

Wearables' Sustainability-Related Challenges through Examining Smartwatch Users' Post-Purchase Online Reviews

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Introduction and background. In the digital transformation era, technology is pervasive, is available everywhere, and significantly influences an individual's daily life. Although the presence of technology makes our life much convenient, it has some drawbacks. For instance, wearable technology, also called as wearables, has sustainability-related challenges because they consist of materials or parts which are hard to recycle. To fully incorporate sustainability into developing wearables, the entire process of its design, manufacturing, usage, and disposal should be fully engaged with user experiences. Wearables are different than many other products, which face into many unforeseen sustainability-related drawbacks. To the best of our knowledge, to date, limited studies exist to address consumers' concerns and awareness regarding wearables' sustainability-related challenges. Thus, the purpose of this study was to explore consumers' awareness of wearables' sustainability-related challenges by examining their post-purchase online reviews of wearables.

Method. Two smartwatches, Apple Watch Series 5 (iWatch 5) (Apple, 2020) and Samsung Galaxy Active 2 (Active 2) (Samsung, 2020), were chosen for this study since they were reported as the two most famous and trendiest smartwatches in 2020 (Eugen, 2020). Two smartwatches with the basic price and features (e.g., basic band, minimum memory, and screen size, no cellular feature) were selected because they were the most affordable and available options for a wide range of consumers. All users' reviews of iWatch 5 and Active 2 from October 1, 2019 to March 31, 2020 were extracted via the "Amazon Exporter Pro" application, resulting a total of 1,532 review comments (721 for iWatch 5 and 811 for Active 2). Summative content analysis, deductive and inductive coding approach, was utilized for data analysis (Hsieh & Shannon, 2005). To conduct the deductive phase of content analysis, by applying the circular economy theory (Charter, 2018), a set of codes related to sustainability features of high-tech products were predefined. Following three major sustainability-related coding categories were extracted: durability (physical durability, emotional durability, battery durability, and customization options), disassembly (disassembly of components and batteries), and biodegradability. By applying a systematic sampling approach, the coder coded every fifth online review comments. Through the second phase of content analysis, inductive coding, further themes along with their subthemes were derived including functionality (comfortability, synchronicity to cellphone, and ease of use), trackability (physical and mental health tracking), and aesthetics (design). These themes and subthemes, derived from the inductive phase, may not directly reflect sustainability attributes of wearables but may represent users' main concerns about a set of wearables' attributes which may indirectly impact long-term satisfaction of its use, which leads to extend its lifespan.

Results. Within users' post-purchase reviews for both iWatch and Active 5, durability was the most commonly raised comments (60.87% & 45.13%), followed by functionality (21.74% & 21.68%), trackability (11.96% & 20.35%), and aesthetics (5.43% & 12.38%), respectively. Among the three key sustainability attributes (durability, disassembly, and biodegradability) identified from the previous theory, durability was only mentioned in the comments.

Durability. Among all comments for Active 2, 45.13% belonged to the durability feature; among those, 52.94% were related to battery durability followed by emotional durability (20.59%), customization options (18.63%), and physical durability (7.84%). For iWatch 5, around 61% of the total comments reflected the durability feature; among those, 78.85% were again related to battery durability followed by emotional durability (12.50%), physical durability (5.36%), and customization options (3.75 %).

Functionality. Approximately 21% and 22% of the comments for Active 2 and iWatch 5, respectively, were related to the functionality feature. For iWatch 5, comfortability (55%) was the dominant feature followed by sync-ability to the cellphone (30%) and ease of use (15%). For Active 2, sync-ability to the cellphone (46.94%) was the dominant feature followed by comfortability (36.74%) and ease of use (16.32%). Users expressed their positive sentiments about the sync-ability feature by commenting how easy they could communicate with others without carrying the phone everywhere.

Trackability. Among the trackability-related comments, physical tracking (e.g., fitness tracking) was the main trackability feature for iWatch 5 (72.72%) and Active 2 (76.08%), followed by mental tracking (e.g., sleep tracking) (27.27% for iWatch and 23.19% for Active 2). Active 2 users expressed their satisfaction with the accuracy of tracking for both fitness and sleep patterns. For iWatch 5, users often expressed its inconvenience because of not embedding a sleep pattern tracking application.

Aesthetics. Among all the comments, 12.38% and 5.43% belonged to the aesthetic design feature of Active 2 and iWatch 5, respectively. Online reviews revealed users' positive feedback regarding the aesthetic design aspect (e.g., color choice, screen shape) of both smartwatches. Active 2 users expressed more positive sentiments about the new design features added in the product.

Conclusion. We highlighted users' criteria and challenges of using wearables, smartwatches in this study, through analyzing their online review posts. Among the four major identified themes (durability, functionality, trackability, and aesthetics), durability was the only theme directly related with wearables' sustainability-related attributes. In terms of durability, battery-durability was considered as one of the main sustainability-related challenges by smartwatch users at the post-purchase phase. The rest of its direct sustainability attributes (disassembly and biodegradability) was not revealed as the key features in this study, reflecting users' limited knowledge about these attributes and lack of awareness about sustainable wearables. Functionality, trackability, and aesthetics do not directly reflect the sustainability aspect of wearables but can influence consumers' long-term satisfaction and intention of its use. Simply, we can argue that these attributes have indirect relationships with users' sustainability

practices. Thus, to fully incorporate sustainability practices in the future generations of wearables, high-tech companies and brands are responsible to increase the level of consumers' sustainability awareness through (a) incorporating potential sustainability-related features into wearables and (b) educating consumers the innovative approaches they incorporate for developing sustainable wearables.

The findings of this study are useful for future researchers in the wearables' design and development area when they are looking for key sustainability-related features of wearables. This study was only focused on users' online review posts from two favorable smartwatches, only one type of wearables, which was the limitation of this study. Further studies should be conducted to examine consumers' awareness of sustainability-related challenges for diverse high-tech embedded wearables including smart apparel and footwear. The findings of this study demonstrates that consumers still have limited sustainability awareness of wearables at the post-purchasing stage, which leads to a new discussion question on how to enhance potential users' sustainability awareness of wearables prior to or during their purchasing stage.

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