The perceived relationship between digitalization and ecological, economic, and social sustainability

Barbara Brenner a,*, Barbara Hartl b

a Danube University Krems, Austria
b Vienna University for Economics and Business, Austria

ABSTRACT

Sustainability, in terms of ecological, economic, and social sustainable development, and the advancing digitalization represent some of the most substantial societal challenges today. However, little is known about how different actors and decision-makers perceive the relationship of those two challenges. In our paper, by building upon framing theory and social representations theory, we address that gap by investigating how different actors perceive the interrelationship between digitalization and ecological, economic, and social sustainability. Such research is particularly important because understandings of digitalization and sustainability determine how different actors, including managers and policymakers, act in response to those imperatives. Following a multi-method approach, we combined media analysis with two experimental studies examining how various actors frame the relationship between digitalization and sustainability in media discourses and which dimension of sustainability—ecological, economic, or social—dominates. Building upon these results, the studies assess whether the extent of digitalization affects the perception of those three dimensions. Among our findings, perceptions of ecological and economic sustainability but not social sustainability seem to be affected by the extent of digitalization. For future research, those findings indicate the need for a more nuanced view on sustainability that accounts for its different dimensions, especially the social dimension and its relationship with digitalization. Beyond that, because the perceived link between digitalization and ecological, economic, and social sustainability guides how various actors, including managers and policymakers, respond to those imperatives, our work also has substantial practical implications as well.

1. Introduction

Worldwide, current policy and management agendas are dominated by two imperatives: digitalization and sustainability. The complexity and speed of digitalization, paired with the fundamental challenge of achieving sustainable development goals, propel those agendas (George et al., 2016; United Nations, 2016). Despite nascent academic interest in how digitalization has positive as well as negative potential for sustainability (e.g., Del Río Castro et al., 2021; Seele, 2016; Seele and Lock, 2017), a profound understanding of the relationship between these megatrends among individual actors is still lacking (Boone et al., 2017; Song et al., 2017). It is vital to shed light on this relationship as perceptions of digitalization concerning various facets of sustainability determine how diverse actors respond to those imperatives (Dubey et al., 2018). For example, managers who aim to decrease their firms’ ecological footprint may opt to reduce business travel in favor of hosting virtual meetings if they believe that an increased extent of digitalization can promote ecological sustainability. Similarly, European Union (EU) policymakers promote introducing smart meters in households to achieve the sustainable development goals of the EU (Parliament and Wilson, 2015).

With this paper, by investigating how the interplay between digitalization and sustainability is framed regarding the ecological, economic, and social dimensions of sustainability, we strive to add to the emerging multidisciplinary discussion about how both megatrends have imposed major transitions upon the ways in which different actors imagine the world. We believe that such a discussion is critical, given that managers and policymakers increasingly need to respond to the advent of a digitalized world and sustainable development goals at the same time. In that light, answering our research questions should further illuminate...
current representations of the interrelationship between digitalization and sustainability.

As one of the most daunting challenges of our times, climate change has promoted the concept of sustainability and its practices into the mainstream (e.g., Fridays for Future). As a result, academic interest in the topic has amplified among scholars in various disciplines (Bansal, 2019; George et al., 2016; York et al., 2018). However, addressing these trends urgently requires a social and economic transformation (Allen et al., 2018).

The fact that digitalization is of critical importance not only to ecological sustainability, but to three pillars of development—economic development, social inclusion, and environmental protection—has been recognized globally (OECD, 2017 p. 18, United Nations, 2015). However, digitalization and sustainability have until only recently been primarily discussed in isolation in top-tier journals (Bansal, 2019). Scholarly contributions concerning perceived links between those challenges have been few and far between. Research addressing the relationship between digitalization and sustainability either focus on one specific element of digitalization, such as the potential influence of information and communications technology (ICT) on sustainable development (Del Río Castro et al., 2021; Melville, 2010), or address only one form of sustainability (ecological, economic, or social), rather than providing a comprehensive picture of digitalization and sustainability. Of course, these issues need to be addressed by managers and policymakers; however, very little is known about how different actors frame the relationship between digitalization and ecological, economic, and social sustainability. In response, building upon framing theory (Burke, 1937; Weick et al., 2005) and social representations theory (Moscovici, 1981), our research questions address that gap by seeking to clarify current understandings of the interrelationship between digitalization and ecological, economic, and social sustainability. On the one hand, how do diverse actors frame the relationship between digitalization and various dimensions of sustainability in media discourses? On the other, which dimension of sustainability—ecological, economic, or social—dominates those frames?

In our research, we applied framing and social representations theory to understand how digitalization is perceived in relation to ecological, economic, and social sustainability and stimulate future research on that vital topic in multiple domains. For those purposes, we followed a multi-method approach combining qualitative and quantitative techniques to study that complex phenomenon with three major objectives. First, we used a qualitative approach to identify how digitalization is framed in terms of ecological, economic, and social sustainability in media discourse, and based on our findings, we propose three testable hypotheses. Second, we tested our hypotheses concerning digitalization and ecological, economic, and social sustainability in different experimental settings. Third, we discuss our findings, propose an agenda for future research on the relationship between digitalization and sustainability, and outline some critical managerial implications.

2. Theoretical background

Although the convergence of digital and sustainability imperatives has begun to gain momentum in both the private and public sector, scholars have yet to conduct rigorous, systematic research that fully explores that nexus (Delmas et al., 2019; George et al., 2020). In the following, we first introduce the conceptual backgrounds of digitalization and ecological, economic, and social sustainability. Second, we review the nascent literature on the relation between digitalization and sustainability and point to the specific research gap we address.

2.1. Digitalization

The digitization of information and communication, the increased role of digital social networks and commercial platforms have greatly affected the functioning of economies worldwide and, in turn, societies, businesses, and people’s lives (European Commission, 2020; Lakhani et al., 2014). Digitalization transforms how organizations, institutions, and societies operate and how people interact. Indeed, everyday products such as cars and watches have software-based digital capabilities embedded in them. Organizations use intelligent management systems, and algorithms are set to become part of new organizational routines (Bailey et al., 2019). Digital technologies can be categorized into four non-mutually exclusive groups: efficiency technologies (e.g., “cloud technology”), connectivity technologies (e.g., the Internet of Things), trust disintermediation technologies (e.g., blockchains), and automation technologies (e.g., artificial intelligence and big data) (Lanzolla et al., 2018). At the same time, digitalization is multifaceted and often based on the synchronous adoption of multiple bundles of those digital technologies (Lanzolla et al., 2018). As a result, digitalization can enable people to work and consume anytime and anywhere (Weijo et al., 2014). Today, a variety of digital technologies, including artificial intelligence, machine learning, data analytics, robotics, digital platforms, social media, digital traces, blockchains, and 3D printing, increasingly reshape human action, interaction, and decision-making (Colbert et al., 2016; Faraj et al., 2018; Hammi et al., 2018; Iansiti and Lakhani, 2020; Jarzabkowski, 2018). Their applications are pervasive, ranging from consumer credit-risk assessment, product design, platform work, and health care diagnoses to hiring, predictive policing, custom manufacturing, automated fraud detection, consumer services, and surveillance (Bailey et al., 2019). However, the potential impact of digitalization remains to be seen. Since it took a century to grasp the full effects of earlier technological revolutions such as steam and electricity, the digital transformation is likely to have generations yet to go (OECD, 2017, 2020).

Given that digitalization is a complex phenomenon, definitions still deviate. Scholars distinguish digitization, digitalization, and digital transformation as three interrelated but distinct concepts. For one, digitization is the process of converting physical or analog information into digital formats for processing, storage, and transmission by computers (Dougherty and Dunne, 2012; Loebbecke and Picot, 2015). Digitization is commonly driven by technologies that focus on enhancing efficiency by automating existing processes. By contrast, digitalization describes how the use of information and communications technology alters an organization’s business model, including creating new or improved ways of delivering services, communicating, and improving the quality of offerings (Li et al., 2018; Ramaswamy and Ozcan, 2016). Such a change often involves new sociotechnical structures with digital artifacts that would be impossible without information technology as a critical enabler (Dougherty and Dunne, 2012). Last, the digital transformation is the most pervasive phase, one that leads to the emergence of entirely new business models based on radically novel logics to create and capture value (Iansiti and Lakhani, 2017; Kane et al., 2015; Lakhani et al., 2014; Parker et al., 2016; Verhoeft et al., 2021; Zott and Amit, 2008). Of course, others have taken a flow-oriented perspective in differentiating digitization, digitalization, and the digital transformation (Parker et al., 2016; Verhoeft et al., 2021). In this paper, we use the overarching term digitalization to capture all forms of digital transformation.

2.2. Ecological, economic and social sustainability

Achieving ecological, economic, and social sustainability is one of the most pressing goals societies are facing today (Bansal, 2019), one that has yet to be realized partly because sustainability is such a complex concept. The most often quoted definition of sustainability comes from the United Nations World Commission on Environment and Development, which describes sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” and that it “should become a central guiding principle of the United Nations governments and private institutions, organizations, and enterprises” (WCED, 1987 p. 43). The WCED also states that sustainable development requires the
simultaneous adoption of environmental, economic, and equity-related principles if it is to accomplish the purpose of securing intergenerational and intertemporal equity (Bansal and DesJardine, 2014; Slawinski and Bansal, 2015). To that end, competitiveness, legitimation, and ecological responsibility often motivate ecological responsiveness (Bansal and Roth, 2000; Slawinski and Bansal, 2015). In business contexts, sustainability can be defined as “the ability of firms to respond to their short-term financial needs without compromising their (or others’) ability to meet their future needs” (Bansal and DesJardine, 2014 p. 71). Both definitions assume a systems perspective, according to which economic, societal, and ecological systems need to remain in balance at a macro level over time.

The three principles undergird sustainable development—environmental integrity, economic prosperity, and social equity—are often referred to as the triple bottom line (Elkington, 1994, 1998, 2018). Because organizations are prominently affected by digitalization and at once key players in promoting sustainability, they are often at the epicenter of the societal debate (George et al., 2016). In turn, because organizations have to apply the principles of the triple bottom line to meet sustainable development requirements (Bansal, 2005; Bansal and Song, 2017), they cannot merely focus on economic value but need to also consider the environmental and social value that they potentially contribute or destroy (Elkington, 2004; Gao and Bansal, 2013). In that sense, “Corporate sustainability requires managers to simultaneously address widely diverging but interconnected concerns for the natural environment, social welfare, and economic prosperity” (Hahn et al., 2014). Bansal (2005) extended the principles to sustainable corporate development at the level of the firm, including corporate environmental management, corporate social responsibility, and economic prosperity through value creation, and, in turn, adopting sustainable business practices has been shown to enhance resilience and afford long-term benefits for firms (Amui et al., 2017; Ortiz-de-Mandojana and Bansal, 2016). In that context, the term corporate environmental management encompasses all of a firm’s efforts to reduce the size of its ecological footprint. Such initiatives include pollution control (Aragon-Correa, 1998; Hart, 1995), pollution prevention (Klassen and Whybark, 1999), and product stewardship that embraces the circular aspects of the economy (de Sousa Jabbour et al., 2018). Social sustainability involves three processes: environmental assessment, stakeholder management, and social issues management (Wood, 1991). Economic prosperity via value creation builds upon the notion that firms create value through the goods and services that they produce and offer (Bowman and Ambrosini, 2000). Thus, by producing novel goods that meet demand while at once lowering input costs or enhancing the efficiency of production, value is created (Conner, 1991).

Sustainability requires intertemporal trade-offs in strategic decision-making that consider both the short and the long term (Bansal and DesJardine, 2014; Bansal and Song, 2017). Recognizing that need, in September 2015, 193 member states of the United Nations adopted 17 sustainable development goals to end poverty, protect the planet, and ensure prosperity for all as part of a sustainable development agenda (United Nations, 2015).

2.3. Digitalization and ecological, economic, and social sustainability

Despite a burgeoning body of literature exploring the link between digital technology and sustainability, most contributions largely focus on ecological sustainability (e.g., Del Río Castro et al., 2021; Gouveia et al., 2018; Isensee et al., 2020; Seele, 2016; Seele and Lock, 2017; van der Velden, 2018) or a combination of ecological and economic sustainability. Domains range from sustainable digital entrepreneurship (e.g., Luthra et al., 2019), smart, sustainable cities (e.g., Sodiro et al., 2019), optimizing energy efficiency (e.g., Luna et al., 2019), circular economies (e.g., Ajwani-Ramchandani et al., 2021), green supply chain management (e.g., Shaharudin et al., 2019), intelligent manufacturing (e.g., Ma et al., 2020), optimization through digital technologies including artificial intelligence, programming, blockchain, Internet of things or big data (Ahmad et al., 2021; Camarena, 2020; Dubey et al., 2018; Frank, 2021; Gholizadeh et al., 2020; Li et al., 2021), R&D cooperation and innovation (e.g., Tumelero et al., 2019) to digitalization, and sustainability in small and medium sized enterprises (Isensee et al., 2020). Nevertheless, as recent literature reviews (Del Río Castro et al., 2021; Isensee et al., 2020) have underscored, the literature on the topic remains somewhat fragmented. Evidence on genuine contributions of digital paradigms to varying facets of sustainability remains scarce. Those and other contributions often lack theoretical development. Notwithstanding the underlying promise of such a nascent field, there remains an obvious need for developing theory about digitalization in relation to social, economic, and ecological sustainability (Del Río Castro et al., 2021; Kuntsman and Rattle, 2019; MacFeely, 2019; Seele and Lock, 2017). Beyond that, to the best of our knowledge, empirical research on the social representations of relationships between digitalization and ecological, economic, and social sustainability by different actors and their framing in media has been limited. However, such contributions are vital to the emerging field, precisely because representations of digitalization in relation to various facets of sustainability determine how individuals, including managers and policymakers, act in response to those imperatives (Boone et al., 2017; Dubey et al., 2018).

Nevertheless, a positive perceptual bias seems to exist in managerial decision-making in relation to digitalization and sustainability. According to a recent survey of 100 companies and research institutions, managers expect digitalization to positively affect the environmental dimension of sustainable development in Industry 4.0 in Germany (Niehoff and Beier, 2018). Expectations for improved resource efficiency via digitalization, albeit not based on fundamental research, are also relatively high. However, trade-offs between resource consumption and resource efficiency in digitalized production warrant consideration (Beier et al., 2017). In that light, society has reached its planetary limits for growth, but “what has escaped the attention of most management researchers is the speed by which society is reaching its limit to growth may be accelerated by […] disruptions of technology and institutions” (Bansal, 2019 p. 9).

2.4. Social representations theory and framing theory

To shed light on how individuals come to understand the relationship between digitalization and sustainability, for this paper, we have adopted social representations theory (Moscovici, 1981) and framing theory (Benford and Snow, 2000). Framing theory unveils the structure and format of news articles (Reyes-Sosa et al., 2020). Social representations often emerge as a result of media discourse, besides interpersonal discussions, and thus, cover more than what is presented in the media (Morgan et al., 2010). According to social representations theory (Duckheim, 1984; Moscovici, 1961/1976), “Human behavior is sensible within a cultural context that validates and legitimates such behavior” (Sammut et al., 2015 p. xiii). In essence, a social group develops a shared understanding of specific aspects of reality that shapes the group members’ perspectives, in our case, an understanding of digitalization and sustainability. Consequently, the meanings of events and of social phenomena are not givens but represented as contrived understandings shared among social subjects (Moscovici, 1988). In that sense, social representations can be defined “as systems of values, ideas, and practices that establish social order and facilitate communication” (Sammut et al., 2015 p. 6). Given that ideas concerning social objects and emerging phenomena, including digitalization and sustainability, circulate in the public, communications and media outlets are critical in producing and disseminating social representations (Sammut et al., 2015). Once a social representation is established, individuals or groups can form opinions about the represented phenomena, i.e. digitalization and sustainability, and act in response (Bugden et al., 2017).

In framing theory, frames are thought to act as cognitive schemas that guide interpretations and actions, whereas specific words are
conceived as providing cues for particular frames (Cornelissen and Werner, 2014). Since their conception (Burke, 1937), frames have been widely applied within the social sciences (Benford and Snow, 2000), as an extensive review has shown by Cornelissen and Werner (2014). By extension, frame-based inferences have been used as the cognitive basis of sensemaking (Weick, 1995 p.110). Frames help to organize experience and guide action (Cornelissen and Clarke, 2010).

To provide a more nuanced perspective on the interrelationship between digitalization and ecological, economic, and social sustainability, we have extracted frames from news articles published in daily newspapers in Austria. Austria represents an ideal setting for our investigation. As a long-term member of the European Union (EU), Austria is not only committed to the EU’s directives on digitalization (European Commission, 2020) but also prominently stresses the need for digitalization in its national policies (Bundeskanzleramt und Bundesministerium für). In the current Digital Economy and Society Index based on five dimensions—connectivity, human capital, the use of internet services, the integration of digital technology, and digital public services—Austria ranks 13th of 28 EU member states, slightly above the EU average (European Commission, 2020).

Based on the literature on digitalization and sustainability as well as the theories of social representations and framing, we aim to cast light on the perceived relationship between digitalization and ecological, economic, and social sustainability by answering three research questions:

- RQ1 How is the relationship between digitalization and sustainability framed?
- RQ2 What roles do different dimensions of sustainability (e.g., ecological, economic, and social sustainability) play within the identified frames?
- RQ3 How does information about digitalization affect people’s perception of different dimensions of sustainability?

3. Overview of the studies

In what follows, we present one qualitative and two quantitative studies to demonstrate how the relationship between digitalization and sustainability is framed in media and whether the information on digitalization affects people’s perceptions of different dimensions of sustainability. In Study 1 (media analysis), we applied a qualitative methodology to identify how the relationship between digitalization and dimensions of sustainability is framed. Media are common data sources for identifying discourses about socially relevant issues (e.g., in research on sustainability-related issues), including smart meters (Hielscher and Sovacool, 2018), the sharing economy (Yuana et al., 2019), or strategic change (Bednar et al., 2013). As such, media coverage plays a key role in creating and reproducing discourses about how digitalization and sustainability interact, providing an ideal data source for our research. Our study followed an exploratory approach because research on the relationship between digitalization and sustainability remains scarce. In a first step, we identified and compared frames that organize the discussion on how digitalization and various dimensions of sustainability are related. Based on our results and to test the hypotheses derived, we conducted two quantitative studies—a laboratory experiment (Study 2) and an experimental online questionnaire (Study 3)—to investigate whether digitalization is perceived differently in its relationships with the economic, ecological, and social dimensions of sustainability.

3.1. Study 1: Framing the relationship between digitalization and sustainability

3.1.1. Method

To identify dominant frames for understanding the relationship between digitalization and sustainability, we analyzed news data published in Austria while following a common approach to framing analysis (Yuana et al., 2019, p. 1156). Our study’s time frame began with the first article in the database and ended at the beginning of October 2019. We used Factiva, an international press database containing news, economic, and corporate information. Covering worldwide news starting from 1985 in several languages, Factiva ranks among the most extensive media archives in the world. Table 1 presents the search criteria used to obtain relevant news data. The search resulted in 79 press releases, seven of which were duplicates and thus removed from the dataset. The first press release was published on April 17, 1997, whereas the latest was published on September 19, 2019.

The data were analyzed using qualitative content analysis (Mayring, 2003) by two coders who used the qualitative data software NVivo to categorize the data. As typical in studies on emerging fields and transformations (Dobusch and Schüßler, 2014; Oliver and Montgomery, 2008), we primarily focused on two aspects: the dimension of the meanings (i.e., the frames applied and the dimension of sustainability addressed) and the type of actors using the frames. We started developing first-order codes close to the data for a preliminary glimpse of the topics discussed. That process was complemented by coding the various dimensions of sustainability and the type of actors. As a final step, we derived frames from all media sources following an inductive approach, which allowed us to combine the identified codes into frames.

Table 1

| Criteria                  | Value                                                                 |
|--------------------------|----------------------------------------------------------------------|
| Keyword                  | “Digitalization and sustainable” [German Original: “Digitalisierung und nachhaltig”] |
| Operator                 | AND                                                                  |
| Period                   | 01.01.1990 - 01.10.2019                                              |
| Sources                  | four Austrian Newspapers (Die Presse, Der Standard, ZEIT Österreich, Kurier) and three online sources of Austrian newspapers (Die Presse, Kurier Online, Krone.at) |
| Topic                    | News                                                                 |
| Geographical region      | Austria                                                              |
| Language                 | German                                                               |
| Author, company, branch  | No restrictions                                                     |

3.1.2. Results

Overall, we identified four frames in our sources: two neutral ones that did not make an assessment, a negative or skeptical one, and a positive or euphoric one (Table 2).

3.2. Frame 1: Stand-alone challenges

In the first frame, digitalization and sustainability are treated as two independent phenomena that provide unique challenges that need to be mastered separately. Although digitalization and sustainability are often mentioned in one breath, they are perceived as stand-alone, independent constructs. The use of both concepts paints a vague picture of two buzzwords that are popular, as exemplified in Article 16 from 2019: “The whole world speaks of digitalization, Industry 4.0, and most recently also about climate change and global warming.” Therein, regarding the different dimensions of sustainability, sustainability is most often mentioned in general (n = 8), followed by its relationship with ecological sustainability (n = 6), climate change, and resource depletion. However, the concepts of social sustainability (n = 2) and economic sustainability (n = 1) are less prominent.

The frame is future-oriented and describes how digitalization and sustainability imperatives are changing and will continue to alter the world—for instance, “Digitalization, communication, globalization or sustainability shape the conditions and content” (Article 54, 2017). The passive role of observers of that change is complemented by a more or less explicit call for action: it is necessary to deal with the challenges caused by the change, including “building up competencies” (Article 14,
Table 2  
Identified frames of the relationship between Digitalization and Sustainability.

| Frame 1: 'Stand-alone challenges' | Neutral; Message: Digitalization and Sustainability are mentioned independently from each other. Both are perceived as two independent challenges that need to be mastered separately. | ‘The whole world speaks of digitalization, Industry 4.0, and most recently also about climate change and global warming. Do these topics concern you too? Absolutely. Digitalization and the eco-social market economy, the challenge of producing as sustainably as possible - these are topics that will have an even more impact on us in the future’ (Article 16, 2019) ‘Renewable energy and climate protection. Healthcare. Digitalization and IT’ Governor Hans Peter Doskozl (SPÖ) sees these three areas as ‘the major central challenges that we have to solve together’ (Article 14, 2019) |
| Frame 2: 'Digital impact' | Neutral; Message: Digitalization and Sustainability are perceived as connected: Digitalization has an impact on sustainability, but the relationship is not assessed. | ‘Digitalization and Internet technology will change every business in the long term’ (Article 79, 2012) ‘In the most diverse sectors of digitalization, on the one hand, the fascinating opportunities of their use are to be grasped, on the other hand, the limits of use are shown’ (Article 35, 2018) |
| Frame 3: 'Digital ruin' | Negative; Message: Digitalization and Sustainability are perceived as connected: does not result in a sustainable solution. | ‘Citizens should become smart for their smart residents. Critics fear that technology will eat their children’ (Article 68, 2016) ‘Many older people can no longer keep up with the pace of digitalization’ (Article 67, 2017) |
| Frame 4: 'Positive catalyst' | Positive; Message: Digitalization and Sustainability are presented as the aim to be approached with digitalization as a means to sustainability. Digitalization positively impacts sustainability, it supports sustainability through transparency, efficiency and available knowledge. | ‘They make a conscious decision to take full advantage of the opportunities offered by digitalization. This is a path that we also want to take in Lower Austria to create new jobs’ (Article 51, 2017) ‘A very important area is digitalization, with which agriculture could be operated much more sustainably’ (Article 17, 2019) |

2019). The diversity of actors addressed in the frame, including political actors, designers, authors, companies, and other institutions, highlights that changes due to digitalization and sustainability concern various parts of society.

In sum, digitalization and sustainability in the first frame are discussed as two phenomena that are (1) not yet well elaborated and understood, (2) represent independent constructs, and (3) put pressure on various societal actors to actively adapt to novel challenges—ever shorter innovation cycles, ever faster work processes and procedures, information dissemination and processing, digitalization—even amid ‘increasing pressure to do business sustainably and transparently’ (Article 69, 2016).

3.3. Frame 2: Digital impact

The second frame, which we called “Digital impact,” was the least dominant in the sample (Fig. 1). In that frame, digitalization and sustainability are perceived as connected such that digitalization impacts sustainability. That relationship is perceived as an indisputable fact, as reflected in an article from 2012 stating, “Digitalization and internet technology will change every business in the long term” as one of “ten highly provocative commandments [that] should lead to sustainable innovation” (Article 79, 2012). While the impact of digitalization on sustainability is presented as irrefutable, the direction of that impact remains unclear. Added to that, the data shows no evidence about whether increasing digitalization results in a more or less sustainable future. Instead, the relationship between digitalization and sustainability is expressed as a one-way street to an unknown destination.

Similar to the first frame, the second one stresses the need for timely, adept responses to those challenges. On the contrary, a lack of or slow adaption to the new circumstances is viewed as a possible weakness: “The majority of banks are not fast enough on the way to the new world, which not only consists of digitalization but has a lot to do with it” (Article 77, 2014). In the frame, it is taken for granted that digitalization will affect sustainability. Economic sustainability (n = 4) was mentioned more often than general sustainability (n = 2) and social sustainability (n = 2). Companies are the actors who mostly use the frame, and they discuss digitalization as being crucial to various industries, as summarized in 2017: “Therefore, everyone—whether hairdresser, craftsman or doctor—should think about what digitalization means for their own company” (Article 61, 2017). Notably, however, the ecological dimension of sustainability is not discussed in that frame.

3.4. Frame 3: Digital ruin

In the third frame, digitalization and sustainability are perceived as being interrelated in a clearly negative direction. Digitalization is described as not sustainable, as harming sustainability, and/or as preventing sustainable advancement. The discussion in that frame evolves around the negative consequences of digitalization for individuals (e.g., increased social pressure) and society at large (e.g., innovations that become essential at ever-faster rates).

Although the frame considers ecological sustainability (n = 2) and economic sustainability (n = 3), the social dimension of sustainability dominates the frame (n = 9) because digital upheaval is expected to cause massive changes that ultimately harm society. Some parts of society, including older adults and immigrants, may even be excluded because they may be unable or unwilling to adapt to the digital environment. In turn, a societal divide may emerge: “Austria threatens to split into a two-tier digital society” (Article 61, 2017).

Although journalists most often apply the third frame, political actors also raise concerns along the same lines. All actors express skepticism about whether digitalization contributes to the good of all and thus call for a more cautious approach by arguing that society should address digitalization more critically and consciously—and that “maybe we should even refuse some things” (Article 44, 2018).

3.5. Frame 4: Positive catalyst

By far, the most dominant frame in media data in our sample was frame four, “Positive catalyst” (Fig. 1). In that frame, digitalization is seen as a significant enabler for sustainability, which is understood as an important goal achieved by digitalization. Thus, digitalization can pave the way to a more sustainable future and is likewise discussed to impact sustainability in general (n = 6), social sustainability (n = 5), and ecological sustainability (n = 8). A positive impact on climate change, reducing CO₂, and more sustainable agriculture and energy savings typically receive mention in the frame. Although ecological problems can indeed be redressed by digitalization, it plays a more critical role for
economic sustainability \(n = 17\), because it results in economic sustainability through efficiency, automation, and connectivity. Tools necessary to exploiting digital transformation have already been implemented in companies and education: “It has been shown that digitalization has already arrived in the classrooms” (Article 42, 2018). Above all, the idea of smart cities with smart solutions is presented as the golden way forward, because those intelligent, connected, smart cities are powered by infrastructure such as the Internet of Things or blockchains and include “smart grids” (Article 47, 2017), “smart cars” (Article 73, 2016), and “smart ports” (Article 74, 2016). Companies apply the fourth frame most often, followed by journalists, political actors, and research institutions.

3.5.1. Discussion and development of hypotheses

Study 1 suggests that media discuss the positive effects of digitalization on the economic or the ecological dimension of sustainability more often than on social sustainability, which remains far more controversial than the other two. Our analysis of the media data revealed that the context of the discussion prevails over the impact on and application of digital technology in companies. Notwithstanding critical scientific reports on the rebound effects of energy and resource use in the wake of the increased use of digital technology, the predominantly positive picture of digitalization and its potential impact on the ecological footprint in our media analysis supports that notion. Adding research question 3, we thus hypothesized that the extent of digitalization affects the perception of ecological and economic sustainability but not the perception of social sustainability:

**H1.** The extent of digitalization affects the perception of ecological sustainability.

**H2.** The extent of digitalization affects the perception of economic sustainability.

Whereas we assumed that both economic and ecological sustainability are the focus of attention, we expect that social responsibility would be less prominent. By focusing on coarser issues such as minimizing an organization’s ecological footprint while at once maximizing profit, social issues may get less attention.

**H3.** The extent of digitalization does not affect the perception of social sustainability.

Following a multi-method approach, we set out to test our hypotheses in a quantitative laboratory experiment (Study 2). Given that companies are at the forefront of digital disruption and sustainable management, we decided to use a company-based scenario in Study 2. We described a company using either low or high extents of digitalization to examine whether the company’s different descriptions affected perceptions of economic, ecological, and social sustainability. As Study 1 revealed, the discussion on digitalization and sustainability in media is relatively young; the first article to use both digitalization and sustainable was published in 1997. Thus, to control for possible time effects in Study 2, we provided information on the founding year in our laboratory experiment. In what follows, we present the laboratory experiment using a 2 (i.e., low vs. high extent of digitalization) by 2 (i.e., founding year of the company: 1978 vs. 2018) design.

### 3.6. Study 2 Testing the relationship between digitalization and sustainability in a laboratory experiment

#### 3.6.1. Method

A sample of 206 business students (48.1% women; \(M_{\text{age}} = 21.96, SD_{\text{age}} = 3.06\)) participated in the laboratory experiment. Most participants (79.6%) had no leadership experience, whereas 15.5% indicated having 1–2 years of experience, and 4.9% indicated they have 3–5 years. Most participants also indicated meeting basic qualifications for entering university as their highest level of education (91.3%).

#### 3.6.2. Procedure

All participants were asked to imagine being part of a commission tasked with evaluating a company’s sustainability. The introduction to the fictive company read as follows:

Imagine that you are part of a commission that supports sustainable businesses with a small financial grant. Eighty of the 100 companies that applied for the grant can be funded. Each company submitted an application, but more information for the funding decision is unavailable. Please consult the application of one company below and report your assessment of the company’s sustainability. There are no right or wrong answers; it is your subjective assessment. For some statements, you will not be able to access specific information from the description, but please make an assessment nonetheless.

#### 3.6.2.1. Independent variable.

After reading the introduction, participants were assigned to one of four conditions in which they were presented with one of four different versions of the company’s grant application (Fig. 1). Thus, using a between-subject design, we manipulated the extent of digitalization (low vs. high) and the company’s founding year (1978 vs. 2018).

![Fig. 1. Frequency of identified frames over time.](image-url)
3.6.2.2. Dependent variables and demographic variables. Participants had to complete a questionnaire assessing their perception of the company’s ecological, economic, and social sustainability on a 7-point Likert scale ranging from 1 (not at all) to 7 (entirely). At the end of the questionnaire, demographic variables (i.e., gender, age, nationality, education, mother tongue, occupational status, and leadership experience) were requested.

3.6.3. Results

Correlations between the three forms of sustainability, overall means, and their standard deviations and confidence intervals appear in Table 3.

To test whether the extent of digitalization and the company’s founding year affected perceptions of sustainability, we conducted a multivariate analysis of variance (MANOVA) with those elements as independent variables and perception of sustainability as the dependent variable. The analysis revealed that the extent of digitalization significantly affected the perception of sustainability, $F(3, 200) = 5.735$, $p = .001$, $\eta^2_p = .079$, whereas the founding year did not, $F(3, 200) = 0.506$, $p = .678$, $\eta^2_p = .002$. There was also no significant interaction effect of digitalization or founding year on the perception of sustainability ($p > .948$).

As expected, univariate analyses for each dependent variable (i.e., ecological sustainability, economic sustainability, and social sustainability) revealed a significant effect of the extent of digitalization on ecological sustainability ($p = .008$) and economic sustainability ($p < .001$), as shown in Table 4. Moreover, as shown in Fig. 2, the extent of digitalization had no effect on the perception of social sustainability ($p = .872$). The analysis additionally revealed no significant main effect of the founding year of the company ($p > .254$) and no interaction effect ($p > .641$). Thus, H1, H2, and H3 were all supported: The extent of digitalization affected the perception of the company’s ecological and economic sustainability but not the perception of social sustainability (Fig. 3).

3.7. Study 3 Testing the relationship between digitalization and sustainability with an experimental online questionnaire

3.7.1. Method

A total of 244 people living in Austria completed the experimental online questionnaire. Because the study again focused on evaluating a company’s digitalization, retirees were excluded from the sample because they are no longer part of the labor market. The final sample thus consisted of 194 (48.5% women, 0.5% [1 person] without a reported gender) participants with a mean age of 42.38 years ($SD_{age} = 12.33$). Most participants reported having either an academic degree (29.9%) or vocational training (29.4%) as their highest level of education (i.e., 4.1% compulsory school, 13.4% secondary school, and 23.2% higher education entrance qualification), and 70.1% reported being employed, 7.2% self-employed, 7.2% unemployed, 5.7% in educational training, and 7.8% as “Other.” Approximately 40% had no leadership experience (42.3%), and 14.9% had more than 10 years; 12.9% had 6–10 years of leadership experience, 12.9% had 3–5 years, and 17.0% had only 1–2 years.

3.7.2. Procedure

Participants were recruited via a market research agency asked to form a representative sample of Austrian citizens, and the questionnaire was distributed via an online link. Again, all participants were asked to imagine being part of a commission to evaluate a company’s sustainability. In the hypothetical scenario, the independent variables and the dependent variable were the same as in Study 2. Participants were also asked to indicate how important they considered ecological, economic, and social sustainability to be on a Likert scale from 1 (Extremely unimportant) to 7 (Extremely important).

3.7.3. Results

Correlations between the three forms of sustainability, overall means, and their standard deviations and confidence intervals appear in Table 3. The data were analyzed using MANOVA. To test whether the extent of digitalization and the company’s founding year affected perceptions of sustainability, a MANOVA was conducted with the extent of digitalization and founding year as independent variables and perception of sustainability as the dependent variable. The multivariate analysis revealed that the extent of digitalization significantly affected the perception of sustainability, $F(3, 188) = 2.804$, $p = .041$, $\eta^2_p = .043$, whereas the founding year did not, $F(3, 188) = 0.286$, $p = .836$, $\eta^2_p = .005$. There was also no significant interaction effect of digitalization and founding year on perceptions of sustainability ($p > .840$).

With results presented in Table 4, univariate analyses for each dependent variable (i.e., ecological sustainability, economic sustainability, and social sustainability) revealed, as expected, a significant effect of the extent of digitalization on ecological sustainability ($p = .029$). The analysis also revealed the tendency of digitalization to affect the perception of economic sustainability ($p = .149$) but not social sustainability ($p = .381$). Furthermore, the analysis revealed no significant main effect of the company’s founding year ($p > .516$) or any interaction effect ($p > .652$). Thus, H1 and H3 were supported: The extent of digitalization affected the perception of the company’s ecological sustainability but not the perception of social sustainability (Fig. 4).

3.7.3.1. Exploratory analyses. Detailing the effect of digitalization on economic sustainability, Table 5 provides the perception of sustainability among participants by level of education. Participants with compulsory education ($n = 8$) and secondary school degrees ($n = 26$) were not considered because their group sizes were too small. The results indicate that participants with vocational training perceived the effect of digitalization differently: High extents of digitalization resulted in lower evaluations of economic and social sustainability.

Performing the MANOVA with extent of digitalization and founding year as independent variables and perception of sustainability as the dependent variable while excluding participants with vocational training revealed that the extent of digitalization significantly affected the perception of sustainability ($F(3, 131) = 3.160$, $p = .027$, $\eta^2_p = .067$), whereas the main effect of founding year ($p = .622$) and the interaction effect of digitalization and founding year did not ($p = .698$). Univariate analyses for each dependent variable (i.e., ecological sustainability, economic sustainability, social sustainability) revealed a significant effect of extent of digitalization on ecological sustainability ($p = .024$, $\eta^2_p = .038$) and economic sustainability ($p = .017$, $\eta^2_p = .042$) but not on social sustainability ($p = .846$). Furthermore, the analysis revealed no significant main effect of the company’s founding year ($p > .393$) and no interaction effect ($p > .674$).

### Table 3

| Steady and study 3. Correlation Table. | (MSD) | 95% CI | Econ | Social |
|---------------------------------------|-------|--------|------|--------|
| Ecological sustainability (Ecol)      | Study 2 | $[3.59,3.91]$ | $[.286^{***},.249^{***}]$ |
|                                      | 2      | (1.17) |      |        |
|                                      | Study 3 | $[3.66,3.99]$ | $[.572^{***},.305^{***}]$ |
|                                      | 3      | (1.19) |      |        |
| Economic sustainability (Econ)        | Study 2 | $[3.58,3.96]$ | $[.170^*]$ |
|                                      | 2      | (1.38) |      |        |
|                                      | Study 3 | $[3.82,4.19]$ | $[.462^{***}]$ |
|                                      | 3      | (1.31) |      |        |
| Social sustainability (Social)        | Study 2 | $[4.40,4.77]$ | $[.858^{***},.955^{***}]$ |
|                                      | 2      | (1.35) |      |        |
|                                      | Study 3 | $[4.01,4.38]$ | $[.289***]$ |
|                                      | 3      | (1.31) |      |        |

Note: Pearson correlations. * * * represent statistical significance at the $p < .05$, $p < .01$, $p < .001$ levels, respectively.
3.7.3.2. Importance of sustainability. A repeated measurement analysis of variance (ANOVA) was calculated to test whether the different forms of sustainability are considered to be of different importance. Mauchly’s test indicated that the assumption of sphericity had not been violated, $\chi^2(5) = 11.41, p = .823$, therefore degrees of freedom need no correction. The analysis showed a significant effect indicating that the different forms of sustainability are perceived to be of different importance, $F(2, 386) = 11.662, p < .001, \eta^2_p = .057$. All three forms of sustainability seem rather important, but social sustainability ($M = 5.613, SE = 0.106$) was considered as more important than ecological sustainability ($M = 5.17, SE = 0.111$) and economic sustainability. ($p = .005, M = 5.32, SE = 0.105$). The effect size is $f = 0.025$ and can thus be interpreted as a small to medium-sized effect.

### Table 4
Study 2 and Study 3. MANOVA Results of univariate analyses.

| Dependent variable                  | Independent variable                  | Study 2         | Study 3         |
|-------------------------------------|---------------------------------------|-----------------|-----------------|
|                                     |                                       | $F$ (df = 1)    | $p$             | $\eta^2_p$     | $F$ (df = 1) | $p$ | $\eta^2_p$ |
| Ecological sustainability (Ecol)    | Digitalization                        | 7.224           | .008            | .04            | 4.821       | .029 | .03        |
|                                     | Founding Year                         | 1.310           | .254            | .01            | .319        | .573 | <.01       |
|                                     | Digitalization x Founding Year        | 0.085           | .771            | <.01           | 0.204       | .652 | <.01       |
| Economic sustainability (Econ)      | Digitalization                        | 13.273          | <.001           | .06            | 2.097       | .149 | .01        |
|                                     | Founding Year                         | 0.025           | .873            | <.01           | 0.423       | .516 | <.01       |
|                                     | Digitalization x Founding Year        | 0.217           | .641            | <.01           | 0.121       | .729 | <.01       |
| Social sustainability (Social)      | Digitalization                        | .026            | .872            | <.01           | 0.771       | .381 | <.01       |
|                                     | Founding Year                         | .095            | .758            | <.01           | 0.049       | .824 | <.01       |
|                                     | Digitalization x Founding Year        | .043            | .836            | <.01           | 0.030       | .862 | <.01       |

![Fig. 2. Manipulation of independent variable.](image)

Fig. 2. Manipulation of independent variable.

4. Discussion

4.1. Main contributions

As megatrends, digitalization and sustainable development urge major transitions in our world. Although digitalization offers new pathways and (unseen) possibilities, its potential to achieve or impede sustainability of ecological, economic, and social human systems remains unclear (Seele and Lock, 2017). A burgeoning body of academic literature on the potential relationship of digitalization and sustainability primarily focuses on the latter’s ecological aspects (Seele, 2016; Seele and Lock, 2017) and needs further theoretical development (Del Río Castro et al., 2021). More importantly, empirical evidence on how the relationship between digitalization and ecological, economic, and social sustainability is perceived by different actors remains scant.
Drawing on social representations theory and framing theory, we add to the discussion about the nexus of digitalization and various dimensions of sustainability. Because the framing and social representations of that relationship impact how various actors, including managers and policymakers, act in response to those imperatives, such work constitutes a vital undertaking. In that light, using a multi-method approach combining qualitative and quantitative experimental research methods allowed us to open up the so-called “black box” of this nexus and show how different actors frame the relationship between digitalization and ecological, economic, and social dimensions of sustainability. Our work thus adds to the literature in several fundamental ways.

Table 5
Study 3. Exploratory analysis.

|                              | Vocational Training | Higher education entrance qualification | Academic Degree |
|-----------------------------|---------------------|----------------------------------------|-----------------|
|                             | Digitalization      |                                        |                 |
| Low (N = 34)                | M                   | M                                      | M               |
| High (N = 23)               | M                   |                                        |                 |
|                             | Ecological sustainability | 3.65                          | 3.5            | 3.92        |
|                             | Economic sustainability | 3.94                          | 3.83           | 3.83        |
|                             | Social sustainability | 4.32                          | 4.38           | 4.38        |

Fig. 3. Study 2. Means and standard errors of perceived sustainability across the four conditions. Note. Dlow ... low level of digitalization, Dhigh ... high level of digitalization.

Fig. 4. Study 3. Means and standard errors of perceived sustainability across the four conditions. Note. Dlow ... low level of digitalization, Dhigh ... high level of digitalization.
4.2. Implications for theory

First, drawing on framing theory, we have identified four distinct frames regarding the relationship between digitalization and sustainability: two frames are neutral, whereas another indicates a negative connotation and the last a positive one. The frame of stand-alone challenges depicts digitalization and sustainability as two independent challenges that need to be addressed separately. By contrast, the frame of digital impact implies that digitalization impacts sustainability but does not indicate any nature or direction of that relationship. Next, the frame of digital ruin characterizes digitalization as harming sustainability. Interestingly, although the ecological and the economic dimensions are indeed referred to within that frame, the most prominently mentioned dimension is social sustainability. As to why, media articles tend to engage in the discussion of a social, digital divide caused by increased levels of digitalization. Mostly journalists and political actors are the prime contributors to that debate. Last, the frame of positive catalysts suggests that digitalization paves the way to more sustainability in general and to the ecological and social dimensions of sustainability in particular. Interestingly, digitalization is most prominently framed as affecting the economic dimension of sustainability; thus companies apply that frame most often, followed by journalists and political actors. Our findings add to an emerging stream of literature on digitalization and sustainability by providing important, fine-grained empirical insights into the complexity of differing perceptions on digitalization in terms of ecological, economic, and social sustainability. Drawing on framing theory allowed us to unveil varying neutral, positive, and negative frames that we could test quantitatively in an experimental setting.

Second, our laboratory experiment and our experimental online questionnaire supported the findings of our qualitative analysis: The extent of digitalization affected the perception of the fictive company’s ecological and economic sustainability but not the perception of its social sustainability. As proposed in H1 and H2, we also found a significant effect of the extent of digitalization on perceptions of ecological and economic sustainability. On top of that, the exploratory analysis in Study 3 indicated that people with vocational training may perceive the link between digitalization and economic sustainability differently. Our results show that respondents with vocational training associated high extents of digitalization with less economic and social sustainability. In 2020, the sectors with the largest share of vocational training in Austria were the craft sector (43.0%), industry (15.1%), and trade (13.9%) (Chamber of Commerce, 2020). Respondents with vocational training may feel more at risk of losing their jobs with increased levels of digitalization (e.g., automation and robotics). In response, future research needs to consider those differing perceptions of digitalization regarding social sustainability from sector to sector. As hypothesized in H3, we additionally found no effect of degree of digitalization on the perception of social sustainability, possibly because social sustainability is a far more complex construct that runs counter to straightforward assumptions and perceptions. Of course, research on social sustainability is generally lacking compared with the other already established ecological and economic dimensions (Eizenberg and Jabareen, 2017), and that oversight indicates promising avenues for future research.

Third, we have responded to the call for more theoretical contributions in an emerging research field using both framing theory and social representations theory. Our experiments contribute to literature on the nexus between digitalization and sustainability by illuminating the social representations of digitalization and ecological, economic, and social sustainability. Our findings have implications for future research and call for a more nuanced view on the interrelationship of digitalization and sustainability that accounts for different dimensions of the latter. Social sustainability, in particular, has been integrated relatively late in the debate on sustainable development, hence the lack of theoretical and empirical studies regarding the dimension (Eizenberg and Jabareen, 2017). Given that the literature primarily focuses on digitalization regarding ecological sustainability, our study supports a more complete, nuanced picture by elucidating the perceived relationship between digitalization and social and economic sustainability.

Fourth, by combining media analysis with a laboratory experiment and an experimental online questionnaire, our study answered the call for more multi-method research (Del Rio Castro et al., 2021). The experimental method used addresses the issue of internal validity, which is often a shortcoming of other methods (c.f. Tosi et al., 2003).

4.3. Implications for policymakers

Last, our study has profound implications for policymakers, managers, and scholars alike. The nexus of digitalization and ecological, economic, and social sustainability includes many issues at organizational and societal levels that are inextricably connected, interdependent, and often conflicting (Bansal, 2002; Hahn et al., 2014). That dynamic presents a highly ambiguous and complex context for decision-making in which managers and policymakers need to address multiple conflicting economic, environmental, and social outcomes simultaneously and tend to rely on the frames and social representations already in circulation (Bogner and Barr, 2000). Therefore, it is critical to clarify which understanding of decision-makers (e.g., policymakers and managers) considering digitalization have regarding ecological, economic, and social sustainability, because how focal actors perceive the relationship between digitalization and various sustainability dimensions influences their decisions. Our findings suggest that the social representations of digitalization concerning ecological and economic sustainability seem to be firmly established in the minds of various actors. Our multi-method investigation also revealed that debates in the mainstream media influence people’s perceptions while scientific research on the effects and potential rebound effects of digitalization on various economic, social, and ecological dimensions remains in its infancy. Thus, policymakers need to be acutely aware of their perceptions on and inferences about the relationship between digitalization and ecological, economic, and social sustainability. At the same time, they need to account for differing perceptions on the nexus of digitalization and those forms of sustainability in their communication strategies targeted to their respective stakeholders and audiences. More specifically, they can actively shape social representations of the nexus by proactively engaging in public discourses in media. Ongoing and timely contributions to the public debate can help to prepare the groundwork for potential future regulations.

4.4. Limitations and directions for future research

Study 1 focused on mainstream media and did not account for social media. Although data from social media may complement our data, we identified two daunting hurdles that have to be considered when using social media. The first is visibility. Often, social media users can choose whether they want to make their messages visible to the public or not, a problem that El-Awaisi et al. (2020) discussed in their content analysis. The growing discussion about fake user accounts (i.e. Liu, 2019), fake pages (i.e. Parkas et al., 2018), fake followers (i.e. Cresci et al., 2015), and fake online reviews (i.e. Malbon, 2013; Moon et al., 2020; Munzel, 2016) has addressed nearly all social media platforms. Both hurdles need to be sized up before conducting a social media analysis intended to provide valuable results about digitalization and sustainability. Future studies could indeed complement those endeavors by analyzing social media posts on the incredible variety of social media platforms (e.g., Facebook, Twitter, Instagram, TikTok, and 9gag), each with a different focus, types of communication, rules, and user groups that together provide ample opportunities to communicate about digitalization and sustainability.

Examining our research questions in a laboratory setting limited the generalizability of our results. As mentioned, the company described in
the experiment was fictive. That approach was carefully chosen because the description of an existing company might have triggered participants’ foreknowledge of the companies’ digital strategy or its handling of sustainable issues, which could have confounded the results. Furthermore, the sample used in the laboratory experiment consisted of business students. Although research has indicated that such students are suitable surrogates for business managers (Remus, 1986), we decided to validate our student sample results using a different sample in Study 2 with an experimental online questionnaire.

Last, we studied Austria as a representative advanced economy in Western Europe with an average record when it comes to digitalization. Future studies may investigate how perceptions on the nexus of digitalization and sustainability may differ in other countries that rank above or below that average. It would also be interesting to see how the nexus of digitalization and ecological, economic, and social sustainability is perceived in emerging economies and how that compares to perceptions in their more advanced counterparts.

5. Conclusion

The interrelationship of digitalization and sustainability is a highly relevant, multidisciplinary area for future research given pressing developments in both arenas. Drawing on framing theory and social representations theory, we have provided a multi-method analysis of how different actors perceive the nexus between digitalization and sustainability in three of its dimensions. Our paper aims to spark a more pronounced debate on that interrelationship and to propose that it needs to be analyzed and discussed in greater detail. We also highlight managerial implications for policymakers who can actively shape social representations of the nexus by proactively engaging in public discourses in media. In doing so, we hope that our work can stimulate future research on the connection between those constructs.

CRediT authorship contribution statement

Barbara Brenner: Conceptualization, Writing – original draft, Visualization, Writing – review & editing, Project administration. Barbara Hartl: Conceptualization, Data management, Methodology, Formal analysis, Writing – review & editing, Software, Validation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Ahmad, T., Zhang, D., Huang, C., Zhang, H., Dai, N., Song, Y., Chen, H., 2021. Artificial intelligence in sustainable energy industry: status Quo, challenges and opportunities. J. Clean. Prod. 289, 125139.

Allen, M.R., Dube, O.P., Solecki, W., Aragón-Donard, F., Cramer, W., Humphreys, S., Kainuma, M., Kala, J., Mahowald, N., Mulugetta, Y., Perez, R., Wairiu, M., Zickfeld, K., 2018. Framing and context. In: Masson-Delmotte, V., Zhai, P., Pörtner, H.O.,ip, D., 2000. Value creation versus value capture: towards a coherent definition of value in strategy. Br. J. Manag. 11 (1), 1–15.

Burke, K., 1937. Attitudes toward History. Editorial Publications, CA.

Chamber of Commerce, 2020. Lehrlingsstatistik -Hauptergebnisse der WKO-Verbandsstatistik. Wirtschaftskammer Österreich, Vienna.

Colbert, A., Yee, N., George, G., 2016. The digital workforce and the workplace of the future. In: Future Academy of Management Journal 59 (3), 731–739.

Conner, K.R., 1991. A historical comparison of resource-based theory and five schools of thought within industrial organization economics: do we have a new theory of the firm? J. Manag. 17 (1), 121–154.

Cornelissen, J.P., Clarke, J.S., 2010. Imaging and rationalizing opportunities: inductive reasoning and the creation and justification of new ventures. Acad. Manag. Rev. 35 (4), 539–557.

Cornelissen, J.P., Werner, M.D., 2014. Putting framing in perspective: a review of framing and frame analysis across the management and organizational literature. Acad. Manag. Ann. 8 (1), 181–235.

Crespo, D. Pietro, R., Perna, M., Spognardi, A., Tesconi, M., 2015. Fame for sale: efficient detection of fake Twitter followers. Decis. Support Syst. 80, 56–64.

Dobusch, L., Schüer, E., 2014. Copyright reform and business model innovation: regulatory propaganda at German music industry conferences. Technol. Forecast. Soc. Change 83, 24–39.

Doherty, D., Dunne, D.D., 2012. Digital science and knowledge boundaries in complex innovation. Organ. Sci. 23 (5), 1467–1484.

Dobus, L., Schüßler, E., 2014. The Division of Labour in Society. Translated from the French Edition of 1893 by W. D. Hall with an Introduction by Lewis Coser. Macmillan, London.

Eizenberg, I., Jabareen, Y., 2017. Social sustainability: a new conceptual framework. Perspect. 16 (2), 122–128.

El-Awaiad, A., O’Carroll, V., Koraysh, S., Kummar, S., Huber, M., 2020. Perceptions of who is in the healthcare team? A content analysis of social media posts during COVID-19 pandemic. J. Interprof. Care 34 (5), 622–632.

Elkington, J., 2004. Towards the sustainable corporation: win-win win business strategies for sustainable development. Calif. Manag. Rev. 36 (2), 90–100.

Elkington, J., 1998. Partnerships from Cannibals with Forks: the Triple Bottom Line of 21st-century Business. New Society, Stony Creek, CT.

Elkington, J., 2004. Enter the triple bottom line. In: Heinricus, A., Richards, J., Nance, L. (Eds.), The Triple Bottom Line. How Does It All Add up? Assessing the Sustainability of Business and CSR. Earthscan, London Sterling, VA, pp. 1–16.

B. Brenner and B. Hartl

Journal of Cleaner Production 315 (2021) 128128

Dobusch, L., Schüer, E., 2014. Copyright reform and business model innovation: regulatory propaganda at German music industry conferences. Technol. Forecast. Soc. Change 83, 24–39.

Doherty, D., Dunne, D.D., 2012. Digital science and knowledge boundaries in complex innovation. Organ. Sci. 23 (5), 1467–1484.

Dobus, L., Schüßler, E., 2014. The Division of Labour in Society. Translated from the French Edition of 1893 by W. D. Hall with an Introduction by Lewis Coser. Macmillan, London.

Eizenberg, I., Jabareen, Y., 2017. Social sustainability: a new conceptual framework. Perspect. 16 (2), 122–128.

El-Awaiad, A., O’Carroll, V., Koraysh, S., Kummar, S., Huber, M., 2020. Perceptions of who is in the healthcare team? A content analysis of social media posts during COVID-19 pandemic. J. Interprof. Care 34 (5), 622–632.

Elkington, J., 2004. Towards the sustainable corporation: win-win win business strategies for sustainable development. Calif. Manag. Rev. 36 (2), 90–100.

Elkington, J., 1998. Partnerships from Cannibals with Forks: the Triple Bottom Line of 21st-century Business. New Society, Stony Creek, CT.

Elkington, J., 2004. Enter the triple bottom line. In: Heinricus, A., Richards, J., Nance, L. (Eds.), The Triple Bottom Line. How Does It All Add up? Assessing the Sustainability of Business and CSR. Earthscan, London Sterling, VA, pp. 1–16.
