Wearable Technology and Women Empowerment in the Technology Industry:
An Inductive-Thematic Analysis

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ABSTRACT

The extant literature has significantly contributed towards the body of knowledge on wearable technology by exploring its potential for enhancing the well-being of consumers. Another strand of literature focuses on the challenges being faced by women in the wearables industry. This study has critically investigated the prevailing status of women in the gendered imbalance technology industry, particularly the wearables industry. To elucidate this, the study has followed the qualitative approach by conducting an inductive-thematic analysis on the interviews of women achievers in the wearables industry. The findings revealed that the future of wearable technology seems bright in the following sectors: AR/VR and artificial intelligence (AI) industries, medical, sports and fitness sectors, clothing and jewelry industry, military, and other industrial applications. However, it would be more promising if women employees and entrepreneurs are encouraged at all levels, and their roles are substantiated in the organizations by reducing challenges and appreciating them for their achievements.

KEYWORDS

AR/VR, Artificial Intelligence, Fash-Tech, Fem-Tech, Gender Stereotypes, Self-Health Monitoring, Thematic Analysis, Wearable Technology, Women in Tech

INTRODUCTION

"Internet of Things" (IoT) has given rise to a new term "Internet of Everything" (IoE) by offering personalized and customized products to the users, embedded with smarter-integrated sensors and wireless internet. Such inter-connected devices have revolutionized the way people live and interact by transforming their day-to-day lifestyle and providing immense benefits. One such evolving application of IoT is wearable technology whose ecosystem is fairly complex to comprehend.

Wearable technology involves implanting sensors into accessories like watches, glasses, shoes or other items of clothing for the purpose of converting humans into a powerhouse of bio-metric data (Bhavsar, 2018). The rationale behind emergence of wearable technology was to provide pervasive and mobile access to the real-time information to its users. According to Scalar Market Research (2017), the global wearable market is estimated to grow from USD 29.92 billion to USD 71.23 billion from 2016 to 2021, growing at a CAGR (Compound Annual Growth Rate) of 18.9%. Similarly, it has been predicted that the global shipment of wearable devices will increase from 222.9 million units in 2019 to 302.3 million units in 2023.

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Initially, the application of wearables was restricted to the specialised domains of military, manufacturing and healthcare experts including engineers and doctors. Recently, wearable technology has also acquired a significant position in the consumer electronics arena by addressing their specific needs and issues. Although, the most commonly used consumer wearable devices include smartwatches, smart-glasses and fitness trackers, the future of wearables generation is blooming due to the introduction and amalgamation of hybrid technologies such as artificial intelligence (AI), augmented reality (AR)/virtual technology (VR), e-clothing, among others (Jabil, 2018).

Furthermore, the series of innovations and ameliorations have led to the development of wearables "by-the-women" and "for-the-women" particularly in the field of fashion and self-health monitoring. Women designers have pioneered a new window of incredible possibilities by developing jewellery and clothing with non-intrusive applications and features. For example, a simple bracelet could be transformed into an aesthetically appealing new generation accessory which could retrieve data relating to user's health and safety, routine activities, social media notifications and other communication-related updates (Queiroz, 2019).

The advent of digital environment in the recent years has created an exclusive entrepreneurial opportunity wherein anyone with a laptop, creative imagination and some innovative product/idea could start his/her own business (LeBlanc, 2015). However, gender biases deter women from initiating and growing new endeavours. About half the population on this planet comprises women, but slow progress has been noticed in this direction with only few women entering the technology landscape as founders, developers and designers. Some of the "Fortune 500 companies" have women CEOs wherein they run the largest sectors of our economy such as auto, military, technology, retail, and energy. For example, Mary Barra runs the second largest auto industry in the world. Phebe Novaskovic and Kathy Warden run the largest defence manufacturers on the planet. As of 2020, women held only 26.5 per cent positions as executive/senior-level managers (Catalyst, 2020). This is because the tech-world has been subjugated by the male partners and investors who are comparatively less persuasive in promoting female led start-ups and business due to which the entire industry is missing out on some potentially great ideas.

PROBLEM DEFINITION

The seminal researches have revealed insights about the application of wearables across different sectors including mining and construction (e.g. Mardonova & Choi, 2018), tourism (e.g. Hassan et al., 2017), textiles (e.g. Hwang et al., 2016), sports (e.g. Camomilla et al., 2018), medical and healthcare (e.g. Dong et al., 2018). But there has been paucity of literature that investigates the anticipated trajectory and potential consequences of wearable devices for the society. Therefore, the first research question for this study has been postulated as follows:

(RQ1) What is the current and future state of art wearable technology along with the implications it hold for the society?

Moreover, the society fails to acknowledge that male-dominated workforce in the industry would isolate female customers from the market due to lack of their recognition to resolve the thriving issues pertaining to women community (Fell, 2017). In order to mitigate this problem, #WomenInTech initiative has gained momentum across the world that aims to narrow down the gender technology gap by empowering women to create innovative solutions and claiming equality in the community. Despite the existence of discerning literature on the serious issue of gender disparity in the workplace, the subject matter often gets dismissed as a frivolous whining.

In the light of the above arguments, the second research question for this study has been identified as follows:

(RQ2) What is the significance of #WomenInTech initiative in the wearables industry by highlighting the recognition offered and obstacles faced by women?

To achieve its purpose, this study has examined the subjective accounts of few influential women in the wearable industry, who have achieved legitimacy within the masculinised environment of the techie industry, to identify and analyse themes and sub-themes in the perceptions, beliefs and attitudes of the respondents. Such qualitative investigation into the concept of wearable technology would significantly contribute towards (a) exploring trends, applications and implications of wearable technology in near future, and (b) highlighting the crucial role of women in the technology sector by breaking down the deep rooted stereotypical relationship of technology and masculinity while presenting a refreshing and much needed notion on gender and career.

REVIEW OF LITERATURE

The growing importance of human-computer interaction and evolution of ubiquitous computing has led to the revolution in the field of wearable technology. Within the scope of this study, wearable technology has been defined as any computer which can be worn on body by the users. These devices have the potential to acquire, store and process considerable amount of information with their capability to seamless interaction with cloud and web based services (Gamble & Hale, 2019). Wearables help in making everyday life choices better by enhancing users' responsibility and self-regulation. Marne et al. (2016) demonstrated that future wearables would work with greater efficiency, accuracy, flexibility and enhanced privacy measures in order to carry out complex tasks. Previous researches have examined the applications of wearable technology across various fields: healthcare (Talukdar et al., 2019), forensic and clinical sciences (Ferreira et al., 2019), sports (Aroganam et al., 2019), biofeedback human skill-training (Shan, 2020), smart textiles (Mokhtari et al., 2020), infotainment (Sinnapolu & Alawneh, 2020), military and AR/VR industries (Vermetten et al., 2020), etc.

Despite advancing rapidly from the technology perspective and offering well-being solutions, the stagnating rate of diffusion and penetration of wearables among wider society raise an issue of concern. The existing studies have revealed that major hindrances in its successful dissemination include users' lack of awareness and tabled suspicions relating to its performance, privacy, accessibility, and sustainability, environmental and societal impact. For instance, Bianchi and Oakley (2016) raises the questions on privacy and security of future wearables by reviewing work on wearable authentication on the basis of token, passwords and biometric sensors. Another research has extended a sustainable perspective to wearables' trends and applications by including dimensions such as improving the quality of individual life, social impact, and social public interest, well-being, healthcare, assistance for disabled, relief from relief, and public safety (Lee et al., 2016).

On the other hand, a plethora of studies have raised their concerns about the issue of gender divide in technology industry. Recently, Striebing et al. (2020) highlighted that gender equality in research and innovation (R&I) at the structural level among European Union states is influenced by the relative size of the business enterprise sector and the share of women among holders of tertiary education. Within the domain of wearable development itself, research advanced that till 2014, most common wearables were music devices, heating devices, gaming devices, and fitness trackers but since 2015, significant shift towards women specific wearables have been observed whereby future seems to be bright in garments, health and manufacturing sectors (Berglund et al., 2016). For instance, Cifor and Gracia (2019) have analyzed a series of gendered implications in the physical and interface design of fitness trackers for the purpose of attaining normative femininity by considering the real needs and particularities of the health and well-being of women. Similarly, previous studies (e.g. Almeida et al., 2019) have conducted the exploratory researches for designing bio-responsive wearable textiles in order to generate intimate health literacy, and promote quantified self-care among women. Another

study by Shelby (2019) has discussed a case of post-feminist technology i.e. "anti-rape wearables" by examining their effectiveness and practicality in reproducing gender along a strict binary.

Although, incessant efforts have been taken all over the globe to promote women in the related field, but still their representation in the computing sector is growing at the diminishing rate. The reasons behind this disparity are the conventional barriers and problems experienced by the women in the sector which is considered to be "men-specific". Women stumble upon negative stereotypes at every phase of their lives including school and university level by deterring them from choosing science as a career (Edmunds et al., 2016). The obscure explanations includes tech is a demanding career which requires long working hours, strong physical and mental strength, greater mathematical and logical abilities (Miller et al., 2015). Another hindrance to their motivation to seek tech as an ambition is lack of senior women role models in the field (Beasley & Fischer, 2012).

Hardey (2020) emphasized on paying attention to lack of diversity and restriction on women progression in the technology sector. It should be understood that diversity is the key to creativity, innovation and problem solving in any organization (Duarte et al., 2015). Technology itself is an innovative sector and people with similar experiences and backgrounds would not be able to contribute creative ideas for future developments (Friedman et al., 2016). Women's social sensitivity and emotional intelligence is vital for the success of any work team as they have better ability to observe, interpret, and value the feelings and opinions of others (Thompson, 2015). This can only be achieved by equal distribution and free speech representation of women in the workplace.

From the review, it is apparent that extant literature has not discussed the trends in wearable technology and issue of women empowerment in the industry collectively, highlighting the need for this research.

RESEARCH METHODOLOGY

Research Design

This study has presented the analysis of the interviews originally published in a blog by "Women of Wearables" (Butkovic, 2018). The primary aim of the article was to identify and compile a list of the top 100 Women from all over the world in Wearable and related technologies community for demonstrating their active ad prominent role in this creative and diverse industry.

Exploratory research design has been undertaken for this study. A total of 50 interviews (from the list of 100 interviews), where female participants were in direct association with the wearable technology, have been selected on the basis of judgment (purposive) sampling. Content from these selected interviews have been analysed and interpreted using inductive-thematic analysis approach.

Ethical Considerations

Ethical permission to use the interviews for conducting the stated research has been obtained a priori from the designated authority before the research process began.

Structure of the Interviews

The selected interviews came out as semi-structured interviews. Semi-structured interviews are in-depth interviews where the respondents have to answer formalized set of open-ended questions, allowing for a discussion with the interviewee rather than a straightforward question and answer format. They allow informants the freedom to express their feelings and opinions in their own terms and provide reliable and comparable qualitative data for subjective content analyses. The participants were asked the following questions:

1. their introduction, backgrounds and current working profile;
2. their biggest achievements till date;
3. challenges and obstacles of being in the wearables industry;

4. key trends in the wearable technology and the industry in near future;
5. importance of #WomeninTech initiative for them;
6. female role models in the industry, they admire the most;
7. suggestions they would like to give to women who aspire to become a part of the Tech industry."

Coding and Analysis Procedure

The study has analysed the content from the interviews using *thematic analysis – inductive approach.* Braun and Clarke (2006) have defined thematic analysis as a technique that identifies analyses and present themes or patterns from or within the data by organizing, minimizing and analysing the data in a rich manner. *Thematic analysis* has been selected as a method of analysis in this study because it helps in understanding diverse perceptions of participants in an insightful way by highlighting their similarities and differences. It helps the researchers in dealing with large set of data by producing unambiguous and organized results by following a well-structured procedure. It also helps in reaching at discerning conclusions from the real life experiences of the participants by explaining the social context related to the interpretation of such experiences (Rishi & Gaur, 2012). Braun and Clarke (2006) have further explained *inductive – thematic analysis* as a data driven method in which the process of coding and identification of themes is not done on the basis of researcher's critical presumptions and theoretical commitments rather it is based on the specific research question emerging from the data and coding itself.

RESULTS

Demographic Characteristics of the Respondents

The summary of demographic characteristics of selected 50 women participants in terms of their geographical region, educational qualification, job profile and experience (in years) has been shown in Table 1.

Table 1. Demographic Characteristics (N = 50, Gender = Female)

Geographical Region	No. of Participants		Position/ Designation	No. of Participants	
	Total	%		Total	%
USA	21	42	Founder/ Co- Founder	27	54
Canada	2	4	CEO	1	2
Brazil	1	2	CFO	1	2
UK	14	28	COO	1	2
Europe	6	12	Engineer/ Product Developer	9	18
Asia	6	12	Designer	4	8
			Director/ Head of Department	7	14
Educational Qualification			Experience (in years)		
Graduate	18	36	Less than 5 years	22	44
Post Graduate	19	38	5 – 10 years	19	38
Doctorate	11	22	More than 10 years	9	18
Professional Degree/ Course	2	4			

Extraction of Themes

All the semi structured interviews were transcribed before the data analyses. The transcripts in word format were changed to rich text format (RTF) to upload to the NVivo Software. As mentioned earlier, *inductive – thematic analysis* was used for the data analysis process. Accordingly, the transcripts were carefully scrutinised with the aim of identifying themes and sub-themes related to the research questions. This study has followed a *six-stage approach* to conduct the thematic analysis as presented in Figure 1. In the first stage, both the authors have carefully gone through the interviews individually to assemble thoughts. Then, NVivo software was run on the transcripts to produce initial codes. Figure 2 has depicted the Word-Cloud of most cited Top 50 terms from the interviews.

In stage two, the strategy of *multiple coding* was followed as it allows each researcher to independently analyse the data and produce the codes which will lead to the cross checking of the codes generated and enhances the overall quality of data interpretation. Reliability of content analysis is generally measured by the degree of reproducibility i.e., ratio of the number of coding agreements to the total coding judgments. Inter-coder reliability was calculated using the Perreault and Leigh (1989) formula which came out to be 0.88, lying within the accepted range of 0.80 to 1. Further, any form of discrepancy was taken care of by the authors. This stage resulted in generation of 194 codes.

In stage three, researchers started searching for the prospective themes: main and sub-themes. In this study, a theme which presented some structured and patterned meaning within the data has been characterized as a *main theme* while a theme which elaborated the understanding, complexities and comprehensiveness of the main theme in a structured way has been characterized as a *sub- theme* (Braun & Clarke, 2006). To identify main theme or sub-theme, following inclusion criteria were established (Creswell, 2007):

- *Inclusion criteria for a main-theme (IC1)*: it should have appeared at least twice in the entire data and has been meticulously discussed by the participants.
- *Inclusion criteria for a sub-theme (IC2)*: it should also have appeared at least twice in the entire data and can be easily recognized in tandem with the identified main theme. In this stage, 194 codes which were identified in stage two have been categorized into 12 initial main-themes.

In stage four, the identified 12 themes were reviewed, revised and refined meticulously. This stage involved combining some of the potential themes into one main theme while others were extended or discarded. It helped in reduction of 12 initial themes into five final, validated and meaningful themes that capture the essence of the entire data.

In stage five, the final identified themes were named and their sub-themes are clearly defined as shown in Table 2. In the final stage i.e. sixth stage, interpretation and analysis of the final results have been conducted. The next section presents the description of the main-themes and their respective sub-themes with few of the related extracts from the participants' interviews followed by the discussions of the results.

SUMMARY OF THEMES

Data analyses in the previous section has led to the extraction of five final themes and sub-themes (Table 2) which has been discussed in this section:

Future Trends in the World of Wearable Technology

The theme 'future trends in the world of wearable technology' has captured the forthcoming trends in the wearable industry. It has highlighted the industries and sectors in which the interviewees believed that development in wearable technology would not only solve prevalent problems but also assist them in becoming more effective and powerful.
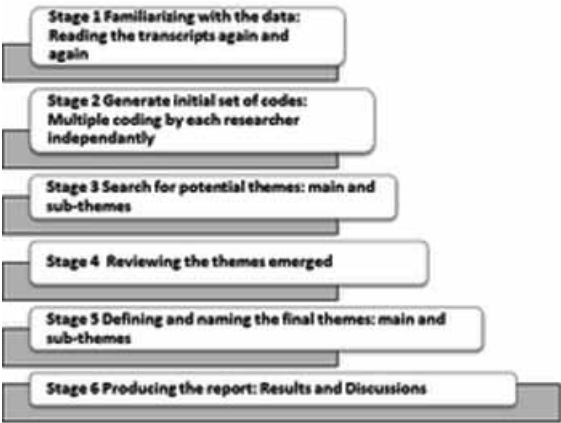
Figure 1. Stages of Thematic Analysis

Stage 1 Familiarizing with the data: Reading the transcripts again and again

Stage 2 Generate initial set of codes: Multiple coding by each researcher independantly

Stage 3 Search for potential themes: main and sub-themes

Stage 4 Reviewing the themes emerged

Stage 5 Defining and naming the final themes: main and sub-themes

Stage 6 Producing the report: Results and Discussions

Table 2. Validated Final Main-Themes and Sub-themes

Validated Main-Themes	Validated Sub-Themes
Future trends in the world of wearable technology	• AR/VR and Artificial intelligence (AI) industries • Medical, sports and fitness sectors • Clothing and Jewellery industry • Military and other industrial application
Implications of wearable technology for the society	• Environmental Impact • Social impact • Privacy and Security Regulations
Significance of #WomeninTech initiative	No sub-theme emerged
Role of women employees in the organization	No sub-theme emerged
Obstacles faced and recognition awarded by society to women entrepreneurs	• Obstacles Faced • Recognition Awarded

Figure 2. Word Cloud of Top 50 terms

AR/VR and Artificial intelligence (AI) industries: The traditional role of AI was limited to the personalization of e-mails and chat bots. But as we move forward, AI has pushed the wearable technology to the next level, AI voice-driven assistances and analytics have been used in different types of wearable devices for improving their security and performance. However, AR (augmented reality) and VR (virtual reality) are still in the initial stages of advancement for wearables but have the great potential in influencing quality, performance, maintenance, and productivity in both consumer (AR glasses, AR headsets, bio-sensors etc.) and industrial spaces. One of the respondents talked about the new dimension of AI:

'Emotional technologies: so sensors collecting information on emotions (for example, when someone is nervous or scared) and a given environment or device reacts on the basis of that emotion.' (Respondent Id: 35)

Medical, sports and fitness sectors: Wearables have come in light as a revolutionary transformation for sports and fitness enthusiasts through their ubiquity and benefits of self-monitoring. In the field of healthcare, more capable and accurate sensors have the potential to monitor data and predict major health risks like cancer, dementia disorder etc. Fem-tech i.e. female technology is also evolving by providing women with reliable information and making them self-assured with respect to their intimate and reproductive health (e.g. pregnancy, pelvic health and menstruation trackers). Other growing markets in wearables healthcare sector could target the elderly people (e.g. a robotic home friend for the older people), babies and kids, people with special needs and pets (e.g. wearable like "Trackener" for horse).

'I love the direction that things are going in terms of the "empowered patient". I would like to see that continue and be more embraced by the medical establishment.'(Respondent Id: 28)

Clothing and Jewellery industry: Wearables have added a new dimension of "Fash-tech" to the textiles and accessories industry by merging fashion, technology and function aesthetically. This particular segment of wearables has targeted the "Millennial" generation with their appealing inventions including illuminating clothing and bags, heating massage shirts and coats, solar clothing, "gamification" of garments; smart rings, earrings and bracelets which can act as activity trackers, emergency help solutions, GPS, etc.

'Smart textiles can be worn on and in the body but can also be used in architecture, furnishings, automobile and industrial applications, to name a few.' (Respondent Id: 11)

Military and other industrial applications: Other trend in the wearable industry involves applications that are striding towards offering innovative solutions to the acute problems rather than just being a technology. For instance, Power saving wearables have been developed which could work on solar energy and bio-fuels like glucose. Another technology includes development of soft exoskeleton for military which would help in mitigating fatigue. Few companies are also designing products that aim towards improvising workers' health and safety.

'Immersive technologies…say a large factory, sensors might be able to detect where living being are located and fire fighters might be able to navigate their way….using virtual maps…onto their goggles.' (Respondent Id: 08)

Implications of Wearable Technology for The Society

The theme 'Implications of wearable technology for the society' encapsulated the perspective of these woman respondents on the contribution of wearable technology towards the sustainable future of the society. However, whether this technology is a boon or bane for the society, it is a conflicted issue. These women have described wearables as a mixed blessing which offer advantages as well as disadvantages.

Environmental Impact: Wearable devices should be develop in such a way that they are capable of fulfilling their energy requirements from the sustainable sources like wind, heat or sun while keeping in consideration the dire consequences of manufacturing processes on the environment. In order to save the planet, companies should promote greener processes to complete the production of these devices. For instance, LABFRESH is a green shirt wearable manufacturer, fighting against the concept of irresponsible consumption, by persuading customers to stop buying cheap goods which are thrown away after few uses.

'….horrendous environmental and labour and the unethical supply chain issues of sourcing rare earth minerals in war torn countries to make these devices..' (Respondent Id: 17)

Social impact: The issue of women health has been treated as a taboo in less developed nations and the need for critical diagnosis in this segment was long overdue. The advent of wearable technology and suitable apps has led to the empowerment of women by making them more aware and conscious towards their health giving rise to the rapidly advancing dimension of Fem-tech. Another social issue which was raised by the participants was of local manufacturing. Such initiative will not only promote responsible manufacturing among companies but also convince the customers to indulge in the habits of local buying.

'Try to devise products for the emerging and developing nations and make a device which will help tackle real issues in society.' (Respondent Id: 44)

Privacy and Security Regulations: One of the major hindrances in the acceptance of wearable technology by the society is the threat to privacy and security of the wearable tech users from their personal and sensitive data being collected unethically by the wearable manufactures. There is urgent need to develop strict privacy laws and standards at global level because of the faster rate of development and increasing inter-connectivity among these devices.

'…first we have to set the standards. Also we have to talk about security and privacy laws. What happens if the first smart jackets get hacked?...' (Respondent Id: 32)

Significance of #WomeninTech Initiative

The theme 'Significance of #WomenInTech initiative' evinced the importance of this strategic initiative by emphasizing on the need to restore balance in this patriarchal society in order to empower the talented women all over the word in the technology industry.

All the respondents stated that #WomeninTech initiative is plying a very significant role in bridging the gap in the gendered-imbalance industry. The diversity in the wearables industry would result in development of such innovations and technologies that would cater to specific needs of the society. With the help of this initiative, women in the successful tech-executive positions would be able to motivate, connect and support other young girls and women to become a productive member Of the industry.

'…in order to make a change and see a change, we need to be different than the people around us who have for years been only promoting men and ignoring women….' (Respondent Id: 5)

The respondents, however, put forth that being a part of wearable industry does not mean that their roles should be restricted to the designing of clothing and jewellery accessories rather they can be anything they want from programmers to engineers or anyone else. They should have equal life choices and opportunities as men:

'…we should raise awareness that not only men are able to create new technologies. Tech is not masculine!' (Respondent Id: 16)

Role of Women Employees in the Organization

The theme 'role of women employees in the organization' apprehended whether women held senior designations or lead positions in respondents' organization or not. This theme also tried to reveal the proportion of male-female diversity in the workplace of respondents.

Some of the interviewees stated that they emphasize on having the optimum and efficient mix of men and women in their core teams. Some of them further elaborated on the issue by acknowledging that they focus on having a male/female balance provided all of them are skilled and trained designers, engineers, product developers etc. They are not at all hesitant in hiring women for senior positions like hardware engineers, chief strategists, head of design team, etc. in their ventures. For instance, founder of an IoT accelerator which invests in start-ups said that they try to invest in 50% of those applications which come from women founders.

'…Women make up 1/2 of the world's population. The world would be a better place if we also made up 1/2 of the technology industry.' (Respondent Id: 33)

Obstacles Faced and Recognition Awarded by Society to Women Entrepreneurs

The theme 'Obstacles faced and recognition awarded by society to women entrepreneurs' referred to two aspects: firstly, the challenges or problems women encountered while making their career in the wearable sector and secondly, awards and recognitions accorded to the women in the industry for their success and achievements by the society.

Obstacles faced: Majority of the respondents agreed to the fact that their experiences in the industry were not very smooth and they continue to face resistant to change because the society still believes in positive correlation of technology and masculinity. Some of the common problems they faced related to identifying the right partners, sponsors and VCs to collaborate (who are equally talented and experienced), securing the investment and funding needs, promotion of their venture, creating awareness among communities about the need of their products, developing the content in local language of the users, existence of too few women founders in this niche industry, among others.

'Investment is very male-orientated industry with very little diversity... I very quickly realized that VCs are mainly male, the tech industry is mainly male.' (Respondent Id: 04)

Recognition Awarded: In this study, all the interviewees have marked their presence in the wearables' space with some or the other significant IoT developments. Majority of them have been awarded by the world's most prestigious organizations or societies such as Forbes, BBC, European Union, Times Magazine, MIT, Nominet, CES, among others. Such accolades not only highlight the importance of women in tech space but also inspire, motivate and boost the confidence of other women to come forth and give their valuable insights and assistances to the industry.

'When we first launched the brand we were included in Time Magazine's Top 25 inventions of the year, along with the Apple watch…Being included in that roundup felt pretty remarkable.' (Respondent Id: 21)

DISCUSSIONS

The findings of this qualitative study resulted in emergence of five critical themes, among which first two themes pertain to future, trends and application of wearable devices while the last three themes correspond to significant role women are playing in disproving the ethos that technology and masculinity are embedded together by marking their empowering presence in the wearable technology space. To illuminate the identified themes, this study has presented few narrative fragments of the respondents.

Future of Wearable Technology: For Individuals, Organizations, and Society

Wearables are being used for living a healthier, smarter and mobile lifestyle for many years now. The findings highlighted that addition of artificial intelligence (AI) with the right blend of augmented reality (AR)/ virtual reality (VR) into the world of wearables have enhanced their capabilities beyond something imaginable. AI has transformed wearables into intelligent machines which can not only understand the interaction between user and his environment but also provide phenomenal performance in terms of security, personalization and ease of use (Buttice, 2019). Today, the applications of AR/ VR are not restricted to gaming and entertainment only rather sophistications in wearable technology have extended their operations to the field of military, manufacturing and medicine as well. Military can use them to train soldiers by stimulating real-life combat situations while surgeons and doctors can experience surgical scenarios and test the medical equipments even before they are manufactured, in a cost-effective and risk-free manner (Yelverton, 2018).

The analysis also suggested that Fem-tech and Fash-tech has created a big buzz recently. The future of Fem-tech (technology that boosts female health and wellness) seems quite exciting because of the two reasons: first, continual innovations in sensor and real-time technologies and secondly, drastic change in perceptions of the people. Women are more open in talking about their health and bodies; they feel more empowered in self-tracking and self-monitoring over traditional doctor-patient relationship (Draper, 2018) For instance, some of the respondents were associated with ventures focusing particularly on women health such as a fertility window tracker for women by "Ava Science Inc." and a wearable for pregnant women to monitor and understand their contractions by "Bloomlife". Wearable technology has also infused its potential in fashion industry by developing fash-tech (fashion technology) apparel and jewellery. For instance, 'Gamergirls' collection by a venture named "Phi: Illuminated Design" has given a new definition to interaction by designing beautiful, elegant and feminine dresses which can be used as screen display while playing video games. However, currently such kind of advancement in fash-tech is considered as a luxury market alluring and serving the customer's high-end needs of status and conspicuous consumption (Arnault, 2018).

The qualitative analysis recommended that interaction of humans with wearable technology would become more beautiful if technology developers could start assessing its societal and environmental impacts on humanity. The horrendous impacts of development of wearable technology on the environment, labour and supply chain management need to be investigated closely. For instance, Fashion causes pollution; like fashion, it is believed that wearable technology would result in heaps of mass consumed and mass dumped hard-to-recycle electronic waste (Kuusk, 2016). Wearable manufacturer should focus on greener processes to develop sustainable wearables and thereby saving the planet. Lee et al. (2016) defined sustainable wearables as the wearable technology whose applications would have positive impact on the enhancing the quality of life, socio-environmental impact and the public interest. Sustainable wearables could be more adaptable with features such as self-cleaning, self-repairing, expanded life cycle and contributing meaningful addition to user's values and lifestyle. Wearables can also help in achieving social sustainability by allowing for remote healthcare and counteracting issues relating to aging population and significant reduction in healthcare costs (Vaajakari, 2018).

Another major concern down the road includes lack of security regulations with respect to privacy of information tracked and collected by corporate wearable devices manufacturers (Adapa et al., 2018). In some cases, intimate data and personal information about users is captured, stored as

well as transmitted to the unidentified third parties). One of the respondents clearly pointed out the fact that the pace with which wearable technology is developing; there is an urgent need to develop security standards and laws in this direction globally.

Women as Wearable Tech Developers, Managers, and Entrepreneurs

The results of the study underlined that the sobering lesser number of females entering into technology industries is a serious issue of concern from the feminist perspective. The presence of gendered inequalities in the field of scientific knowledge and technology has been long and well-recognized but still culture within these sectors remain adamantly impervious to change and pursue to extend deep rooted gender stereotypes. One of the respondents explained that problem lies at the primary level where boys are inclined towards technology and girls are prompted towards soft skills. The society should train both the sexes equally so that women who aspire to join technology are more confident and have skills to create stronger identities for themselves. Women have the power to transform the technology world by making significant intellectual contributions in the industry (Samulewicz et al., 2012).

#WomenInTech is an initiative to increase empowerment of women in terms of power, visibility and responsibility in the technology industry worldwide. For instance, Apple's Women in Tech program involves providing training sessions to women to resolve the issue of women scarcity in senior executive and computer programming jobs (Liedtke, 2018). The year 2018 has tried to change sexism within the industry by giving rise to many women tech leaders all over the world. Such initiatives will not only help in achieving desired diversity in tech by challenging societal norms but will also generate more innovations and better customer/client base to cater the wider range of needs which were earlier ignored such as women health.

Despite such efforts, there still exists huge gap between men and women occupying senior positions in any organization. Higher the positions in technology, fewer are the women in them (Tally, 2018). Another research revealed that acceptance of codes developed by women programmers were more than that of men but till their gender was kept secret (Wong, 2016). The findings of this study also advanced that women are not commonly seen commanding senior technology roles in the industry. The situation calls for taking desperate measures towards encouraging and providing opportunities for women so that they can be seen on the C-suite, representing the boards.

Finally, the study identified the perceived challenges faced by the women and recognition awarded to them in this gender imbalance sector. The tech environment is not very keen to support women entrepreneurs, making it difficult to them to have an active voice and space. Researchers have proved that women face more problems in securing external equity or bank loans as compared to men (e.g. Coleman & Robb, 2009; Kuschel et al., 2017). As employees, women are offered lesser salaries than men for the same job profile and as entrepreneurs, they are offered less investments by VCs as compared to men.

Although, the respondents appreciated that their achievements have been recognized worldwide with significant titles and awards. But still, they feel uncomfortable and absurd when their gender is treated as an achievement or a novelty in the gender biased techie industry. Both men and women are equally qualified and proficient in the field. Therefore, both should have access to equal opportunities and choices to become either a tech founder, entrepreneur, member of board or product designer or even engineers and programmers. In other words, if the industry strives to achieve excellence, it is required to open itself for self-evaluation and improve the overall work environment for women. This can be achieved by making gender based sensitive alterations in the organizational structures of the tech workplace, providing requisite educational credentials and hands-on vital technical training to women, and fostering gender diversity among companies' boards in order to promote healthy discussions for better ideas and decisions.

CONCLUSION AND IMPLICATIONS

The strength of this qualitative analysis is that it provides insights about the future development in wearable technology by dwelling upon the issue of gender interplay within the allegedly biased environment of the technology industry focusing particularly on wearable tech industry. *Theoretically*, the findings of the study have made significant contribution to the body of knowledge in the field of wearable technology by confirming that wearables have the ability to transform the future experiences of the users. The study has developed several themes which offered insights about the current trends and future applications of the wearable technology and impact it could exert on the society and the environment. Moreover, this qualitative analysis has also tried to paint a true picture of the existence of sexism in wearable tech industry by analysing the perceptions of the respondents regarding significant role played by women in the industry, positions they are offered and obstacles they faced.

The arguments raised by this study have far-reaching recommendations and practical implications for various stakeholders like wearable tech developers and marketers, tech industry and venture capitalists, and policy makers.

Wearable developers and marketers: Future wearable devices should be developed beyond data tracking accessories in the form of sustainable devices which enhance quality of life of the individuals, society as well as the environment. They should have tiny, reliable and efficient battery life mechanism, sourcing its power from renewable sources like wind, sun and water. Future technology should be evolved in the pursuit of further advancement in Fem-tech, health and wellness of aged people, aids for disabled, disaster management, women security and public relief by integration of capable sensors, cautious privacy standards, AR/VR technologies and improvement in artificial and emotional intelligence.

Industry and Venture Capitalists: Instead of condemning women for lack of skills, qualification and interests and thereby barring their ingress in the technology 'habitus', the 'gatekeepers' of the industry should become more democratic and more respectful towards the diversity. Venture capitalists should develop a radical vision to fund women founders after understanding that co-production of feminism and technology would create such products that would resolve problems and cater needs which can be better understood by women.

Policy makers: Policy initiatives recommend that the wearable technology could serve as a great platform in balancing social and gender inequalities from the society, provided: firstly, strict methods, standards and regulations are implemented for preserving privacy of the wearable users; secondly, vision for official inclusion of women in the modern tech community is prioritized and strategized by the government through mainstreaming practices like establishment of training and skills development programs; and thirdly, systematic follow-up on the implementation of policies should be done so that aspirations can be turned into reality rather than being entangled into the web of rhetoric and articulation.

LIMITATIONS AND SCOPE FOR FUTURE RESEARCH

The ability of this study to draw generalized results is limited by the technique of thematic analysis. Firstly, the interviews with the well-established and prominent women in the wearables industry create a success bias in the sense that it fails to reflect the knowledge and experiences of the people who are still struggling to achieve a position in the tech space. Secondly, this study relates to only one specific technology sector i.e. wearable technology. However, this study sets a promising background for future researchers who may undertake similar in-depth analysis to compare and understand the issue of gender equality and technology industry in other sectors as well as in different countries. Thirdly, this study lacks quantitative data on participation of women in wearables industry disaggregated by their age, qualification, ethnic and indigenous backgrounds. Future studies can overcome this limitation

by analysing the impact of these and more factors on the equality of career opportunities in STEM sector. Finally, concerns related to human and technology interaction with respect to development of the wearable technology, its future, trend and applications will be paramount in the near future and researchers will be required to incessantly and critically examine such advancements in the technology for the success of the future wearables.

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