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Article

The Leading Digital Technology Companies and Their Approach to Sustainable Development

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Abstract: The increasingly stellar attraction of the digital technologies and the growing, though not universal, consensus of the need to build a sustainable future, are two powerful trends within society. The aim of this article is to offer an exploratory review of how the leading companies within the digital transformation market have addressed sustainable development. As such, the article's originality and value lie in offering a review of current corporate thinking within that market. The study adopts an inductive, qualitative approach based on an examination of published company reports, and identifies six major sustainability themes being actively promoted and supported. The article concludes that the current sustainability objectives of the technology companies are driven as much by commercial reality as any altruistic motives, and that support and promotion of the circular economy may offer the best opportunity for digital technologies to meaningfully impact sustainable development.

Keywords: digital technologies; sustainable development; digital transformation; circular economy; sustainability



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1. Introduction

The relationship between digital transformation and sustainability is receiving increasing attention in the academic and business literature. Von Kutzschenbach and Daub [1] (p. 179), for example, concluded that “business leaders and managers are at a point where they need to rethink the way business can leverage digital transformation in order to support engagement with sustainability challenges”. In a similar vein, Bansal [2] (para. 1) recognised that “as business activities breach planetary boundaries, sustainable development is more critical and urgent than ever” but claimed that “major advances in digital technologies and the erosion of social institutions has created a perfect storm, so that sustainable development may be an even more elusive ideal”. While some commentators argue that “the digital technology industry is one of the least sustainable and most environmentally damaging industrial sectors in the modern world” [3] (para. 1), others claim that “digital technologies can contribute to a more sustainable future” [4] (para. 1). This positive perspective is evidenced in the so-called “Industry 4.0”, which promises to transform the way industries produce, develop, and sell their goods. Industry 4.0 entails the integration of digital technologies in the network of industrial machines that generate and exchange information, and make decisions based on that information [5]. Through the deployment of the Internet of Things, cloud computing, artificial intelligence, big data analytics, smart sensors, adaptive robotics, and machine learning, traditional factories are evolving to become more efficient and more sustainable “smart factories” with a reduced carbon footprint [6].

With these thoughts in mind, this article provides an exploratory review of how the leading companies within the digital transformation market have approached sustainable development, addressing a number of contemporary issues related to the current debate on digital transformation. Following this brief introduction, the research method is outlined

and two research questions are posed. The origins, evolution and definition of some of the key concepts are then discussed, and the following section reports on the findings from an examination of company reports and published material from 10 leading digital technology companies. A discussion section then surfaces and assesses other emergent issues. Finally, the concluding section provides a brief summary and suggests possible areas for future research.

2. Method of Enquiry

In looking to review how the leading companies in the digital transformation market approached sustainable development, the authors adopted a simple two step method of enquiry, which they believe to be appropriate for an exploratory review. First, a review of relevant academic publications was undertaken to establish basic definitions and meanings, and also to examine the relationship between digital transformation and sustainable development, as evidenced in the extant literature in the environmental, business and management sectors, and information and communication technology literature. Second, the authors selected the 10 leading companies within the digital transformation market, as listed by Meticulous Market Research [7], namely Cognizant, HP Inc., Microsoft Corporation, Intel Corporation, Google LLC, IBM Corporation, Accenture PLC, Cisco Systems, SAP SE, and Oracle Corporation were selected for investigation. The authors took the view that, as leading players in the digital transformation market, they might be seen to reflect innovative approaches to addressing sustainable development within the sector.

The vast majority of large companies use the Internet to report annually on their commitments to sustainable development and on their achievements in looking to meet these commitments. An Internet survey was conducted on Google in March 2021, using “sustainable development” and the name of each of the selected companies as key phrases. The information generated by this search formed the empirical information for this article. This material is in the public domain on the World Wide Web, and the authors took the view that they did not need to seek the selected companies’ permission to use it. When outlining issues of the reliability and the validity of information drawn from Internet sources, Saunders et al. [8] emphasised the importance of the authority and the reputation of the source, and the authors felt that both these conditions were met.

Some researchers have employed forms of content analysis to systematically identify themes and issues on corporate websites. However, given that the aim of the paper was to provide an exploratory review to illustrate how the selected companies addressed sustainable development, rather than to provide a comprehensive or comparative analysis of leading companies in the digital transformation market, and that the material on sustainable development was clearly structured within the reports, the authors were minded that employing content analysis techniques was neither appropriate nor necessary. Rather, the authors decided to identify the key themes and narratives by an informed reading of the relevant corporate material and through application of the “display and analysis” technique put forward by Miles and Huberman [9]. These authors note that “as part of data analysis, data display is designed to assemble organized information into an immediately accessible, compact form (e.g., types of matrices, graphs or charts) so that the analyst can see what is happening and draw justified conclusions” [9] (p. 11). Based on this analysis, the article draws heavily on selected quotations from the information technology companies’ websites, in the belief that this approach would convey corporate authenticity and offer a greater depth of understanding.

Cognizant is a US multinational corporation, which provides a range of digital, technology, operations, and consulting services. HP Inc. is a US multinational information technology company, which develops and manufactures personal computers, printers and 3-Dimensional printing solutions. Microsoft Corporation is a US multinational company, which develops, manufactures, licenses, supports and sells computer software, consumer electronics and personal computers. Intel Corporation is a US multinational technology company and is the world’s largest semi-conductor chip manufacturer. Google LLC is a US

multinational technology company, established in 1998, that specialises in Internet services and products, including the world's most used search engine. IBM Corporation is a US multinational technology and consulting company, founded in 1910, with operations in over 170 countries. Accenture PLC is a multinational company headquartered in Ireland, and its business operations span strategy, consulting, technology software and business process outsourcing. Cisco Systems is a US multinational technology company that develops, manufactures and sells networking hardware, software and telecommunications equipment. SAP SE is a German multinational software corporation that develops business enterprise software to manage business operations and customer relations. Oracle Corporation is a US multinational corporation, which sells data base software and technology, cloud engineered systems and software products.

The research approach was qualitative and inductive, through which the authors attempted to address two main research questions (RQs):

- RQ1: How are the leading players in the digital transformation industry addressing sustainability?
- RQ2: How does this inform the debate regarding the relationship between digital transformation and sustainable development?

3. Origins and Definitions

In the corporate environment, digital transformation concerns the adoption of digital technologies to replace analogue or manual processes, and may involve the integration of digital technologies in all areas of a business or service, and thus the claim that it has the potential to revolutionise the way businesses operate and deliver value to customers. However, digital transformation involves cultural as well as technological change. Indeed, Tabrizi et al. [10] go as far as to claim that “digital transformation is not about technology” (para. 1) and that “if people lack the right mindset to change and the current organizational practices are flawed, digital transformation will simply magnify those flaws” (para. 3). More specifically, the authors emphasised that companies should integrate their approach to digital transformation into their overall business strategy, align their technology investments with their business goals, acknowledge employee fears about job losses and harness their employees' knowledge to develop understanding of how digital transformation will affect the customer experience.

The term “digital transformation” has been widely used in the business and information technology literature, and has generated a large number and a wide range of definitions. Gong and Ribiere [11] (p. 10), for example, reviewed 134 definitions before formulating their “unified definition”, namely, “a fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders”. By way of clarification, the authors suggested that an entity could be an organisation, business network, an industry, or society. Verhoef et al. [12] (p. 889) defined digital transformation as “a change in how a firm employs digital technologies, to develop a new digital business model that helps to create and appropriate more value for the firm”. Vial [13] (p. 121) developed a “conceptual definition” of digital transformation, namely, “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies”.

While digital transformation may have become a buzz phrase in recent years, Me-near [14] suggested that its origins date back to the first half of the twentieth century. More substantively, Schallmo, Williams and Boardman [15] argued that the ideas of digital products, service and mediums were already well understood from the 1990s onwards, particularly in the retailing and advertising sectors. Further, they suggested that from 2000 onwards, the increasing development of smart devices and social media platforms drove fundamental changes in the ways customers communicated with businesses, and

revolutionised customers' expectations and their increasing enthusiasm for, and reliance on, multi-channel retail provision.

The explicit expression of the concept of sustainable development has recent origins. Writing in the mid-1980s, Peter Bartelmus [16] (p. ix), then Chief of Environmental Statistics at the United Nations, claimed that, "despite the continuing efforts of international organisations to promote environmental issues, no generally recognized model of the relationships between environment and development is available". The following year, the first formal definition of sustainable development, namely "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [17] (p. 43) was framed. Since then, the concept has been extended to recognise its environmental, social and economic dimensions, to embrace equity across geographical space, as well as over time, to incorporate business imperatives as part of corporate sustainability strategies, and to encompass a wide range of human endeavours.

However, sustainable development has come to mean "different things to different people" [18] (p. 20), and, as such, it is a contested concept, which has been defined in a number of ways. On the one hand, there are sets of definitions based in and around ecological principles which focus principally on conserving natural resources and protecting ecosystems. In an early definition, Goodland [19] (p. 3) defined environmental sustainability as "the maintenance of natural capital", while Porritt [20] (p. 33) defined "ecological sustainability" as "the capacity for continuance into the long-term future, living within the constraints and limits of the biophysical world". On the other hand, there are broader definitions which look to include social and economic, as well as environmental goals. For the United Nations Environmental Protection Agency [21] (para. 2) "to pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations". Mensah [22] (p. 14) suggested that "achieving sustainable development hinges on a number of principles", and that the dominant messages in addressing these principles relate "to conservation of ecosystem and biodiversity, production systems, population control, management of human resources, conservation of progressive culture and people's participation".

More specifically, investors, consumers, governments and the media have become more aware of, and concerned about, the environmental and social impacts of business activities. Companies have come to acknowledge sustainable development as one of the emerging drivers of competition, and as a significant source of both opportunity for, and risk to, long term competitive advantage, and have developed corporate sustainable development strategies. However, critics see corporate enthusiasm for sustainable development as little more than a veiled and cynical ploy, popularly described as greenwash, and typically described as "communication that misleads people into forming overly positive beliefs about an organization's practices and products" [23] (p. 223).

There are a number of conceptual approaches which look to locate sustainable development within a wider social and economic framework that merit attention. Firstly, a distinction is often made between weak and strong sustainable development. Ihlen and Roper [24] (p. 43) for example, argued that "strong sustainability puts the stock of natural resources first, while weak sustainability implies that capitalism may be restructured to cope with environmental problems without requiring a total transformation of the political-economic system". Secondly, Chan et al. [25] argued that stakeholder theory was a key perspective in theorising corporate sustainable development. This approach argues that, in addressing sustainable development, companies should look to incorporate the expectations of all their stakeholders, including the company itself, shareholders, customers, suppliers, and society as well as the environment. Thirdly, legitimation theory, identified by Freudenreich et al. [26] as the theoretical framework most applied in sustainability reporting studies, argues that in addressing and reporting on sustainable development, companies are pursuing a legitimation strategy, which effectively masks unsustainable practices and strengthens their license to operate. Hrasaky [27] (p. 174) drew on legitimation theory in arguing that companies in the carbon intensive sector within Australia, were

pursuing “a moral legitimization strategy”. Fourthly, there are a set of critical theoretical approaches epitomised by the work of Castro [28], and Amsler [29] (p. 124), for example, emphasised the need “to explore the complex processes through which competing visions of just futures are produced, resisted and realized”.

4. Findings

Taking the above perspectives into consideration, this section reports on how the selected companies, major producers of digital products and services, have approached the concept of sustainable development, and thereby addresses RQ1. All of the selected companies emphasised their corporate concern for, and commitment to, sustainable development, albeit in a variety of ways. In demonstrating its commitment to “putting sustainability at the heart of our strategy”, SAP SE [30] (p. 221), for example, claimed that “sustainability is now firmly anchored in our business strategy, governance, and executive compensation system”. In a similar vein, in introducing its “sustainable impact strategy”, HP Inc. [31] (p. 7) reported on its “commitment to create positive, lasting change for the planet, its people, and our communities. This serves as a guiding principle for delivering on our corporate vision—to create technology that makes life better for everyone, everywhere”. Jon Chorley, Chief Sustainability Officer at Oracle Corporation, stressed that “sustainability is inherent in the way we think about and approach nearly every aspect of our business”, and that the company is “committed to building a resilient future for our planet, for humanity and for future generations” [32] (p. 93). Under the banner “Sustaining Our Environment”, Cognizant [33] (para. 1) claimed that “as responsible stewards of the environment, we strive to protect our resources for the future and to enhance the quality of life for our associates and the global community”.

Leaving aside these high-level aspirations, the specific measures put forward by these companies fall into two related spheres of operation: one, within their own companies; and two, with their suppliers, customers and the wider world. A number of themes are observable in both spheres (Figure 1). Some of the selected companies reported on stakeholder engagement exercises undertaken to identify these issues, and to inform their approach to sustainable development, while others took it upon themselves to identify what they saw to be the major issues. Six main themes can be identified.

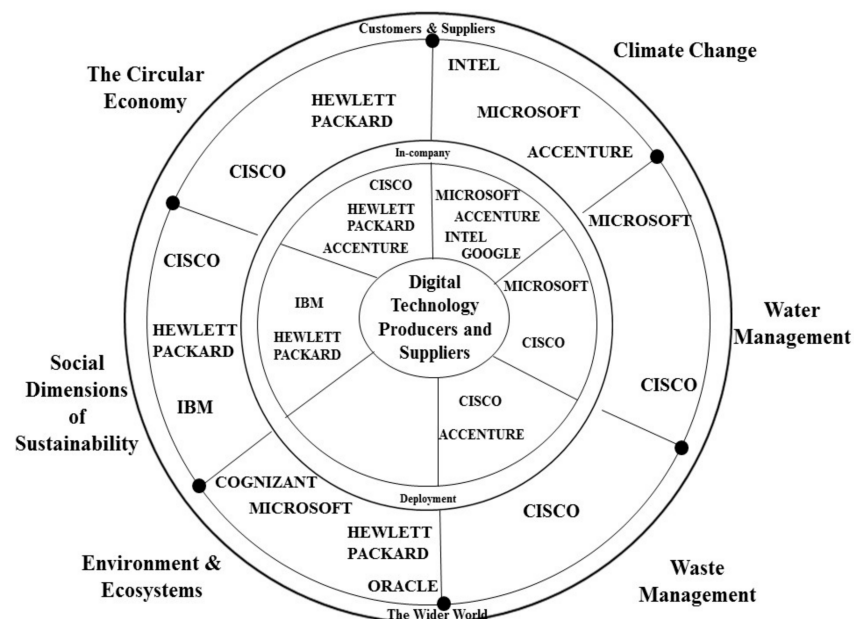


Figure 1. The sustainable development initiatives of the technology companies.

Firstly, climate change, as reflected in a focus on carbon dioxide emissions, carbon footprints and the transition to a low carbon economy, was very much the dominant issue. Intel [34] (p. 35) for example, reported “climate change is a serious environmental, economic, and social challenge” and “we focus on reducing climate risks related to our direct climate footprint—the emissions resulting from our own operations, our supply chain, and the marketing and use of our products”. In addressing reducing its carbon footprint, Intel reported reducing carbon dioxide emissions by some 30% since 2000, that reducing its energy use is central to its overall climate change strategy, and that the company looks to purchase renewable energy and to invest in alternative energy installations. Microsoft Corporation [35] (p. 42) asserted its belief that the company’s “most important contribution to carbon reduction will come not from our own work alone, but by helping our customers, partners, and suppliers reduce their carbon footprints through our learnings and with the power of data, artificial intelligence and digital technology”.

Accenture [36] (p. 23) reported that “climate change is increasingly affecting living and working conditions, and now is the time to act”, that “we are seeing impacts on the environment, our clients, our business, our communities and our people”, and emphasised “we are committed to playing a leading role in the transition to a low-carbon economy through our actions”. Accenture’s environmental strategy is focused on driving the local carbon economy with suppliers and customers, reducing its own carbon emissions, and engaging with its stakeholders to reduce their environmental footprint. In recognising that “our data centres represent the vast majority of our electricity use”, Google [37] (p. 21) reported on its initiatives to make its data centres more efficient, including the introduction of smart temperature and lighting controls, redesigning how power is distributed to reduce energy loss, reusing waste heat, and applying machine learning to drive energy efficiency and automatically optimise cooling.

Secondly, the importance of water management was also seen as an important issue by some of the selected companies. In presenting an overview of its approach to water resource management, Microsoft Corporation [35] claimed that the company was “taking responsibility for our own water use and developing technology to help others do the same” (p. 31), and that “we will reduce the water intensity of our direct operations, replenish in water stressed regions where we work, and enable access to 1.5 million people-becoming water positive by 2030” (p. 32). Under the banner “Managing Our Water Use”, Cisco Systems [38] (p. 75) stressed its understanding of “the importance of reducing water consumption as much as we can in our operations and supply chain. It’s essential to protect this limited resource, not only for our business needs, but also for the sake of the communities in which we operate, because access to clean, fresh water is a critical human need”. Cisco’s water strategy is built around benchmarking and reporting water use and risk, conserving water in the company’s own operations, and working towards water neutrality targets at all the company’s sites.

Thirdly, some of the selected companies also reported on improving waste management operations. Cisco Systems [38] (p. 17), for example, emphasised that the company was “committed to responsibly managing our waste throughout our direct operations and our supply chain” and reported that “we take steps to reduce the amount of waste we produce and divert the waste we do generate through recycling, composting, and donations”, and that “in fiscal 2020, we avoided sending approximately 80 percent of the waste generated at our facilities to landfill globally”. Accenture [36] (p. 28) reported its commitment to “managing our waste responsibly to build a circular economy. This includes reducing our electronic waste (e-waste) to landfill and innovating how we repurpose food waste and reclaim ocean plastics”. More specifically, the company highlighted the problems of e-waste, which can cause environmental pollution and human health problems, if sent to landfill, suggesting that 50 million tonnes is currently created each year, and that this figure will more than double by 2050.

Fourthly, the circular economy, and a circular business model, featured in several of the companies’ reports. HP Inc. [31] (p. 74), emphasised its commitment to “help

our customers to invent the future” and that “by applying rigorous sustainable design principles, we help to drive progress towards a circular and low-carbon economy”. Under the banner “Circular Economy and Supply Chain Excellence”, Cisco Systems [38] (p. 43) claimed to be helping to change the world “by transforming the way we do business—the way we design and build products and solutions, the way we think about the lifetime of an asset, and the way we use our technology to support customers in their own business transformations”. Here, Cisco Systems [38] reported that its circular economy initiatives were built around circular design, circular operations, circular consumption, circular solutions and ecosystem leadership. In addressing circular consumption, for example, the company looks to “manage our equipment for multiple lifecycles and deploy new business models to facilitate this approach” (p. 85). Looking to the future, Accenture reaffirmed its belief that the circular economy would have a central role to play in minimising its e-waste.

Fifthly, some of the selected companies emphasised their commitment to ecosystems and biodiversity in a variety of ways. Microsoft Corporation [35] (p. 59) acknowledged that “nature, and the benefits that it provides, are the foundation of our society, cultures, and the global economy. We depend on well-functioning ecosystems for clean air, water, food, medicine, energy, and building materials”, but that “these very ecosystems are threatened or already in decline”. In looking to address these problems, the company claimed “assessing the planet’s health must become a more sustained, efficient, and integrated practice that allows us to understand exactly what is happening over time” but argued that “there is massive potential for technology to revolutionize our environmental assessment practices, so they can be conducted faster and cheaper, and—for the first time—be able to operate at a truly global scale” (p. 59). HP Inc. [31] (p. 89) reported on its “Sustainable Forests Collaborative initiative”, launched in 2019, which looks to protect, restore and improve the responsible management of forests, and to estimate the carbon and nature co-benefits of forest restoration and improved forest management.

Sixthly, the selected companies reported on a variety of the social dimensions of sustainability, including the importance of employees, diversity and inclusion, digital responsibility and commitments to society. IBM [39] (p. 15), for example, reported that the company “is committed to its employees professional growth and well-being”. More specifically, IBM reported on its approach to the health and safety of its employees, skills leadership and diversity and inclusion. In addressing health and safety, IBM [39] (p. 16) emphasised that its “commitment to employee health, safety and well-being is integrated with programs built on evidence based strategies, real-time strategies and innovative solutions”, which promotes “business and organizational resilience”. The company also reported on its commitment to accelerate leadership and development for its employees and that its “strategy for leadership and learning is driven by data, rooted in science, and deeply human centred” (p. 19).

In reporting on “diversity and inclusion”, IBM [39] (p. 20) argued that the company “solves the hardest problems in business and society”, and that such work “requires a highly skilled, truly diverse workforce and an inclusive culture that enables people from all backgrounds to thrive”. A number of companies also reported on their approach to diversity at its suppliers. HP Inc. [31] (p. 41), for example, argued that “a strong commitment to diversity and inclusion underpins everything we do, including our business relationships with suppliers”. The company claimed that it helps to foster greater equality and representation throughout its supply chain, and that this, in turn, strengthens both the company’s business and local economies. This includes encouraging “small businesses and companies owned by women, minorities, veterans, service-disabled veterans, LGBTQ + individuals, and aboriginal or indigenous individuals, to compete for our business” (p. 41).

Under the banner “Technology for Good”, Cisco Systems [38] (p. 110) reported “the same technology that generates sales for our business can also be used by nonprofits working to solve the world’s greatest challenges, such as hunger, economic inequality, and lack of access to education, including training in digital skills. We’re helping them address these challenges by investing in technology-enabled, early-phase solutions and forming

long-term partnerships that allow organizations to use technology to increase their impact". HP Inc. [31] (p. 65) reported on community giving and volunteerism. Here, the focus was on "technology-enabled education and skills-building; environmental stewardship, resilience, and disaster recovery" and "inclusion and empowerment for underrepresented and marginalized people". To encourage employee volunteering, its employees are granted four hours of paid volunteer time each month, and in 2019 over 8000 of its employees contributed some 145,000 h to local voluntary programmes across more than 50 countries.

5. Discussion

Consideration of the findings outlined above suggests a number of themes of relevance to the wider debate regarding how digital transformation and sustainable development are related and interact (RQ2).

Firstly, the relationship between digital technology deployment and sustainable development is complex. In reporting on their approach to sustainable development, these leading companies in the digital transformation marketplace addressed a wide variety of environmental and social issues, which were seen to illustrate the companies' commitments to the transition to a sustainable future. Some of the existing literature supports the logic and feasibility of this intent. For example, in arguing that "digital transformation can take sustainability to new heights", Le [40] (para. 3) maintains that "sustainability can serve as a catalyst for many companies to integrate digital technology into all areas of their business", and that "as the pressure for environmental responsibility mounts, digital technologies such as predictive analytics and the internet of things, can help organizations effectively achieve sustainability goals". In a similar vein, the World Economic Forum [41] (para. 5) claimed that "with increasing pressure on the world's resources and an urgent need to cut emissions, digital transformation can help set the world's economy on a sustainable footing" (para. 5). However, other sources also indicate that the relationship between the two concepts is not as straightforward as some might suggest. Indeed, the World Economic Forum [41] (para. 8) acknowledged that "a number of challenges will need to be addressed if the full potential of digital transformation is to be realized". These challenges include, as noted in some of the cited company reports, the carbon dioxide emissions from the data centres and the networking equipment used to drive the digital technologies, and the environmental problems associated with the mining of the rare earth minerals required in many digital devices and in the disposal of e-waste. More expansively in cataloguing "environmental pressures related to the digital transformation", Liu et al. [42] (p. 42) identified and outlined a wide range of "direct, indirect and systemic impacts". The authors concluded that "digitalisation has not been sufficiently explored from an environmental perspective" (p. 82), and emphasised the need to explore consumers' attitudes to sustainable consumption and "to collate information on effective options for educating consumers and strengthening their capacities with regard to a sustainable digitalisation" (p. 93).

Secondly, commercial objectives underpin companies' approaches to sustainable development, as much as altruistic concerns for their own staff and the wider community. For example, the selected companies' commitments to their employees, focusing upon empowering employees and health and safety, also help to promote stability, security, loyalty and efficiency amongst the workforce. Equally, while some of the companies' environmental agendas and achievements are designed to reduce carbon dioxide emissions and to increase energy efficiency, they also serve to reduce operating costs. These initiatives are driven as much by the need for business continuity as for the preservation and enhancement of natural and social capital. More widely, there are issues about whose interests are best served by digital transformation. While some of the selected companies emphasised their responsible use of new digital technologies as part of their commitment to sustainable development, this issue has received little attention in the academic literature.

Thirdly, in enabling a circular economy, digital technology products and their innovative deployment can foster the mutually beneficial convergence of digital transformation

and sustainable development. Wynn and Jones [43] have pointed out how this is of relevance in other industry sectors, notably the automotive sector, and Pardo [44] (p. 1) notes, in relation to the circular economy, that “digital technologies will be pivotal in bringing about this systemic change”. The author observes that “the creation, extraction, processing, and sharing of data enabled by digital technologies such as sensors, connected devices and online platforms will lead to a smarter use of resources”, that “companies can also sell products as a service by using sensors to monitor their usage” (p. 1). In addition, the author notes that “digitalisation can contribute to lifting some of the barriers that currently prevent the recycling and recovery of materials” (p. 1), and that “blockchain technology should be further explored as it can help to gain more knowledge on material cycles and processes through the value chain and enable to share data in a secure environment” (p. 2). Pardo [44] highlights the need for a European Union policy framework in promoting the use of digital technologies in Europe to achieve circular economy objectives. At the same time, the digital technology companies themselves could also play a more central role here, through clearly defined industry use cases in which their technologies are contributing to advancing the circular economy, through training and awareness programmes and industry sector initiatives.

Fourthly, the review has a number of practical implications. As public concern about the transition to a more sustainable future, and arguably more particularly about the growing impact of climate change, becomes more apparent, so the leading companies in the digital transformation market may increasingly look for ways to communicate their sustainability strategies and achievements, to both their investors and clients and more generally to the general public. In pursuing such a course, the leading companies in the digital transformation market may look beyond corporate social responsibility, which often has a restricted public audience, to find alternative communication methods for their sustainability measures. Companies in some sectors of the economy—for example, the motor vehicle manufacturers and the power companies—are already employing both conventional and social media outlets to celebrate their sustainability achievements, and the leading companies in the digital transformation market may be well advised to follow their example.

Fifthly, there are implications for the conceptual frameworks used to theorise sustainable development. At a simple level, the selected digital transformation companies’ approach to environmental and social responsibility seems consistent with Ihren and Roper’s [24] characterisation of weak sustainability, in that it looks to work within, rather than to fundamentally challenge, existing economic and political systems, and that it gives priority to economic growth. Here, it is important to recognise that the vision of the future held by the leading companies within the digital transformation market is couched within the dominant global economic and political idiom, and that it is very much at odds with Amsler’s [45] belief that sustainable development is not possible under global capitalism. More substantively, some, but not all, of the selected companies reported on the stakeholder engagement exercises they conducted as an integral part of their sustainable development processes. On the one hand, the role of a range of stakeholders might be seen to be important in informing how these companies have developed their approach to sustainable development. On the other hand, there was little or no indication of the weight given to the various stakeholders’ views in determining corporate sustainable development strategies. At the same time, in publicly reporting on how they address sustainable development, the selected companies might be seen to be pursuing a strategy which shows them to be acting in a responsible manner, and in effect to be giving themselves license to operate, in an increasingly competitive and contested business and social environment. Finally, while the selected companies claim to offer a new digital technology enabled vision of the future, this vision seems very different from Amsler’s [45] call to search for alternative, simpler, and less harmful ways of organising life.

6. Conclusions

This article has examined the approach to sustainable development of 10 digital technology companies and attempted to identify the key elements of their activities and aims in this arena, and set them within the broader debate of the interaction of digital transformation and sustainability. The authors recognise that this exploratory review has its limitations, not least that it draws its material from a selective review of the extant academic literature and from the corporate websites of the leading companies in the digital transformation market. The research has not included any face-to-face interviews, or focus group sessions, with representatives from those companies. However, the authors believe that it provides a platform for future research, and several broad research agendas can be identified.

There have been some recent research initiatives in this field. George et al. [46], for example, explored how digital technologies are helping to tackle climate change and promote sustainable development. More specifically, George et al. [46] highlighted six problems that are hidden beneath the surface of sustainable development, formulated a series of digital sustainability pathways—grounded in the innovative and creative deployment of digital technologies—and proposed a research agenda that generates novel questions for entrepreneurship business models and ecosystems. Pappas et al. [47] (p. 479) examined how “big data and business analytics ecosystems can pave the way towards digital transformation and sustainable societies”. Further studies could focus on how leading digital technology companies develop their sustainability strategies, and the role of their stakeholders, including suppliers, employees, customers, and non-governmental organisations, in that development process. In particular, research on how digital transformation can promote the circular economy, and how industry technology users and the consumer public can pursue such initiatives, would be particularly useful.

Kiron and Unruh [48] (para. 1) concluded that “digitalization and sustainability are two of the most powerful market influences in today’s corporate landscape” but suggested that “the intersection of these trends, however, remains largely unexplored territory”. Wade [49] also warned that these two trends have developed more or less independently of each other, and that they must now be considered in unison. Wade [49] (para. 2) concludes “the risks to humanity of poor or unethical digital practices are increasing rapidly and can no longer be ignored”. Looking to the future, it seems vitally important that the leading companies in the digital transformation market maintain their positive enthusiasm about the commercial and social benefits of digital transformation, but that they also temper that enthusiasm with a continuing vigilance about the challenges of digitalisation that reflects a wide range of stakeholder concerns. Maintaining that balance may prove more important than driving the digitalisation agenda itself.

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References

1. von Kutzschenbach, M.; Daub, C.H. Digital Transformation for Sustainability: A Necessary Technical and Mental Revolution. In *New Trends in Business Information Systems and Technology*; Dornberger, R., Ed.; Studies in Systems, Decision and Control; Springer: Cham, Switzerland, 2021; Volume 294, pp. 179–192. [[CrossRef](#)]
2. Bansal, P.T. Sustainable Development in an Age of Disruption. *Acad. Manag. Discov.* **2019**, *5*, 8–12. [[CrossRef](#)]

3. ICTworks. Digital Technologies Are Part of the Climate Change Problem. 2020. Available online: <https://www.ictworks.org/digital-technologies-climate-change-problem/#.YJzsHbdKipo> (accessed on 13 May 2021).
4. EIT Climate-KIC. New Report Outlines How Digital Technology Can Help Solve Climate Change Challenge. 2019. Available online: <https://www.climate-kic.org/press-releases/new-report-outlines-growing-potential-for-digital-technology-to-help-solve-climate-change-challenges/> (accessed on 3 May 2021).
5. Oztemel, E.; Gursev, S. Literature Review of Industry 4.0 and Related Technologies. *J. Intell. Manuf.* **2020**, *31*, 127–182. [CrossRef]
6. Zheng, P.; Sang, Z.; Zhong, R.Y.; Liu, Y.; Liu, C.; Mubarak, K.; Yu, S.; Xu, X. Smart Manufacturing Systems for Industry 4.0: Conceptual Framework, Scenarios, and Future Perspectives. *Front. Mech. Eng.* **2018**, *13*, 137–150. [CrossRef]
7. Meticulous Market Research. Top Ten Companies in Digital Transformation Market. 2020. Available online: <https://meticulousblog.org/top-10-companies-in-digital-transformation-market/> (accessed on 11 May 2021).
8. Saunders, M.; Lewis, P.; Thornhill, A. *Research Methods for Business Students*, 8th ed.; Pearson Education Limited: London, UK, 2018.
9. Miles, M.B.; Huberman, A.M. *Qualitative Data Analysis: An Expanded Sourcebook*, 2nd ed.; Sage: Thousand Oaks, CA, USA, 2009.
10. Tabrizi, B.; Lam, E.; Girard, K.; Irvin, V. Digital Transformation Is Not about Technology. Harvard Business Review Analytic Services. 2019. Available online: <https://hbr.org/2019/03/digital-transformation-is-not-about-technology> (accessed on 13 May 2021).
11. Gong, C.; Ribiere, V. Developing a unified definition of digital transformation. *Technovation* **2021**, *102*, 102217. Available online: <https://www.sciencedirect.com/science/article/abs/pii/S0166497220300894> (accessed on 11 May 2021). [CrossRef]
12. Verhoef, P.C.; Broekhuizen, T.; Bart, Y.; Bhattacharya, A.; Dong, J.O.; Fabian, N.; Haenlein, M. Digital transformation: A multidisciplinary reflection and research agenda. *J. Bus. Res.* **2021**, *122*, 889–901. [CrossRef]
13. Vial, G. Understanding digital transformation: A review and a research agenda. *J. Strateg. Inf. Syst.* **2019**, *28*, 118–144. [CrossRef]
14. Menear, H. The History of Digital Transformation. 2020. Available online: <https://technologymagazine.com/data-and-data-analytics/history-digital-transformation> (accessed on 13 May 2021).
15. Schallmo, D.; Williams, C.; Boardman, L. Digital Transformation of Business Models—Best Practice, Enablers, and Roadmap. *Int. J. Innov. Manag.* **2018**, *21*, 1–17. [CrossRef]
16. Bartelmus, P. *Environment and Development*; Allen and Unwin: Boston, MA, USA, 1986.
17. World Commission on Environment and Development. Our Common Future. 1987. Available online: <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf> (accessed on 17 April 2020).
18. Aras, G.; Crowther, D. Governance and Sustainability: An investigation into the relationship between corporate governance and corporate sustainability. *Manag. Decis.* **2008**, *46*, 433–448. [CrossRef]
19. Goodland, R. The Concept of Environmental Sustainability. *Annu. Rev. Ecol. Syst.* **1995**, *26*, 1–24. [CrossRef]
20. Porritt, J. *Capitalism as if the Earth Matters*; Earthscan: London, UK, 2007.
21. United Nations Environmental Protection Agency. Learn about Sustainability; What Is Sustainability? 2014. Available online: <https://www.epa.gov/sustainability/> (accessed on 6 May 2019).
22. Mensah, J. Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Soc. Sci.* **2019**, *5*, 1653531. [CrossRef]
23. Lyon, T.P.; Montgomery, A.W. The Means and End of Greenwash. *Organ. Environ.* **2015**, *28*, 223–249. [CrossRef]
24. Ihlen, O.; Roper, J. Corporate Reports on Sustainability and Sustainable Development: We Have Arrived. *Sustain. Dev.* **2014**, *22*, 42–51. [CrossRef]
25. Chan, A.P.C.; Oppong, G.D. Managing the expectations of external stakeholders in construction projects. *Eng. Constr. Archit. Manag.* **2017**, *24*, 736–756. [CrossRef]
26. Freudenreich, B.; Ludeke-Freund, F.; Schaltegger, S.A. Stakeholder Theory Perspective on Business Models: Value Creation for Sustainability. *J. Bus. Ethics* **2020**, *166*, 3–18. [CrossRef]
27. Hrasky, S. Carbon footprints and legitimation strategies: Symbolism or action? *Account. Audit. Account. J.* **2012**, *25*, 174–198. [CrossRef]
28. Castro, C. Sustainable Development: Mainstream and Critical Perspectives. *Organ. Environ.* **2004**, *17*, 195–225. [CrossRef]
29. Amsler, S. Embracing the Politics of Ambiguity: Towards a Normative Theory of Sustainability. *Capital. Nat. Soc.* **2009**, *20*, 111–125. [CrossRef]
30. SAP SE. Integrated Report 2020. Available online: <https://www.sap.com/integrated-reports/2020/en.html> (accessed on 14 March 2021).
31. HP Inc. Sustainable Impact Report. 2020. Available online: <https://h20195.www2.hp.com/v2/GetDocument.aspx?docname=c06601778> (accessed on 14 March 2021).
32. Oracle. Corporate Citizenship Report. 2019. Available online: <https://www.oracle.com/a/ocom/docs/corporate/citizenship/ccr2019-report.pdf> (accessed on 14 March 2021).
33. Cognizant. Sustaining Our Environment. 2021. Available online: <https://www.cognizant.com/about-cognizant/> (accessed on 14 March 2021).
34. Intel Corporation. Corporate Responsibility at Intel. 2020. Available online: <https://www.intel.co.uk/content/www/uk/en/corporate-responsibility/corporate-responsibility.html> (accessed on 13 May 2021).

35. Microsoft Corporation. 2020 Environmental Sustainability Report. 2020. Available online: <https://www.microsoft.com/en-us/corporate-responsibility/sustainability/report> (accessed on 13 May 2021).
36. Accenture. Building a Future of Shared Success. 2020. Available online: https://www.accenture.com/_acnmedia/PDF-120/Accenture-Corporate-Citizenship-Report-2019.pdf (accessed on 14 March 2021).
37. Google LLC. Environmental Report. 2020. Available online: <https://www.gstatic.com/gumdrop/sustainability/google-2020-environmental-report.pdf> (accessed on 13 May 2021).
38. Cisco Systems. Powering an Inclusive System for All: 2020 Corporate Social Responsibility Impact Report. 2020. Available online: https://www.cisco.com/c/dam/m/en_us/about/csr/esg-hub/_pdf/csr-report-2020.pdf (accessed on 13 May 2021).
39. IBM. IBM and Good Tech: Modeling Responsible Stewardship in the Digital Age. 2020. Available online: <https://www.ibm.org/responsibility/2019/IBM-2019-CRR.pdf> (accessed on 14 March 2021).
40. Le, D. Digital Transformation Can Take Sustainability to New Heights. 2020. Available online: <https://www.jdsupra.com/legalnews/why-digital-transformation-can-take-33879/> (accessed on 13 May 2021).
41. World Economic Forum. How Can Digital Enable the Transition to a More Sustainable World? 2021. Available online: <http://reports.weforum.org/digital-transformation/enabling-the-transition-to-a-sustainable-world/> (accessed on 13 May 2021).
42. Liu, R.; Gailhofer, P.; Gensch, C.-O.; Kohler, A.; Wolff, F. Impacts of the Digital Transformation on the Environment and Sustainability. 2019. Available online: https://ec.europa.eu/environment/enveco/resource_efficiency/pdf/studies/issue_paper_digital_transformation_20191220_final.pdf (accessed on 9 May 2021).
43. Wynn, M.; Jones, P. Industry approaches to the Sustainable Development Goals. *Int. J. Environ. Stud.* **2021**. [CrossRef]
44. Pardo, R. How the Circular Economy can benefit from the Digital Revolution. Commentary 2018; European Policy Centre. Available online: https://circulareconomy.europa.eu/platform/sites/default/files/knowledge_-_how_the_circular_economy_can_benefit_from_the_digital_revolution.pdf (accessed on 13 May 2021).
45. Amsler, S. Gesturing towards radical futurity in education for alternative futures. *Sustain. Sci.* **2019**, *14*, 925–930. [CrossRef]
46. George, G.; Merrill, R.K.; Schillebeeckx, S.J.D. Digital Sustainability and Entrepreneurship: How digital Innovations Are Helping to Tackle Climate Change and Sustainable Development. *Entrep. Theory Pract.* **2020**. [CrossRef]
47. Pappas, I.O.; Mickalef, P.; Giannakos, M.N.; Krogstie, J.; Lekakos, G. Big data and business analytics ecosystems: Paving the way towards digital transformation and sustainable societies. *Inf. Syst. e Bus. Manag.* **2018**, *16*, 479–491. [CrossRef]
48. Kiron, D.; Unruh, G. The Convergence of Digitalization and Sustainability. MIT Sloan Management Review. 2018. Available online: <https://sloanreview.mit.edu/article/the-convergence-of-digitalization-and-sustainability/> (accessed on 9 May 2021).
49. Wade, M. Corporate Responsibility in the Digital Era. MIT Sloan Management Review. 28 April 2020. Available online: https://sloanreview.mit.edu/article/corporate-responsibility-in-the-digital-era/?utm_source=newsletter&utm_medium=email&utm_content=merges%20sustainability%20and%20digitization&utm_campaign=Enews%20BOTW%205/1/2020 (accessed on 1 May 2020).