Setting the Relationship between Human-Centered Approaches and Users' Digital Well-being: A Review

Leticia Polanco-Diges [iD] [1]
José Ramón Saura [iD] [2]
Patricia Pinto [iD] [3]

1. Department of Business Economics, Rey Juan Carlos University, Madrid, Spain
2. Department of Business Economics, Rey Juan Carlos University, Madrid, Spain
3. Faculty of Economics, Research Centre for Tourism, Sustainability and Well-being, University of Algarve, Faro, Portugal

ABSTRACT

With the advancement of technology and advent of the new digital era, the society is getting increasingly exposed to novel technologies, digital platforms, or smart devices. This reality opens a wide range of questions about the benefits and challenges of technology and its impact on humans. In this context, the present study investigates the relationship between human-centered approaches and their application to achieve users' digital well-being, as well as explores whether marketing and business industry are sufficiently considering human-centered approaches in their implementation of practices that care for users' digital wellbeing. To this end, we conduct a systematic literature review. The exploratory results confirm that the implementation of human-centered   approaches makes it possible to achieve a greater user well-being in the marketing and management sector. Additionally, we also identify and discuss seven more relevant areas. Our review concludes with a discussion of the theoretical and practical implications of our findings for further research on the use of human-centric and digital well-being concepts.

CORRESPONDING AUTHOR CONTACT José Ramón Saura joseramon.saura@urjc.es Department of Business Economics, Rey Juan Carlos University, Madrid, Spain

1. Introduction

In recent years, the pace of technological growth has become exponential. Any advance or progress in this aspect has an impact on many areas, such as business, economy, government, society, education, or healthcare (Cecchinato et al., 2019). Undeniably, all advantages and benefits offered by those new technologies aim to make people's lives to make it easier. However, behind all the benefits, there is a fine line that delimits to what extent such technologies can be positive for users (Akram & Kumar, 2017).

In many cases, smart devices or digital platforms are designed in such a way that they create addiction and the need to constantly and uncontrollably use them (Longstreet & Brooks, 2017). This has given rise to different initiatives such as the "digital detox day", whose main objective is to disconnect users from the excessive use of technology, over-information, and non-stop instant messaging (Syvertsen & Enli, 2019; Bouncken et al., 2022).

According to Centers for Disease Control and Prevention (CDC) (2019), there are different types of well-being such as, for example, material well-being, physical, psychological, social, or emotional well-being. However, in the new digital era where people are 24/7 surrounded by technology, applications and devices, digital well-being could be considered yet another type of well-being. Therefore, the study of digital well-being is of vital importance in all disciplines and sectors where the use of new technologies is present (Saura et al., 2021).

At the same time, owing to the great technological advances, the marketing and business industry has dramatically changed in the last decades. Advanced technologies, such as Artificial Intelligence (AI), machine learning, data mining, among others, are being determinant for business success in online environments (Kelleher et al., 2015).

Most companies are adapting and beginning to reformulate their processes in order to take advantage of all benefits brought by the new advanced technologies. In this way, the incorporation and support of technology in each department leads to improved results. Considering technology as an essential part of a company's day-to-day operations can be decisive in many aspects, including decision-making, problem-solving, innovation, getting to know the target audience, and so on.

Nowadays, companies base their strategies on the massive amount of data they collect from digital environments. Collectively, these huge amounts of data are known as Big Data, a term that refers to large volumes of data that are used, upon their analysis and interpretation, to obtain actionable information in business environments, achieve more effective and personalized actions. While the analysis of Big Data can be seen as an advantage for customers, as companies offer customers a wider range of products and services, the excess of options, information and opinions of other users can jeopardize and deteriorate customers' shopping experience, thus reducing customer satisfaction in tourism business (Martínez-Navalón et al., 2020; Brown et al., 2021).

In the marketing industry, new technologies have opened an infinite number of alternatives for the development of much more advanced strategies. In order to apply all their advantages, other disciplines, such as psychology, data science, computer science, neuroscience, among others, must come into play (Saura, 2021; Calabro et al., 2021). On the other hand, online companies and organizations that use digital platforms as their main channel of selling and communication base their strategies on the data obtained from users. Using these data, companies and organizations can carry out more effective and personalized actions by studying user behavior in digital ecosystems (Agapito & Lacerda, 2014; Kang & Yang, 2020).

In recent years, social media have become the main communication channel, as well as a sales platform for many businesses, both online or offline (Chen et al., 2022). A good social media communication strategy helps companies to establish and build a strong relationship and loyalty with social media (Schreiner et al., 2019; Saura et al., 2021b). According to Enginkaya and Yılmaz (2014), companies increasingly use social media not only for digital advertising, but also to manage customer services, mine innovation ideas, and create engaged brand communities. It is equally important to highlight User-Generated Content (UGC) as a primary means of interaction between users to share ideas, generate engagement, and create communities (Saura et al., 2022).

Social networks are platforms designed for communication among users. However, in some cases, digital architectures are intentionally designed to modify user behavior and incite other types of

actions (Literat & Brough, 2019). Specifically, social networks are designed in a very rigorous way to hold people's attention and capture their interest. The field that studies and implements such design is known as Human-Centered Computing (HCC).

Of note, irresponsible and excessive use of social media can cause serious problems for users, particularly those referred to millennials or digital natives. Some of these problems include addiction, stress, anxiety, or lack of concentration. In the long-term, mental problems could be irreversible unless the society becomes more aware of the hazards of irresponsible or excessive use of social media (Rojas, 2018; Lyu et al., 2022). Other challenges associated with the use of technology and digital platforms are related to violations of user privacy, the spread of fake news, or psychological disorders such as addiction. All these issues generate in users a sense of unease and distrust and lead them to perceive technology as something harmful and negative (Bleier & Eisenbeiss, 2015; Borges-Tiago et al., 2020).

In the recent COVID-19 pandemic, remote working has become a new way of working (Wang et al., 2020). The use of virtual platforms such as Zoom, Microsoft Teams, Google Meet, and others has increased exponentially, making it difficult to switch off at the end of a long working day (Martín & Fernández, 2022). However, without such platforms, many companies would not have been able to continue or reinvent their businesses during the months of confinement (Belo et al., 2014). This situation has adversely affected not only employment and workers, but also has had a significant impact on other sectors, such as education and health systems (Monge & De Russis, 2019; Pal et al., 2020).

On the other hand, the exceptional nature of the situation that the society is experiencing now has led to rapid integration of new technologies in healthcare systems and health consultations. For instance, new applications have been developed to perform online consultations and attend to patients requiring health care and frequent monitoring of their medical issues. These types of assistance platforms have also been implemented in psychology, personal training, nutrition, and other areas. All such platforms focus on promoting people's well-being and ensuring their safety.

Similarly, other applications have also been designed to monitor Covid-19 cases. For instance, some applications track infected citizens to prevent the spread of the virus and to identify possible outbreaks. However, there have been many doubts regarding data privacy and the control that institutions or governments have over citizens through the use of such applications. This type of distrust and fear generates in users' unease and rejection of such applications (Ribeiro-Navarrete et al., 2021).

Therefore, in summary, the negative side of technology influences both individual general well-being (Stankov & Gretzel, 2021) and what it is called Digital Well-being (DW), a concept that has been used to explain the impact of technology on people's physical and mental health (Irish Internet Safety Awareness Centre 2019).

To date, human-centered (or human-centric) approaches—i.e. approaches that place humans at the center of all strategies so that people can feel good in all aspects where technology is the protagonist and, in addition, help them in their daily lives to achieve well-being and satisfaction (Stankov & Gretzel, 2020; How et al., 2020)—have been applied in numerous spheres. However, a thorough understanding of the characteristics, goals, targets, and outcomes of these approaches remain poorly understood. To fill this gap in the literature, the present study addressed the following research questions.

• RQ1: Are human-centric (HC) approaches used together with technology to promote digital user well-being (DW)?

• RQ2: Are HC approaches part of business and marketing strategies in digital environments?

• RQ3: What are the main future lines and themes of research on HC and DW?

The originality of the present study lies in the fact that we conduct a systematic review of the terms human-centric and digital well-being and studying their influence on business and marketing. The remainder of this paper is structured as follows. The theoretical framework that defines HC and describes its varieties is provided in Section 2. The methodology used in the present study is explained in Section 3. Section 4 reports the results of our systematic literature review. The study ends with a general conclusion, a discussion of future research agenda, and an outline of limitations of the present study (Section 5).

2. Theoretical Framework

This section aims to clearly define human-centric approaches, as well as outline their main areas of study and characteristics, with a particular focus on the business environment. On the other hand, the term digital well-being will also be defined considering the contributions of other authors in the scientific literature (Kikot et al., 2014). We will also identify the factors that affect users' digital well-being and the main themes that can help to promote this concept.

2.1 Human-centric Approaches

The term "human-centric approaches" was coined due to the rapid growth of technology in recent decades. On the one hand, novel technologies have favored the creation of new business models, as well as the development and innovation of new products that facilitate more agile and precise decisions in our daily lives (Future of Architecture Human-Centric Approach, Accenture, 2020; Human-Centered Approach to Business, Accenture, 2020).

However, on the other hand, continuous and rapid technological advancement has also led to the emergence of major challenges on the societal level (Ewa Lechman et al., 2020). People have become vulnerable to available technology, such as social media addiction, data privacy, fake news, and so forth (Zivnuska et al., 2019; Ribeiro-Navarrete et al., 2021). Furthermore, the excess of information has led users to become more and more demanding in their decision making, and their needs and interests have started to change faster, making it difficult to satisfy them. Thus, the application of advanced technology together with the application of human-centric approaches is considered a key factor today (Future of Architecture - Human-Centric Approach | Accenture, 2020; Human-Centered Approach to Business | Accenture, 2020).

Major defining characteristics of human-centered approaches are summarized in Table 1 (Talbert, 1997; Snyder & Snyder, 2008).

Table 1. Main Characteristics of Human-centric Approaches

Characteristic	Definition
Human experience	The main objective of the HC approaches is to put people at the center of any action that is to be taken to improve their lives. Knowing and understanding user behavior is fundamental for this type of approaches.
Set of process	All HC approaches must follow a series of prior processes before implementation.
Observation	Observation is essential for the understanding of the current environment and context to orientate actions focused on people.
Critical thinking	It consists of having the ability to be able to analyze and evaluate information in a given context in an objective way. It allows us to see the world in a more objective way, without cognitive biases.
Problem-solving	The HC approach is applied when a problem that needs to be solved arises.
Advanced technology	HC approach relies on advanced technologies, such as AI, ML or Big Data and aims to better understand users and perform more personalized actions.
Data-driven oriented	HC approaches need data to better understand, analyze, and interpret the environment and people in order to improve their lives and experiences.
Dynamic	Due to the volatility in the ever-changing world, HC approaches must constantly adapt to the new needs of the society in conjunction with the advancement of technology.

Source: Own Elaboration

In the present study, we defined human-centric approaches as the ways in which a discipline, technology, action, or strategy is understood and applied in any field. A human is at the center of everything, and everything developed around him or her must preserve human autonomy, intelligence, and well-being. To date, the term "HC approaches" has been extensively in the scientific literature in areas such as design, artificial intelligence, innovation, leadership, computing, marketing, and so on.

There is a wide variety of human-centered approaches. The main objective of those different approaches is to solve problems and satisfy human needs using technology by placing the human being at

the center (Kumar et al., 2020). Also, this concept is used to refer to the development and improvement of intelligent systems technology (Bannon, 2011; Eskridge et al., 2014). Table 2 provides descriptions of major human-centered approaches developed to date.

Table 2. The Main Human-Centered Approaches

Human-centered approach	Definition
Human-Centered Design (HCD)	In this approach, the design of any system or product should be developed considering user needs and expectations. It favors innovation, improves user well-being, and the quality of systems or products (Zoltowski et al., 2012; Fernandez-Carames & Fraga-Lamas, 2018).
Human-Centered Interaction (HCI)	This concept considers the relationship between technology and people, focusing mainly on human values, ethics, and morals (Bannon, 2011).
Human-Centered Innovation (HCIa)	This approach seeks innovation by prioritizing social factors, such as culture, values and people's behavior, before the development or implementation of any action or strategy (Perelman, 2007).
Human-Centered Systems (HCS)	HCS are systems that complement human skills and are adapted to people's needs taking into account the paradigm shift from passive end users to active contributors in the development phases (Talbert, 1997).
Human-Centered Interfaces (HCIb)	The term HCIb is used to refer to the design of more natural virtual environments to achieve greater user immersion and collaboration, thereby enhancing user experience (Talbert, 1997).
Human-Centered Leadership (HCL)	HCL refers to the application of leadership by focusing on the self, self-awareness, self-care and mindfulness, in order to build trust and interaction in a group of people (Kennedy et al., 2020).
Human-Centered Computing (HCC)	HCC embraces a set of human-centered methodologies in any field of computing. It is applied when people have a direct interaction with technology in devices and systems (Jaimes et al., 2006).
Human-Centered Data Science (HCDS)	HCDS focuses on collecting data from users who leave the Internet in order to conduct more enriching and meaningful quantitative and qualitative research (Aragon et al., 2016; Kogan et al., 2020).
Human-Centered AI (HCAI)	HCAI refers to the development of systems with AI incorporating the HC approach to enhance human self-efficacy, promote creativity, or facilitate social participation (Auernhammer, 2020; Shneiderman, 2020).
Human-Centered ML (HCML)	HCML focuses on combining ML techniques and human feedback to obtain a more effective data analysis (Fiebrink & Gillies, 2018; Riedl, 2019).
Human-Centered Algorithm Design (HCAD)	This concept, initially proposed by Baumer (2017), incorporates human-centered practices for the design of algorithms that will later be incorporated into digital platforms and systems.
Human-Centered Security (HCSa)	The term HCSa is a human-centered approach to enhance user privacy and security when using technology and browsing the Internet (Renaud & Cutts, 2013; Barhamgi et al., 2021)

Source: Own Elaboration

As argued by Lepri et al. (2021), owing to advances in technologies such as ML or AI, it has become possible to better understand user behavior based on the data users generate in digital environments. The interpretation of these data can help to apply HC approaches in any field.

Furthermore, Zimmermann et al. (2021) noted the implementation of HC approaches in large companies, such as those known as GAFAM (Google, Apple, Facebook, Amazon, and Microsoft), could help users to be more secure and empowered with the use of technology. Similarly, Deibert (2018) argued that it is important to implement HC approaches in institutions and governments to preserve human rights in digital environments. Other relevant areas for the application of HC approaches are health systems support and digital innovation projects (Przybilla et al., 2018).

In the last year and a half, the education sector has been adversely affected by the COVID-19 pandemic, which has led to the emergence of new technological solutions to ensure that students' learning can be guaranteed during this time. As noted by Karakaya (2020), HC approaches should be applied during the development of new learning methods in digital environments.

Finally, companies such as IDEO have been pioneers in incorporating HC approaches in their practic-

es, obtaining successful results in each of their projects, such as the implementation of HCD practices in problem solving based on innovation in the business environment (IDEO). Similarly, HC approaches can be incorporated in a large number of areas characterized by a close interaction between technology and humans.

2.2 Digital Well-being

The term digital well-being, or digital wellness, has been variably defined in the literature. For instance, Birnholtz et al. (2019) defined DW as the positive physical and mental impact that the use of technology brings to us, and how it helps our perception of the overall well-being. On the other hand, the authors also argued that DW can be negatively affected by the following three aspects: (i) the continuous engagement caused by technology; (ii) self-interested and unethical use of technology to obtain greater benefits; and (iii) beliefs that favor people's discomfort, insecurity, and invalidity.

According to Marie and DeVito (2019), DW is related to satisfaction that users experience when using technology. Furthermore, the authors also argued that, while, for marginalized groups, the use of on-line platforms may help to counteract the feelings their loneliness, some users can also may experience negative emotions. The authors concluded with an argument on the need of fining balance between the positive and negative aspects of technology use.

Furthermore, Sang and Huang (2019) defined DW as the state in which people find it pleasant and ben-eficial to use technology in their daily lives. For their analysis, the authors relied on the Theory of Planned Behavior (TPB), a theory whose main objective is to understand how the design of technology can affect people's digital well-being.

In another relevant study, Peters et al. (2018) proposed a model to improve people's DW. This model was labelled the Model for Motivation, Engagement, and Thriving in User Experience (METUX). Used to evaluate the impact of technology on people's well-being, this model focuses on the following three key concepts: (i) autonomy; (ii) competence; and (iii) relatedness. Similar ideas were also voiced in several other studies (Widdicks & Pargman, 2019; Widdicks, 2020; Burr & Floridi, 2020).

Table 3. Key Concepts to Evaluate the Impact of Technology and its Influence on DW

Concept	Definition
Autonomy	A person's sense of acting consistently following his/ her goals and values when interacting with technology or digital media.
Competence	The feeling that the individual feels capable of and skilled in interacting with technology and digital environments.
Relatedness	The sense of belonging and acceptance of feeling connected to other users through the use of technology and social networks.
Data privacy	Excessive concern about data privacy in digital environments and the inability to have control over it.
Self-awareness	Awareness of users' use of technology and ensuring that their self-determination is not violated.

Source: Own Elaboration

According to Gui et al. (2017), the conditions for feeling DW include the prerequisite that digital media should be oriented towards users' sense of pleasure, security, and satisfaction. On the other hand, the authors also argued that DW has a great impact on general wellbeing.

Likewise, Roffarello and De Russis (2019) referred to DW in relation to the creation of applications that help users to engage in healthier behavior with social networks and technology. Furthermore, the authors also highlighted that one of the main problems in achieving DW is the overuse of technology.

To date, many studies have documented that excessive use of technology can lead to increased stress, addiction, lack of productivity, or lack of control (Dabbish et al., 2011; Mark et al., 2014; Mark et al., 2015). Similarly, Burr et al. (2020) argued that a major concern in the present-day society is the so-called tech-nostress, which is caused by the excessive use of Information and Communication Technologies (ICT). Technostress has a strong negative impact on human physical and mental health.

Such issues have led researchers to discuss ethical implications of technology for users and social well-

being. For instance, Burr et al. (2020) analyzed three general themes that expose opportunities and risks related to DW. In Table 4 briefly defines the three general themes explained by Burr et al. (2020) and their relation to DW.

Table 4. Implications of these Themes in the DW

Theme	Implication
Positive computing	More ethical promotion of the development and design of digital technologies in terms of privacy, security, innovation, all focused on user well-being to enhance human capabilities.
Personalized human-computer Interaction	Offering a personalized technology to each individual to meet their needs, motivations and favor DW by monitoring user behavioral data combined with advanced management and analysis.
Autonomy and self-determination	Encouraging user freedom and independence when using technology and prevention of behaviors that could adversely influence other people's wellbeing.

Source: Own Elaboration

3. Methodology

To answer the research questions posed in the present study, we conducted a systematic literature review (SLR). This methodology has been previously used by other authors, and the results have proven to be enriching for both academia and industry (Webster & Watson, 2002; Stieglitz et al., 2018).

SLRs are mainly aimed at identifying and synthesizing findings found in the literature. According to Snyder (2019), the results of a SLR can provide a clear understanding of a specific topic—in this case, of the DW and HC approaches especially applied in the business and marketing industry.

A SLR requires the collection of information for subsequent analysis and interpretation. Therefore, in the present study, we followed a systematic sequential process proposed by Polanco-Diges and Debasa (2020). Specifically, articles related to the research topic were collected and a first evaluation was carried out to ensure that they were relevant to address our research questions. For this, a PRISMA statement was conducted (Moher et al., 2015).

The searches for relevant publications were performed in the following four databases: Web of Science, ScienceDirect, IEEE Xplore, and ACM Digital Library. The results of these searchers are summarized in Table 5.

Table 5. SLR Results

Database	No. of Results	No. of Relevant Results
Web of Sciences	13	6
ACM Digital Library	7	2
IEEE Explore	74	11
Science Direct	49	22

Source: Own Elaboration

Table 6 shows key terms used in database searchers. A total of three searches were conducted.

Table 6. Search Terms used in the SLR

	Abstract		By topic	Databases
1st search	Human centric OR human-centered	*AND*	Digital well-being OR digital wellness	Web of Sciences
2nd search	Human centric OR human-centered	*AND*	Digital marketing OR business	ACM Digital Library IEEE Explore
3rd search	Digital marketing	AND	Digital well-being OR digital wellness	Science Direct

Source: Own Elaboration

The first search was carried out with the term "human centric" OR "human centered" included in the abstract and the term "digital well-being" OR "digital wellness" in the results section of reviewed papers. In addition, the results were filtered to include only reviews and research articles; all papers had to be Open Access publications.

The first search returned a total of 76 articles. However, to be more specific and to keep only the most relevant information for further analysis, an exhaustive content analysis of the papers was performed. As a result of this filtering process, a total of 30 articles were retained in the dataset

In the second search, the following terms were considered. On the one hand, we searched for the term "human centric" OR "human centered" appearing both in the results section and in the abstract and, at the same time, the term "digital marketing" would have to be present in the results when it appeared like a subject. As in the first search, the results were filtered to include only Open Access articles and reviews.

The second search returned a total of 48 papers, but not all of these papers were relevant, so a first analysis was carried out in order to compile the most relevant studies. This led to the identification of 9 most relevant studies.

Finally, the third and last search was performed to find publications containing the term "digital marketing" in the abstract and that the results sections; the term had to be related to the terms "digital well-being" OR "digital wellness". In the third search, 19 results were obtained, 11 of which were then evaluated as relevant to the present study.

In Table 7, the column 'Total results' corresponds to all results obtained from each of the searches prior to subsequent filtering. The second column corresponds to the number of articles after filtering. The third column reports the final number of articles retained in the database after duplicates were removed.

Table 7. Resulted Searches

Search	Total results	Final results	Results (without duplicates)
1st search	76	30	
2nd search	48	9	41
3rd search	19	11	

Source: Own Elaboration

To better understand the process, Figure 1 shows the PRISMA flow diagram for each of the steps and the corresponding results.

Figure 1. PRISMA Flow Diagram
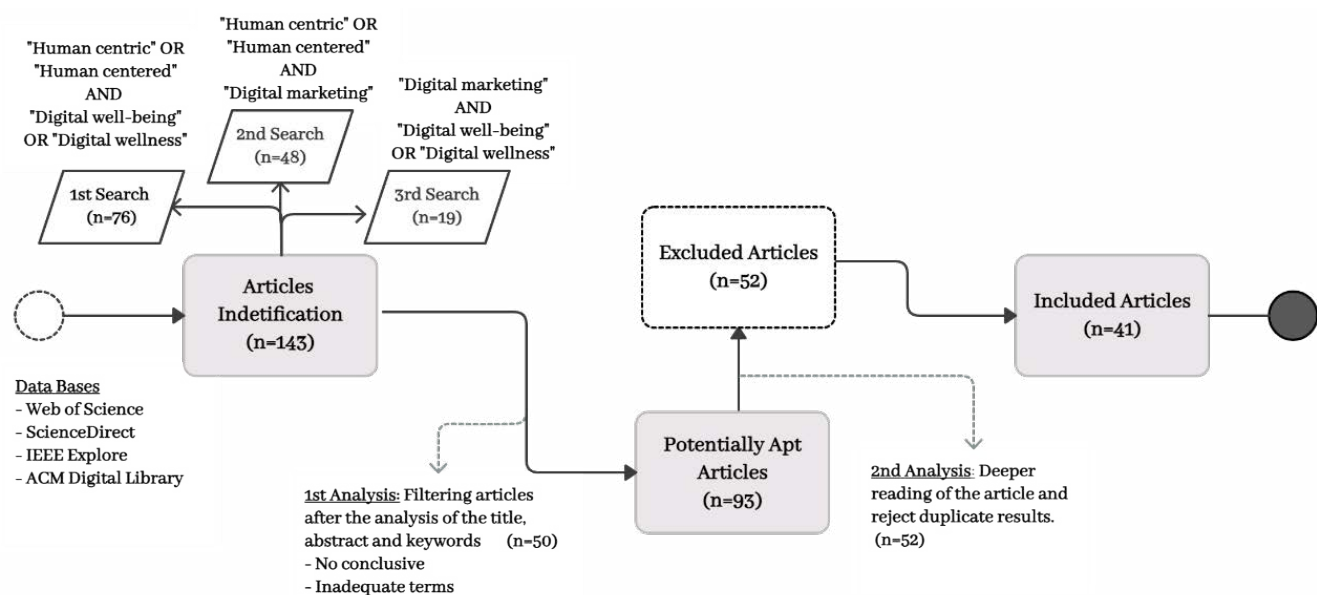
Source: Own Elaboration

To justify the importance of the included papers, we followed the steps previously proposed by Saura (2021). Table 8 shows the authors, journal, category, and main focus of each investigation (namely, human-centric, digital well-being, and/or digital marketing).

Table 8. Relevant Studies found in the SLR

Author	Journal	Category	Main focus in SLR		
			Human centric	Digital well-being	Digital marketing/ Business
Aguilar et al. (2021)	*Computers, Environment and Urban Systems*	Interdisciplinary; Computer based-research	●	●	
Alwis et al. (2021)	*IEEE Open Journal of the Communications Society*	Science; Technology	●	●	
Biloria (2021)	*Frontiers of Architectural Research*	Architectural science and technology	●	●	
Bouraqia et al. (2020)	*IEEE Access*	Communication technology	●	●	
Chin et al. (2018)	*Mindfulness*	Psychology; Psychiatry		●	
Corbett & Spinello (2020)	*Heliyon*	Computer Science; Information Systems	●		●
Dwivedi et al. (2020)	*International Journal of Information Management*	Information management	●	●	●
Forlano (2017)	*She Ji: The Journal of Design, Economics, and Innovation*	Innovation; design; economics	●	●	
Garcia-Magarino et al. (2019)	*IEEE Access*	Data Mining for Internet of Things	●		
Garrido-Hidalgo et al. (2018)	*IEEE Access*	Communication technology	●		
Gesualdo et al. (2021)	*Human Vaccines & Immunotherapeutics*	Biotechnology & Applied Microbiology	●	●	●
Jacobson et al. (2019)	*Journal of Retailing and Consumer Services*	Consumer behavior; Managerial decisions		●	●

Author	Journal	Topic			
Javaid et al. (2019)	*IEEE Access*	Security and Privacy for Cloud and IoT	•		•
Jonathan et al. (2021)	*JMIR Mental Health*	Psychiatry	•	•	
Junginger (2017)	*She Ji: The Journal of Design, Economics, and Innovation*	Innovation; design; economics	•		•
Kaasinen et al. (2020)	*Computers & Industrial Engineering*	Communication technologies	•	•	•
Kamali et al. (2020)	*IEEE Access*	Computer and information processing	•	•	
Kolesnichenko et al. (2021)	*Sustainability Science*	Science & Technology	•	•	
Lepri et al. (2021)	*IScience*	Interdisciplinary	•	•	
Li et al. (2018)	*IEEE Access*	Human-Centered Smart Systems and Technologies	•		•
Meshram et al. (2020)	*Journal of Advanced Research*	Computer Sciences	•	•	•
Muratovski **(**2015)	*She Ji: The Journal of Design, Economics, and Innovation*	Innovation; design; economics	•		•
Nicholson et al. (2018)	*BMJ Open*	General & Internal Medicine	•	•	
Parker & Grote **(**2020)	*Applied Psychology*	Psychology	•	•	
Paschen et al. **(**2020)	*Business Horizons*	Business	•		•
Poggenpohl (2020)	*She Ji: The Journal of Design, Economics, and Innovation*	Innovation; design; economics	•	•	•
Rangaswamy et al. (2020)	*Journal of Interactive Marketing*	Innovation	•	•	•
Rinkus et al. (2005)	*Journal of Biomedical Informatics*	Biomedical informatics methodologies	•		
Rowe & Lester (2020)	*Journal of Adolescent Health*	Multidisciplinary; Health and well-being	•	•	
Roy et al. (2021)	*ACM Transactions on the Web*	Information systems	•		•
Sánchez-Vergara et al. (2021)	*Journal of Cleaner Production*	Sustainable development and sustainability	•		•
Saura **(**2021)	*Journal of Innovation & Knowledge*	Innovation		•	•
Suchan et al. (2021)	*Artificial Intelligence*	AI, robotics	•		
Tao et al. (2018)	*IEEE Access*	Computer and information processing	•		
Torkura et al. (2020)	*IEEE Access*	Communication technology	•	•	
van der Bijl-Brouwer (2017)	*She Ji: The Journal of Design, Economics, and Innovation*	Innovation; design; economics	•	•	
Vermeer et al. (2019)	*International Journal of Research in Marketing*	Marketing research		•	•
Williams & Corwith (2021)	*Education and Information Technologies*	Education & Educational Research	•	•	
Wulfovich et al. (2019)	*Frontiers in Psychology*	Psychology	•	•	
Zeng & Xiang (2021)	*IEEE Access*	Computational and artificial intelligence	•		
Zhang et al. (2020)	*IEEE Access*	Computer and information processing	•		•

Source: Own Elaboration

On the other hand, a summary of the main purpose of each of the investigations has been made, specifying the author and the title of the paper (see table 9).

Table 9. Obtained Results and Main Purpose

Author	Article Title	Main Purpose
Aguilar et al. (2021)	OGITO, an Open Geospatial Interactive Tool to support collaborative spatial planning with a maptable	The authors developed a software application namely OGITO (Open Geospatial Interactive Tool) based on human-centered design and agile methods. This allows the usability and functionality of the software to function correctly.
Alwis et al. (2021)	Survey on 6G Frontiers: Trends, Applications, Requirements, Technologies and Future Research	The study focuses on key driving trends towards 6G, applications, requirements for its implementation and collects related work about this topic. They explore this new paradigm taking into account the influence on society and how 6G can empower and enrich peoples' life.
Biloria (2021)	From smart to empathic cities	It proposes a change of perspective to understand smart cities and gives rise to a new model called emphatic cities. It is characterised by incorporating human-centric and ethical approaches to achieve greater well-being and inclusion in cities.
Bouraqia et al. (2020)	Quality of Experience for Streaming Services: Measurements, Challenges and Insights	In this review, the authors introduce the concept of Quality of Experience (QoE) that includes an objective and subjective perspective when using technology and digital platforms. The objective perspective corresponds to the technical features, the Quality of Service, however, the subjective it is related to the individual experience of the user (emotions, feelings, expectations...) interacting with technology.
Chin et al. (2018)	Mindfulness Training Reduces Stress at Work: a Randomized Controlled Trial	Workers spend long hours in front on screens and it provokes severe damage to their health. Therefore, mindfulness training programs can reduce those effects and improve people's wellness.
Corbett & Spinello (2020)	Connectivism and leadership: harnessing a learning theory for the digital age to redefine leadership in the twenty-first century	This review focus on the study of connectivisim and leadership. The authors propose the study of technology from a connectivist framework to understand how new technologies affect our brains, ways of leading and learning. To do so, they introduce a new concept, "the connectivist leadership".
Dwivedi et al. (2020)	Setting the future of digital and social media marketing research: Perspectives and research propositions	This research describes issues and challenges related to the usage of AI, AR, e-WoM, mobile marketing and advertising among others and the ethical concerns therein.
Forlano (2017)	Posthumanism and Design	The author summarizes literature about posthumanism focusing on design practices among humans and technology.
Garcia-Magarino et al. (2019)	Human-Centric AI for Trustworthy IoT Systems With Explainable Multilayer Perceptrons	The authors support the application of Human-Centric AI in IoT systems to understand and learn about user's preferences, interests and so on. The study proposes Human-Centric AI techniques that make easier the interaction between humans and technology while achieving transparency and trustworthiness.
Garrido-Hidalgo et al. (2018)	IoT Heterogeneous Mesh Network Deployment for Human-in-the-Loop Challenges Towards a Social and Sustainable Industry 4.0	This research proposes Human-centric approach systems to get an optimal collaboration system between humans and machines through technologies such as IoT in Industry 4.0 environments.
Gesualdo et al. (2021)	Digital tools, multidisciplinarity and innovation for communicating vaccine safety in the COVID-19 era	The research supports the implementation of Human-Centered design to promote campaigns regarding the vaccine Covid-19 to inform society combined with data science, design thinking or digital marketing strategies.
Jacobson et al. (2019)	Social media marketing: Who is watching the watchers?	This research analyses the user's perception of social media and introduce a new concept named Marketing comforts that entails the individual's comfort when their data is used for different digital marketing strategies like advertising or opinion mining.
Javaid et al. (2019)	ARCA-IoT: An Attack-Resilient Cloud-Assisted IoT System	The study proposed a complex system, ARCA-IoT, to face three challenges of IoT (trustworthiness, interoperability, and scalability) This system is designed following a user-centric approach.
Jonathan et al. (2021)	A Smartphone-Based Self-management Intervention for Bipolar Disorder (LiveWell): User-Centered Development Approach	It explains the development of wellness and mental health application to help users with disorders. The application follows a Human-Centric approach. It is confirmed that technological support and usability help user's well-being.
Junginger (2017)	Design Research and Practice for the Public Good: A Reflection	This study focuses on the applicability of Human-Centered Design to identify new ways of working in the public sector. It is explained different cases in where design leadership and design management are applied in the business sector to understand how they will work and how they can suit the public sector.
Kaasinen et al. (2020)	Empowering and engaging industrial workers with Operator 4.0 solutions	This study presents a new concept called Operator 4.0 that arises from the application of the Human-Centric approach in Industry 4.0. This new concept could not take place without the incorporation of new technology in factories, so the impact it has on workers, their wellbeing and adoption are studied.
Kamali et al. (2020)	Virtual Coaches for Older Adults' Wellbeing: A Systematic Review	It is researched the role of virtual coaches to improve the wellbeing of older adults. The e-coaching system architecture is divided into three parts: i) Monitoring, (ii) processing and (iii) intervention medium. Each of these phases reflects a Human-Centric structure.
Kolesnichenko et al. (2021)	Sociological modeling of smart city with the implementation of UN sustainable development goals	This study focuses on the development of smart cities through a hybrid sociological and technological concept. Smart technologies as AI will interpret big data to provide solutions and to ensure citizens' wellbeing.
Lepri et al. (2021)	Ethical machines: The human-centric use of artificial intelligence	This study presents solutions in three areas that the authors have considered important for incorporating Human-Centric AI: privacy and data ownership, accountability and transparency and fairness.
Li et al. (2018)	An Anti-Noise Process Mining Algorithm Based on Minimum Spanning Tree Clustering	The authors propose an anti-nose process mining algorithm to implement in the Business Process Management (BPM) to build and improve human-centric information and company efficiency.

Meshram et al. (2020)	Fractional chaotic maps based short signature scheme under human-centered IoT environments	This research addresses one of the major challenges of Human-Centered IoT, the data protection of users. They propose a Short Signature Scheme (SSS) to reduce the processing time and verification of signature operations and improve the caption of attacks.
Muratovski (2015)	Paradigm Shift: Report on the New Role of Design in Business and Society	The author examines multinational investment in the design field and the benefits they obtained from design practices. It is demonstrated that design could be considered as a strategic resource and how contributes to the al success of social innovation and sustainability projects.
Nicholson et al. (2018)	Pre-post, mixed-methods feasibility study of the WorkingWell mobile support tool for individuals with serious mental illness in the USA: a pilot study protocol	The authors focus on the analysis of a mobile support tool designed to help individuals with mental illnesses. The study confirms the effectiveness of this app in the well-being and quality of life of individuals.
Parker & Grote (2020)	Automation, Algorithms, and Beyond: Why Work Design Matters More Than Ever in a Digital World	The authors identify the positive effects of new technology such as AI, robots and automation in individuals. However, technology can also affect negatively on social, human, legal and ethical aspects. It concludes by enhancing the importance of educating and training people for the implementation of more human-centred forms of technology.
Paschen et al. (2020)	Collaborative intelligence: How human and artificial intelligence create value along the B2B sales funnel	This research studies the role humans play with the adoption of advanced information and communication technologies such as AI, and how it affects the traditional Human-Centric process in B2B sales.
Poggenpohl (2020)	Waste and Agency in the Digital Era: Who's in Charge?	This study presents an overview of the short- and long-term consequences of the use of technology. It does so from a human and material point of view. It retains a pragmatic stance for the use of Human-Centered design in new technologies and business models.
Rangaswamy et al. (2020)	The Role of Marketing in Digital Business Platforms	This research focuses on how Digital Business Platforms (DBP) are designed to encourage user interaction and the use of these platforms.
Rinkus et al. (2005)	Human-centered design of a distributed knowledge management system	This paper presents a Human-Centered distributed information design methodology to be implemented in a management system for biomedical engineers (BMEs) showing the value of this human-centric methodology in the design information systems.
Rowe & Lester (2020)	Artificial Intelligence for Personalized Preventive Adolescent Healthcare	It is studied the effectiveness of implementing AI technologies y Human-Centered applications of AI to improve teenagers' wellbeing. Additionally, it is presented challenges related to privacy, ethics and bias in clinical and adolescent lives.
Roy et al. (2021)	An Integrated Approach for Improving Brand Consistency of Web Content: Modeling, Analysis, and Recommendation	The study analyses the consistency of brand companies by computing methodologies to improve them. The brand personality should be customer-centric transmitted and integrating human qualities to generate trust and retain customers.
Sánchez-Vergara et al. (2021)	The emergence of the sharing city: A systematic literature review to understand the notion of the sharing city and explore future research paths	This review focuses on the study and evolution of sharing cities in recent years with greater involvement of technology. This type of city is created from a Human-Centric perspective to guarantee the well-being of citizens.
Saura (2021)	Using Data Sciences in Digital Marketing: Framework, methods, and performance metrics	The author carries out an exhaustive analysis of the relationship between data science and its implication in digital marketing. It is found different topics that influence the development of digital marketing strategies.
Suchan et al. (2021)	Commonsense visual sensemaking for autonomous driving – On generalised neurosymbolic online abduction integrating vision and semantics	The study implements a Human-Centered Computing and Design in the development of autonomous driving.
Tao et al. (2018)	Outlet: Outsourcing Wearable Computing to the Ambient Mobile Computing Edge	The research proposes a system based on the Mobile Computing Edge (MEC) to take advantage of the computing resources of the user's ambient without the need for specific cloudlet servers to store and process information generated by wearable devices (smartphones, smartwatches…). This type of system reduces dependence on internet connectivity and availability, improving the user experience.
Torkura et al. (2020)	CloudStrike: Chaos Engineering for Security and Resiliency in Cloud Infrastructure	The study proposes a model to guarantee stronger cloud infrastructure security due to its vulnerabilities. The authors use a Risk-driven Fault Injection (RDFI) to address the challenges of cloud platforms regarding cloud security issues.
van der Bijl-Brouwer (2017)	Designing for Social Infrastructures in Complex Service Systems: A Human-Centered and Social Systems Perspective on Service Design	It studies the design service with a human-centered perspective that helps and contributes to resolving complex societal problems.
Vermeer et al. (2019)	Seeing the wood for the trees: How machine learning can help firms in identifying relevant electronic word-of-mouth in social media	This article investigates the importance that an aesthetic icon in consumer's perception when it is presented in an app.
Williams & Corwith (2021)	Beyond Bricks and Mortar: The efficacy of online learning and community-building at College Park Academy during the COVID-19 pandemic	Due to the Covid-19, schools should adapt to the new era of online learning. An important issue, they should address is the emotional well-being of their students that could be achieved by the correct use of digital technologies.
Wulfovich et al. (2019)	"I Must Try Harder": Design Implications for Mobile Apps and Wearables Contributing to Self-Efficacy of Patients With Chronic Conditions	It focuses on mobile health technologies such as mobile apps and wearables and how they are positive and effective in supporting patients and improving their wellbeing.
Zeng & Xiang (2021)	Edge Oriented Urban Hotspot Prediction for Human-Centric Internet of Things	It focused on the Human-Centric IoT and MEC (Mobile Edge Computing) application to identify accurately traffic regions in urban city areas through online and offline human behaviour.
Zhang et al. (2020)	Overview of Edge Computing in the Agricultural Internet of Things: Key Technologies, Applications, Challenges	The authors study the application of Edge Computing in IoT Agriculture when it is combined with other technologies like AI, VR or Blockchain, everything with a human-oriented approach. Challenges related to privacy, security, data processing among others are presented.

Source: Own Elaboration

4. Results

This section presents the results of data analysis. Before starting with a more in-depth discussion of the findings, Figure 3 shows the main areas where the DW and HC approaches are related, as suggested by our findings.

Figure 3. Main Areas where DW and HC Approaches are Connected
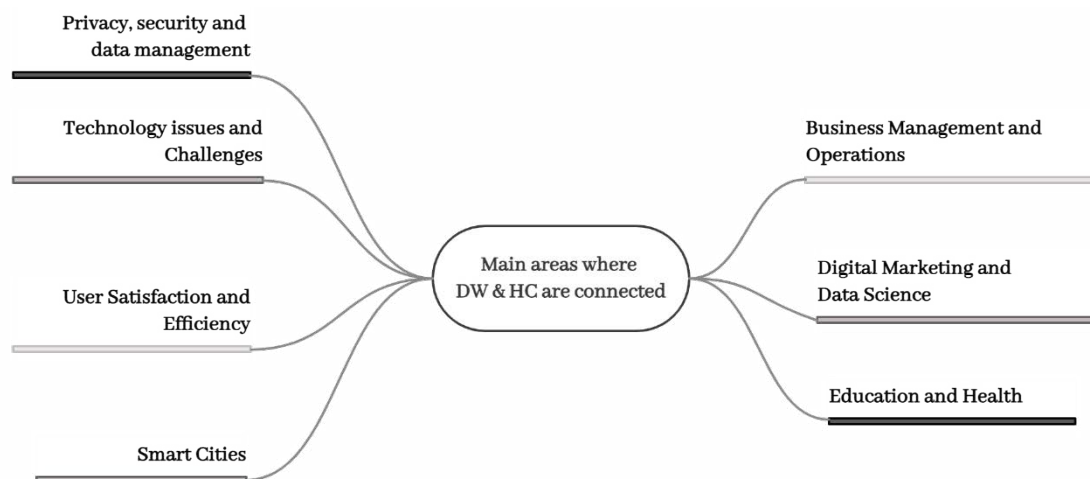
Source: Own Elaboration

4.1 Privacy, Security and Data Management

Different authors state that use security and privacy are among main user concerns when interacting with technology (e.g., smartwatches, smartphones, etc.) or when using platforms in the online environment (e.g., social networks, e-commerce, etc.). This concern and lack of self-control over the data are important factors that influence users' DW, leading to the rejection of the use of technology or more serious problems such as anxiety or stress (Javaid et al., 2019; Garcia-Magarino et al., 2019; Dwivedi et al., 2020).

As argued by Kaasinen et al. (2020) and Meshram et al. (2020), IoT devices or applications can present many challenges related to user privacy and security. However, the development of human-centric systems or models can serves as a solution to these challenges to improve not only users' wellbeing, but also workplace environment and company effectiveness (Li et al., 2018). For instance, Meshram et al. (2020) proposed a new signature system, the Short Signature Scheme (SSS), to reduce the verification and processing time of transactions while safeguarding user privacy.

4.2 Technology Issues and Challenges

Furthermore, Poggenpohl (2020) stated that the misuse of technology and digital platforms can have negative consequences in the long term. Therefore, this study focused on investigating digital wastefulness from two different perspectives: psychological and physical.

From a psychological point of view, the wasteful technology has a negative impact on human beings. According to the results of this study, technology that constantly pursues innovation and development causes us anxieties, addiction, and continuous adaptation to new models or systems.

Furthermore, the use of technologies such as Artificial Intelligence (AI) or Intelligence Augmentation (IA) calls into question who is in control of technology, promoting the idea that technology should contribute and collaborate with humans, rather than supplant their identity' said differently, technology should be designed based on human-centered values. This idea was also supported by other authors, such as Forlano (2017), Garrido-Hidalgo et al. (2018), Sánchez-Vergara et al. (2021), and Parker and Grote (2020).

From a physical perspective, the wasteful technology has to do with the waste of materials and energy generated by new technologies. In a world of constant change and innovation, a technology becomes obsolete increasingly sooner, which causes a significant amount of environmentally unsustainable pollution

(Palos-Sanchez et al., 2018). Accordingly, Poggenpohl (2020) supported the idea of creating technological devices that can be repairable or recyclable to achieve greater sustainability, as well as increase the useful life of each product. In this way, the author proposed to implement a life-cycle approach in new business models so that to continue supporting innovation, but, at the same time, reduce environmental degradation (Reyes-Menendez et al., 2018; Agapito & Quelhas Brito, 2020).

However, despite highlighting many challenges in the use of advanced technology, most authors underscored the great benefits of the novel systems or models based on AI, ML or IoT that favor the coexistence and adaptation between humans and technology in different fields (Garcia-Magarino et al., 2019; Rowe & Lester, 2020; Parker & Grote, 2020).

Mobile Edge Computing (MEC) is another term identified in the literature when talking about the use of IoT technologies or devices. Several authors proposed this system to ensure greater security of the data that users leave on the Internet. MEC allows data to be processed in locations close to where they were created without the need for cloud computing. At the same time, this type of systems allows data to be analyzed in real time, which is an advantage for companies for which data analysis and interpretation are key elements of their business (Zeng & Xiang, 2021).

Tao et al. (2018) also proposed systems based on the MEC, intending to avoid dependence on continuous connectivity and Internet availability for the use of wearable devices. Introducing such systems would allow users to access available information more quickly from devices such as smartwatches or smart glasses.

Finally, Torkura et al. (2020) addressed the issue of security and data management in relation to cloud computing. Specifically, the author proposed a system called Risk-driven Fault Injection (RDFI) to be more effective and capable of dealing with cloud computing vulnerabilities and security issues.

4.3 User Satisfaction and Efficiency

Furthermore, Bouraqia et al. (2020) investigated a new concept called Quality of Experience (QoE) that focuses on the user for the development of applications or technological systems. QoE considers not only the efficiency of the technical part and the offered functionalities, but also user satisfaction that emerges when users interact with applications or technological systems. In a similarly, Vermeer et al. (2019) focused on the aesthetic parts of technological systems and user perceptions of their design.

As demonstrated by Aguilar et al. (2021), the combination of HCD and agile methods has a positive impact on users. Specifically, HCD improves usability of new technologies for users, which leads to greater effectiveness, efficiency, and user satisfaction. On the other hand, agile methods improve the functionality of the application, making it possible to meet customer requirements in a short time. Finally, Fornalo (2017) and Lepri et al. (2021) analyzed advanced technology and associated problems related to discrimination between humans. Based on the results, the authors advocated for design practices that support equality and fairness between humans and technology.

4.4 Smart Cities

Another important topic in the reviewed studies was new models of understanding cities, i.e. smart cities (Kolesnichenko et al., 2021) and sharing cities (Sánchez-Vergara et al., 2021). In both models, technology plays a major role, and interaction with humans is part of everyday life. Therefore, in order to guarantee well-being of citizens with regard to technology, human-centric practices are implemented as one of the main characteristics in this type of cities. Likewise, Biloria (2021) proposed another model called empathic cities, which also include the same principles as those of smart cities.

4.5 Business Management and Operations

Implementing new technologies in companies leads to more in-depth studies on the impact such technologies have on employees and workers' well-being (Garrido-Hidalgo et al., 2018; Chin et al., 2018; Kaasinen et al., 2020). The main objective of such technologies is to find a balance and optimal adaptation for the proper functioning of operations and to achieve a more sustainable and satisfactory human-technology coexistence.

Advances in information and communication technologies not only have had a large impact on workers, but also have modified traditional sales processes, such as those with a human-centric perspective (Stankov & Gretzel, 2020). Accordingly, Paschen et al. (2020) argued that technologies such as AI still present some problems, particularly when they are applied in B2B sales processes that require human support. This supports the idea that advanced technology is only useful when it can increase human intelligence and collaborate with people without replacing them (Stankov & Gretzel, 2021).

Furthermore, Lepri et al. (2021) expressed their concern about the risks of using algorithmic decision-making processes, such as the lack of transparency, violation of user privacy, discrimination, and bias. The authors proposed addressing these limitations from a multidisciplinary perspective where areas such as machine learning, human computer interaction, ethics, social and cognitive psychology, or law are integrated to give rise to a human-centric AI model that is more respectful of citizens and ethical rules (Martínez-Navalón et al., 2020).

Finally, among the reviewed articles, several papers dealt with the application of human- centered design in management, leadership, and innovation (Junginger, 2017; van der Bijl-Brouwer, 2017; Corbett & Spinello, 2020; Gesualdo et al., 2021). On the other hand, Muratovski (2015) analyzed different multinational companies that introduce human-centered design practices in different strategies related to innovation, management, recruitment, or marketing strategies, among others. The results of this study demonstrated that such companies obtain positive return for their investment.

4.6 Digital Marketing and Data Science

With regard to digital marketing and data science, Dwivedi et al. (2020) outlined a series of challenges and issues related to digital marketing and social media. On the one hand, the authors supported the implementation of tools and mechanism to create a more confident content and to make it easier for users to take decisions based on data, thereby ensuring user DW. On the other hand, the authors argued that it is essential to analyze user behavior on social networks and to explore how user-generated content (UGC) influences users. In addition, the authors noted that new technologies are a fundamental tool for increasing what they call Customer Engagement Behavior (CEB) to improve user experience and well-being.

In addition, Dwivedi et al. (2020) also discussed the role of AI and AR in digital marketing. In general terms, the authors supported the use of these technologies in digital marketing strategies due to their usefulness for decision making and ability to provide a better understanding of customers. Dwivedi et al. (2020) also supported the implementation of Explainable AI (XAI), an AI approach that helps companies in their social media marketing strategies to perform much more personalized actions focused on customers, taking into account their interests and tastes. However, Dwivedi et al. (2020) also highlighted several ethical issues related to the user DW, such as privacy, fraud, lack of transparency, data violation, transparency, and so forth. Accordingly, the authors highlighted the need to develop ethical AI design and governance. The authors suggested three areas where further study on user behavior and their interaction with technology would be needed, namely (1) users' dependence on technology; (2) the influence of the user, technology, and a brand/company, and (3) cognitive and emotional user limitations. These aspects are fundamental to achieve user DW.

Furthermore, Saura (2021) outlined a series of topics where the implementation of digital marketing strategies using data science has a relevant impact. These topics are as follows: Medical data and eHealth, Smart cities and governance, Internet of Things (IoT), Data privacy and management, People, Development of new machine learning models, Operational CRM and data management, Sustainable strategies based on data and social media listening.

All these topics are related to user DW, as the strategies in these areas are developed based on the data generated by users in digital ecosystems. For that reason, the technology and the interpretation of the data must be as transparent and accurate as possible so that the impact on DW is positive and does not harm humans (Garcia-Magarino et al., 2019; Dwivedi et al., 2020; Lepri et al., 2021).

Furthermore, Rangaswamy et al. (2020) considered it important to design Digital Business Platforms (DBP) in a way to avoid generating confusion or distrust in users. To this end, a user-friendly design was proposed to encourage and improve user satisfaction when using these platforms.

In another relevant study, Jacobson et al. (2019) showed that users feel uncomfortable when mar-

keters use their social media data to develop digital marketing strategies, which leads to a negative DW. Therefore, the authors proposed to develop guidelines and standards to use social media data that would favorably influence both users and marketers. To this end, the authors introduces a new concept called Marketing Comforts, where the well-being and comfort of users were sought through the analysis of their data to carry out personalized digital marketing for each individual user. In a similar study, Roy et al. (2021) focused more on the creation of Brand Personality to build trust and retain customers.

Finally, Vermeer et al. (2019) used machine learning techniques to analyze user sentiment in social networks through UGC and e-WoM. Using this technique enabled authors to identify insights to detect dissatisfied users, as well as to obtain relevant information from users to improve digital marketing strategies on digital platforms. Other authors, including Dwivedi et al. (2020), also considered the analysis of UGC and e-WoM to be relevant to identify issues and salient user concerns.

4.7 Education and Health

In a study focusing on the domain of health, Williams and Corwith (2021) investigated how the COVID-19 pandemic led to the new era of online learning. This new educational model had a profound impact of students' DW. The authors argued that it is essential to be aware of making responsible and correct use of digital technologies to avoid harm to mental health of teenagers.

Furthermore, Rowe and Lester (2020) stated that incorporating AI technologies and human-centered applications of AI would adolescents to prevent health problems according to their behavioral habits. Similarly, Kamali et al. (2020) confirmed using an e-coaching system architecture with HC approaches improves older adults' DW.

In another pertinent investigation, Nicholson et al. (2018) confirmed the effectiveness of apps designed to treat mental illnesses. These apps, when developed with an HC approach, were proved to effectively improve individuals' quality of life.

Finally, Wulfovich et al. (2019) demonstrated the positive impact of mobile health technologies designed with HC approach on patients. Such apps enable a considerably more accurate and controlled monitoring of patients' illnesses, thus improving their well-being and sense of security and being taken care of by healthcare systems.

5. Conclusion

To conclude, based on the results of the systematic literature review undertaken in this study, we identified seven areas where the DW and HC approaches are related. This finding highlights the interdisciplinarity of the concepts DW and HC approaches. Indeed, due to the recent digital transformation, the concepts of DW and HC approaches are currently applicable in any discipline. Accordingly, work must be done to try to ensure that both DW and HC approaches positively complement each other and ensure human wellbeing.

With regard to the first research question addressed in this study, we found that HC approaches are being applied in most areas where advanced technology has a significant presence. Among many other areas, this includes, for instance, the design of digital platforms such as websites, social networks, or e-learning platforms, as well as the development of devices or machines that facilitate human work in factories or, on the user level with smart devices.

HC approaches are considered for the development and design of the architecture of digital platforms and smart devices. In this way, user experience and satisfaction can be improved, thereby creating a friendly coexistence between humans and technology.

As suggested by the results of the present review, key technologies to foster user-technology interaction without creating any harm to the health and well-being of individuals include AI, ML, AR or IoT. On the other hand, as seen in our results, many challenges and issues slow down the implementation of advanced technology in some areas. Accordingly, it is necessary to study the long-term hazards that such technology can cause in each of these fields and learn how to avoid possible negative effects on users. To this end, relevant policies should be created, and limits to the power

that technology has over human beings should be set. To achieve user DW, it is equally important to address the issues related to user data security and privacy.

At the same time, advanced technologies such as AI, ML, AR or IoT are extremely powerful and effective when used with large amounts of data. Despite the dangers of irresponsible and unethical use of these new technologies, being sceptic about them does not favor progress and innovation, as these technologies also offer great benefits to the society, if they are used in the right way and with a human-centric perspective.

Furthermore, according to the results, we can conclude that, in the business and marketing fields, HC approaches lead to the development of more personalized strategies by analyzing the data generated by users in digital environments, also known as UGC. In this way, users receive information that is of interest to them, which positively influence their well-being and satisfaction. On the other hand, our results also revealed that companies offer services or implement initiatives that aim to improve user well-being in digital environments, which has a positive effect on user satisfaction and perception of a brand.

5.1 Theoretical Implications

Based on the results of the present study, we identified seven areas where there is a close relation between DW and HC approaches. We believe that the introduction of the term digital well-being is a relevant contribution to the academia and research with the purpose of continue investigating more effective and beneficial ways to incorporate advanced technologies such as AI, ML, AR or IoT to enhance DW through HC practices. Other important implications of our results is that they underscore the importance of user DW and show how DW can influence in their behavior, opinions and its interaction with digital environment.

5.2 Practical Implications

Advanced technologies and digital environment are an essential part of the development and implementation of marketing strategies. In addition, advanced technologies and digital environment generate considerable economic and non-economic benefits. Some of them can range from having a better knowledge and understanding of user needs owing to Big Data to knowing the kind of strategies or practices that are working best when users interact with technologies.

Accordingly, a better awareness about the characteristics and implications of DW for users will help marketing specialists to improve KPIs performance and identify improvements by implementing HC approaches, as well as make better strategy decisions.

Finally, our results suggest that manifesting commitment to user DW can become a highly pioneering way for companies to differentiate themselves from other companies running their business in the digital sphere. Predictably, such companies would be positively valued by consumers. Therefore, businesses should consider building strong brand awareness and acquire a competitive advantage promoting DW in their company's values and practices in the digital domain.

5.3 Future Research Agenda and Limitations

Table 10 outlines different lines of research in each of the identified areas for further study. In summary, an in-depth study of the DW and HC approaches would be of great interest and can be reasonably be expected to make a significant contribution to both academia and practitioners because of the influence of these concepts on all areas.

Table 10. Future Research Agenda

Subject	Future Research Propositions
Privacy, security, and data management	Which are there most suitable HC approaches that can be implemented to empower user privacy control in digital environments?
Technology issues and challenges	What are the solutions to address the challenges of new technologies considering the DW concept and HC approaches as the main axis?
User satisfaction and efficiency	What do a user with a positive DW and a user with a negative DW differ in terms of their behavior when receiving digital marketing strategies with a HC approach?
Smart cities	What impact do smart cities have on citizens' DW? What new policies with a HC perspective would ensure the DW of society in smart cities?
Business management and operations	What are the new forms of leadership and internal communication methodologies applying HC approaches in remote workplaces to foster employees' DW?
Digital marketing and data science	What are behavior patterns of users with a positive and negative DW during their customer journey to applied strategies from a HC perspective?
Education and health	How should new digital education models be created so that they do not affect students' DW? Are HC approaches necessary to encourage patients to use e-Health apps, and do they harm users' DW?

Source: Own Elaboration

The present study has several limitations. First, in some cases, we explored DW in the literature without referring to the exact term,but maintaining the characteristics of digital well-being. In fact, most of the analyzed articles refer only to the concept of wellbeing, which presumably encompasses all types of wellbeing (including also digital well-being). Second, we failed to identify previous publications on the relationship between the concepts of DW and HC approaches. Finally, as illustrated by our literature review, little research where digital marketing strategies focusing on DW would be explored together with HC approaches is currently available.

Therefore, the present study is one of the first attempts to analyze the interconnection between DW and HC approaches. Given the lack of education and information about possible medium- and long-term negative consequences of the use of technology, the importance of such investigation can hardly be overestimated.

REFERENCES

A study on Digital Well-being - Think with Google. (2021). Think with Google. https://www.thinkwithgoogle.com/feature/digital-wellbeing-statistics/

Agapito, D., & Lacerda, A. (2014). Marketing and Brand Design of Destination Experiences: The Role of ICT. *Journal of Spatial and Organizational Dynamics, 2*(3), 201-216. https://www.jsod-cieo.net/journal-tsw/index.php/jtsw/article/view/31

Agapito, D., & Quelhas Brito, P. (2020). A Dyadic Approach to Adolescents' Risky Online Behaviors. *Journal of Spatial and Organizational Dynamics, 8*(3), 244-267. https://www.jsod-cieo.net/journal-tsw/index.php/jtsw/article/view/246

Aguilar, R., Calisto, L., Flacke, J., Akbar, A., & Pfeffer, K. (2021). OGITO, an Open Geospatial Interactive Tool to support collaborative spatial planning with a maptable. *Computers, Environment and Urban Systems, 86*, 101591. https://doi.org/10.1016/j.compenvurbsys.2020.101591

Akram, W., & Kumar, R. (2017). A Study on Positive and Negative Effects of Social Media on Society. *International Journal of Computer Sciences and Engineering, 5*(10), 351–354. Research Gate. https://doi.org/10.26438/ijcse/v5i10.351354

Al-Menayes, J. J. (2015). Dimensions of Social Media Addiction among University Students in Kuwait. *Psychology and Behavioral Sciences, 4*(1), 23-28. https://doi.org/ 10.11648/j.pbs.20150401.14

Alwis, C. D., Kalla, A., Pham, Q.-V., Kumar, P., Dev, K., Hwang, W.-J., & Liyanage, M. (2021). Survey on 6G Frontiers: Trends, Applications, Requirements, Technologies and Future Research. *IEEE Open Journal of the Communications Society, 2*, 836–886. https://doi.org/.1109/ojcoms.2021.3071496

Aragon, C., Hutto, C., Echenique, A., Fiore-Gartland, B., Huang, Y., Kim, J., ... Bayer, J. (2016). Developing a Research Agenda for Human-Centered Data Science. In *Proceedings of the 19th ACM Conference on Computer Supported Cooperative Work and Social Computing Companion - CSCW '16 Companion.* https://doi.org/10.1145/2818052.2855518

Auernhammer, J. (2020). Human-centered AI: The role of Human-centered Design Research in the development of AI. *DRS2020: Synergy.* https://doi.org/10.21606/drs.2020.282

Bannon, L. (2011). Reimagining HCI. *Interactions, 18*(4), 50. https://doi.org/10.1145/1978822.1978833

Barhamgi, M., Huhns, M. N., Perera, C., & Yolum, P. (Eds.) (2021). Introduction to the Special Section on Human-centered Security, Privacy, and Trust in the Internet of Things. *ACM Transactions on Internet Technology, 21*(1), 1–3. https://doi.org/10.1145/3445790

Baumer, E. P. (2017). Toward human-centered algorithm design. *Big Data & Society, 4*(2), 205395171771885. https://doi.org/10.1177/2053951717718854

Belo, A., Fernandes, S., & Castela, G. (2014). Social Networks' Users: Profiles and Motivations. *Journal of Spatial and Organizational Dynamics, 2*(3), 217-228. https://www.jsod-cieo.net/journal-tsw/index.php/jtsw/article/view/32

Biloria, N. (2021). From smart to empathic cities. *Frontiers of Architectural Research, 10*(1), 3–16. https://doi.org/10.1016/j.foar.2020.10.001

Birnholtz, J., Baruah, D., Vashista, R., Macapagal, K., Rawat, S., & Dange, A. (2019). *Digital Well-being at the Margins: Gay and Bisexual Men in the US and India*. https://digitalwellbeingworkshop.files.wordpress.com/2019/04/03-wellbeing_birnholtzetal_190204.pdf

Bleier, A., & Eisenbeiss, M. (2015). The Importance of Trust for Personalized Online Advertising. *Journal of Retailing, 91*(3), 390–409. https://doi.org/10.1016/j.jretai.2015.04.001

Borges-Tiago, T., Tiago, F., Silva, O., Guaita Martínez, J. M., & Botella-Carrubi, D. (2020). Online users' attitudes toward fake news: Implications for brand management. *Psychology & Marketing*. https://doi.org/10.1002/mar.21349

Bouncken, R. B., Lapidus, A., & Qui, Y. (2022). Organizational Sustainability Identity: 'New Work'of Home Offices and Coworking Spaces as Facilitators. *Sustainable Technology and Entrepreneurship*, 100011. https://doi.org/10.1016/j.stae.2022.100011

Bouraqia, K., Sabir, E., Sadik, M., & Ladid, L. (2020). Quality of Experience for Streaming Services: Measurements, Challenges and Insights. *IEEE Access, 8*, 13341–13361. https://doi.org/10.1109/access.2020.2965099

Brown, A., Meriton, R., Devinney, T., Kafouros, M., Gerardo, F. S., & Bhandal, R. (2021). Migrant human and political capitals value in entrepreneur enterprise performance. A comparative study of four emerging markets. *International Entrepreneurship and Management Journal, 17*(2), 665–692. https://doi.org/10.1007/s11365-020-00710-w

Burr, C., & Floridi, L. (Eds.) (2020). Ethics of Digital Well-Being. *Philosophical Studies Series*. https://doi.org/10.1007/978-3-030-50585-1

Burr, C., Taddeo, M., & Floridi, L. (2020). The Ethics of Digital Well-Being: A Thematic Review. *Science and Engineering Ethics*. https://doi.org/10.1007/s11948-020-00175-8

Calabro, A., Torchia, M., Jimenez, D. G., & Kraus, S. (2021). The role of human capital on family firm innovativeness: the strategic leadership role of family board members. *International Entrepreneurship and Management Journal, 17*(1), 261–287. https://doi.org/10.1007/s11365-020-00657-y

CDC. (2019). *Well-Being Concepts*. Centers for Disease Control and Prevention. https://www.cdc.gov/hrqol/wellbeing.htm

Cecchinato, M. E., Rooksby, J., Hiniker, A., Munson, S., Lukoff, K., Ciolfi, L., Thieme, A., & Harrison, D. (2019). Designing for Digital Well-being. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*. https://doi.org/10.1145/3290607.3298998

Chen, N., Sun, D., & Chen, J. (2022). Digital transformation, labour share, and industrial heterogeneity. *Journal of Innovation & Knowledge, 7*(2), 100173. https://https://doi.org/10.1016/j.jik.2022.100173

Chin, B., Slutsky, J., Raye, J., & Creswell, J. D. (2018). Mindfulness Training Reduces Stress at Work: a Randomized Controlled Trial. *Mindfulness, 10*. https://doi.org/10.1007/s12671-018-1022-0

Chou, C., Condron, L., & Belland, J. C. (2005). A Review of the Research on Internet Addiction. *Educational Psychology Review, 17*(4), 363–388. https://doi.org/10.1007/s10648-005-8138-1

Corbett, F., & Spinello, E. (2020). Connectivism and leadership: harnessing a learning theory for the digital age to redefine leadership in the twenty-first century. *Heliyon, 6*(1), e03250. https://doi.org/10.1016/j.heliyon.2020.e03250

Dabbish, L., Mark, G., & González, V. M. (2011). Why do i keep interrupting myself? In *Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems - CHI '11*.

Deibert, R. J. (2018). Toward a Human-Centric Approach to Cybersecurity. *Ethics & International Affairs, 32*(4), 411–424. https://doi.org/10.1017/s0892679418000618

DesignMind: 5 Characteristics of the Human-Centered Approach. (2017, October 19). NewSchool of Architecture & Design. https://newschoolarch.edu/blog/designmind-5-characteristics-of-the-human-centered-approach/

Dwivedi, Y. K., Ismagilova, E., Hughes, D. L., Carlson, J., Filieri, R., Jacobson, J., Jain, V., Karjaluoto, H., Kefi, H., Krishen, A. S., Kumar, V., Rahman, M. M., Raman, R., Rauschnabel, P. A., Rowley, J., Salo, J., Tran, G. A., & Wang, Y. (2020). Setting the future of digital and social media marketing research: Perspectives and research propositions. *International Journal of Information Management*, 102168. https://doi.org/10.1016/j.ijinfomgt.2020.102168

Eskridge, T. C., Still, D., & Hoffman, R. R. (2014). Principles for Human-Centered Interaction Design, Part 1: Performative Systems. *IEEE Intelligent Systems, 29*(4), 88–94. https://doi.org/10.1109/mis.2014.68

Fernandez-Carames, T. M., & Fraga-Lamas, P. (2018). A Review on Human-Centered IoT-Connected Smart Labels for the Industry 4.0. *IEEE Access, 6*, 25939–25957. https://doi.org/10.1109/access.2018.2833501

Fiebrink, R., & Gillies, M. (2018). Introduction to the Special Issue on Human-Centered Machine Learning. *ACM Transactions on Interactive Intelligent Systems, 8*(2), 1–7. https://doi.org/10.1145/3205942

Forlano, L. (2017). Posthumanism and Design. *She Ji: The Journal of Design, Economics, and Innovation, 3*(1), 16–29. https://doi.org/10.1016/j.sheji.2017.08.001

Future of Architecture – Human-Centric Approach | Accenture. (2020). Future of Architecture – Human-Centric Approach | Accenture. WordPressBlog. https://www.accenture.com/us-en/blogs/software-engineering-blog/dalal-de-human-centric-digital-architecture

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., Wang, Y., Fu, H., & Dai, J. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *PLOS ONE, 15*(4), e0231924. https://doi.org/10.1371/journal.pone.0231924

Garcia-Magarino, I., Muttukrishnan, R., & Lloret, J. (2019). Human-Centric AI for Trustworthy IoT Systems With Explainable Multilayer Perceptrons. *IEEE Access, 7*, 125562–125574. https://doi.org/10.1109/access.2019.2937521

Garrido-Hidalgo, C., Hortelano, D., Roda-Sanchez, L., Olivares, T., Ruiz, M. C., & Lopez, V. (2018). IoT Heterogeneous Mesh Network Deployment for Human-in-the-Loop Challenges Towards a Social and Sustainable Industry 4.0. *IEEE Access, 6,* 28417–28437. https://doi.org/10.1109/access.2018.2836677

Gesualdo, F., Bucci, L. M., Rizzo, C., & Tozzi, A. E. (2021). Digital tools, multidisciplinarity and innovation for communicating vaccine safety in the COVID-19 era. *Human Vaccines & Immunotherapeutics*, 1–4. https://doi.org/10.1080/21645515.2020.1865048

Gui, M., Fasoli, M., & Carradore, R. (2017). Developing a New Theoretical Tool For Media Literacy Research. *Italian Journal of Sociology of Education, 9*(1), 155–173. https://doi.org/10.14658/pupj-ijse-2017-1-8

Helenb. (2016, March 24). HelenB's e-learning blog: What is "Digital Well-being (DW) "? HelenB's E-Learning Blog. https://design-4-learning.blogspot.com/2016/03/what-is-digital-wellbeing.html

How, M.-L., Cheah, S.-M., Khor, A. C., & Chan, Y. J. (2020). Artificial Intelligence-Enhanced Predictive Insights for Advancing Financial Inclusion: A Human-Centric AI-Thinking Approach. *Big Data and Cognitive Computing, 4*(2), 8. https://doi.org/10.3390/bdcc4020008

Human-Centered Approach To Business | Accenture. (2020). Www.accenture.com. https://www.accenture.com/us-en/insights/strategy/human-centered-business

Jacobson, J., Gruzd, A., & Hernández-García, Á. (2019). Social media marketing: Who is watching the watchers? *Journal of Retailing and Consumer Services, 53*. https://doi.org/10.1016/j.jretconser.2019.03.001

Jaimes, A., Sebe, N., & Gatica-Perez, D. (2006). Human-centered computing. In *Proceedings of the 14th Annual ACM International Conference on Multimedia - MULTIMEDIA '06*. https://doi.org/10.1145/1180639.1180829

Javaid, S., Afzal, H., Babar, M., Arif, F., Tan, Z., & Ahmad Jan, M. (2019). ARCA-IoT: An Attack-Resilient Cloud-Assisted IoT System. *IEEE Access, 7*, 19616–19630. https://doi.org/10.1109/access.2019.2897095

Jonathan, G. K., Dopke, C. A., Michaels, T., Bank, A., Martin, C. R., Adhikari, K., Krakauer, R. L., Ryan, C., McBride, A., Babington, P., Frauenhofer, E., Silver, J., Capra, C., Simon, M., Begale, M., Mohr, D. C., & Goulding, E. H. (2021). A Smartphone-Based Self-management Intervention for Bipolar Disorder (LiveWell): User-Centered Development Approach. *JMIR Mental Health, 8*(4), e20424. https://doi.org/10.2196/20424

Junginger, S. (2017). Design Research and Practice for the Public Good: A Reflection. *She Ji: The Journal of Design, Economics, and Innovation, 3*(4), 290–302. https://doi.org/10.1016/j.sheji.2018.02.005

Kaasinen, E., Schmalfuß, F., Özturk, C., Aromaa, S., Boubekeur, M., Heilala, J., Heikkilä, P., Kuula, T., Liinasuo, M., Mach, S., Mehta, R., Petäjä, E., & Walter, T. (2020). Empowering and engaging industrial workers with Operator 4.0 solutions. *Computers & Industrial Engineering, 139*, 105678. https://doi.org/10.1016/j.cie.2019.01.052

Kamali, M. E., Angelini, L., Caon, M., Carrino, F., Rocke, C., Guye, S., Rizzo, G., Mastropietro, A., Sykora, M., Elayan, S., Kniestedt, I., Ziylan, C., Lettieri, E., Khaled, O. A., & Mugellini, E. (2020). Virtual Coaches for Older Adults' Wellbeing: A Systematic Review. *IEEE Access, 8*, 101884–101902. https://doi.org/10.1109/access.2020.2996404

Karakaya, K. (2020). Design considerations in emergency remote teaching during the COVID-19 pandemic: a human-centered approach. *Educational Technology Research and Development*. https://doi.org/10.1007/s11423-020-09884-0

Kelleher, J. D., Namee, B. M., & D'arcy, A. (2015). *Fundamentals of machine learning for predictive data analytics: Algorithms, worked examples, and case studies*. MIT Press.

Kennedy, K., Campis, S., & Leclerc, L. (2020). Human-Centered Leadership: *Nurse Leader, 18*(3), 227–231. https://doi.org/10.1016/j.mnl.2020.03.009

Kikot, T., Costa, G., Fernandes, S. & Águas, P. (2014). Why Use-Centered Game-Based Learning in Higher Education? The Case of Cesim SimBrand. *Journal of Spatial and Organizational Dynamics, 2*(3), 229-41. https://www.jsod-cieo.net/journal-tsw/index.php/jtsw/article/view/33

Kogan, M., Halfaker, A., Guha, S., Aragon, C., Muller, M., & Geiger, S. (2020). Mapping Out Human-Centered Data Science. In *Companion of the 2020 ACM International Conference on Supporting Group Work*. https://doi.org/10.1145/3323994.3369898

Kolesnichenko, O., Mazelis, L., Sotnik, A., Yakovleva, D., Amelkin, S., Grigorevsky, I., & Kolesnichenko, Y. (2021). Sociological modeling of smart city with the implementation of UN sustainable development goals. *Sustainability Science*. https://doi.org/10.1007/s11625-020-00889-5

Kumar, A., & Nayar, K. R. (2020). COVID 19 and its mental health consequences. *Journal of Mental Health*, 1–2. https://doi.org/10.1080/09638237.2020.1757052

Kumar, J., Konar, R. & Balasubramanian, K. (2020). The Impact of Social Media on Consumers' Purchasing Behaviour in Malaysian Restaurants. *Journal of Spatial and Organizational Dynamics, 8*(3), 197-16. https://www.jsod-cieo.net/journal-tsw/index.php/jtsw/article/view/243

Leonard, P., Kai, K., Manuel, W., Helmut, K. (2018). A Human-Centric Approach to Digital Innovation Projects in Health Care: Learnings from Applying Design Thinking. In *PACIS 2018 Proceedings*. 226. https://aisel.aisnet.org/pacis2018/226

Lepri, B., Oliver, N., & Pentland, A. (2021). Ethical machines: The human-centric use of artificial intelligence. *IScience, 24*(3), 102249. https://doi.org/10.1016/j.isci.2021.102249

Li, W., Zhu, H., Liu, W., Chen, D., Jiang, J., & Jin, Q. (2018). An Anti-Noise Process Mining Algorithm Based on Minimum Spanning Tree Clustering. *IEEE Access, 6*, 48756–48764. https://doi.org/0.1109/access.2018.2865540

Literat, I., & Brough, M. (2019). From Ethical to Equitable Social Media Technologies: Amplifying Underrepresented Youth Voices in Digital Technology Design. *Journal of Media Ethics, 34*(3), 132–145. https://doi.org/10.1080/23736992.2019.1638259

Longstreet, P., & Brooks, S. (2017). Life satisfaction: A key to managing internet & social media addiction. *Technology in Society, 50*, 73–77. https://doi.org/10.1016/j.techsoc.2017.05.003

Lyu, C., Peng, C., Yang, H., Li, H., & Gu, X. (2022). Social capital and innovation performance of digital firms: Serial mediation effect of cross-border knowledge search and absorptive capacity. *Journal of Innovation & Knowledge, 7*(2), 100187. https://https://doi.org/10.1016/j.jik.2022.100187

Marie Walker, A., & A. DeVito, M. (2019). Stigma in Supportive Online Spaces: Special Challenges for Well-Being. In *ACM CHI Conference.*

Mark, G., Iqbal, S., Czerwinski, M., & Johns, P. (2015). Focused, Aroused, but So Distractible: Temporal Perspectives on Multitasking and Communications. In *CSCW '15: Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (February 2015, pp. 903–916). https://doi.org/10.1145/2675133.2675221

Mark, G., Wang, Y., & Niiya, M. (2014). Stress and multitasking in everyday college life. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. https://doi.org/10.1145/2556288.2557361

Martín, J. M. M., & Fernández, J. A. S. (2022). The effects of technological improvements in the train network on tourism sustainability. An approach focused on seasonality. *Sustainable Technology and Entrepreneurship, 1*(1), 100005. https://doi.org/10.1016/j.stae.2022.100005

Martínez-Navalón, J. G., Gelashvili, V., & Saura, J. R. (2020). The Impact of Environmental Social Media Publications on User Satisfaction with and Trust in Tourism Businesses. *International Journal of Environmental Research and Public Health, 17*(15), 5417. https://doi.org/10.3390/ijerph17155417

Meshram, C., Ibrahim, R. W., Obaid, A. J., Meshram, S. G., Meshram, A., & El-Latif, A. M. A. (2020). Fractional chaotic maps based short signature scheme under human-centered IoT environments. *Journal of Advanced Research*. https://doi.org/10.1016/j.jare.2020.08.015

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., ... Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews, 4*(1). https://doi.org/10.1186/2046-4053-4-1

Monge Roffarello, A., & De Russis, L. (2019). The Race Towards Digital Well-being (DW). In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI '19*. https://doi.org/10.1145/3290605.3300616

Muratovski, G. (2015). Paradigm Shift: Report on the New Role of Design in Business and Society. *She Ji: The Journal of Design, Economics, and Innovation, 1*(2), 118–139. https://doi.org/10.1016/j.sheji.2015.11.002

Nicholson, J., Wright, S. M., & Carlisle, A. M. (2018). Pre-post, mixed-methods feasibility study of the WorkingWell mobile support tool for individuals with serious mental illness in the USA: a pilot study protocol. *BMJ Open, 8*(2), e019936. https://doi.org/10.1136/bmjopen-2017-019936

Pal, D., Vanijja, V., & Patra, S. (2020). Online Learning During COVID-19. In *Proceedings of the 11th International Conference on Advances in Information Technology*. https://doi.org/10.1145/3406601.3406632

Palos-Sanchez, P., & Saura, J. R. (2018). The Effect of Internet Searches on Afforestation: The Case of a Green Search Engine. *Forests, 9*, 51. https://doi.org/10.3390/f9020051

Parker, S. K., & Grote, G. (2020). Automation, Algorithms, and Beyond: Why Work Design Matters More Than Ever in a Digital World. *Applied Psychology*. doi.org:10.1111/apps.12241

Paschen, J., Wilson, M., & Ferreira, J. J. (2020). Collaborative intelligence: How human and artificial intelligence create value along the B2B sales funnel. *Business Horizons*. https://doi.org/10.1016/j.bushor.2020.01.003

Perelman, L. J. (2007). Toward human-centered innovation. In *Innovation's Vital Signs Workshop*, Washington DC.

Peters, D., Calvo, R. A., & Ryan, R. M. (2018). Designing for Motivation, Engagement and Wellbeing in Digital Experience. *Frontiers in Psychology, 9*. https://doi.org/10.3389/fpsyg.2018.00797

Petrescu, M., & Krishen, A. S. (2020). The dilemma of social media algorithms and analytics. *Journal of Marketing Analytics*. https://doi.org/10.1057/s41270-020-00094-4

Poggenpohl, S. H. (2020). Waste and Agency in the Digital Era: Who's in Charge? *She Ji: The Journal of Design, Economics, and Innovation, 6*(3), 331–344. https://doi.org/10.1016/j.sheji.2020.07.003

Polanco-Diges, L., & Debasa, F. (2020). The use of Digital Marketing Strategies in the Sharing Economy: A literature Review. *Journal of Spatial and Organizational Dynamics, 8*(3), 217-29. https://www.jsod-cieo.net/journal-tsw/index.php/jtsw/article/view/244.

Rangaswamy, A., Moch, N., Felten, C., van Bruggen, G., Wieringa, J. E., & Wirtz, J. (2020). The Role of Marketing in Digital Business Platforms. *Journal of Interactive Marketing*. https://doi.org/10.1016/j.intmar.2020.04.006

Renaud, K., & Cutts, Q. (2013). Teaching human-centered security using nontraditional techniques. *ACM Transactions on Computing Education, 13*(3), 1–23. https://doi.org/10.1145/2492687

Reyes-Menendez, A., Palos-Sanchez, P. R., Saura, J. R., & Martin-Velicia, F. (2018). Understanding the Influence of Wireless Communications and Wi-Fi Access on Customer Loyalty: A Behavioral Model System. *Wireless Communications and Mobile Computing*, 2018. https://doi.org/10.1155/2018/3487398

Ribeiro-Navarrete, S., Saura, J. R., & Palacios-Marqués, D. (2021). Towards a new era of mass data collection: Assessing pandemic surveillance technologies to preserve user privacy. *Technological Forecasting and Social Change, 167*, 120681. https://doi.org/10.1016/j.techfore.2021.120681

Riedl, M. O. (2019). Human-centered artificial intelligence and machine learning. *Human Behavior and Emerging Technologies, 1*(1), 33–36. https://doi.org/10.1002/hbe2.117

Rinkus, S., Walji, M., Johnson-Throop, K. A., Malin, J. T., Turley, J. P., Smith, J. W., & Zhang, J. (2005). Human-centered design of a distributed knowledge management system. *Journal of Biomedical Informatics, 38*(1), 4–17. https://doi.org/10.1016/j.jbi.2004.11.014

Rowe, J. P., & Lester, J. C. (2020). Artificial Intelligence for Personalized Preventive Adolescent Healthcare. *Journal of Adolescent Health, 67*(2), S52–S58. https://doi.org/10.1016/j.jadohealth.2020.02.021

Roy, S., Sural, S., Chhaya, N., Natarajan, A., & Ganguly, N. (2021). An Integrated Approach for Improving Brand Consistency of Web Content. *ACM Transactions on the Web, 15*(2), 1–25. https://doi.org/10.1145/3450445

Sánchez-Vergara, J. I., Ginieis, M., & Papaoikonomou, E. (2021). The emergence of the sharing city: A systematic literature review to understand the notion of the sharing city and explore future research paths. *Journal of Cleaner Production, 295*, 126448. https://doi.org/10.1016/j.jclepro.2021.126448

Sang, Y., & Huang, Y. (2019). Understanding Digital Well-being Systems through the Lens of the Theory of Planned Behavior (TPB). https://digitalwellbeingworkshop.files.wordpress.com/2019/04/06-understanding-digital-wellbeingsystems-through-the-lens-of-thetheory-of-planned-behavior-tpb.pdf

Saura, J. R. (2021). Using Data Sciences in Digital Marketing: Framework, methods, and performance metrics. *Journal of Innovation & Knowledge*. https://doi.org/10.1016/j.jik.2020.08.001

Saura, J. R., Ribeiro-Soriano, D. & Iturricha-Fernández, A. (2022). Exploring the challenges of remote work on Twitter users' sentiments: From digital technology development to a post-pandemic era. *Journal of Business Research, 142*(March), 242-254. https://doi.org/10.1016/j.jbusres.2021.12.052

Saura, J. R., Ribeiro-Soriano, D., & Palacios-Marqués, D. (2021). Setting B2B Digital Marketing in Artificial Intelligence-based CRMs: A review and directions for future research. *Industrial Marketing Management, 98*(October), 161-178. https://doi.org/10.1016/j.indmarman.2021.08.006

Saura, J. R., Ribeiro-Soriano, D., & Palacios-Marqués, D. (2021b). Setting privacy "by default" in social IoT: Theorizing the challenges and directions in Big Data Research. *Big Data Research, 25*, 100245. https://doi.org/10.1016/j.bdr.2021.100245

Shneiderman, B. (2020). Human-Centered Artificial Intelligence: Three Fresh Ideas. *AIS Transactions on Human-Computer Interaction, 12*(3), 109-124. HTTPS://DOI.ORG/ 10.17705/1thci.00131

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333-339. https://doi.org/ 10.1016/j.jbusres.2019.07.039

Snyder, L. G., & Snyder, M. J. (2008). Teaching critical thinking and problem solving skills. *The Journal of Research in Business Education, 50*(2), 90.

Stankov, U., & Gretzel, U. (2020). Tourism 4.0 technologies and tourist experiences: a human-centered design perspective. *Information Technology & Tourism*. https://doi.org/10.1007/s40558-020-00186-y

Stankov, U., & Gretzel, U. (2021). Digital well-being in the tourism domain: mapping new roles and responsibilities. *Information Technology & Tourism*. https://doi.org/10.1007/s40558-021-00197-3

Suchan, J., Bhatt, M., & Varadarajan, S. (2021). Commonsense visual sensemaking for autonomous driving – On generalised neurosymbolic online abduction integrating vision and semantics. *Artificial Intelligence, 299*, 103522. https://doi.org/10.1016/j.artint.2021.103522

Talbert, N. (1997). Toward human-centered systems. *IEEE Computer Graphics and Applications, 17*(4), 21–28. https://doi.org/10.1109/38.595262

Tao, L., Li, Z., & Wu, L. (2018). Outlet: Outsourcing Wearable Computing to the Ambient Mobile Computing Edge. *IEEE Access, 6*, 18408–18419. https://doi.org/10.1109/access.2018.2814215

Torkura, K. A., Sukmana, M. I. H., Cheng, F., & Meinel, C. (2020). CloudStrike: Chaos Engineering for Security and Resiliency in Cloud Infrastructure. *IEEE Access, 8*, 123044–123060. https://doi.org/10.1109/access.2020.3007338

van der Bijl-Brouwer, M. (2017). Designing for Social Infrastructures in Complex Service Systems: A Human-Centered and Social Systems Perspective on Service Design. *She Ji: The Journal of Design, Economics, and Innovation, 3*(3), 183–197. https://doi.org/10.1016/j.sheji.2017.11.002

Vermeer, S. A. M., Araujo, T., Bernritter, S. F., & van Noort, G. (2019). Seeing the wood for the trees: How machine learning can help firms in identifying relevant electronic word-of-mouth in social media. *International Journal of Research in Marketing, 36*(3), 492–508. https://doi.org/10.1016/j.ijresmar.2019.01.010

Wang, B., Liu, Y., Qian, J., & Parker, S. K. (2020). Achieving Effective Remote Working during the COVID-19 pandemic: a Work Design Perspective. *Applied Psychology, 70*(1). https://doi.org/10.1111/apps.12290

Widdicks, K. (2020). When the Good Turns Ugly: Speculating Next Steps for Digital Well-being Tools. In *Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society*. https://doi.org/10.1145/3419249.3420117

Widdicks, K., & Pargman, D. (2019). Breaking the Cornucopian Paradigm. In *Proceedings of the Fifth Workshop on Computing within Limits*. https://doi.org/10.1145/3338103.3338105

Williams, K. M., & Corwith, A. (2021). Beyond Bricks and Mortar: The efficacy of online learning and community-building at College Park Academy during the COVID-19 pandemic. *Education and Information Technologies*. https://doi.org/10.1007/s10639-021-10516-0

Wulfovich, S., Fiordelli, M., Rivas, H., Concepcion, W., & Wac, K. (2019). "I Must Try Harder": Design Implications for Mobile Apps and Wearables Contributing to Self-Efficacy of Patients With Chronic Conditions. *Frontiers in Psychology, 10*. https://doi.org/10.3389/fpsyg.2019.02388

Zeng, Y., & Xiang, K. (2021). Edge Oriented Urban Hotspot Prediction for Human-Centric Internet of Things. *IEEE Access, 9*, 71435–71445. https://doi.org/10.1109/access.2021.3078479

Zhang, X., Cao, Z., & Dong, W. (2020). Overview of Edge Computing in the Agricultural Internet of Things: Key Technologies, Applications, Challenges. *IEEE Access, 8*, 141748–141761. https://doi.org/10.1109/access.2020.3013005

Zimmermann, A., Howlett, R. J., & Jain, L. C. (Eds.) (2021). Human Centred Intelligent Systems. *Smart Innovation, Systems and Technologies*. https://doi.org/10.1007/978-981-15-5784-2

Zivnuska, S., Carlson, J. R., Carlson, D. S., Harris, R. B., & Harris, K. J. (2019). Social media addiction and social media reactions: The implications for job performance. *The Journal of Social Psychology*, 1–15. https://doi.org/10.1080/00224545.2019.1578725

ORCID

Leticia Polanco-Diges [iD] https://orcid.org/0000-0002-2524-6336

José Ramón Saura [iD] https://orcid.org/0000-0002-9457-7745

Patricia Pinto [iD] https://orcid.org/0000-0002-3153-2830

Notes on contributors

Leticia Polanco-Diges research has focused on digital marketing strategies and advanced technology to better understand user behaviour in a digital environment. Other complementary research area is related to incipient topic of users' digital well being and its influence on customers' decision making and brands' perception. The study of these topics have provided a broader knowledge for deciding business objectives and executing commercial tactics wisely. Besides, the researcher has had experience in marketing agencies and currently is working on the pharma sector implementing marketing strategies following omnichannel approaches and insights analytics.

Jose Ramon Saura research has focused on the theoretical and practical insights of various aspects of Digital Marketing and User Generated Content (UGC), with a specific focus around three major research approaches applied to digital business and marketing: data mining, knowledge discovery and information sciences. Jose Ramon Saura held positions and made consultancy at a number of other companies including Google, Deloitte, L'Oréal, Telefónica or

MRM//McCann, among others. Currrenctly, he is associated professor (tenured) at Rey Juan Carlos University, Department of Business Economics,

Patrícia Pinto holds a PhD in Quantitative Methods Applied to Economics and Business. She is Associate Professor at the Faculty of Economics, University of Algarve, Portugal. She is the coordinator of the Research Centre for Tourism, Sustainability and Well-being (CinTurs) and director of the PhD in Tourism of the University of Algarve. Her current research interests are in applied statistics and modelling especially in Tourism Management (Sustainable Tourism, Destination image and branding, Marketing segmentation, Consumer behavior).