because of the money that it takes"

For the specific theme of "Advantages," and "Future Prospects", emphasizing design solution related to functional and size issues and ideating different marketing strategies was reported by the majority of the participants. For example, participant reported:

In our relaunch, we're going to add potentially pants, but most likely more shirts, possibly a bra that's better suited for people with limited dexterity and for people with and walks in their chest and then potentially jackets as well. So, a lot of making sure things are sensory friendly, MRI friendly.

V. DISCUSSION

Target Consumer Perspective

The results of this study indicate that several variables play a significant role influencing consumer acceptance of adaptive clothing. The data obtained from surveys and interviews were used to evaluate consumer perceptions of and attitude towards adaptive clothing. Perceptions are categorized in the model according to the perceived ease of using adaptive clothing and the perceived usefulness of adaptive clothing for the target consumer. We have identified consumers' perceived ease of using adaptive clothing through the lens of consumers' current clothing selection for their child (or "alternative solutions" in comparison to the "solution" of adaptive clothing). We have identified consumers' perceived usefulness of adopting adaptive clothing through the lens of consumers' attitude towards their child's current clothing issues (or "pain points").

Perceived Ease of Adaptive Clothing: Alternative Solutions

One key finding of this study is that target consumers were neither aware of the definition of "adaptive clothing," nor that is an apparel product category. The majority of target

consumer survey and interview respondents selected commercial clothing for their child that was sufficient, but not ideal. We analysed the interview data based on the 5F design framework to understand respondents clothing needs related to Fit, Fasteners, Fabric, Function, and Fashion [35]. According to this framework, the fit, fasteners, fabric, function, and fashion need for clothing are investigated to provide maximum satisfaction in clothing. The study found several challenges based on the 5F criteria.

Fit

Results show that respondents experienced challenges with finding appropriate clothing size and fit (n = 9). As an alternative solution, respondents purchase clothing that is larger than the child's actual size. Respondents also select clothing styles that are loose to accommodate the lack of actual appropriate fit than the child. For example, respondents stated,

I often get pants for her in like an extra small women's. Because something's going on with the children like she's at size 14 or 16 now in her waist because she's got a bigger waist. And so, I either get a [size]16 children or an extra small woman [s size] and then I have to cut the legs out because they're eight inches down. But then they cover her body in a way that's, you know, that her body should be covered and that makes her feel uncomfortable running and dancing and playing.

Clothing alteration is another way that some participants reported to solve their children's everyday fit challenges (n = 4). Common examples of alterations include hemming pant and sleeve length or total redesign. Hemming may provide a temporary solution but may compromise the clothing aesthetic and proportion. Redesigning clothing requires either personal sewing expertise or additional cost of hiring a tailor. Respondents viewed these options as either time-consuming, complex, or expensive.

Fasteners

According to the data, fasteners influence consumers' purchase decisions. Fasteners represent the second F of the 5F Framework™ [35]. Fasteners such as zippers, buttons, hooks etc., are important closure methods that help put on and off clothes [15]. Participants preferred soft elastic in comparison to buttons or zippers because elastic was reported as easier than any other fasteners to put on and take off garments. Hook and loop straps were also preferred due to ease of use. Participants noted,

"We just do elastic waistband, that's our life, elastic waistband."

Fabric

Fabric properties, such as stretch and texture, are also an important consideration for consumers' purchase decisions. Respondents state that clothing fabric choices are made based on ease of dressing and the child's comfort. For this reason, participants choose stretchy fabric with a soft texture (n = 6). In addition, clothes without tags were reported as a high priority due to the child's sensory sensitivity issues. For

example, participants stated,

“[Clothing] necessarily made of a soft material that he [participants child] would easily tolerate.”

Function

Clothing function can be defined as the functional criteria that provide comfort, ease, and practical features (i.e., easy to access) that reduce clothing challenges [35]. Respondents noted that dressing their child is difficult with typical commercial clothing. Fastener and design detail location (such as pockets) in typical commercial clothing add an extra barrier for easy access (n = 6). As an alternative solution, stretchy clothing with simple closures is the most preferred option. For example, participants stated,

“I kind of always put her in like leggings, like for the simple fact that, you know, it's easier for her than a jean, you know, to try to remove for me.”

Fashion

Data indicated that respondents focused more on clothing function and fit than fashion issues when purchasing clothing (n = 6). One could assume that fashion considerations are a higher order concern when compared to function and fit. However, aesthetics was still a reported need. For example, participants said:

“She's a girl. She's into dresses now. So, I just put the leggings on under a dress or whatever. So that works for us.”

Perceived Usefulness: Pain Points

The survey and interview findings were incorporated into the 5F Framework™ [35] to address consumer's broad range of clothing-related challenges. This study found several issues within these five criteria.

Fit

Fit may be considered one of the most complex terms in fashion literature and thus may be defined in diverse ways [15]. Fit is related to the shape and size of the user's body, overall appearance, comfort, fabric choices, style preferences, functional requirements, and so forth of the garments [1], [10], [35], [37]. Historically, fit is considered one of the major issues for people with disability or people with a unique body shape [15].

Most of the respondents in this study stated finding accurate sizes for their children with an atypical body (compared to industry sizing standards) is a daily challenge (n = 9). Typical fit challenges experienced by parents/caregivers of children with Down syndrome are sleeve and pant lengths being too long and too tight, tops and dresses being too tight or ill-fitting in the torso, and clothing proportion being unflattering. For example, participants reported,

For regular clothing for Malakai [participant's child], it's either that the arms fit him and thinking of a long sleeve shirt, the arms fit in perfectly with the torso, or the torso is long enough, but the arms are much too long, and then he ends up chews on them when they are too long, and then that totally destroys the sleeves.

Fasteners

Fasteners needing fine motor skills were reported as the second most critical challenge in everyday clothing (n = 8). As children with Down syndrome have limited fine motor control skills [15], they may struggle to manipulate zippers, buttons, snaps, etc. in performing independent dressing tasks. For example, one participant said,

I don't want to restrict her from a button or tie or things like that. I mean, I want to teach her those, but I also want her to be able to, you know, remove things easily and not get frustrated.

Fabric

Fabric is another essential part of the 5 F Framework™ and represents a key challenge for the consumers [35]. In this study, respondents reported that anything stretchy, soft, breathable provides comfort for their children (n = 7). For this reason, cotton was identified as a preferred choice for children due to comfort. However, many of the participants expressed disappointment with the performance of 100% cotton clothing, such as wrinkling and shrinkage. Sensory-friendly fabric was another important requirement reported by the participants. Due to the child's cognitive and/or sensory impairments, clothing with tags, stiff structure, etc., were reported as a major concern. For example, participants reported,

“My daughter doesn't like tags and textures and different things.”

Function

The data support previous studies' findings that typical commercial garments do not adequately meet the functional needs of children with Down syndrome [35]. Examples of some common challenges are clothing proportion, length, and fastener location. Additional challenges include clothing that easily facilitates dressing and toileting. For example, participants stated,

We don't do anything complicated. If we are wearing something complicated, like one time we had that [regular] shirt that was [in] a [different] style [and] it was complicated and I had to help her put it on.

Fashion

Fashion refers to the preferred style of clothing that addresses the user's aesthetic needs [9], [15]. Historically, fashion has a strong relationship with an individual's expression [38]. Regardless of disability, aesthetically appealing and high-quality products work as a medium for self-expression and social acceptance [39]. In this study, respondents expressed frustration in finding age and size appropriate comfortable and fashionable clothes for their children in the commercial market (n = 7). As a result, these limitations of clothing styles may lead to negative impact on the child's psychosocial life. For example, participants reported,

“It is harder, like I mean, I dressed my daughter cute as I can, I mean, sometimes fashion can be a challenge to blend in better in the larger society”.

Brand Motivation

Recently, small and large apparel companies have launched adaptive clothing lines to meet consumer's demands [40]. However, data indicate that these brands may not address the clothing requirements specific to consumers with Down syndrome. This apparel industry gap suggests the need for further investigation into brands' motivation for entering the adaptive clothing market and perspective about adaptive clothing for consumers with Down syndrome.

The results of this study indicated that the factors influencing technology acceptance (in this case, adaptive clothing) vary by brand. For this study, we conducted a series of interviews with both small and large adaptive apparel brands. Interview data were explored and contextualized within TAM to study each brand's perceived usefulness and perceived ease in the adaptive apparel business. Perceived ease was analysed according to the brands' perception that the addition of adaptive clothing would be a business advantage. Perceived usefulness was analysed according the brands' perception that the addition of adaptive clothing would be a business challenge.

Perceived Ease: Business Advantages

Respondents from both large and small apparel companies expressed common issues or themes related to the adaptive clothing market. These include: (1) *social capital*, which refers to apparel brands' goal to serve a larger group of people having disabilities, (2) *consumer's demand*, which refers to brands' goal to meet consumers need for clothing, (3) *social media distinction*, which refers to brands' current initiative of marketing products, and (4) *universal design*, which refers to brands' design approach to serve the population.

a. Social Capital

Results suggest that brands invest in the addition of adaptive line in order to serve a wide consumer base beyond their current target market. Brand participants report being motivated by several reasons, such as a family member (e.g., Runway of Dreams), by their medical profession (e.g., Abilitree), or social goodwill (e.g., Tommy Hilfiger). However, they all cited the same goal: to provide fashionable, functional, normative clothing options to the users with "special needs" such that they could dress them by themselves. Moreover, the collective aim was to offer clothing that improves an individual's self-image, self-esteem, and confidence. For example, participants reported,

I guess the main [area] where we had to just say the focus was, was to allow children with disabilities to feel that they could dress. So [that] it was easier for them to get the product on and off easy for them to feel like they had fashionable options. So that's where we had to sort of start because of the breath and that, you know, there was a lot of thought put into there for to cover the most amount of disability.

A respondent from Tommy Hilfiger™ stated,

"You know, like what the goals were, and that was it like we want to get the most product out."

b. Consumer Demand

Brand participants stated that there are limited available adaptive clothing options, yet there is a growing consumer need. Data indicated that most of the small apparel brands offering adaptive clothing focused on a specific type of disability, whereas large brands are more general in their product offerings. Nevertheless, both types of apparel companies offer minimal selection in comparison to the typical clothing consumer. As a result, a large portion of the population living with Down syndrome is still underserved. For example, a respondent from Abilitree™ reported,

There needs to be new, bigger adaptive brands... [T]here's a wide audience that's a fifth of the world or something close to that. And that there aren't many options like that just means you essentially have a huge market need that's not being filled or addressed.

c. Social Media Distinction

Both small and large apparel brand representatives reported that social media outlets create awareness for adaptive apparel brand offerings. Brands aim for their social media outlets, such as Facebook™, Instagram™, and Tik-Tok™ to distinguish the brand, and thus facilitate consumer education and purchase decisions on adaptive apparel. For example, a respondent from Runway of Dreams™ reported,

I think social media has really catapulted this whole topic into the forefront. I think mediums like Tik-Tok™, people with disabilities are rock stars on Tik-Tok™ are viewed incredibly differently.

d. Universal Designs

The majority of brand study participants (90%) stated they use a universal design approach in terms of ROI (return on investment) because serving every population with a specific type of disability creates too much customization and unprofitable markets. By generalizing adaptive clothing designs, the brands aim to serve a larger population, thus aiming to improve profitability. For instance, substituting magnets for zippers provides universal ease with dressing no matter the target population. For example, a respondent from Tommy Hilfiger™ reported,

That's the first question that comes to mind is like, how do you incorporate all disabilities, and the reality is you can't you know. There's no [way] unless you were doing custom clothing. There's no way to accommodate all different disabilities, so we tried to make it as democratic as we can.

Cross-Collaboration

100% of brand respondents stated that adaptive clothing represents a new business experience for the company. Small brands may understand specific consumer needs, but struggle to understand the apparel market and supply chain process. On the other hand, large brands may have more control within the apparel supply chain, but not direct target consumer knowledge. Brands cited that cross collaboration was a benefit for both partners. They also note that collaboration may increase adaptive product demand and enhance each

company's portfolio. For example, respondent from Runway of Dreams™ reported,

Tommy and Runway Dreams were the first collaboration that ever did anything in a mainstream capacity for adaptive clothing. So, the fact that since then we have five more mainstream brands, two of which are in the budget-conscious category of Target and Kohl's, that they both have adaptive versions of their children's wear line and is great progress, that this will eventually be a part of every brand's portfolio, because it's the way that the world is going. There are still platforms like Zappos that is trying to pull together brands that are more specific. So, I would say I think we're in a really exciting time right now in the industry, and they're really, really working hard to try to make a difference.

Perceived Usefulness: Business Challenges

Both small and large apparel brands share similar perspectives on the advantages of offering adaptive clothing. However, business challenges for both large and small brands need to be analyzed to identify shared pain points for the adaptive clothing industry. Interview data indicated these common issues include adaptive market size, production costs, supply chain issues, and adaptive product standardization.

a. Adaptive Market Size

The perception that the adaptive clothing market is small represents a pain point for apparel companies. Small brands often target a specific population of individuals with disabilities, resulting in narrow market share. For example, a respondent from Abilitree™ reported,

It takes a long time to be profitable, and it requires huge volumes of orders and huge volumes of production to actually get those costs down enough that you're making something. So that's been a challenge, but not insurmountable.

On the other hand, larger brands have a limited selection for a generalized target population. Consequently, these adaptive clothing products may *actually* only serve a small number of the target population, leading to the perception of low buying power of these consumers. For example, respondent from Runway of Dreams™ reported,

Until the consumers of that product show that they have buying power, then the brands won't focus on the specific disability. I mean just in terms of scale. If you say that you're producing ten thousand boy shirts for your main line and then your adaptive line, you're only producing at the most a thousand. It would be hard to segment that thousand into different types of disabilities.

b. Production Costs

High production costs and less profit were reported as a major business challenge for adaptive apparel companies, in terms of ROI. In addition, limited investment and other financial resources constrained adaptive market growth. For example, a respondent from NBZ™ reported,

Enough investments are needed to start and expand the adaptive business because extra expenses are involved in

the production. If I had more money, I would love to expand.

c. Supply Chain Issues

Participants reported difficulties and struggles related to the production and supply chain. Brands identified lack of expertise in supply chain management as one of the significant challenges for the beginner companies. Besides, US-based factories are reported to be more expensive than outsourcing factories. Regardless of location challenges, finding appropriate factories and skilled manpower is hard for the companies. In addition, factories need training on sewing, pattern making, and the application of appropriate trims, which adds extra cost to the product. Consequently, high product cost leads to customer dissatisfaction. For example, a respondent from Abilitree™ reported,

It's just been a learning process is like figuring out how do we find manufacturers. And right now, we're opting for US-based domestic factories, which are more expensive usually, but same quality, and then lower environmental cost. So, kind of just navigating all of that has definitely been a challenge

d. Product Standardization

Adaptive brands have begun to develop size categories to minimize fit issues [40]. Some participants reported that they use their own body measurements as standard to fix the size categories. Others have developed their own method to collect data from a small sample size that lacks enough information to develop a standard size or age category. As a result, accuracy in fit could hardly be achieved by the companies [41]. Also, determining size and age categories is reported to be a time-consuming process for smaller companies, which ultimately impacts production. However, the larger brands reported using no fit models in the product development stage, which they do differently in regular clothing lines. Fit models are only involved in product testing before sending the samples for mass production. For example, a Respondent from Ashley by Design™ reported,

"We used Ashley as the standard because she was an average size Down syndrome person".

Adaptive Market Barriers

To understand the barriers on consumers and brands acceptance of adapted clothing, we recreated a model applying the extended model of TAM (Fig. 3). We found that accessibility and lack of knowledge are the major barriers experienced by the adaptive clothing consumers and brands.

Accessibility

Although several brands in the current market offer adaptive garments [1], most of the consumers purchase conventional ready-made clothes for their children with special needs. This can be attributed to the fact that limited accessibility, such as inappropriate sizing of regular clothes, limited knowledge about adaptive cloth brands, and, most importantly, high costs, makes it so harder for the user to afford such dresses. In the interviews, many parents repeatedly

mentioned that “it is “harder,” “difficult,” and “challenging” to find an appropriate dress for my child.” Participants expressed their frustration towards purchasing clothes in different categories, for example, bottoms/tops, footwear, undergarments, one-piece, summer shorts, skirts, Halloween

clothing, onesies, and sportswear. Leggings, sweatshirts, and sweatpants are found popular options in the parent's group for their children. For example, consumers cited that,

“I kind of always put her in leggings, like for the simple fact that it’s easier for her than a jean.”

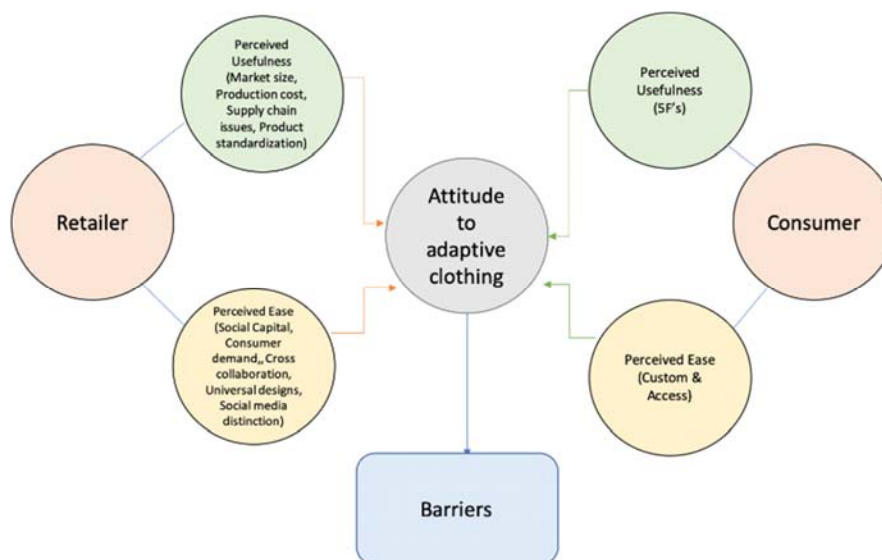


Fig. 3 Recreated TAM Model

Size Unavailability

Limited availability of the appropriate size and fit is a significant issue reported by the consumers. There are several products in the market, but a few could satisfy the consumer's unmet size and fit needs [42]. This dissatisfaction continues perhaps due to the lack of information in the data collection procedure explained by the companies. However, direct communication with the target consumer and a proper strategic data collection approach may limit the size unavailability barriers. For example, consumers cited that,

If you [brands] collect all the information about this [children with Down syndrome] body type and size and you design clothing according to that would alleviate problems [issues related size].

High Cost

Cost is another major barrier that influences consumers' purchase decision [10]. A few consumers could build brand loyalty with any adaptive brand because those are cost prohibitive than regular garments. Also, adaptive clothes are mostly available on online platforms, which sometimes adds extra cost to the purchase. As a result, consumers make do with regular clothing with less purchase satisfaction. However, interview data indicated that mainstream brands could easily dominate this sector, expanding their line to manufacturing adaptive clothing. For example, consumers reported,

It's not hard to find cute dresses, it's hard to find cheap dresses in size. I think if there was a clothing line for kiddo's with Down syndrome that had designs and was actually affordable, then definitely [I will purchase that].

Limited Knowledge about Adaptive Clothing

Limited knowledge about adaptive clothing is another common barrier found among consumers. Consumers knew little or nothing about adaptive clothing. This could be the result of weak marketing and brand strategies of the mainstream brands. However, an increase in advertisements on the company's website, news, social media portal, etc., and promotional campaigns by the mainstream brands (e.g., Target, Tommy Hilfiger) could minimize this knowledge gap [43], [44]. For example, consumers reported,

I don't know exactly [about adaptive clothing] I think you have to do a lot of my kind of search to find it. I can't even remember the last time that I've seen an advertisement for adaptive clothing. I think if I did see more advertisements or it was displayed more in stores that would catch my eye.

Lack of Awareness

In this study, lack of awareness was found one of the major barriers for the brands. Companies agreed that lack of education is still the biggest gap in the industry and is yet to be overcome. Although adaptive brands have a positive intention to help individuals with disabilities, a lack of knowledge about target consumers and their clothing needs perhaps limits the brand's capability to serve consumers properly. To understand consumers and their specific clothing needs, many brands supported social media as the most effective platform to create awareness in the target market [44], [45]. However, creating awareness through social media was also a hurdle for smaller companies. Companies experienced rejection advertising their models on several social media platforms because of the

standard marketing policy. On the other hand, some brands never prefer social media to communicate with their consumers. As a result, brands fail to connect with consumers properly. For example, brands representatives from Runway of Dreams™ and Abilitee™ reported,

I would say that the biggest gap is still the education piece. I think that the industry at large does. I think they're getting there doesn't really understand the size of the population, the spending power of the population, and the fact that people with disabilities very much care about what they look like, how they dress.

To raise awareness. So it's just like your standard marketing. So, we did try, like ads, for example, on Facebook and Instagram, and those are often rejected.

Lack of Research

Although large and small brands are taking the cross-collaboration approach to understanding consumer's clothing-related challenges and preferences, lack of research slows down brand's overall business progress [43]. Special consideration on research and development can help companies knowing the consumers and limiting current clothing issues in the adaptive market.

VI. RECOMMENDATION AND CONCLUSION

To date, education is the biggest gap in the adaptive market. However, educational institutions can take certain measures to connect and minimize the knowledge gaps/barriers between adaptive clothing consumers and brands. For example, universities can initiate several programs to educate smart clothing brands [43]. Suggested programs may include:

- 1) University researchers should create focus group discussion panels with both existing adaptive brands and consumers. These discussions would engage brands with their target market and identify given challenges and possible solutions.
- 2) Educational programs on smart/adaptive clothing should be tailored as mandatory courses for fashion and apparel studies and should be designed as multidisciplinary courses under STEM disciplines. Adding the courses in multiple disciplines would inspire researchers and cultivate smart clothing creators to solve current adaptive market issues.
- 3) Universities should encourage organizing on-campus campaigns, catwalks events focusing on adaptive fashion, invite outside guests (including brand representatives) to create awareness.

The result showed that brands are taking several measures to meet consumer's demand for clothing. Apparently, they are failing to earn the buying power from the consumers, which is a big barrier for the retailers. The most effective approach to educate consumers could be offering short-term certificate courses for brand representatives to minimize this gap. Universities can educate brand representatives on the 5F's design needs, the recreated TAM model, etc., to get a clear market overview. Detailed documentation on difficulties may help them design strategic tools to find solutions and develop

standard production methods, which perhaps help commercialize the product and serve the adaptive market.

Other measures to spread awareness may be taken by the retailers to build direct communication with consumers. The result indicated that brands show less interest in the adaptive wear R&D, where several companies jumped into smart clothing development in the past decades [45]. This is high time brands raised awareness by offering sponsorship to the research projects and collaborate with educational institutions to develop counselling-based products. Brands can also collaborate with several Down syndrome organizations, health clinics, etc., to educate the consumers through them and draw the public eye.

This study aimed to identify the gap between consumers and brands in the adaptive clothing market. After completing this study, we were able to identify the possible gap and, based on the data and participant's assessment, proposed some recommendations. These recommendations may direct to further research in adaptive clothing design and development to create a difference in the current adaptive market and serve a large portion of the underserved population.

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