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Towards a critical realist approach to the dark side of digital transformation

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The Dark Side of Information Systems (IS) is a school of thought which explores the detrimental consequences that can arise from IS phenomena such as digital transformation (DT). Critical Realism (CR), meanwhile, is a philosophical approach which can lend a deeper understanding of dark phenomena thanks to its emphasis upon the role of deep-lying, generative mechanisms. However, as our paper demonstrates, the extant research base applying a CR approach in the exploration of dark phenomena in general is small with respect to examining the potential dark consequences of DT. Our paper therefore introduces the CR philosophical approach to the research of dark phenomena, through a case study of the digital transformation of Britain's land-based betting industry. This example highlights how a CR approach unearthed a generative mechanism formed by the productivity of digital platform-based forms of gambling. Whilst platforms provide novel gambling markets and ease-of-access which may be seen positively by the consumer, our example shows that the generative mechanism formed by the productivity of platform gambling gives rise to the continuous exploitation of staff and customers alike in addition to the continuous accumulation of capital by operator. We demonstrate that, as opposed to specific, pre-identified dark phenomena such as addiction or technostress, dark phenomena caused by generative mechanisms may be unknown, perceived positively or differently over time. A CR approach can facilitate a deeper understanding of how these generative mechanisms and subsequent dark phenomena emerge and evolve, and promote wiser approaches to DT.

KEYWORDS

critical realism, dark side of IS, digital transformation, information systems, socio-economic impact

Introduction

The dark side of digital transformation (DT) has emerged as a significant stream in Information Systems (IS) research (Turel et al., 2017). Contrary to Fukuyama (1992) assertion that the proliferation and interconnectivity of digital technologies are an uncomplicated improvement in the lives of their users, the notion of the dark side of DT acknowledges that IS can inflict serious detrimental effects on their users. The symptoms of the dark side of DT are extensive and can include aspects such as IT-related addiction, technostress, cyberbullying, IT misuse, deception, and a disrupted work-life balance (Tarafdar et al., 2012). Extant research within the field investigates how such negative symptoms are caused by DT. However, we agree with the argument made by Mikalef et al. (2022), which highlights how this categorization of dark phenomena omits—to our knowledge—the exploration of other emerging, dark phenomena, and, we believe, thus failing to capture how all sources of IS can inflict detrimental impacts.

A philosophical approach that enables the exploration of evolving, dark phenomena exists in Critical Realism (CR) (Spagnoletti et al., 2022). Just as the dark side is positioned as an alternative to the conventional school of thought in relation to DT, CR offers an alternative to positivist or interpretivist approaches (Dobson, 2001). CR argues that positivism in particular may suffer from empirical reductionism (Mingers and Standing, 2017). CR accepts that there is much we do not know; like the parable of the blind men trying to describe an elephant, what we experience and observe—the basis of scientific knowledge—is neither the whole story nor necessarily completely accurate. There are actualities beyond our experience, and they are shaped by deep forces which CR tries to describe. CR specifically seeks to investigate the role of underlying, generative mechanisms. These deep-lying, generative mechanisms—whether social, physical or conceptual (Sayer, 2000)—are independent and enduring entities which act in certain ways, giving rise to empirical phenomena (Mingers et al., 2013). Additionally, CR seeks to form alternative conclusions to those generated by positivism or interpretivism which may suffer from what Bhaskar (2008) termed, "epistemic fallacy" (p. 16), which takes place when new knowledge is influenced by our own pre-conceptions. Foucauldians in IS might view "generative mechanisms" as models of relations applicable in different contexts, such as panopticism (see Marsden, 1999). Other social scientists might see Collingwood's absolute pre-suppositions in Bhaskar's epistemic fallacies (Collingwood, 1940). CR as a corpus builds upon a range of such views and offers unique contemporary insights for critical understanding of IS phenomena.

CR-led inquiry has the ability within the field of IS to explore the importance of generative mechanisms in the transformation of socio-technical structures (Dwivedi et al., 2015; Mingers and Standing, 2017). These generative mechanisms may be characterized by factors which influence user behavior (Zamani and Pouloudi, 2020), the affordances of an IS (Kempton, 2022) defined as "the potential for behaviors associated with achieving an immediate concrete outcome and arising from the relation between an artifact and a goal-oriented actor or actors" (Volkoff and Strong, 2017, p. 235), or a combination of both. Williams and Wynn (2018) argue that CR can enhance the creativity of IS-related theorizing, whilst Wynn and Williams (2012) have previously constructed a set of CR methodological principles for IS research. CR approaches, however, are rarely applied to the investigation of dark phenomena. We contend that CR methodological principles can be adapted to the exploration of dark phenomena which arise from DT, and their relationship to socio-economic structures. Our research question then is: How can a Critical Realist approach contribute a deeper understanding of the dark phenomena to arise from digital transformation? We answer this research question by introducing CR methodological principles and demonstrating their use within an illustrative example, namely the digital transformation of the land-based betting industry in Great Britain. Our illustrative example demonstrates how a richer, deeper understanding of dark phenomena could encourage alternative systems design which seeks to avoid detrimental socio-economic impact.

The paper is organized as follows. Firstly, we present an introductory review of the dark side of IS, and introduce how we believe such a categorization may omit dark phenomena which evolve, are unknown, or are perceived differently over time. Next, we introduce CR philosophical principles which can contribute a deeper understanding of phenomena, owing to their emphasis on the role of deep-lying, generative mechanisms. Thirdly, we highlight the scarce nature of extant research which has sought to explore dark phenomena from a CR-based approach. To encourage more CR-based research into dark phenomena, we outline a series of methodological steps which can uncover deep-lying, generative mechanisms. We finally demonstrate how these steps can be used in an illustrative example, focused upon the DT of the land-based betting industry. This illustrative example not only provides an insight into the application of CR methodology into DT, but also provides a deeper understanding of the detrimental, socio-economic impact of DT.

Existing understandings of the dark side

The concept of the dark side of DT was born from the viewpoint that digital advancements can have detrimental side effects (Raufflet and Mills, 2017). Turel et al. (2017) provide a categorization of dark phenomena. Dark phenomena are wide-ranging and could be characterized by a distorted work-life balance (Benlian, 2020), technostress (Salo et al., 2019), addiction (Park et al., 2016), or by misuse such as cyberbullying (Chan et al., 2019) or deception (Carlson et al., 2004). Previous research has explored how dark phenomena may arise from a wide range of IS or IT-related artifacts such as social networking sites (Salo et al., 2019; Cheikh-Ammar, 2020), online auction sites (Turel et al., 2011) and in online gaming (Gong et al., 2021; Lee et al., 2021).

However, the pre-identification of dark phenomena may be open to the accusation of being subject to a methodological individualism that misses more systemic phenomena (Venkatesh, 2008; Dafoe et al., 2021), or to the use of fore-projections which influence the outcomes of research (Hassan, 2014). Previous studies have generally adopted a positivist or interpretivist approach, exploring specific dark phenomena as hypothesized by researchers. The study of dark phenomena according to such methodologies however may omit other dark occurrences which emerge within the field. Mikalef et al. (2022) argue that, in fact, the categorization of dark phenomena is very difficult, that such phenomena evolve over time, and can even have positive outcomes. The exploration of dark phenomena which evolve in this way therefore requires an alternative methodology which—rather than testing specific hypotheses—can explore how phenomena are changeable and are affected by other structures. Given this, we argue that current understandings of the dark side can be expanded using a Critical Realist approach which emphasizes the importance of forces operating within open systems which generate evolving phenomena.

Critical realism

We aim here to briefly summarize the key philosophical tenets of CR, a philosophy which Wynn and Williams (2012) and Mingers and Standing (2017) have previously introduced more fully to the field of IS, in order to situate our argument. CR

is positioned by Bhaskar (2008) as an alternative to positivist knowledge which he argues suffers from "epistemic fallacy" (p. 16), or the conflation of epistemology and ontology where questions about Being are answered with our knowledge of Being (Mingers et al., 2013). CR seeks to establish an alternative to positivism which it argues fails to achieve a deep understanding of causality due to its "easily accessible and 'objective' methods" (Yeung, 1997, p. 55). These methods are used to make generalizations—however rigorous (Mingers, 2015)—across wider settings (Eisenhardt, 1989). CR also positions itself as an alternative to interpretivism. Interpretivist research is guided by principles such as contextualization, abstraction and generalization which lead to knowledge of a "complex whole from preconceptions about the meanings of its parts and their interrelationships" (Klein and Myers, 1999, p. 71). The use of preconceptions also introduces bias into our understanding of phenomena. Alternatively, CR underlines the inherent fallibility of knowledge—or the nature of knowledge as being restricted to what can be empirically known through preconceptions.

CR also provides an alternative viewpoint to the empirical reductionism of positivism and the reliance upon preconceptions of interpretivism through the investigation of deep-lying, generative mechanisms which give rise to empirical phenomena. To achieve this, Bhaskar (2008) provides a transcendental realist analysis of society which divides mechanisms, events and phenomena into three strata or "hierarchies" (Mingers, 2011, p. 306). The "empirical" stratum—much like the tip of an iceberg which is only viewable above sea level—consists of phenomena which are directly observed or experienced. Below this, the "actual" stratum is characterized by events which are known to occur, but are not directly observed or experienced (Bhaskar, 2008; Mingers, 2011). Finally, the "real" is the underpinning stratum which CR philosophy seeks to explore, consisting of entities which form the broader structures of society, and the generative mechanisms which define what occurs within societies (Sayer, 2000). Generative mechanisms are entities—whether physical, social or conceptual (Sayer, 2000)—which behave in certain ways to generate empirical phenomena (Mingers et al., 2013). Generative mechanisms could therefore take a wide variety of forms within the process of DT, whether characterized by the physical presence of an IS or artifact, the interaction of a user which enacts the perceived affordances of novel IS (see Hutchby, 2001; Volkoff and Strong, 2013), or external socio-economic factors (Spagnoletti et al., 2022).

Furthermore, disparate generative mechanisms can merge to form a diachronic, emergent mechanism, the properties of which are distinct from those of its original component parts (Elder-Vass, 2005). CR-based research thus investigates how generative mechanisms emerge and evolve. For example, Sayer (1992) describes a generative mechanism formed by the merger of the social roles of landlord and tenant. Exploring the social construct of "tenancy" through the individual breakdown of each actor (the landlord, or the tenant) cannot provide the insights that CR-based research can evince through examining how interaction between landlord and tenant forms a new, broader, social mechanism (see Danermark et al., 2002), known to some as the "rentier" society (Sadowski, 2020). The emergence of such "mechanisms" occurs within open systems where "each component can itself be treated as

a system and 'opened up' to reveal another set of components and relations. This process can go on for an indefinite number of levels until we reach the bedrock of indissoluble forces" (Mingers, 2011, pp. 306–307). Mechanisms are interconnected between structures and are thus subject to constant transformation. This carries significant implications for any phenomenon under study: if the underlying mechanisms are subject to constant transformation, then so are the generated phenomena.

Although positivist and interpretivist approaches to the dark side have previously given valuable findings, the adoption of CR philosophy would present an alternative approach toward a deeper understanding. Such an approach would present findings as explainable (due to the enactment of specific, generative mechanisms) rather than predictable (due to objective causes). This approach would allow IS scholars to consider the specific internal and external factors—driven by generative mechanisms—which would otherwise be missed through positivist and interpretivist research. Volkoff and Strong (2013), for example, demonstrate the organizational process changes which emerge from the interaction of specific mechanisms formed by separate user behaviors and the affordances of IT artifacts. The awareness of deep-lying generative mechanisms related to user behavior and IT functionality, they contend, can help researchers to establish problems within information systems and thus develop alternative systems design.

On a sociological level, CR philosophy highlights the dialectical relationship between structure and agency. Structure and agency are well known concepts in IS (Giddens, 1984; Archer, 1995; Orlikowski, 1996). In CR, structure and agency are reflected in the way CR differentiates between what it terms transitive and intransitive science. Transitive science is created by human agency, whilst intransitive science is characterized by the realm of structures, and the mechanisms described above. This realm, for CR, exists independently from human reality (Mingers, 2011). Bhaskar (2008) uses the atomic composition of oxygen as an example of this divide, outlining how oxygen remains constant separately from our evolving understanding of the world. Indeed, the intransitive realm must exist separately from human agency so that we may develop our understanding of it (Brown et al., 2002). Our understanding of the social world, on the other hand, is a product of—yet also separate from—nature (Hu, 2018). This is incorporated within Bhaskar's (2020) four planes of social being, a social cube comprising structure, practice and subject process, within which he contends that all social phenomena occur. The four planes consist of (i) the material relations of actors with nature; (ii) interpersonal, subjective relationships between actors; (iii) the role of broader social structures, and (iv) the stratified personality of the actors themselves. Bhaskar (2020) contends that these planes are interdependent, highlighting that whilst social structures pre-exist—and are separate from—agency, they are also reproduced and transformed by actors. In summary, CR philosophy—not unlike Archer (1995) - acknowledges how the world would exist whether we did or not, and that the structure—whilst distinct from agency—limits or enables the actions of agency which in turn, reshapes the structure (Danermark, 2017). This constant reproduction of the structure and its relationship with agency aligns with the CR emphasis on open systems, and the evolving tendencies of generative mechanisms.

Dark phenomena are subject to constant transformation (Mikalef et al., 2022). CR thought has the potential to shed light upon the dark side of DT beyond current scholarship, through its critique of the formulation of fallible knowledge, in addition to its investigation of factors which could act as generative mechanisms as opposed to simply exploring an unintended consequence of artifact design or implementation. Thus, we argue the growing awareness of detrimental impacts in the field of IS (Myers, 2021), though still generally researched from a positivist or interpretivist approach, could gain greater and broader insight into its subject matter through CR. However, CR-based inquiry is yet to be widely applied to the emergence of dark phenomena.

Applying CR to the dark side of digital transformation

Following our introductory section on the nature of CR, we now explore the potential for its application toward the explanation of dark phenomena. Table 1 demonstrates how a CR-led exploration can contribute to knowledge through a summary of its approach, as well as its potential contribution to dark side research. Whereas positivism and interpretivism rely on the testing of hypotheses or a qualitative cycle informed by fore-projections, CR relies on methodologies designed to uncover the generative mechanisms which generate dark phenomena. Generative mechanisms which form dark phenomena may also reflect perceived affordances of an IS or artifact, which differ from the IS or artifact itself (see Hutchby, 2001, 2003). A CR approach, in summary, would be better suited to investigate the dark phenomena which—as Mikalef et al. (2022) also argue—may evolve, be unknown or even be perceived as positive occurrences. Importantly, CR-led research can demonstrate how dark phenomena can arise within the context of wider, external factors. These factors include socio-economic structures which are not included within the original list of dark phenomena outlined in section 2.

To demonstrate the potential for research into dark phenomena from a CR perspective, we carried out a brief literature search to explore extant research. Acknowledging, with Boell and Cecez-Kecmanovic (2015), that systematic literature reviews are not unproblematic, for the purposes of this paper we adopted the principles of a systematic search. We searched for previous CR-led studies into the exploration of dark phenomena with search terms: '("Critical Realism") AND ("Addiction" OR "cyberloafing" OR "cyberbullying" OR "deception" OR "disrupted work-life balance" OR "interruptions" OR "misuse" OR "technostress" OR "impulsive use of IT" OR "health")', into the AIS Library, EBSCO, Proquest, Scopus and Web of Science databases. Our search also focused upon the Basket of Eleven journals (see Association for Information Systems, 2023). Searches were conducted in January 2023 and May 2023, and papers were included here if published from 2013 onwards—thus giving a window of research during the past 10 years—and if they specifically adopted a CR approach to dark phenomena. The search provided only five papers, all of which nonetheless make valuable, CR-led contributions to the dark side

school of thought (Henningsson and Kettinger, 2016; Gebre-Mariam and Bygstad, 2019; Øvrelid and Bygstad, 2019; Spagnoletti et al., 2022; Haag et al., 2023).

Firstly, Haag et al. (2023) highlight the importance of deviant affordances, or the unintended affordances of technology which may allow employees to deviate from their organization's IT policies. Identified from the qualitative data given by alumni and students of an IS course in Germany, the generative mechanisms which drive the enactment of deviant affordances are uncovered as conceptual in nature, supporting employee and organizational goals alike. These generative mechanisms relate to tension, deadlock and actualization. The tension mechanism, the authors contend, emerges from the tension between organizational goals and user intention. The deadline mechanism emerges from the perception of actors of organizations' efforts to solve their tensions. Finally, the actualization mechanism emerges from the decision of the user to engage in deviant IT use to support their own—and at least one organizational—goal. Actors' and organizations' goals evolve, whilst their alignment—although it may lead to deviant IT use—may also be perceived as positive with dark phenomena occurring from deviant behavior performed albeit for the right reasons. In summary, dark phenomena may emerge from mechanisms which are perceived as positive are indeed evolve over time (see Table 1 above and Mikalef et al., 2022). However, whilst these deviant, generative mechanisms were explored according to a CR approach, they were conceptualized within closed conditions. This causes a tension according to CR philosophy which emphasizes the importance of open systems (Mingers, 2011), and also excludes the possibility of wider, socio-economic factors influencing generative mechanisms.

Henningsson and Kettinger (2016) meanwhile adopt a CR approach to explore the generative mechanisms responsible for integration deficiencies in post-merger IS. Through a CR-based exploration of 37 published case studies from across the world, the authors highlight how causal configurations which give rise to deficiencies within merged systems are created from four outlined methods of systems merger: absorption, coexistence, best-of-breed, and renewal. Generative mechanisms emerge from the interaction between these merger strategies with other external and internal factors such as power relations, socio-cultural differences, merger unreadiness, the extent of the integration itself, as well as time pressures. The outcome of the interaction between generative mechanisms, merger strategies and context can consist of a wide variety of deficiency-related outcomes for post-merger IS. These outcomes can again be wide-ranging, although grouped as lasting business inefficiencies, integration-related overspending, process delays, detrimental staff reaction, temporary business disruptions, and unrealized potential. Henningsson and Kettinger (2016) also make recommendations on how to mitigate for the effects of context in analyzing how best to avoid deficiencies by recommending alternative systems design. This, they contend, would be achieved through an understanding of the impact of IS integration strategies, and the management of contextual factors. Phenomena are only explainable within CR philosophy; however the authors provide enough context on the wider socio-cultural structures to enable other researchers on how similar mechanisms may act in other settings. On the other hand, the authors also provide a wide category of outcomes which may not occur within

TABLE 1 Comparison of positivism, interpretivism and critical realism and their contribution to dark side research.

Approach	Summary of approach	Contribution to dark side research
Positivism	Testing of pre-determined hypotheses through objective methodologies, generating generalisable findings (Eisenhardt, 1989; Yeung, 1997).	Testing and/or exploration for the presence of pre-determined dark phenomena. For example, addiction or technostress.
Interpretivism	Exploration of theories according to a hermeneutic cycle, where "we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships" (Klein and Myers, 1999, p. 71). Methodological steps such as contextualization, abstraction and generalization may lead to generalized findings informed by fore-projections (Hassan, 2014).	Understandings of the dark side of IS limited to these categories.
Critical realism	Retroductive analysis of mechanisms which: - Could be social, physical or conceptual (Sayer, 2000) - Could represent the perceived affordances of a system (Hutchby, 2001, 2003; Volkoff and Strong, 2017; Kempton, 2022) - Evolve over time - Interact with mechanisms within other open systems - May have formed from the merger of other, pre-existing mechanisms (Bhaskar, 2008; Mingers, 2011). - Exist on the four planes of social being (Bhaskar, 2020). - Generate empirical phenomena.	The uncovering of generative mechanisms responsible for evolving, unknown dark phenomena. Dark phenomena may be: - Perceived as positive - Unknown (as opposed to pre-determined symptoms) - Perceived differently over time - Emerging from any IS or IT-related artifact (Mikalef et al., 2022). CR analysis results in alternative system design, factoring internal and external factors, based on explanation and separate to pre-conceived notions.

other settings. Dark phenomena—as outlined in Table 1—may be unknown or be perceived positively.

Thirdly, Spagnoletti et al. (2022) explore the generative mechanisms responsible for the emergence of online black-markets (OBMs). The authors identify within their qualitative dataset gathered from European stakeholders the key events, actors and entities which merge to generate the phenomena of OBMs. Their CR analysis uncovers an overarching OBM infrastructure, emerging from the interactions between administrators, sellers and buyers, which is subject to constant evolution. This evolution occurs as a result of the specific, conceptual generative mechanisms responsible for dark, OBM-related phenomena: commoditization, platformization, and resilience. These generative mechanisms are retroductively analyzed as giving rise to dark phenomena, whilst also constantly transforming as a result of evolving markets and innovation. Spagnoletti's et al. (2022) analysis therefore highlights the importance of generative mechanisms, but also their role within open systems. Whilst highlighting the CR assertion the explainable nature of phenomena over the notion of generalization, the authors highlight how a deeper understanding of OBMs toward the training of law enforcement agencies and cyber-intelligence units.

Gebre-Mariam and Bygstad (2019) adopt a CR approach to identify the generative mechanisms which influence the trajectory of digitally transformed healthcare systems within developing countries. In doing so, the authors draw on Archer's (1995) morphogenetic approach, highlighting a cycle which occurs through three different stages. The cycle commences with the prior structural conditioning of reality. Secondly, the relationship of agency to the structure is mediated through socio-cultural interaction. Finally, the socio-cultural mediation of agency results in structural elaboration (Archer, 1995). Gebre-Mariam and Bygstad (2019) identify generative mechanisms which influence the DT of healthcare systems. The four generative mechanisms identified were formed by factors driven by culture, structures and actors alike. The cultural mechanism emerged from tendencies related to project-driven factors, driven by international non-government organizations (NGOs), whilst the structural mechanism was driven by the need to optimize

prior, manual data collection methods within healthcare systems. Socio-cultural interaction then occurred through an agency-driven mechanism, with influence of NGOs and state actors as embedded within the structure influencing DT. The final, scaling mechanism represented the socio-cultural mediation of the study, with widescale adoption of DT impacted by the interests of NGOs and state actors as opposed to central health-related stakeholders. Digital transformation—which may have been perceived positively—was hindered by the influence of NGO interests and an over-reliance on external actors due to the asymmetrical relationship between NGOs and local health institutions.

Finally, Øvrelid and Bygstad (2019) adopt a CR approach toward the role of discourse in the transformation of digital infrastructures within the Norwegian health sector. Specifically, the authors combine their CR approach with Foucault (1972) archaeological framework which seeks to explore how discourse enters into different fields or disciplines, as well as 'analyse the whole network to understand the content and the implications of the discourse' (Øvrelid and Bygstad, 2019, p. 225). The combination of these approaches facilitated a deep investigation of emerging discourses and their ability to alter the system trajectories within three case studies related to the health sector. Importantly, their case study analysis showed that the mechanism of discursive formation, namely '[a] system of dispersion that identifies and enters into arenas where struggling programmes reside and that may contain the power to change an infrastructure in crisis' (Øvrelid and Bygstad, 2019, p. 234), can detrimentally impact DT if it does not interact with mechanisms formed by other material structures, technological solutions supported by management and other actors, and the ability to scale. Importantly, Øvrelid and Bygstad (2019) demonstrate that although discursive formations can consist of a positive approach toward DT, the absence of support and infrastructure can result in a relationship between positive discourse and dark phenomena.

These papers demonstrate a CR analysis into their authors' respective dark phenomena, and the analysis also demonstrated by the above authors accords with much of the themes highlighted

within Table 1. Indeed, generative mechanisms evolved over time (Spagnoletti et al., 2022), were perceived positively by some actors (Gebre-Mariam and Bygstad, 2019; Øvrelid and Bygstad, 2019), represented the affordances of a system (Haag et al., 2023), or emerged from other pre-existing mechanisms (Henningsson and Kettinger, 2016). These five papers highlight a potential for the adoption of CR guidelines to explore the dark phenomena of DT. We therefore next outline a set of CR methodological steps which can help not only to uncover generative mechanisms, but also to highlight their fluid nature.

Critical realist methodological steps

In this section, we outline how research into dark phenomena can be achieved through a novel application of Wynn and Williams' (2012) methodological principles for CR in IS. The initial stages of this are broadly similar to the relevant stages of Klein and Myers' (1999) hermeneutic cycle, seeing the key events within the field explicated and then theoretically redescribed according to a "proto-theory" (Collier, 1994, p. 165) whilst mindful of the fallibility of knowledge as highlighted earlier. The third stage, retroduction, however, is the central mode of inference for CR-based research. Retroductive analysis constructs and explores the structure under study, whilst seeking to expose the relationship between underlying, generative mechanisms and empirical phenomena (Belfrage and Hauf, 2017). Wynn and Williams' (2012) methodological principles—we contend—are well suited if followed according to the step chart we present in Figure 1.

Explication of events

CR research relies upon the subjective experiences embedded within qualitative data (Zachariadis et al., 2013; Mikhaeil and Baskerville, 2019). This initial stage thus asks researchers to extract themes from participants' values or experiences. We recommend that themes are abstracted through thematic analysis. Braun and Clarke (2006) define this as a "method for identifying, analyzing and reporting patterns (themes) within data" (p. 79) which can be manipulated to fit a range of philosophical approaches. Thematic analysis is carried out through methodological steps which include immersion within the data, the generation of codes and the subsequent generation and definition of the most prevalent themes. Thematic analysis already appears in the CR literature, providing guidance on the analysis of data against experiential and inferential themes (Wiltshire and Ronkainen, 2021). Fryer (2022) has also recently provided guidance on how a CR approach can be applied to thematic analysis which seeks to link concepts related to CR philosophy to the broad stages outlined by Braun and Clarke (2006). However, whilst Fryer (2022) argues that the development of themes can also allow the emergence of causality between deeplying, generative mechanism and phenomena, we contend that further analysis is yet required to establish the most accurate explanation for the phenomenon under study.
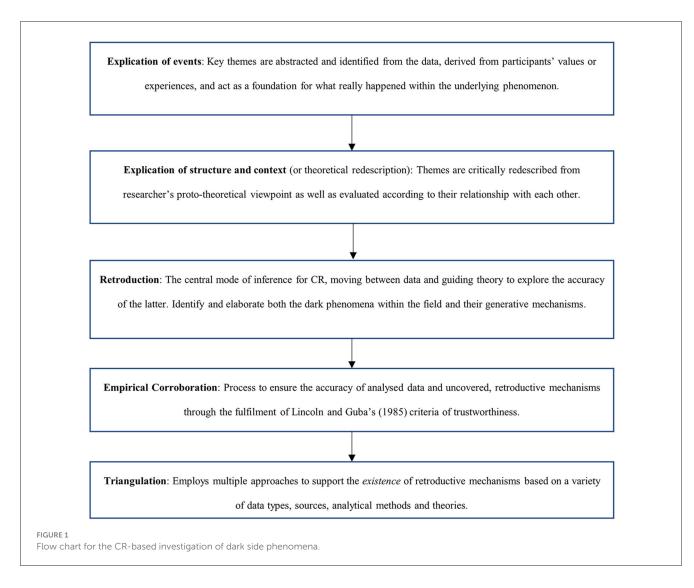
Explication of structure and context

This is the abductive step taken within the process and requires the researcher to theoretically redescribe the explored themes and their relationships with each other according to the guiding proto-theory (Wynn and Williams, 2012). The choice of a guiding proto-theory also allows the researcher to commit to an initial investigation geared toward specific research questions and aims (Ononiwu et al., 2018). At this second stage, the explication of structure and context appear similar to the approach taken by interpretivism, with initial analysis guided by preconception (Klein and Myers, 1999). However, the intention of this stage is not only to explore the accuracy of the study's guiding proto-theory, but also to explore themes which may reflect the presence of generative mechanisms which interact with each other, within open systems. The explication of a structure and its generative mechanisms depends upon the analysis of prevalent themes which indicate "the occasional realization of a causal mechanism, with relatively enduring tendencies, in a bounded region of time and space" (Wynn and Williams, 2012, p. 794). The presence of prevalent themes indicates the presence of deeper mechanisms, the most important of which are uncovered through retroduction.

Retroduction

CR-based inquiry relies heavily on retroduction, which itself is both a deductive and inductive process (Jagosh, 2020). Retroduction is a creative process, requiring iterative movement between phenomena and proto-theory to investigate the causal mechanisms which generate empirical phenomena (Bhaskar, 2009). This provides a key departure from positivism or interpretivism; retroduction provides a richer explanation of phenomena by considering all emergent data rather than the acceptance or rejection of a statement. Within the dark side school of thought, retroduction would uncover generative mechanisms which provide a richer explanation of dark phenomena, as opposed to testing for the presence of pre-determined phenomena. Retroduction requires creative methods in the analysis of qualitative data to discover mechanisms which generate empirical phenomena (Zachariadis et al., 2013). Methodologically, this process moves beyond the initial explication of structure and context carried out in the previous stage, requiring the researcher to analyze all data to explore the accuracy of other theoretical explanations. Uncovered mechanisms may validate, slightly amend or completely disprove the guiding proto-theory. Retroduction therefore requires the researcher to consider a wide range of theoretical perspectives to uncover the most accurate explanation for the generative mechanisms, thus avoiding empirical fallibilism (Wynn and Williams, 2012).

Recent examples demonstrate the retroductive discovery of generative mechanisms which differ from the researchers' guiding proto-theory. Zamani and Pouloudi (2020) found that the behavior of users whose IT-artifacts did not live up to expected standards was not characterized by discontinuance as expected, but rather by generative mechanisms formed by users' abilities in solution identification and cost-benefit

Explication of events: Key themes are abstracted and identified from the data, derived from participants' values or experiences, and act as a foundation for what really happened within the underlying phenomenon.

Explication of structure and context (or theoretical redescription): Themes are critically redescribed from researcher's proto-theoretical viewpoint as well as evaluated according to their relationship with each other.

Retroduction: The central mode of inference for CR, moving between data and guiding theory to explore the accuracy of the latter. Identify and elaborate both the dark phenomena within the field and their generative mechanisms.

Empirical Corroboration: Process to ensure the accuracy of analysed data and uncovered, retroductive mechanisms through the fulfilment of Lincoln and Guba's (1985) criteria of trustworthiness.

Triangulation: Employs multiple approaches to support the *existence* of retroductive mechanisms based on a variety of data types, sources, analytical methods and theories.

FIGURE 1
Flow chart for the CR-based investigation of dark side phenomena.

assessments. Wiredu et al. (2021), meanwhile, discovered the cognition framework generated by aspects of digital platforms was an evolution from the structure provided by their guiding media ecology theory. The internalization of IT media was managed by an entity which itself was dependent on IT assimilation and management. These studies demonstrate how a CR-based inquiry—informed by retroduction—can provide a richer explanation of phenomena in addition to amending the guiding proto-theory and resulting in stimulus for alternative system design. Nonetheless, although deep-lying, generative mechanisms are uncovered through rigorous analysis, they should also be empirically corroborated in order to further confirm their presence.

Empirical corroboration

Empirical corroboration is a process which ensures that the analyzed data accurately reflect the tendencies of uncovered, generative mechanisms, thus corroborating them as the most accurate explanation for the observed phenomenon. A wide range of criteria are available for judging the reliability to CR-led

findings (Javidroozi et al., 2018). As CR methodology relies on the gathering and analysis of qualitative data, we propose that Lincoln and Guba's (1985) criteria for the trustworthiness of the study—when achieved—can fulfill the requirement for empirical corroboration of retroductively analyzed data. These criteria— dependability, transferability, credibility and confirmability—are dependent upon the very objectivity and reflexivity needed to uncover generative mechanisms. Credibility is achievable through data triangulation, where retroductive findings are corroborated against other sources. Transferability concerns the extent to which findings can be generalized elsewhere. This presents a tension as CR philosophy highlights the importance of explanation over prediction (Bhaskar, 2008). Transferability is achievable through a thick description of the phenomena, thus allowing other researchers to make comparisons to other social structures (Lincoln and Guba, 1985). Transferability in this sense is crucial. Other researchers may—without generalizing—compare the findings of mechanisms with other research settings. The purpose of empirical corroboration is to provide an explanation for the presence of generative mechanisms, as opposed to proving their generalizability to other settings (see Zachariadis et al., 2013).

Dependability is synonymous with reliability, and the notion that research decisions are justified, repeatable, thus leading to similar results (Lincoln and Guba, 1985; Noble and Smith, 2015). To achieve this, CR-based research should highlight how methodological principles were followed, reflecting critically on the success of the methodology. Confirmability is achieved when the above criteria are fulfilled (Lincoln and Guba, 1985), the conclusions reached are easily traceable from the data and are objective (see Nowell et al., 2017). CR research should therefore ensure that "findings from qualitative research can provide information about the mechanisms that cause the events at the empirical level" (Zachariadis et al., 2013, p. 860). The concept of confirmability is a key element where CR philosophy sets itself apart from positivism. The conflation of ontology and epistemology means that positivism can be criticized as failing to achieve objective—and therefore, confirmable—conclusions (Bhaskar, 2008). On the other hand, the clear objective link between mechanisms and phenomena can be argued as providing rigorous conclusions despite relying on qualitative data.

Triangulation

Triangulation—familiar in IS as the combining of multiple data sources (Dubé and Paré, 2003)—in CR essentially forms part of the process of ensuring the credibility uncovered through CR analysis. Wynn and Williams (2012) argue that triangulation is best achieved through a mixed-methods approach, allowing the researcher to account for the different natures of structures (e.g. physical, social, conceptual) which form society. Quantitative data which are used to corroborate the presence of retroductively analyzed mechanisms should therefore correlate to the prevalent themes uncovered as part of the earlier process (Zachariadis et al., 2013). CR-based analysis can be triangulated through econometric analysis (Zachariadis et al., 2013), the use of industry data, or the use of other conceptual frameworks (see Bygstad, 2010). Other CR-based studies demonstrate analysis of triangulation through conceptual frameworks as part of the process of retroduction, whilst incorporating external data related to the field of study (Iannacci, 2014). As Dubé and Paré (2003) argue, case research in IS rarely uses any form of triangulation. A CR approach using our proposed methodology not only ensures this, but in a specific form native to CR philosophical principles—the inclusion of retroductively analyzed generative mechanisms as one of multiple data sources.

Critical realism and the detrimental socio-economic impact of digital transformation

To demonstrate how our CR approach could result in an alternative understanding of dark phenomena, we now present as an illustrative example, a study which consisted of a CR-led inquiry into the detrimental socio-economic impact caused by the DT of Great Britain's land-based betting industry. Great Britain's licensed betting offices—colloquially known as betting shops—have seen significant DT since the enactment of the Gambling

Act 2005, and they now host digital channels such as the fixed-odds betting terminal (FOBT), the self-service betting terminal (SSBT) and online gambling. These channels offer distinct forms of gambling. FOBTs offer customers the chance to play digital casino- or slot-based games, whilst SSBTs offer a wider range of sports betting compared to traditional, over-the-counter (OTC) betting. Online gambling offers all these forms of gambling, and is accessible within betting shops through the opening of customer accounts. Our illustrative study highlighted these digital forms of gambling as "platform gambling," or platforms which facilitate the exchange of risk and capital between owners and customers. Furthermore, these different forms of platform gambling joined to create an omnichannel network. The omnichannel approach allowed easier access for customers with a wider range of available markets or products available through a variety of touchpoints (see Hickman et al., 2020).

On the other hand, the proliferation of these channels has recently heightened concerns regarding the impact upon customers who may experience harmful gambling behaviors (Rockloff et al., 2017; Newall et al., 2021; Whelan et al., 2021). Importantly, the development of these platforms has also occurred within a capitalist system which promotes the overconsumption of gambling (Reith, 2013; Young and Markham, 2017). Our study explored these platforms through the proto-theoretical, Marxist viewpoint that "platform gambling" allowed owners to exploit the heterogenous labor of shop workers and customers alike, whether through the alienation of shop-based labor, or through the immaterial labor which heightens spend from customers. In doing so, our study departed from the viewpoint that platform gambling enacts the affordances of data as outlined by Srnicek (2017) to ensure continuous profits. Specifically, platform gambling capitalizes on the ability of data to continuously optimize algorithms, co-ordinate labor, and reduce operating costs through platform optimization. This lens also incorporated the approach of Gimpel and Schmied (2019), highlighting how affordance actualization and subsequent dark phenomena required the interaction between actors and IS or IT-related artifact. We now evaluate how this study contributed a CR-led exploration into an example of detrimental socio-economic impact of DT—in accordance with the points introduced in Table 1—by following the methodology introduced earlier.

Methodology

Our study firstly explicated events through the construction of a proto-theoretical lens, and the gathering and analysis of qualitative data. The proto-theoretical lens positioned platform gambling as a system which exploits the labor of shop-based staff, as well as the immaterial labor of customers. This proto-theoretical lens highlighted the ability of capitalist actors to be able to exploit value from activities not conventionally regarded as labor (Lazzarato, 1996). Thirty-five participants—consisting of betting shop customers, employees and owners from a boardroom or shareholder level—from the Britain's main betting shop operators were interviewed. The explication of events followed Braun and Clarke's (2006) guide for thematic analysis, as outlined earlier. Importantly, all qualitative data were

included within the study's analysis, thus beginning the process of ensuring credibility. The incorporation of all qualitative data also ensured that all stakeholders had their perspective included within the final analysis, regardless of their views in relation to the guiding proto-theory.

Our study secondly explicated the structure and the context of the field of study, by evaluating the most prevalent themes within the data according to the study's proto-theoretical lens. The study explored how the affordances of platform gambling—when actualized—facilitated the exploitation of heterogenous forms of labor. Generative mechanisms characterized by specific themes—the "productivity of data" and the "omnipresence of platform gambling"—were theoretically redescribed in relation to the actualization of the affordances of platform gambling, leading to the redistribution of wealth. Importantly, these generative mechanisms emerged from the presence of other themes present within the qualitative data. The "productivity of data," for example, emerged from separate mechanisms consisting of the productivity of platform gambling itself, online sign-up targets for staff enforced by betting shop operators, and the potential of surveillance capitalism, or the ability of platform gambling to generate revenues from customer data (see Zuboff, 2019). The "omnipresence of platform gambling" meanwhile emerged from factors relating to the availability of platform gambling, the features of platform gambling which encourage continued spend, and viewpoints which perceived the marketing of both land-based and online gambling as being too pervasive across society.

Whilst important, these two generative mechanisms still required interaction between stakeholders. Similarly to Gimpel and Schmied's (2019) conceptual analysis of the relationship between affordance actualization and dark phenomena, the interaction between platform gambling and the various stakeholders of the industry enacted these two generative mechanisms, thus actualizing specific affordances related to platform capitalism (Srnicek, 2017). This interaction resulted in the exploitation of customers through heightened gambling-related spend, and the exploitation of employees through the perceived low-wage received for the duties carried out in relation to the promotion of platform gambling which in turn renders them obsolete. The explication of structure and context therefore highlighted the dark phenomena of platform gambling through the study's proto-theoretical lens, emphasizing how the development of platform gambling benefitted the owners of platforms to the socio-economic detriment of other stakeholders.

However, it was only through retroduction that the study discovered how the specific generative mechanism in relation to the productivity of platform gambling acted as the base of a larger structure. The development and subsequent productivity of platform gambling was subsequently analyzed as generating conditions which led the owners of platform gambling into developments which are unwitnessed by other stakeholders, but are nonetheless known to occur. The "productivity of platform gambling" resulted in the ownership decision to deploy more accessible forms of platform gambling, with more features to encourage further spend. Furthermore, the productivity of platform gambling resulted in the development of loyalty schemes, designed to gather data which further optimizes the use of platform

gambling. Such strategies were perceived as resulting in the "empirical," specifically the diversification of the customer base to encourage further spend, as well as the redeployment and co-ordination of the shop workforce, both of which resulted in the greater profitability of platform gambling. Our illustrative example therefore demonstrated how CR analysis can contribute to the understanding of dark phenomena as highlighted in Table 1 above. Indeed, dark phenomena can arise from a wide variety of IS or IT-related artifacts—such as FOBTs or online gambling—and can also be perceived as positive. For example, the use of platform gambling streamlined the customer experience within land-based settings but encouraged extra spend whilst rendering the workforce obsolete.

The study achieved empirical corroboration by fulfilling Lincoln and Guba's (1985) criteria of the trustworthiness of the study, although transferability and credibility was found during as being difficult criteria to achieve. Transferability, as discussed earlier, presents an issue for CR-informed research as it seeks only to explain phenomena rather than generalize (Bhaskar, 2008). Transferability was achieved within the study under focus through the usage of rich, qualitative data which explained the uncovered mechanisms, and allowed other researchers to make informed judgements on how such mechanisms may also be present within other settings. The main challenge to credibility, meanwhile, was the study's use of guiding, Marxist proto-theory within the retroductive analysis. This challenge was overcome, however, by a comparison of qualitative data with an alternative, neo-liberal theoretical viewpoint. This comparison found that the guiding proto-theory was most suitable description for the dark phenomena which emerged. Indeed, the thematic analysis highlighted the need for further regulation to curb the detrimental impact from platform gambling, as opposed to continued, neo-liberal regulation.

Triangulation was achieved within the study through the comparison of generative mechanisms with industry data sources, through the additional conceptualization of generative mechanisms against other models. Using a micro- and macro-structure approach (Bygstad, 2010), the development of platform gambling was conceptualized within the study as a micro-structure, and then contextualized against a macro-structure in Fleetwood's (2002) stratification of Marxist ontology. Contextualization against Fleetwood's (2002) model found that the development of platform gambling is generated within the circuits of capitalism. The development of platform gambling and productivity based on the commodity of data was compared to Fleetwood's (2002) characterization of the CR real stratum as evolving material-technical and socio-economic relations. Meanwhile, the CR actual stratum was highlighted as consisting of the co-ordination of mass labor, embodied by the strategies related to the provision of accessible forms of gambling with more features alongside loyalty schemes. These strategies are designed to co-ordinate and redeploy immaterial and work-based labor alike. Finally, the empirical stratum—characterized within Fleetwood's (2002) model as the mode of exchange of capital—was characterized within the study by the development and continued use of platform gambling, in addition to profitability for betting shop owners.

Therefore, our illustrative example provided a helpful example of how CR-led inquiry can demonstrate a deeper understanding of dark phenomena, uncovering the detrimental socio-economic

impact which occurred through a specific example of DT. The study also found that the detrimental impact was aided by positive aspects of platform gambling, such as its ease-of-use, accessibility, and its tendency to offer increased value to customers. The study's proto-theoretical approach—although still rooted within a Marxist approach—evolved as a result of retroduction from a lens which focused on the affordances which may facilitate the exploitation of shop customers and employees, to a refocused process which was contextualized as part of the capitalist system itself. Nonetheless, the study highlighted the potential for an alternative systems design, recommending that staff members played a greater role in the relationship between customer and platform gambling.

Summary of approach

Our illustrative example demonstrated how a CR-led exploration can achieve a deeper understanding of how dark phenomena emerge from deep-lying generative mechanisms which can be social, conceptual or physical in nature (Sayer, 2000). The development and optimization of platform gambling requires the interaction between digital platforms, relevant stakeholders, and the development of business models which benefit from platform optimization. Specifically, the mechanism of platform gambling emerges from the development of platforms and the drive to optimize labor—whether immaterial or shop-based—toward their optimization. This simultaneous exploitation of customers and betting shop staff is characteristic of a capitalist system which prioritizes profit without regard for the harm which this may cause. The productivity of platform gambling not only represented the result of socio-technical structures which render staff obsolete, but the mechanism also operated within an economic system which promotes gambling as a commercial activity (Reith, 2013). These structures highlight the social acceptance of the value of profit within the capitalist system, with gambling operators in this example extracting profit from staff and customers alike.

Retroductive analysis should also represent the perceived affordances of generative mechanisms. Our study revealed that the development of platform gambling unlocked affordances around the productivity of data. As highlighted by Srnicek's (2017) notion of platform capitalism, data can further optimize algorithms, co-ordinate labor, cross-subsidize other platforms, and improve profit margins for platform owners. The development of platform gambling within the study allowed the gathering of customer data to improve product offering, co-ordinated the employee and customer base, allowed an omnichannel approach which subsidized and incorporated less profitable platforms, and improved profit margins for owners through the reduction of costs associated with platform deployment. The role of data and the way their optimization of platforms also ensured that the development of platform gambling was a mechanism which evolved over time by its own very nature. The development of platform gambling which was offered to customers in turn evolved from the need to drive further customers into digital forms of betting, and thus evolved according to the data captured from customer's betting habits. Retroduction also highlighted how events within the "actual"

stratum—instigated by gambling operators—allowed owners to optimize platform gambling by altering its features and availability according to customer demand.

Retroductive analysis also demonstrated how the development of platform gambling emerged from the interaction between functions of capitalism which operate according to the four planes of social being (Bhaskar, 2020). For example, the productivity of platform gambling emerged from technology development, its potential in facilitating gambling without the need for staff interaction, the broader socio-economic structures which sustain the importance of economic value, and the normalization of gambling which can impact the individual. Our example therefore uncovered the development of platform gambling as reflecting the emergence of a singular mechanism from others generated by socio-economic and material-technical conditions outlined by Fleetwood (2002). Introduced in Table 2, this relationship against the macro-structure reflected how the material relations between actors and nature—in relation to the production and consumption of gambling—have evolved within the three strata of society as explored by CR philosophy. Mechanisms related to the co-ordination of machinery and the provision of services in relation to gambling, merged with the wider operating mechanism of socio-economic activities which co-ordinate human activities and reproduce social relations. In this sense, the mechanisms specific to the production of platform gambling—according to the principles of open systems (see Mingers, 2011)—interacted with mechanisms responsible for the co-ordination of labor which occurs through DT. The development of platforms was intended not only to hasten consumption and therefore customer expenditure, but also to streamline labor processes. These mechanisms were also driven by the continuous pursuit to generate value, prioritizing capital over individuals themselves.

The generative mechanism was found as facilitating the events of the actual, the co-ordination of mass labor (Fleetwood, 2002), and in this case, the role of platform gambling upon the interpersonal, subjective relationships between actors. The nature of exchange between owners, staff and customers evolved with the role of platform gambling, transforming shop labor, and redirecting customer spend through digital platforms. The latter two groups highlighted how the productivity of platform gambling—which emerged from the development of technology, the interaction between actors, and the wider capitalist system which has transformed into a surveillance-based, data-driven economy—was likely to incur a detrimental impact on staff by rendering them obsolete, and customers by extracting further spend.

As also highlighted within the principles highlighted in Table 1, the study highlighted the empirical phenomena generated by the development of platform gambling. The main phenomenon uncovered was the continuous use of platform gambling, resulting in the constant exchange of capital for the consumption of risk. This exchange translated into accumulative profits for gambling operators. The development of platform gambling was clearly linked to continuous usage and profits through the enactment of the affordances of data, the subsequent co-ordination of the features, the availability of platform gambling, and the optimized labor required to service such platforms.

TABLE 2 The development of platform gambling according to Marxist ontology.

Stratum	Relationship to Marxist ontology (Fleetwood, 2002)	Development of platform gambling according to retroductive analysis
Hierarchy	The mode of exchange of capital.	Continued use of platform gambling for the consumption of risk, resulting in further capital for operators.
Actual	The co-ordination of mass labor.	Co-ordination of betting shop labor—whether customer- or staff-based—toward the features offered by platform gambling. Extraction of customer labor and spend through the use of surveillance capitalism, facilitated by platform gambling. Redeployment of staff labor toward the promotion of platform gambling to customers, or the maintenance of platforms.
Real	The development of material-technical and socio-economic relations.	**Generative mechanism consisting of the productivity of platform gambling.** - Emerging from the growth of platform capitalism, the productivity of data and its potential to optimize gambling without the need for staff interaction, and the drive toward profit accumulation. - Mechanism also dependent on the normalization of the over-consumption of gambling (see Reith, 2013).

Contribution to the dark side of digital transformation

Table 1 above highlights how a CR approach can uncover a deeper understanding of the detrimental impact of DT. Our study demonstrated how transformation may be unknown or multi-faceted in comparison to pre-determined symptoms described elsewhere. Our analysis provided a deeper understanding of dark phenomena than would be generated through positivist or interpretivist approaches owing to its uncovering of mechanisms which operate within wider social and economic structures. The detrimental impacts caused by the development of platform gambling were also perceived as multi-faceted by the study's participants. Although the study did not seek to establish any causality between platform gambling and harmful gambling behaviors, participants argued that more asocial, digital forms of gambling were more likely to result in addiction. A further aspect of the dark side of DT occurred through the mechanization of gambling, thus rendering betting shop staff obsolete whether through the self-service nature of SSBTs, or the targets they were required to hit in encouraging sign-ups to online gambling. Detrimental impacts were also identified within the behavioral surplus derived from the data obtained by loyalty schemes (Zuboff, 2019). Platform gambling therefore not only facilitated a flow of capital from gambling itself, but was also analyzed as generating profit specifically from customer data. In summary, the study's CR-led approach discovered the multi-faceted nature of an example of dark phenomena, and its socio-economic impact. The detrimental socio-economic impact was demonstrated as far-reaching across not only those who may suffer from gambling-related harms, but also customers who perceived a detrimental impact on betting shop environments as a result of asocial technologies, in addition to staff who perceived their roles as threatened by platform gambling. Indeed, dark phenomena may be unknown or perceived differently depending on stakeholder. This perception cannot necessarily be uncovered in depth by experiments in closed, laboratory-controlled conditions.

Equally, our study showed how dark phenomena may also be perceived as positive. Although platform gambling was perceived overall as being harmful to staff and customers alike, there were particular structural and situational characteristics which were perceived as positive by participants despite their possible detrimental effects. Themes in relation to the use of customer data were perceived as positive if their usage benefitted customers with personalized incentivization. Additionally, the ease of use and the numerous sports betting markets offered by SSBTs were seen to be a positive despite their threat to labor, whilst the ability to access online gambling in any location was also seen as a positive by some participants despite its asocial nature. Whilst platform gambling was underlined as incurring a detrimental socio-economic impact, certain aspects were perceived differently or positively over time. Incentivizing customers with free bets to engage with platform gambling, for example, was a positive aspect of a journey into platform gambling which participants perceived as leading to harmful gambling behaviors.

Importantly, the study demonstrated an example of dark phenomena emerging from any IS or IT-related artifact. The system of platform gambling which was explored comprised a network of artifacts, organized as an omnichannel network of platforms accessible to customers from a single, gambling account. However, each element of platform gambling contained a significant number of features. The greater the number of features available within an IS, the greater the number of interactions possible (DeSanctis and Poole, 1994). The greater number of interactions made possible by the generative mechanism of the development of platform gambling facilitated its detrimental socio-economic impact. The uncovered generative mechanisms highlighted how alternative systems could be developed to prevent harms according to societal or individual levels, depending on the levels of the four planes of social being highlighted by Bhaskar (2020). The use of data to extract profit was highlighted as a business model used by operators to the detriment of customers, particularly those experiencing harms. These data are extracted through a development of interwoven touchpoints, within an economy which promotes the over-consumption of gambling (Reith, 2013). This leads to the othering of those who are experiencing harms, individuals who will be formed of their own stratified personalities (Bhaskar, 2020). Individuals may also be experiencing other factors such as

anxiety, addiction, or socio-economic disadvantage, all of which could exacerbate the harms experienced by the platform gambling explored within the illustrative example. The deeper understanding of the dark phenomena uncovered by the illustrative example highlights how the productivity of platform gambling—enabled by the wider economic system—incurs detrimental impacts on a societal and individual level. An understanding of how platform gambling impacts not only society, but the individual, will enable regulators to enforce operators to develop systems design which prevent harm.

Conclusion

Our paper has demonstrated how a CR-led inquiry can lend a deeper understanding of the mechanisms beneath the dark side of IS. As this paper has argued, CR analysis is a creative process, as amply demonstrated by the CR papers already found in IS. Guidance such as that by Brönnimann (2021) and Wiltshire and Ronkainen (2021) will also offer help to researchers pursuing CR-based knowledge. Whilst the methodologies in extant research have guided our understanding of how IS artifacts may provide detrimental impacts, we have demonstrated how a CR-based approach grants a deeper understanding of the dark side itself. Dark phenomena do not merely consist of pre-determined criteria; they can exist within the positive aspects of IS, evolve over time and can be emitted from any IS or IT-related artifact (Mikalef et al., 2022). This is demonstrated through our illustrative example which highlighted the negative socio-economic impact brought by the digitalization of the gambling industry. Future researchers may wish to adopt the process in Figure 1 above or they may wish to use a different path, based on CR philosophical principles.

A deeper understanding of dark phenomena, away from pre-determined symptoms, we contend would facilitate alternative systems design with reduced detrimental impact. This understanding of alternative systems design would benefit policy makers which may seek to protect societies from the unintended consequences of DT. As our illustrative example has shown, CR-led inquiry can uncover dark phenomena which exist *beyond* pre-determined categories. Dark phenomena may be unknown or perceived differently over time, as well as consist of wider socio-economic impacts. Businesses may also benefit from this understanding, as they seek to ensure that they maintain social responsibility by mitigating for generative mechanisms responsible for dark phenomena. Importantly, a CR approach can allow a *deeper understanding* and *explanation* of how generative

mechanisms lead to dark phenomena, offering an alternative to generalizations which are influenced by our own assumptions.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://salford-repository.worktribe.com/OutputFile/1486578.

Author contributions

JW and DK contributed to the conception and design of the study and contributed to manuscript, revisions, and approved the submitted version. JW carried out the literature search within the study and wrote the first drafts of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

JW declares his current affiliation to the Bristol Hub for Gambling Harms Research. The Bristol Hub for Gambling Harms Research is funded by a grant (2022-2027) from the national charity GambleAware which is funded by voluntary donations from the gambling industry. Governance procedures and due diligence provide safeguards to ensure the Hub's independence from GambleAware and the gambling industry. Neither GambleAware nor the gambling industry have any influence over the activities of the Hub or JW's research activities. JW's affiliation to the Hub commenced after the research for the current study took place.

The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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