

Prevalent elements of consumer wellbeing in wearable technology use: An interdisciplinary systematic review and future research agenda

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Abstract

The impact of wearable technology (wearables) on user wellbeing requires closer examination given the growth in adoption across multiple domains including workplaces, leisure, and healthcare. This paper consolidates research on consumer wellbeing and wearables through an interdisciplinary systematic review of 23 empirical journal articles from psychology, information technology and business domains. Our analysis highlights the principal conceptualizations of wellbeing and offers insights into theories, methods, and key variables in these studies. The findings reveal an overemphasis on adoption and usage of wearables in the literature; a narrow definition of wellbeing; and a limited range of theoretical and methodological perspectives. We propose that future research should be holistic, drawing on mainstream wellbeing theories and examining micro, meso, and macro level conceptualizations of wellbeing. Employing diverse methodologies such as longitudinal, time sampling, cross-sectional, qualitative, and quantitative approaches, and randomized control trials. We develop a framework outlining avenues for future research to extend current understanding in this research domain.

KEYWORDS

consumer wellbeing, systematic review, technology adoption, wearable technology, wellbeing theories

1 | INTRODUCTION

Wearables are smart electronic monitoring devices worn by consumers to collect personal health-related and physical metrics through predictive technology, a form of artificial intelligence (Brophy et al., 2021). They include activity trackers, assistive technologies, and human augmentation technologies (Lunney et al., 2016; Raisamo et al., 2019; Wang et al., 2019). Wearables have potential to support physical health and wellness among

users by providing essential real-time biometric data such as mood, sleep, weight, stress, or physical activity (Godfrey et al., 2018). Increased access to such information allows consumers to self-manage their wellbeing, a concept referred to as self-hacking (Piwek et al., 2016), which has led to widespread adoption of wearables. The market has grown exponentially in recent years reaching 1.1 billion connected wearable devices worldwide in 2022 (Statista, 2022). Global revenues for 2023 are projected to exceed 68 billion USD (Statista, 2023).

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As wearables become ubiquitous, there is need to better understand their impact on wellbeing for several reasons. Wearables are designed and marketed based on their potential for positive impact on physical wellbeing (Spil et al., 2021). For example, Fitbit's homepage call to action is "Take charge of your health with the latest from Fitbit" (Fitbit, 2023). Despite marketing consumer wearables as healthcare devices, industry regulation is not well developed (Brophy et al., 2021). There are concerns over data accuracy and storage and transfer of personal data for targeted advertisement and product development, primarily benefiting device manufacturers over consumers. Furthermore, digital addiction which entails overusing digital tools such as wearables leading to physical, emotional, mental, and social problems (Cemiloglu et al., 2022; Kesici & Tunç, 2018), raises questions of digital wellbeing in a social environment where digital media are omnipresent. This necessitates the development of new frameworks to illuminate how, why, and when digital media can support or harm wellbeing (Büchi, 2024).

1.1 | Interdisciplinary conceptualizations of wellbeing

Researchers have struggled with how to define consumer wellbeing particularly from a macro perspective (Malhotra, 2006). Morrow and Mayall (2009) also highlight the complexities of delineating wellbeing. As an umbrella term, "wellbeing" encompasses multiple complementary yet distinct types of wellbeing (Gallagher et al., 2009). Conceptualizations vary by discipline (see Table 1), so we first introduce different types of wellbeing to contextualize our study. Psychology research examines wellbeing at the individual level, which we consider a micro-level dimension of wellbeing (Seligman, 2002). The focus is on subjective wellbeing which comprises hedonic and eudaimonic wellbeing (Diener, 1984; Pomfret, 2021). Hedonic wellbeing is emotion driven, momentary, and typified by short stints of positive affect, alleviation of distress and boredom. Eudaimonic wellbeing is cognitive driven involving extended psychological effects. It is characterized by long-term life satisfaction and human flourishing (objective approach), happiness (subjective approach), engagement, authenticity, personal development, and self-actualization (Huta & Waterman, 2014; Pomfret, 2021; Waterman et al., 2010). Eudaimonic wellbeing is also explored in neuroscience and philosophy.

Emotional wellbeing focuses on individuals and is defined in relation to mental health and wellbeing in psychology and clinical sciences. Digital wellbeing research considers the importance of privacy and digital addiction, in the marketing, IT and psychology literature. Social wellbeing is often the focus of sociology research, concerned with quality of life, social confidence, and connectedness (Gaggioli et al., 2017; Keyes, 1998). Relatedly, a focus on collective wellbeing is important within philosophy, examining positive relationships and positive institutions (Roy et al., 2018). In this study, we consider social and collective wellbeing as meso-level dimensions of wellbeing, bridging the gap between micro- and macro-levels, as they

TABLE 1 Conceptualizations of wellbeing by discipline.

Conceptualization of wellbeing	Discipline	Characteristics	Focus/Level	Authors
Eudaimonic wellbeing	Neuroscience, psychology, and philosophy	cognitive driven; long term life satisfaction; human flourishing personal development/self-actualization.	Individual/micro	Huta and Waterman (2014)
Hedonic wellbeing	Psychology	affect/emotion driven; momentary; short stints of positive affect, alleviation of distress and boredom	Individual/micro	Waterman et al. (2010)
Subjective wellbeing	Psychology	Umbrella term for eudaimonic and hedonic wellbeing	Individual/micro	Waterman et al. (2010)
Social wellbeing	Sociology	social connectedness	Group/meso	Keyes, (1998).
Emotional wellbeing	Psychology, Clinical sciences	mental health and wellbeing	Individual/micro	Cemiloglu et al. (2022)
Digital wellbeing	Marketing, IT, psychology,	digital addiction, privacy	Individual/micro	Cemiloglu et al. (2022)
Collective wellbeing	Philosophy	positive relationships/institutions overall "health" of a community (vitality, opportunity, connectedness, contribution, and inspiration)	Group/meso	Roy et al. (2018)
Consumer wellbeing	Economics/Macromarketing	acquisition, possession, consumption, maintenance, and disposition of economic goods	Economic/macro	Sirgy and Lee (2006)

examine the social and public nature of wellbeing, social connectedness, and embeddedness (Keyes, 1998). Economics and macro-marketing perspectives conceptualize wellbeing in relation to customer satisfaction with goods which results in satisfaction with the consumption process (Malhotra, 2006; Sirgy & Lee, 2006). This conceptualization of consumer wellbeing is wide reaching providing a theoretical foundation to guide marketing research, strategy, and tactics at the micro-level of marketing practice and at the macrolevel in guiding public policy and assessing the aggregate effects of marketing practice on society (Sirgy, 2021).

1.2 | Current wearables and wellbeing research

Prior research has focused on descriptive analysis and intervention studies. The former relates to identifying characteristics of fitness applications and wearables. The latter focuses on behavior change attributable to wearables use (Stragier et al., 2016). Descriptive analysis focuses on the types of behavior addressed by applications associated with wearables such as nutrition and physical fitness (Dimitratos et al., 2020; Shi et al., 2022). Intervention studies examine the potential of social media to support behavior change in the use of wearables (Goodyear et al., 2021). Recent literature reviews on the topic include Loncar-Turukalo et al. (2019) scoping review that identified technology acceptance and privacy as the dominant user-related concerns. Ferreira et al. (2021) review identified wellbeing as a major theme in wearables research. Due to the broad focus of extant literature reviews on wearables, there is still a gap on in-depth insights into the status of the literature on wearables and wellbeing and prevalent elements of consumer wellbeing in wearables use.

This study therefore aims to identify prevalent elements of consumer wellbeing in wearables use and addresses the following research questions: What are prevalent elements of consumer wellbeing in wearables use? What are the principal conceptualizations of wellbeing in the wearables literature? What is the relationship between wearables use and consumer wellbeing? We respond to these research questions using a systematic literature review of psychology, information technology and business literature. From a theoretical perspective, identifying prevalent elements of consumer wellbeing within the context of new technologies such as wearables can be useful for evaluating the application of current frameworks and models to the study of wellbeing and to propose

new models. From a practical perspective, identifying prevalent elements of wellbeing in wearables use could benefit multiple stakeholders by informing design and marketing, policy development, and consumer education.

2 | METHODS

The systematic review followed guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021) which comprises a multi-stage approach to reviewing literature according to inclusion and exclusion criteria (see Table 2). We focused on wearable fitness trackers (wearables) in the context of voluntary use for personal rather than clinical or industrial reasons. The study is restricted to voluntary personal use of wearables for several reasons. First, Loncar-Turukalo et al. (2019) suggest that systematic reviews on wearables should focus on wearable solutions and user concerns in a *pre-specified* application scenario due to the breadth and depth of the field. Second, clinical wearable devices are medical devices subject to stringent regulations, whilst the consumer wearable device market is voluntary and less well regulated (Brophy et al., 2021). Third, the technicality of medical wearable devices would not be suitable for nonspecialist audiences as they pertain solely to medically focused outcomes as indicators of physical health such as rehabilitation and chronic disease management (Lu et al., 2020). Finally, industrial wearable devices serve organizational objectives and differ in use from voluntary wellbeing monitoring, hence are outside the scope of this study.

Based on a preliminary literature review and the focus of this study, the search string: (“wearable technology”) AND (“wellbeing” OR “well being” OR “well-being”) was used in Web of Science, Science Direct and Wiley online databases. Web of Science was selected for its strict peer review and quantity and span of the database, with access to over 171 million records (Gupta et al., 2023). Wiley and Science Direct electronic databases provide comprehensive coverage of empirical studies on the topic of study. The initial search yielded 4579 search results, subsequently reduced by following the inclusion criteria detailed in the PRISMA flowchart in Figure 1. Two raters screened 156 records in the Title and Abstract screening stage. Interrater reliability was assessed using Cohen's *k*-statistic ($k = 0.66$), indicating moderate agreement according to McHugh's (2012) interpretation of Cohen's (1960) work. Where

TABLE 2 Systematic review inclusion and exclusion criteria.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> Peer reviewed journal articles Journal rankings greater than SJR 1.2 or ABS 3 Empirical studies Discipline: business and management, computing/computer science, psychology Consumer focus Voluntary wearables use 	<ul style="list-style-type: none"> Conceptual papers Review papers Studies from medicine-focused (including neuroscience and psychiatry) journals. Studies focusing on use of wearables for medical research Organizational focus

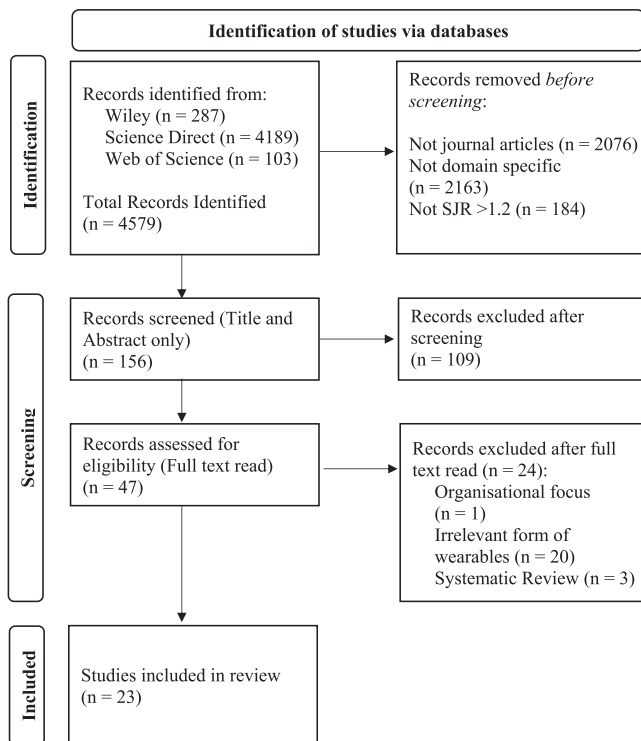


FIGURE 1 PRISMA flowchart outlining systematic review process.

disagreement arose, a third rater made a final decision regarding inclusion. The next stage was a full text read ($n = 47$). A further 24 articles were excluded from the review as follows: systematic reviews ($n = 3$); organizational focus ($n = 1$); focusing on a form of wearables not relevant to our review ($n = 20$). Studies were reviewed on several dimensions (conceptualization of wellbeing; theory and context; methods and findings). The computer data analysis program NVivo, was used to explore the breadth, depth, and detail of themes in the studies to develop theoretical links between themes during data analysis (see Appendix Figure 1).

3 | FINDINGS

This section summarizes the literature review on several dimensions beginning with conceptualizations of wellbeing, then theoretical perspectives and contexts, and methodological approaches. We address the current status of the literature and propose future research directions for each dimension.

3.1 | Conceptualizations of wellbeing

The findings indicate an overemphasis on macrolevel dimensions of wellbeing, and a limited focus on micro and meso-level dimensions (See Table 1). Macrolevel dimensions of consumer wellbeing (henceforth macrolevel wellbeing) are concerned with consumer

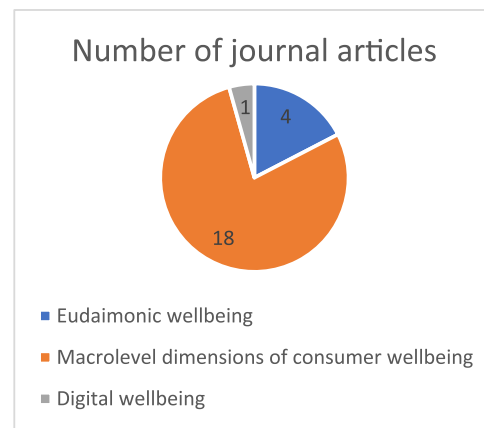


FIGURE 2 Quantity of journals by conceptions of wellbeing.

satisfaction with goods and services across the six experiences in the consumption process (acquisition, preparation, consumption, ownership, maintenance, and disposal) judged to be beneficial at individual and societal level (Malhotra, 2006). According to Sirgy and Lee (2006), a comprehensive consumer wellbeing measure, construed from a macromarketing perspective, should capture consumer satisfaction in respect to all six consumer experiences in the consumption process. Consumers who experience satisfaction across all six stages are likely to have higher overall wellbeing compared to those satisfied with one/few aspects of the consumption process. This focus on satisfaction with the consumption process as a conceptualization of wellbeing could explain the dominance of aspects of macrolevel wellbeing such as adoption and use in the wearables and wellbeing literature.

Some of the studies in this literature review covered multiple concepts of wellbeing, but we classified the articles based on the primary wellbeing focus in the study. Figure 2 shows that macrolevel wellbeing dominates the literature (18 of 23 studies). Articles whose primary focus was on any of the experiences in the consumption process (acquisition/adoption or consumption/use) were classified under macrolevel wellbeing. These include Burbach et al. (2019) who examine product features motivating or inhibiting wearable use, Papa et al. (2020) who focus on the role of product attributes on adoption. Choi and Kim (2016) examine intention to use wearables while (Chuah et al., 2016; Jee & Sohn, 2015; Spil et al., 2021) examine adoption and use. The other articles focusing on macrolevel wellbeing examine factors influencing acceptance (Huang et al., 2022; Wu et al., 2016), use (Lunney et al., 2016), continued use (Hong et al., 2017; Shin & Biocca, 2017), habitual use (Marakhimov & Joo, 2017; Oc & Plangger, 2022; Stragier et al., 2016), resistance to adoption (Ogbanufe & Gerhart, 2022) and older people's adoption (Talukder et al., 2020), or intention to use wearables (Farivar et al., 2020; Javdan et al., 2023). The emphasis within macrolevel wellbeing is adoption and use, with limited attention to disposal, a crucial aspect of macrolevel wellbeing.

Eudaimonia is the primary focus in (4 of 23) studies that examine wearables role in empowerment/disempowerment

(De Moya & Pallud, 2020; Nelson et al., 2016), the positive impact of wearables on physical, and psychological wellbeing (Stiglbauer et al., 2019), and how practices associated with wearable use impact autonomy and reduce stigma (Morozova & Gurova, 2021). Digital wellbeing is illuminated by Maltseva and Lutz (2018) who use privacy theory to test the effect of privacy concerns on trust, self-quantification, and therefore self-disclosure. Other concepts of wellbeing are also reflected in the literature but are not the primary focus and hence are not reflected in the classification in Figure 2. For example, social wellbeing (Morozova & Gurova, 2021; Stragier et al., 2016). (See Appendix Table 1) for a comprehensive overview of other concepts of wellbeing that were peripheral in the studies). Positive psychology emphasizes individual and societal wellbeing (Seligman, 2002), but these types of wellbeing have received limited attention in the research on wearables as illustrated in Figure 2. Our analysis reveals the lack of composite wellbeing conceptualizations in wearables use research, and a narrow focus on macrolevel dimensions of consumer wellbeing (acquisition/adoption and use/consumption) (Sirgy, 2021).

3.2 | Current research limitations on wellbeing conceptualizations and future research directions

Different types of wellbeing may be positively correlated where an increase in one type of wellbeing can lead to an increase in other forms of wellbeing (Gallagher et al., 2009). Few studies have focused on multiple conceptions of wellbeing beyond experiences in the consumption process (acquisition/adoption and use/consumption). Future research could consider other types of wellbeing and illbeing and the interrelationships between them. For example, improved

quality of life; mental and physical health (perceived); satisfaction with tracked physical activities and goal achievement; subjective experience of time allocation and pressure, and personal development/character development. Further research is needed to understand wearables' impact on agency and eudaimonic wellbeing (how wearables influence users' decisions about health and overall wellbeing and whether they diminish consumer agency by overriding this process). (Figure 3).

Most research on wearables adopts a positive stance with limited focus on negative effects such as digital addiction. This is the overuse of digital tools that can create physical, emotional, and social problems (Kesici & Tunç, 2018), or dependency on physical trackers for physical activity (Attig & Franke, 2020). Negative effects such as feelings of guilt and shame in the event of failure to achieve fitness or nutritional goals can also impact other aspects of wellbeing such as eudaimonic wellbeing (Ryff & Singer, 2008). Additionally, wearables can negatively impact mental wellbeing, due to the possibility for data comparison with peers, leading to feelings of deficiency if a user's activity is lower than that of peers (Tikkanen et al., 2023). We therefore propose research into the impact of wearables on emotional wellbeing, which also shifts focus to micro-level wellbeing. Such research could consider positive and negative life transformations, emotional regulation, development of emotional agency in interpersonal relationships for example when using online fitness communities and overcoming limitations on physical activity imposed by fear (Pomfret, 2021). Future research could also examine wearables and user subjectivation and ethical issues arising from such subjectivation. For example, wearables use could lead to users aligning themselves with certain identities and categories with implications for wellbeing (Esmonde & Jette, 2020).

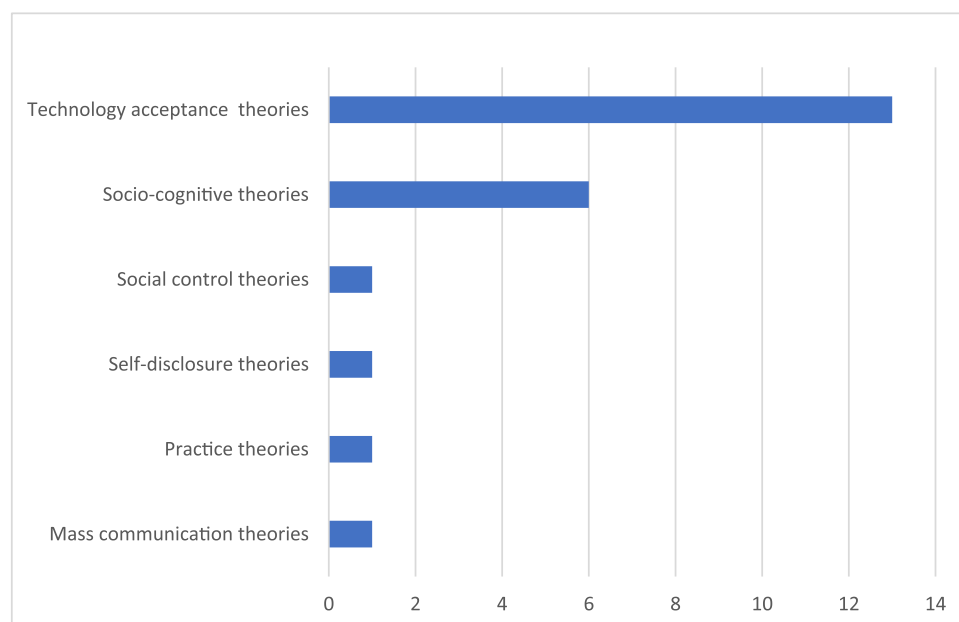


FIGURE 3 Theory classifications.

3.3 | Theoretical perspectives and contexts

Most studies focus on wearable adoption and use illustrating an overreliance on technology acceptance models and theories in the literature (Table 3). Exceptions are De Moya and Pallud (2020), who explore empowerment and disempowerment effects of wearables. Their findings show ambivalent results, identifying 13 effects of quantified-self technology use on empowerment and 11 on disempowerment. Theories in the review can be classified according to key themes in their application as follows. (i) Self-disclosure theories, (ii) Practice theories, (iii) Socio-cognitive theories, (iv) Mass communication theories, (v) Social control theories, and (vi) Technology acceptance-related theories.

The extent to which an individual feels comfortable sharing their private information and data is central to self-disclosure theories (Masaviru, 2016). Practice theories emphasize the routines, habits, and social interactions that shape individual and collective actions (Reckwitz, 2002). Socio-cognitive theories emphasize the reciprocal interactions between cognitive processes, behavior, and the environment (Bandura, 1986). Uses and Gratifications Theory and Media Affordances Theory are mass communication theories (Ruggiero, 2000; Van Dijck & Poell, 2013). Social control theories examine how social systems, institutions, and mechanisms influence and regulate individual behavior within a society (Chriss, 2019). Technology acceptance theories explore how and why individuals or groups decide to accept and use new technologies (Davis et al., 1989).

3.4 | Current research limitations on theoretical perspectives and contexts and future research directions

The analysis shows that extant research predominantly focuses on immediate consumer interaction with wearables, discounting wider factors at play. For example, though motivations to use wearables are explored in current research, these studies do not consider the coexistence of multiple, sometimes conflicting motivations. Future research could potentially include multiple and flexible motives for use, not necessarily mutually exclusive motivations; addressing more than one fundamental wellbeing aspect (Machin et al., 2019). For example, fashion, physical wellness, beauty, and social connectedness (Couch et al., 2019; Rich, 2011). Motivations may further vary between individuals and groups, therefore similarities and differences between motives and benefits in wearables adoption warrants attention in future research. Children's perspectives on wearable use is also a nascent research area. As parents' guide, direct or transact in children's consumption decisions, they could be interviewed as surrogate consumers due to ethical concerns over children's vulnerability. Further research could also consider similarities and differences in wellbeing outcomes between cultures that prioritize individual autonomy versus collectivist cultures. Future research could also examine wearables and wellbeing determinants,

namely, personal, and social factors, incorporating the role of skill level and social capital in wellbeing outcomes.

Differences in wellbeing for institutionally imposed habituation versus voluntary habituation in wearables is another potential research area. Future studies could also shed light on wearables and wellbeing comparisons across social class. For example, the privilege to take work breaks to increase steps or regular water intake may not be available across all social classes whilst at work, due to differing work demands and constraints. Hence there are differences in agency and capacity to make a difference in health and wellbeing across social groups, which can illuminate the relationship between wearables and inequality. Older adults and individuals earning lower incomes are less likely to invest in wearables. Where investment in wearable devices occurs, there are additional barriers in interpreting data or content, suggesting that discrepancies in literacy levels potentially impacts upon the usefulness of wearables (Smith & Magnani, 2019). Similarly, wearables do not work as standalone devices, users may need a smartphone or weighing scale among other items. The role of the networks of actors in wellbeing could also be examined. The role of codesign in user adoption and use, and potential benefits of such initiatives also offers potential for future research.

Mainstream wellbeing perspectives are notably absent in the literature. Future studies could apply perspectives such as life-satisfaction theories (Margolis et al., 2019; Tiberius & Hall, 2010), nature fulfillment theories (Kim, 2020; Kraut, 2007), objective list theories (Arneson, 1999), desire fulfillment theories (Griffin, 1986; Heathwood, 2006), and subjective state theories for a more nuanced development of the literature on wearables and wellbeing. Life satisfaction theories offer a holistic view of wellbeing over an extended time (Margolis et al., 2019). They reflect human priority more closely than current theories in use. By applying life satisfaction theories to wearable studies, researchers can gain insights into overall wellbeing rather than specific life moments (like the Technology Acceptance Models). Nature-fulfillment theories emphasize the cultivation of one's abilities for achieving well-being (Kim, 2020). These theories offer valuable insights into nurturing and utilizing one's full potential, a key aspect of eudaimonic well-being.

Desire fulfillment theories emphasize satisfying desires and avoiding frustrations as crucial for well-being (Heathwood, 2006). These theories face criticism for assuming ideal conditions like perfect information but acknowledge individual preferences unlike prevailing theories (Heathwood, 2006; Rice, 2013). Objective list theories challenge the prevailing view that wellbeing is a list of things that are good for people independently of desire satisfaction and attitudes, creating tensions between hedonic and desire fulfillment theories (Arneson, 1999). They propose that certain elements are inherently valuable for well-being, even if an individual holds negative views towards them (Rice, 2013). The use of objective list theories would challenge current dualist approaches to wellbeing in relation to its hedonic or eudaimonic focus (Thorsteinsen & Vittersø, 2020). Subjective state theories pertain to subjective wellbeing which

TABLE 3 Theories and contexts of application.

Theory	Author/year	Context and application	Theory classification given context of application
Derived from personality and privacy theories	Maltseva and Lutz (2018)	The authors use privacy theory to test effect of privacy concerns on trust, self-quantification, and therefore self-disclosure	Self-disclosure
Practice Theory	Morozova and Gurova (2021)	The authors list categories of practices applicable to wearables including health-related and dietary practices, working practice, cultural and intellectual practices, shopping practices, home-related practices, and experience-oriented practices.	Practice theories
Coping theory and coping model of user adaptation	Marakhimov and Joo (2017)	Examines consumers post adoptive use of information technology in light of privacy concerns.	Socio-cognitive
Cognitive complexity theory and aging theories (resource theory; speed theory; inhibition theory).	Farivar et al. (2020)	Focuses on individuals aged 65+ , to understand their propensity to use wearables and barriers to use.	
Reactance theory	Ogbanufe and Gerhart (2022)	Examines barriers to smartwatch adoption to understand why individuals avoid smart technologies.	
Self-determination theory and the U-Commerce framework	Oc and Plangger (2022)	Examines post adoptive use and how technology characteristics helps users sustain motivation and acquire habitual behaviors.	
Self-Regulation theory	Nelson et al. (2016)	Examines self-observation and self-regulation impact on empowerment and commitment (affective and normative).	
Social Cognitive Theory, Control Theory; Cognitive Dissonance Theory, Theory of the Extended Self; Operant Conditioning Theory	Stiglbauer et al. (2019)	The authors use social cognitive theory to examine self-regulation.	
Uses and gratifications theory (UGT) and Media affordances theory	Stragier et al. (2016)	Examines opportunities for feedback provided by wearable devices and factors responsible for persistent online fitness communities use.	Mass communications
Panopticon metaphor from Foucault's original writings: Four core concepts, namely power, knowledge, body and space	De Moya and Pallud (2020)	Examines whether quantified-self technologies, based on wearable technologies, enable empowerment/disempowerment.	Social control
Chasm theory; first mover advantage theory	Jee and Sohn (2015)	Examines consumer preferences in wearable design using adoption theories.	Technology acceptance
TAM	Lunney et al. (2016)	Examines relationships among health-related outcomes of wearables use such as overall exercise behavior and perceptions of health.	
TAM	Chuah et al. (2016)	Study on adoption of smartwatches. Nonusers and owners from a student sample.	
TAM	Choi and Kim (2016)	Examines whether factors germane to the characteristics of fashion products affect intention to use smartwatches.	
TAM	Huang et al. (2022)	Examines consumer affordability concerns using TAM framework and additional constructs (<i>economic burden</i> and <i>data privacy</i>)	
TAM and other technology adoption including Diffusion of innovations theory; Expectation-confirmation theory; Flow theory	Hong et al. (2017)	Examines the role of innovativeness for continuance intention of smartwatches.	

(Continues)

TABLE 3 (Continued)

Theory	Author/year	Context and application	Theory classification given context of application
TAM/UTAUT	Burbach et al. (2019)	Examines if and how product design influences acceptance and projected use.	
TAM; Innovation Diffusion Theory; UTAUT	Wu et al. (2016)	Examines factors affecting individuals' decision to accept and use smartwatches.	
UTAUT2	Talukder et al. (2020)	Examines elderly use of wearables using TAM model with some adaptation.	
Theory of reasoned action (TRA)	Javdan et al. (2023)	Examines psychological barriers influencing seniors' attitudes and intentions to use wearables.	
TRA and TAM	Papa et al. (2020)	Examines factors influencing adoption of wearables in India	
Trans-theoretical model (TTM) of behavior change.	Shin and Biocca (2017)	Examines user motivation to develop an effective user interface for delivering health information	
USE IT Model	Spil et al. (2021)	Examines what determines the success of IT and the role of both product and process.	

focuses on good health, longevity, and social relationships (Diener, 1984). These theories adopt a focus on individual/microlevel wellbeing which is largely overlooked in the wearables literature.

3.5 | Methodological approaches and key variables

Methodological approaches are predominantly quantitative and focus on understanding factors affecting technology acceptance. Few studies employ mixed methods (Farivar et al., 2020; Javdan et al., 2023), and qualitative approaches (De Moya & Pallud, 2020; Morozova & Gurova, 2021). Within the quantitative studies, antecedents can be broadly categorized as: (i) external factors, (ii) functional factors, (iii) barriers, and (iv) user level factors. External factors include social influence (Ogbanufe & Gerhart, 2022; Spil et al., 2021; Talukder et al., 2020), subjective or social norms (Lunney et al., 2016), reducing stigma (Morozova & Gurova, 2021) and social connectedness (Morozova & Gurova, 2021).

Functional factors related to product attributes are the most researched antecedents of wearables use. Perceived usefulness is an antecedent (Chuah et al., 2016; Lunney et al., 2016; Spil et al., 2021) and a mediator of the effect on intentions to use wearables (Choi & Kim, 2016; Papa et al., 2020). It also extends to perceived ease of use (Chuah et al., 2016; Huarng et al., 2022; Lunney et al., 2016; Wu et al., 2016). There is a tendency to focus on barriers to adoption, consistent with the application of Technology Acceptance Models (Table 3). This ranges from motivational barriers (Javdan et al., 2023), to concerns around data, privacy, and intrusiveness (Huarng et al., 2022; Maltseva & Lutz, 2018; Marakhimov & Joo, 2017; Nelson et al., 2016; Papa et al., 2020). Perceived risk (Spil et al., 2021) and resistance to change (Talukder et al., 2020) are additional concerns. Finally, at user level, research focuses on demographics

(Burbach et al., 2019), personal characteristics (Choi & Kim, 2016; Maltseva & Lutz, 2018), and a need for privacy (Burbach et al., 2019). Figure 4 presents an overview of key relationships between wearables and wellbeing in existing research from the raw/verbatim antecedents and outcomes in the literature.

Based on the antecedents and outcomes (Figure 4) from the reviewed literature, we draw on the Gioia et al. (2013) systematic, conceptual, and analytical approach to new concept development to propose a conceptual framework for wearables and wellbeing. The conceptual framework (Figure 5) is developed using aggregate dimensions from the antecedents and outcomes (Figure 4). The coding of the antecedents (Table 4) and outcomes (Table 5) used in vivo, descriptive, and process coding (Saldana, 2013). The 1st level coding categories were derived directly from the text (Hsieh & Shannon, 2005). In vivo coding uses exact words. Descriptive codes summarize the topic/subject of the text and are used to document and categorize for example, product features. Process codes are words or phrases which capture action for example adoption/consumer action (Saldana, 2013). The descriptive and process coding were also informed by the definitions (antecedents and outcomes) in the articles (See Appendix for verbatim definitions of antecedents and outcomes). Figure 5 further confirms the narrow focus of current research on wearables and wellbeing.

The analysis highlights overreliance on Technology Acceptance Models in current research. Most of the antecedents used in the studies are repeated and can be categorized as Technology Acceptance Models Model variables. Consumer concerns regarding wearables encompass microlevel issues that can influence adoption and use of wearables. These concerns include privacy (trust, intrusive nature of wearables and technology companies), health concerns, anxiety related to using the technology itself (thus acting as a barrier to adoption), perceptions regarding the value of products,

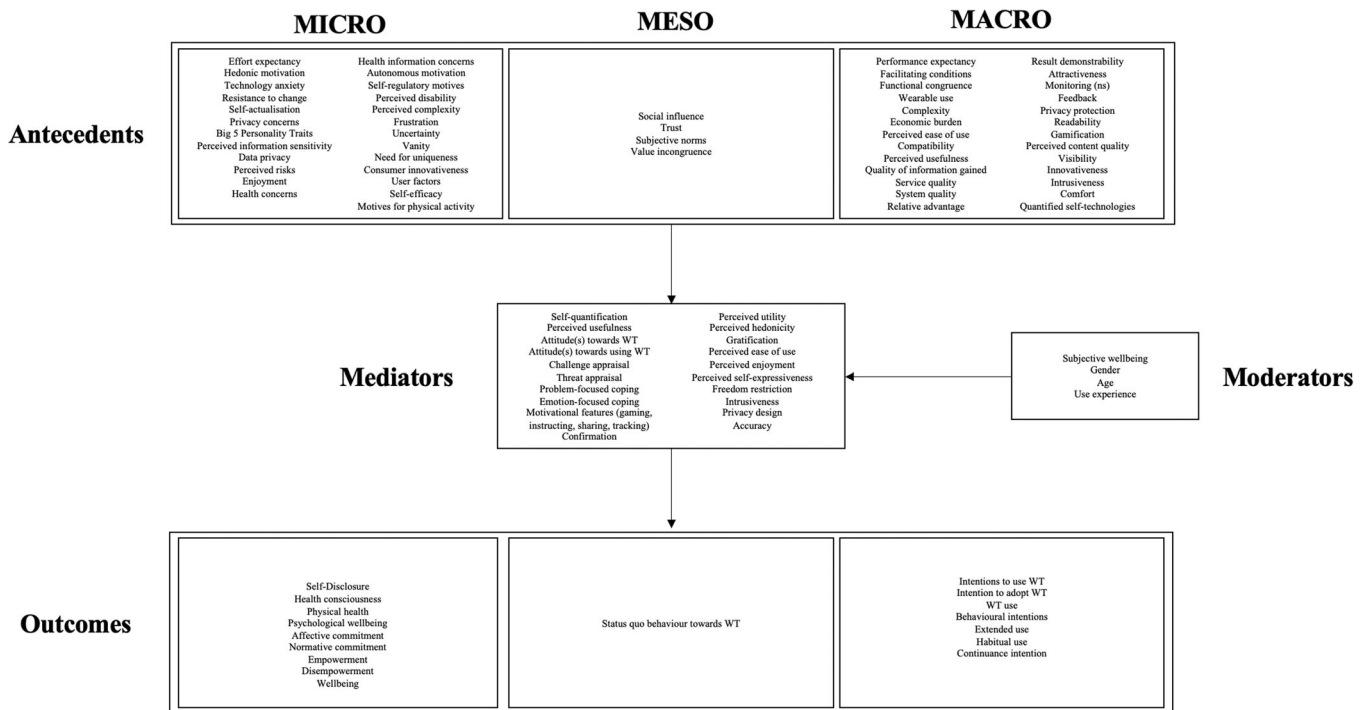


FIGURE 4 Key relationships between wearables and wellbeing in existing research.

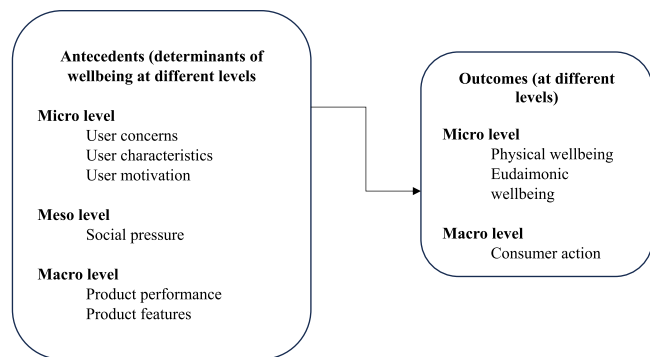


FIGURE 5 Current conceptual model of wearables and wellbeing.

uncertainty, and comfort. Trust can be associated with the service provider's handling of user information and the level of trust individuals place in the data provided by the wearable device. Outcomes such as adoption/acceptance and use of wearables are categorized as consumer action in Table 5. Our categorization of consumer action aligns with Lee et al. (2002) classification of experiences in the consumption process (acquisition, preparation, consumption, ownership, maintenance, and disposal). Consumer action in this context incorporates a spectrum of behaviors and decisions related to wearable technology devices, from adoption to integration of technology into habitual use.

Our analysis indicates that intentions to use wearables (consumer action) is consistently the most widely used outcome variable (Figure 4). Measures of wellbeing such as health consciousness and psychological health (Stiglbauer et al., 2019)

and physical wellbeing (Morozova & Gurova, 2021) are largely overlooked. Outcomes pertaining to behavioral variables (consumer action), dominate the literature, highlighting the narrow focus on adoption and consumption (macrolevel wellbeing) within extant research. This is consistent with the dominant theoretical perspectives. Given the inherent focus on wellbeing in wearables marketing, the paucity of research on microlevel wellbeing needs to be addressed.

3.6 | Methodological considerations, prevalent elements of wellbeing and future research directions

Given the interest in understanding causality within wearables research (Figure 4), it is not surprising that quantitative methodologies dominate the literature. We propose that future studies adopt a wider range of methods to benefit from more detailed insights that qualitative studies can offer. Relatedly, Figure 4 highlights the use of mediators to understand causal relationships, but relatively few moderators are included, namely demographic variables of age and gender (Oc & Plangger, 2022; Wu et al., 2016;), usage (Stragier et al., 2016) and subjective wellbeing (Farivar et al., 2020). To extend current research on wearables and wellbeing, other moderators should be explored such as socioeconomic status, which encompasses education, employment, income, and social class, all evidenced to possess a positive association with levels of wellbeing (Pinquart & Sörensen, 2000).

Extant research in this domain also tends to focus on utilitarian factors as antecedents of behavior change, future research could

TABLE 4 Analysis from antecedents to themes and aggregate dimensions.

Antecedents -1st level coding	2nd order themes	Aggregate dimensions
Economic burden (Huang et al., 2022)	Cost	Product features
Attractiveness (Nelson et al., 2016)	Product features	
Comfort (Papa et al., 2020)	Comfort	
Innovativeness (Choi & Kim, 2016)	Product features	
Perceived compatibility/facilitating conditions (Choi & Kim, 2016; Spil et al., 2021; Talukder et al., 2020; Wu et al., 2016)	UTAT model	
Perceived ease of use (Huang et al., 2022; Lunney et al., 2016; Spil et al., 2021; Wu et al., 2016)	Ease of use – Tam model	
Perceived ease of use/complexity (Chuah et al., 2016; Farivar et al., 2020; Talukder et al., 2020)	Ease of use - Tam model	
Feedback/quality of information (Nelson et al., 2016; Spil et al., 2021)	Perceived usefulness - tam model	Product performance
Monitoring (ns) (Nelson et al., 2016)	Quality- Tam model	
Perceived content quality (Shin & Biocca, 2017)	Quality - Tam model	
Perceived risk/perceived credibility (Spil et al., 2021)	Addition to UTAUT model	
Perceived service quality (Shin & Biocca, 2017; Spil et al., 2021)	Quality - Tam model	
Perceived usefulness (Chuah et al., 2016)	Perceived usefulness - Tam model	
Perceived usefulness (Lunney et al., 2016; Spil et al., 2021; Talukder et al., 2020; Wu et al., 2016)	Perceived usefulness - tam model	
Readability (Nelson et al., 2016)	Ease of use - Tam model	
Result demonstrability (Wu et al., 2016)	Tangibility of benefits/quality content	
Service quality (Spil et al., 2021)	Service quality - TAM model	
System quality (Spil et al., 2021)	Perceived usefulness - TAM model	
Quantified self (De Moya & Pallud, 2020)	Consumer movement	Social pressure
Social influence (Ogbanufe & Gerhart, 2022; Spil et al., 2021; Talukder et al., 2020; Wu et al., 2016)	Social pressure - social influence - UTAT	
Subjective norms (Lunney et al., 2016)	Social pressure	
Big 5 personality traits (Maltseva & Lutz, 2018)	Personality traits	User characteristics
Cognitive age (Farivar et al., 2020)	Self-perception	
Cognitive barriers (Javdan et al., 2023)	User abilities	
Consumer innovativeness (Hong et al., 2017)	Consumer characteristics	
Need for uniqueness (Choi & Kim, 2016)	Consumer characteristics	
Resistance to change (Talukder et al., 2020)	Consumer characteristics	
Value incongruence (Ogbanufe & Gerhart, 2022)	Self-perception	
Vanity (Choi & Kim, 2016)	Personality traits	
Health concerns (Marakhimov & Joo, 2017)	Inaccuracies in health data	User concerns
Intrusiveness (Papa et al., 2020)	Privacy	
Perceived information sensitivity (Maltseva & Lutz, 2018)	Data sensitivity	
Privacy concerns (Huang et al., 2022; Maltseva & Lutz, 2018; Marakhimov & Joo, 2017; Nelson et al., 2016)	Privacy	
Tetechnology anxiety (Talukder et al., 2020)	Consumer concerns	
Trust (Maltseva & Lutz, 2018; Spil et al., 2021)	Psychological state	

TABLE 4 (Continued)

Antecedents -1st level coding	2nd order themes	Aggregate dimensions
Autonomous motivation (Oc & Plangger, 2022)	Autonomous motives	User motivation
Enjoyment motives (Nelson et al., 2016; Stragier et al., 2016; Talukder et al., 2020; Wu et al., 2016)	Enjoyment motives	
Motivational barriers (Javdan et al., 2023)	Negative beliefs/ambiguity	
Self-actualization (Talukder et al., 2020)	Consumer motivation	
Self-regulatory motives (Stragier et al., 2016)	Self-regulation motives	
Social motives (Stragier et al., 2016)	Social networking	
Wearable use (Stiglbauer et al., 2019)	Use	Consumer action

TABLE 5 Analysis from outcomes to themes and aggregate dimensions.

Outcomes (1st level coding)	2nd order themes	Aggregate dimensions
Behavioral intention (Choi & Kim, 2016)	Wearable use	Consumer action
Behavioral intention to use IOT (Papa et al., 2020)	Wearable use	
Continuance intention to use smartwatch (Hong et al., 2017)	Wearable use	
Diffusion, adoption, and habitual use (Spil et al., 2021)	Wearable use	
Extended use (Marakhimov & Joo, 2017)	Wearable use	
Habitual use (Stragier et al., 2016)	Wearable use	
Habitual use (Oc & Plangger, 2022)	Wearable use	
Health consciousness (Stiglbauer et al., 2019)	Health consciousness	
Intention to adopt (Huarng et al., 2022)	Wearable use	
Intention to use (Farivar et al., 2020; Javdan et al., 2023; Talukder et al., 2020)	Wearable use	
Intention to use/not use (Chuah et al., 2016; Ogbanufe & Gerhart, 2022)	Wearable use	
Self-disclosure (Maltseva & Lutz, 2018)	Self-disclosure	
Empowerment/Disempowerment (De Moya & Pallud, 2020)	Empowerment	Eudaimonic wellbeing
Sense of self-accomplishment/psychological wellbeing (Stiglbauer et al., 2019)	Accomplishment	
Wellbeing of consumers over 50 (Morozova & Gurova, 2021)	Consumer wellbeing	
Perceived health benefits (Lunney et al., 2016)	Health benefits	Physical wellbeing
Physical health (Stiglbauer et al., 2019)	Physical activity	

explore hedonic factors as motivators rather than mediating variables, providing deeper insights into complex relationships in wearables and wellbeing. Table 5 shows that most studies use *intentions to use/adopt wearables* as the outcome variable, confirming the limited scope of current research. All the studies included in our review are concerned with wellbeing in some respect; this could be through tracking to improve physical wellbeing, or psychological or subjective wellbeing as previously mentioned. However, even though wearables use is inherently linked to wellbeing, the effects are implicit within the studies but few measure wellbeing explicitly as an outcome variable highlighting an important area for future research.

Although wellbeing is a multidimensional concept with multiple elements (Table 1), many of these are not reflected in the literature. Our framework (Figure 5) demonstrates that current research neglects important aspects of wellbeing, concentrating on causality for adoption and use (macrolevel dimensions). Hence the prevalent elements of wellbeing in current research are on consumer satisfaction with adoption and use. The focus on understanding relationships between variables means extant research on wearables and wellbeing is limited to cross sectional studies. Future research could explore measures of wellbeing that are sensitive to contextual changes such as the use of longitudinal designs and time sampling. Future research could also consider separate evaluations of short

term and long term changes in wellbeing in the context of wearables use (Diener & Seligman, 2004). Sustainability of behavioral modifications due to wearables and the impact on eudaimonic wellbeing could also be explored.

4 | DISCUSSION

Our findings illuminate the narrow focus in research on wearables and wellbeing, neglecting various aspects of wellbeing (Table 1). There is need for more research that considers multiple dimensions of wellbeing at different levels, using mainstream wellbeing theories and comprehensive approaches/methodologies, and considering broader contextual factors, for a holistic understanding of the relationship between wearables and consumer wellbeing. To address the research limitations identified in theoretical lenses used, we propose the integration of mainstream wellbeing perspectives in research on wearables and wellbeing). To address the research limitations identified in methodological approaches, in addition to cross sectional studies, future research could explore measures of wellbeing that are sensitive to contextual changes such as the use of

longitudinal designs and time sampling. Future studies could also adopt a wider range of methods including qualitative studies and randomized control trials.

To address the research limitations identified under contextual factors, we propose future research that considers wider factors beyond immediate consumer interaction with wearables. When studying the impact of contextual factors, researchers need to consider both proximal and distal factors to gain a comprehensive understanding of the complex interplay between variables in wellbeing (Rutter, 1994). Proximal factors in wearables and wellbeing research could include demographics, psychographics, social capital, socioeconomic status, and the immediate physical environment (running tracks, safe walking spaces etc.). Distal factors are not directly related to wearable use but may still impact how consumers use and experience wearables. They include cultural factors, normative factors, and government policy.

To address the limitations identified in wellbeing conceptualizations in the literature, we propose that future research should consider multiple levels and different dimensions of wellbeing. Figure 6 details concepts of wellbeing at the micro, meso and macro levels and specific considerations for future research for each dimension. In our study, we

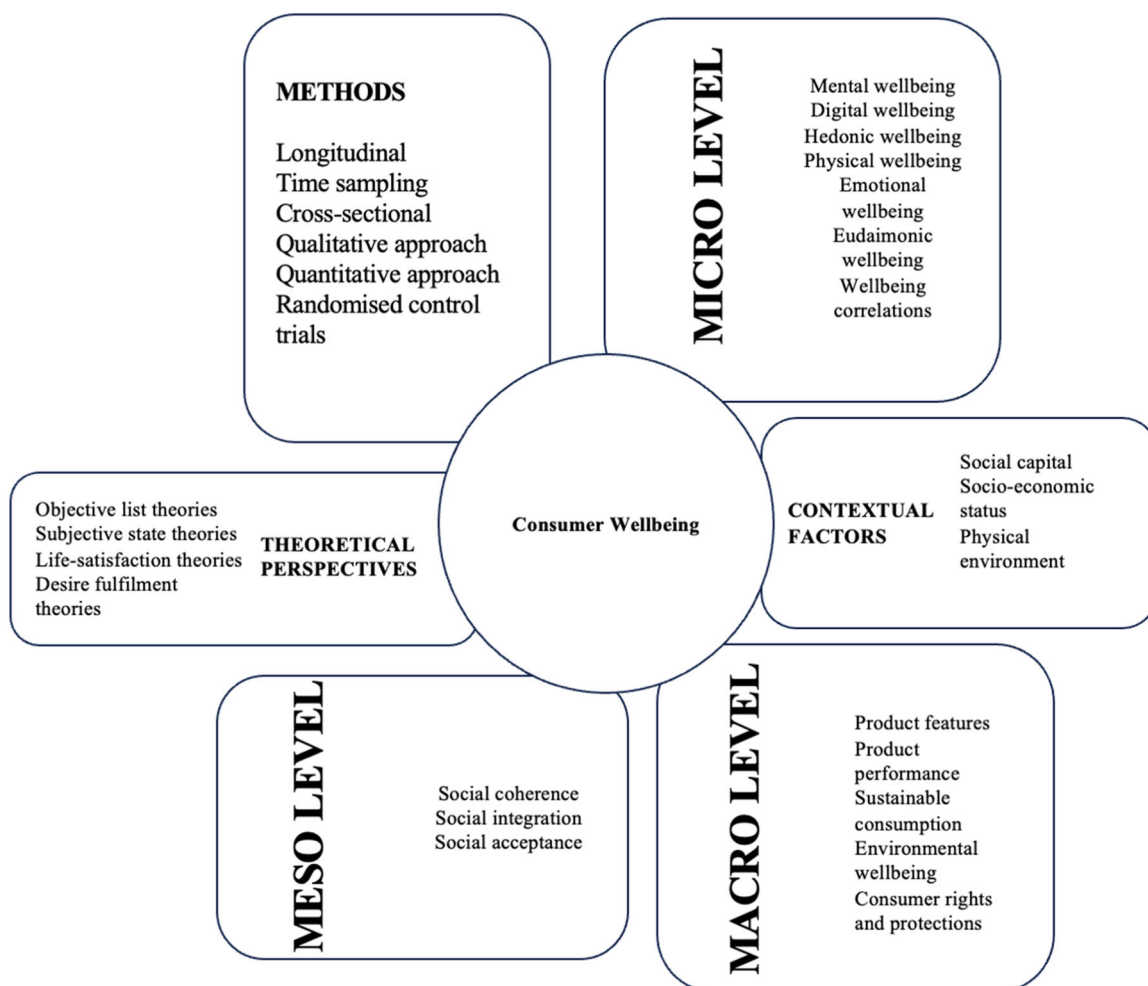


FIGURE 6 An integrated framework of future research directions on consumer wellbeing and wearables.

consider individual levels of wellbeing to be at the micro-level (Table 1). We suggest future research at this level should consider digital, hedonic, physical wellbeing, eudaimonic wellbeing, mental wellbeing, and emotional wellbeing, and their interdependencies. At the meso-level, we propose research into social well-being that considers, social integration, social contribution, social coherence, social actualization, and social acceptance (Keyes, 1998). Finally, macrolevel, adoption and use have been examined extensively but future research on sustainable consumption and environmental well-being as well as consumer rights and protection need further study. Future research could consider different theoretical perspectives, contextual factors, and methodological approaches at different well-being levels (micro, meso, and macro), as these may vary according to dimension of wellbeing in question. Comparing these dimensions would lead to a more holistic understanding of consumer wellbeing.

4.1 | Theoretical and practical implications

The proposed integrated future research framework captures the multidimensional nature of wellbeing, the complex interplay between different contextual factors, and the interrelationships between different types of consumer wellbeing, thus contributing to, and extending current research on wellbeing. Sirgy (2021) highlights deficiencies in current conceptualizations of wellbeing and calls for the use of emerging concepts of eudaimonia and social well-being to help conceptualize and develop new consumer wellbeing concepts and metrics. The proposed framework is applicable to consumer wellbeing in general, not just in the context of wearables. From a practical perspective, the findings show that there has been limited attention to abandonment and disposal (Attig & Franke, 2020). One study in 2017 suggests that about one-third of wearables users abandon the devices within the first few months, and over 80% of users abandon tracking within the first year (Hermsen et al., 2017). The high attrition rate may be attributed to the fact that although wearables can be useful in overcoming initial motivational problems, their use becomes obsolete once the desired behavior is achieved (Karapanos et al., 2016). Other reasons for attrition are battery related but some brands are addressing this challenge through body heat powered devices. The implications for marketing practice include changes in ownership models for wearables. We highlight the need for lease or rental alternatives for consumers. Some brands are already offering rental options with an option to own the device or to return it (Grover, 2023). The use of this model is however limited, and there is need for greater consumer awareness on such alternatives. This would also have implications for environmental and macrolevel dimensions of wellbeing as disposal has received limited attention in the literature.

4.2 | Policy implications

The potential benefits of tracking physical activity and other biometrics such as heartrate cannot be fully realized under current privacy and

data protection regulations. The quantified feedback from wearables has potential to benefit users both physically and economically. For example, reduced insurance premiums (health and life), if there was meaningful data on their daily health and fitness activities, available to third party providers such as insurance companies. The data collected by an independent party (wearables software) could be deemed more reliable than self-reported medical data or a one-off medical check-up. This study proposes policy considerations such as options for informed consent where consumers can share quantified personal fitness and health data for health and life insurance policy applications. Health management applications currently share this data with insurance companies (De Moya & Pallud, 2020) with no economic benefit to the consumer. Our proposals would contribute to improving economic wellbeing. Data inaccuracy from wearables and the potential for fraudulent manipulation where consumers use other people's wearables device information may however need to be considered. The former can be addressed through regulations mandating wearables brands to disclose the brands level of measurement reliability in different contexts of use (De Moya & Pallud, 2020). The latter can be overcome by using additional data such as verified medical check-up data which is already in use.

4.3 | Study limitations

This study's limitations include focusing only on articles from high-ranking academic journals. Whilst this was intended to guarantee the quality of research included in the review, it is possible that other relevant studies may have been excluded because of this criterion. We also used three databases for the literature search. These were chosen due to their broad focus, but using additional databases may increase the search results. We utilized a thematic approach to analyse the focus of current research, which was effective in identifying key themes, but may be limited in understanding relationships between these themes. We have attempted to mitigate this risk by combining this thematic approach with in vivo, descriptive and process coding to analyse relevant aspects of the studies included in the review.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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