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THE WEB OF AUTOMATION ANXIETY: MAPPING DIGITAL FEAR FROM MAINFRAMES TO ARTIFICIAL INTELLIGENCE

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ABSTRACT

Automation anxiety, the pervasive concern about the adverse consequences of technological change, is conceptually fragmented within the Information Systems (IS) literature. Existing research addresses related issues in isolation, thus limiting understanding of how these concerns interact and persist over time. This paper develops an integrated and historically grounded conceptualization of automation anxiety for the IS field. Drawing on an inductive synthesis of IS and social-science research, the paper defines automation anxiety. It identifies five interrelated dimensions: Job Replacement, Deskilling Effect, Supply Chain Risk, Data Vulnerability, and Solow's Paradox. These dimensions are organised into a web of automation anxiety, highlighting how technological risk is shaped not only by calculable hazard but also by socially amplified outrage. To explain the persistence and evolution of automation anxiety, the framework is situated within a longitudinal analysis of five eras of computing, adapted from Moschella's waves-of-power model. The analysis shows how anxieties associated with scale, speed, connectivity, human limits, and combinatorial innovation accumulate, recombine and amplify as technologies persist, layer, and diffuse. By integrating conceptual, interactional, and longitudinal perspectives, this paper positions automation anxiety as a cumulative socio-technical phenomenon rather than a transient or technology-specific reaction. The framework offers IS researchers a structured lens for analyzing technological fear across eras. It provides managers and policymakers with insights into how design, governance, and communication choices can mitigate anxiety in increasingly automated environments.

KEYWORDS

Automation Anxiety, Digital Technologies, Artificial Intelligence, Socio-Technical Systems, Information Systems, Conceptual Framework

1. INTRODUCTION

Automation anxiety has accompanied technological change long before the emergence of digital computing. Across mythological, historical, and economic accounts, the prospect of machines replicating or replacing human activity has repeatedly been associated with fears of loss of control, diminished human agency, and social disruption. Ancient Greek, Roman, Indian, and Chinese myths depict artificial life and self-moving artefacts imbued with both promise and danger, reflecting early anxieties about human–machine relations and the consequences of delegating agency to artefacts (Mayor, 2018). This paper argues that understanding contemporary AI anxiety requires us to see it not as a break from the past, but as the latest and most intense crystallization of these enduring concerns.

These concerns emerged forcefully during the Industrial Revolution. In early nineteenth-century England, the introduction of automated power looms displaced skilled textile workers, triggering the Luddite uprisings of 1811 (Hobsbawm, 1952). Shortly thereafter, the Canuts revolt in Lyon in 1831 similarly reflected resistance to mechanization perceived as threatening livelihoods, skills, and social order (MHL-Gadagne, 2023). These episodes illustrate that automation anxiety has historically been less about technology per se and more about its perceived implications for work, skill, and economic security.

In the twentieth century, automation anxiety became explicitly articulated within economic discourse. Writing in 1930, Keynes famously described "technological unemployment" as a temporary phase of maladjustment arising from society's inability to absorb technological change at the pace at which it generates labor-saving innovations (Keynes, 1963). While Keynes anticipated eventual adjustment, subsequent debates revealed persistent uncertainty about whether technological progress consistently translates into shared economic benefit. These concerns intensified after the Second World War as computing technologies began to reshape organizational and industrial structures.

From the mid-twentieth century onwards, successive waves of computing introduced new configurations of automation anxiety. Early system-centric computing raised concerns about scale, power concentration, and organizational dependence on large, centralized machines. The spread of personal computing shifted anxiety towards skill obsolescence and accelerated change, while networked and internet-based systems heightened concerns about control, surveillance, and organizational boundaries. Automation-pessimism is regularly countered by automation-optimism, such as the "Luddite-fallacy" (Ford, 2009), which argues that job losses are offset by job creation (World Bank, 2019). Across these eras, anxieties associated with Job Replacement remained salient but increasingly intertwined with the Deskilling Effect, emerging forms of Supply Chain Risk, growing Data Vulnerability, and persistent uncertainty over productivity and value creation captured by Solow's Paradox (Solow, 1987; Brynjolfsson, 1993).

Within the IS field, these concerns have been examined extensively, though rarely under a unified conceptual label. As Coase (1960) observed, technological progress is difficult to anticipate due to its inherent complexity and unpredictability. Research on technology adoption and resistance has shown that new systems frequently disrupt established work routines, power relations, and professional identities, generating resistance and anxiety that cannot be explained by technical deficiencies alone (Markus, 1983; Lapointe & Rivard, 2005). Socio-technical studies further demonstrate that planned implementations often produce unintended

organizational and social consequences, particularly where technological change outpaces institutional adaptation (Bostrom & Heinen, 1977; Mumford, 2006).

Despite this rich body of work, automation anxiety remains conceptually fragmented within IS research. Its constituent concerns are typically examined in isolation: Job Replacement within labour-market studies, the Deskilling Effect within labour-process theory, Supply Chain Risk within outsourcing and sourcing literatures, Data Vulnerability within privacy and security research, and Solow's Paradox within studies of IT value and productivity. This fragmentation obscures how these concerns interact and reinforce one another as digital technologies accumulate and converge. Importantly, automation anxiety is shaped not only by objective technological risk but also by how risk is perceived and amplified. Sandman's (1993) formulation of risk as hazard plus outrage highlights how attention, emotion, and social interpretation often drive anxiety more strongly than calculable threat. In the contemporary period, media narratives, industry discourse, and regulatory debates surrounding artificial intelligence have intensified this effect, contributing to what many commentators describe as a crystallization of broader automation anxiety into AI anxiety.

At the same time, automation anxiety cannot be understood without a longitudinal perspective. Digital technologies do not replace one another cleanly; they persist, layer, and recombine across eras of computing. Concerns evident in earlier technological periods emerge in modified form as technologies scale, converge, and operate at unprecedented speed and reach. Tracing automation anxiety across successive eras, therefore, reveals both historical continuity and structural transformation in how technological fear is experienced and expressed.

Against this background, this paper positions automation anxiety as a central socio-technical phenomenon for IS research, requiring an integrated and historically grounded conceptual framework. By drawing together dispersed strands of IS and social-science literature and situating them within a multi-era view of computing, the paper seeks to clarify how automation anxiety emerges, evolves, and intensifies as digital technologies reshape work, organizations, and society. To build this argument, the paper proceeds as follows. Section 2 outlines our aims and objectives. Section 3 develops a conceptual framework of automation anxiety, defining its core dimensions. Section 4 illustrates their interaction, while Section 5 traces their evolution across five eras of computing. Section 6 identifies the cross-era dynamics that sustain this anxiety, and Section 7 concludes with implications for research and practice.

2. AIMS AND OBJECTIVES

This paper aims to develop a coherent and historically grounded conceptual framework of automation anxiety that consolidates fragmented strands of IS research and clarifies how automation-related concerns interact and persist across successive eras of computing. To achieve this aim, the paper pursues three specific objectives.

First, the paper seeks to define automation anxiety and articulate its core dimensions by synthesizing relevant IS and social-science literature. Building on an inductive review of prior research, the framework identifies five recurrent and mutually reinforcing dimensions of automation anxiety: Job Replacement, Deskilling Effect, Supply Chain Risk, Data Vulnerability, and Solow's Paradox, which replace earlier fragmented terminology and provide a consistent analytical vocabulary for examining automation anxiety within the IS field.

Second, the paper examines how these dimensions are reshaped and intensified by contemporary digital technologies, particularly in the post-2020 period characterized by artificial intelligence and large-scale digital convergence. While concerns about Job Replacement remain salient, the analysis shows how automation anxiety increasingly reflects compound effects arising from deskilling, dependence on extended digital supply chains, heightened data exposure, and persistent uncertainty regarding productivity and value realization captured by Solow's Paradox.

Third, the paper situates automation anxiety within five eras of computing, adapting Moschella's waves-of-power framework to demonstrate how technological capabilities, organizational arrangements, and stakeholder concerns co-evolve over time. This longitudinal perspective highlights both continuity and transformation in automation anxiety, showing how familiar concerns are re-expressed as technologies accumulate, scale, and combine across computing eras.

Together, these objectives establish automation anxiety as a unifying socio-technical construct for IS research and provide a structured basis for analyzing how technological fear influences system design, implementation, governance, and organizational response over time.

3. AUTOMATION ANXIETY: A CONCEPTUAL FRAMEWORK

This section develops a conceptual framework of automation anxiety grounded in the Information Systems (IS) and social-science literatures and synthesized through an inductive review process (Tavory and Timmermans, 2014).

To clarify how the dimensions of automation anxiety were derived, we conducted a targeted review of leading Information Systems journals from 1980 to 2025. Because automation anxiety is rarely labelled explicitly, we combined IT-related terms (e.g., "information technology", "digital", "automation") with anxiety-related terms (e.g., displacement, deskilling, risk, outsourcing, productivity) to capture work, organizational, and socio-technical perspectives. Titles and abstracts were screened for relevance, and papers that did not substantively address technological impacts on labour, organizations, or decision-making were excluded. The remaining corpus was examined iteratively, enabling themes to emerge through repeated comparison and synthesis. Across this process, five recurrent and mutually reinforcing attributes consistently appeared in the literature. These form the basis of the integrative framework presented in this paper (Currie, et al., 2026).

This framework is presented in Figure 1, which identifies five recurrent and interrelated dimensions that together constitute automation anxiety (Brynjolfsson, 1993; Solow, 1987; Currie and Willcocks, 1998; Mumford, 2006).

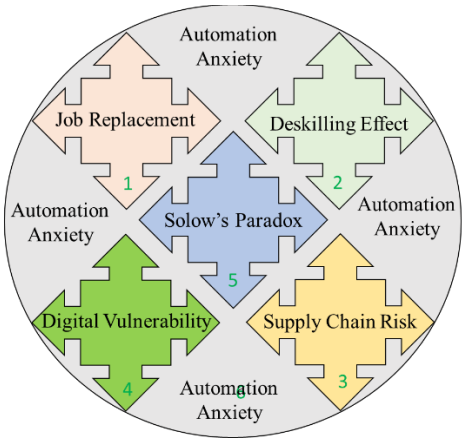

Figure 1. Mind Mapping Automation Anxiety: Emerging Dimensions

Although automation anxiety is widely referenced in academic, policy, and public discourse, it remains weakly defined and conceptually fragmented within the IS literature (Gallers and Currie, 2011). Rather than being treated as a unified construct, it typically appears implicitly across studies examining labour displacement, skill change, outsourcing, data governance, and productivity outcomes (Markus, 1983; Lapointe and Rivard, 2005; Orlikowski and Scott, 2008). The conceptual framework developed here integrates these dispersed concerns into a coherent socio-technical structure that captures both the scope of automation anxiety and the interactions among its constituent dimensions

3.1 Towards a Definition

The terms "automation" and "anxiety" are linked, yet an overall definition remains elusive. Concepts and expressions like techno-stress, fear of obsolescence, and robo-apocalypse, all reflect the "dark side" of technological change (Agogo and Hess, 2018; Mikalef et al., 2022), yet the concept remains under-theorized. Automation is the substitution or augmentation of human work with digital tools (Bhorat, 2023), whereas anxiety is a pyschological response to perceived threats. Automation anxiety is thus defined as: *a widespread, often vaguely felt concern about the potential negative psychological, economic, and social impacts of automation, historically focusing on job displacement, and extending into the general fear of being adversely impacted by machines, AI, and advancing digital technologies*.

What distinguishes automation anxiety from related constructs is its cumulative and interactional character: it emerges not from a single technological threat, but from the reinforcing alignment of employment risk, skill erosion, organizational dependency, data exposure, and uncertain value creation across successive technological eras. This definition emphasizes three important characteristics.

- First, automation anxiety is not limited to employment outcomes; it encompasses organizational, social, and institutional concerns.
- Second, it is frequently diffuse rather than explicitly articulated, emerging through narratives, expectations, and interpretations rather than direct experience.

- Third, it is historically persistent, reappearing across successive waves of technological change even as specific technologies evolve.

3.2 Risk and Automation Anxiety

To explain why automation anxiety intensifies and persists across computing eras, the framework draws on Sandman's (1993) formulation of risk:

Risk = Hazard (likelihood × impact) + Outrage.

In this formulation, hazard refers to the technically assessable probability and severity of harm, while outrage captures the social, emotional, and attentional responses that shape how risks are perceived. Crucially, anxiety is often driven less by calculable hazard than by outrage, that is, by the degree of attention, concern, and emotional amplification a risk receives. This distinction is central to understanding automation anxiety. Many technological risks associated with automation, such as job-loss projections, productivity impacts, and data misuse, are uncertain, contested, and difficult to measure empirically. Yet these risks are frequently amplified by media narratives, industry discourse, policy debates, and high-profile failures, generating anxiety disproportionate to demonstrable hazard (Sandman, 1993; Mills, 2021).

Within this framework, automation anxiety is therefore conceptualized as a socio-technical risk phenomenon, in which perceived threat is shaped by both technological characteristics and institutional context. As digital technologies scale, converge, and become opaque, outrage tends to increase even when hazards remain uncertain or unevenly distributed. This dynamic helps explain why automation anxiety often escalates during periods of rapid innovation and why it crystallizes around technologies, such as artificial intelligence, at specific historical moments.

3.3 Core Dimensions of Automation Anxiety

Figure 1 identifies five recurrent and interrelated dimensions that together constitute automation anxiety. These dimensions are not presented as discrete or independent concerns. Rather, they represent analytically separable but empirically intertwined anxieties that recur across successive eras of computing and intensify as digital technologies scale, converge, and diffuse into organizational and societal life. Each of these elements will be discussed below.

3.3.1 Job Replacement

Job Replacement captures the enduring fear that automation will replace human labour, leading to job loss or the elimination of core tasks. Historically, this has been the most visible and politically salient dimension of automation anxiety, shaping public discourse from early industrial mechanization through to contemporary debates on artificial intelligence (Hobsbawm, 1952; Keynes, 1963; OECD, 2023). Within the IS literature, job replacement anxieties surface repeatedly in studies of technology adoption, resistance, and organizational change, particularly where automation disrupts established roles and employment structures (Ford, 2015; Markus, 1983; Lapointe and Rivard, 2005).

Empirical research has consistently qualified deterministic claims of large-scale technological unemployment. Studies show that automation often reconfigures tasks rather than eliminating entire jobs, while new forms of work emerge alongside technological change (Acemoglu and Restrepo, 2017; Autor et al., 2018; McKinsey Digital, 2023; Willcocks, 2020). Nevertheless, Job Replacement remains central to automation anxiety because it functions as a

symbolic anchor for wider fears about economic security, identity, and social worth. Even when empirical evidence moderates extreme predictions, the outrage component of risk frequently amplifies concern, particularly during periods of rapid technological change and heightened media attention (Sandman, 1993).

3.3.2 Deskilling Effect

The Deskilling Effect refers to anxieties that automation reduces the complexity, discretion, or skill content of work, even where employment is maintained. Rooted in labour process theory, early analyses emphasized how mechanization and managerial control degrade skilled labour and fragment work into routinised tasks (Braverman, 1974; Noble, 1984). Within IS research, similar dynamics are observed where digital systems standardize processes, embed decision rules, and shift judgment from workers to technology (Bostrom and Heinen, 1977; Mumford, 2006).

The Deskilling Effect often operates as a second-order anxiety, intensifying concerns about Job Replacement by shifting attention from immediate job loss to longer-term employability and skill obsolescence. As intelligent systems increasingly support or substitute cognitive tasks, anxieties arise about erosion of professional expertise, reduced autonomy, and diminished opportunities for learning and advancement (Ford, 2015; Seeber et al., 2019; Raisch and Krakowski, 2021). These concerns are particularly salient in knowledge-intensive occupations, where automation affects not only efficiency but also the meaning and identity attached to work.

3.3.3 Supply Chain Risk

Supply Chain Risk captures anxieties arising from the delegation of technological capabilities, processes, or decision-making to external actors. In earlier eras, this dimension was primarily associated with IT outsourcing, where organizations transferred control of information systems to third-party providers to reduce costs or manage complexity (Currie and Willcocks, 1998; Lacity et al., 2010; Mathiassen and Sorensen, 2008). Research in this stream documents persistent anxieties concerning loss of control, hidden costs, vendor dependence, service degradation, and accountability gaps.

In contemporary digital environments, Supply Chain Risk extends beyond traditional outsourcing to encompass cloud infrastructures, digital platforms, software-as-a-service, and AI-enabled ecosystems. As organizations become embedded in extended digital supply chains, risks are redistributed across organizational boundaries, often reducing visibility and managerial control (Benlian et al., 2011). These dynamics generate automation anxiety by exposing organizations and workers to failures, disruptions, and strategic dependencies that are difficult to anticipate or govern.

3.3.4 Data Vulnerability

Data Vulnerability refers to anxieties associated with the creation, storage, use, and governance of data in increasingly digitized environments. As digital technologies rely on large-scale data collection and analytics, concerns intensify around privacy, surveillance, security breaches, misuse of information, and regulatory exposure (Westin, 1967; Bélanger and Crossler, 2011; Zuboff, 2019). Within IS research, data-related anxieties have long accompanied the diffusion of information systems, particularly where data flows extend beyond organizational boundaries.

Data Vulnerability interacts strongly with Supply Chain Risk. Outsourcing, cloud computing, and platform dependence often entail relinquishing direct control over critical data assets, amplifying concerns about accountability, transparency, and trust (Currie and Willcocks, 1998; Pouloudi et al., 2016). In the context of AI, these anxieties are heightened further by opaque data practices, model training processes, and uncertainty about how data are repurposed and recombined at scale.

3.3.5 Solow's Paradox

Solow's Paradox captures persistent uncertainty about whether investments in digital technologies deliver measurable productivity or performance benefits. First articulated in macro-economic terms, the paradox highlights the recurring disconnect between visible technological progress and elusive productivity gains (Solow, 1987). Subsequent IS research has shown that productivity outcomes are often delayed, unevenly distributed, or obscured by organizational misalignment, implementation challenges, and measurement limitations (Brynjolfsson, 1993; Brynjolfsson et al., 2017).

Solow's Paradox contributes to automation anxiety by undermining confidence in the promised benefits of automation. When substantial investments fail to yield clear returns, skepticism grows among managers, workers, and policymakers, reinforcing perceptions that automation may generate disruption without commensurate value, contributing to the outrage dimension of risk. Stakeholders feel the promised hazard of disruption is not balanced by a commensurate reward, fueling skepticism and anxiety. This uncertainty amplifies other dimensions of automation anxiety, particularly when job replacement, deskilling, or outsourcing is justified by anticipated efficiency gains that fail to materialize.

3.4 Automation Anxiety Interactions

Figure 1 conceptualizes automation anxiety as a web of interacting risks, rather than a linear or additive set of concerns. The five dimensions reinforce one another through both hazard and outrage mechanisms. For example, Job Replacement fears are amplified when automation is associated with deskilling trajectories that reduce workers' adaptive capacity (Braverman, 1974). Supply Chain Risk intensifies Data Vulnerability by extending data flows across organizational boundaries (Currie and Willcocks, 1998; Zuboff, 2019), while persistent uncertainty captured by Solow's Paradox undermines confidence in automation initiatives more broadly (Brynjolfsson et al., 2017). Viewed through Sandman's lens, these interactions help explain why automation anxiety often persists even when empirical evidence moderates extreme predictions. As technologies accumulate and converge across computing eras, outrage frequently outpaces hazard, reinforcing anxiety at individual, organizational, and societal levels.

4. THE WEB OF AUTOMATION ANXIETY: AN INTEGRATIVE FRAMEWORK

The following examples are deliberately selective and illustrative; they are not intended to exhaustively represent each dimension, but to demonstrate how automation anxiety materializes through their interaction in organizational settings. Building on the conceptual framework established in Section 3 and visualized in Figure 1, this section illustrates how automation

anxiety emerges in practice through the interaction of its core dimensions. Rather than treating Job Replacement, Deskilling Effect, Supply Chain Risk, Data Vulnerability, and Solow's Paradox as isolated concerns, the examples below show how these dimensions co-occur and reinforce one another in organizational settings. The purpose of this section is illustrative rather than theoretical: it demonstrates how the framework can be used to analyze concrete manifestations of automation anxiety across different contexts of digital transformation.

4.1 Job Replacement, Deskilling Effect, and Supply Chain Risk

A recurrent interaction in IS research concerns the combined effects of Job Replacement, the Deskilling Effect, and Supply Chain Risk. Automation initiatives frequently begin with promises of efficiency and cost reduction, but their implementation often restructures work in ways that generate anxiety across all three dimensions simultaneously.

Enterprise systems such as ERP and CRM platforms provide a well-documented example. While these systems rarely eliminate entire occupational categories, they often standardize processes and embed decision rules that reduce discretion and local expertise. Empirical studies of large-scale ERP implementations show that middle managers and professional staff frequently experience a loss of autonomy and judgement, generating perceptions of deskilling even when employment is retained (Boudreau and Robey, 2005; Markus and Tanis, 2000). These deskilling effects, in turn, heighten concerns about the longer-term relevance and employability of jobs, reinforcing Job Replacement anxiety.

Supply Chain Risk intensifies these dynamics when organizations rely on external vendors, consultants, or cloud-based service providers to implement and maintain such systems. Outsourcing arrangements shift control over critical systems and knowledge beyond organizational boundaries (Benbya et al., 2024), creating dependencies that are difficult to reverse (Currie and Willcocks, 1998; Lacity et al., 2010). Employees may perceive that expertise is being externalized alongside system control, amplifying fears that both jobs and skills are becoming redundant. In this way, automation anxiety arises not from a single source but from the cumulative effects of employment uncertainty, skill erosion, and organizational dependence on external digital supply chains.

4.2 Supply Chain Risk and Data Vulnerability

A second prominent interaction we can look at occurs between Supply Chain Risk and Data Vulnerability, particularly in environments characterized by cloud computing, platform ecosystems, and AI-enabled services. As organizations increasingly rely on external providers for infrastructure, software, and analytics, data flows extend across organizational and jurisdictional boundaries, intensifying concerns about governance, accountability, and control.

IS research on outsourcing and cloud adoption highlights how reliance on third-party providers complicates responsibility for data protection, security breaches, and regulatory compliance (Benlian et al., 2011; Pouloudi et al., 2016). Even when contractual safeguards are in place, organizations often lack visibility into how data are stored, processed, or repurposed within complex digital ecosystems. These uncertainties contribute to Data Vulnerability anxiety, particularly in highly regulated sectors such as healthcare, finance, and the public sector.

The interaction between these dimensions is especially pronounced in the context of AI. Training and deploying AI systems often require large datasets sourced from multiple internal and external repositories. As data are aggregated, shared, and recombined, organizations face heightened exposure to privacy breaches, intellectual-property leakage, and unintended secondary use (Bélanger and Crossler, 2011; Zuboff, 2019). When data governance failures occur, they are frequently attributed not to technical malfunction alone but to the opacity of extended digital supply chains, reinforcing anxiety about both dependency and vulnerability.

4.3 Solow's Paradox as an Amplifier of Automation Anxiety

As a further example, Solow's Paradox plays a distinctive role in the web of automation anxiety by amplifying the effects of other dimensions. Across multiple eras of computing, organizations have invested heavily in digital technologies with the expectation of productivity gains, only to encounter delayed, uneven, or ambiguous performance outcomes (Solow, 1987; Brynjolfsson, 1993). This persistent uncertainty undermines confidence in automation initiatives and magnifies anxiety when anticipated benefits fail to materialize.

For example, outsourcing and automation are often justified by cost savings and efficiency gains. When these gains are not clearly realized, skepticism among managers and employees alike intensifies, intensifying anxieties about Job Replacement and Deskilling Effects. Workers may question whether disruptions to roles and skills are warranted, while managers face pressure to rationalize continued investment despite unclear returns.

Similarly, concerns about Data Vulnerability are heightened when productivity benefits remain elusive. High-profile data breaches, system failures, or regulatory penalties can overshadow incremental efficiency gains, reinforcing perceptions that automation introduces risk without commensurate value. In this way, Solow's Paradox does not operate as a standalone concern but acts as a contextual amplifier, strengthening other dimensions of automation anxiety when promised outcomes remain uncertain.

4.4 Cumulative Effects

Taken together, these interaction examples illustrate how automation anxiety can accumulate through reinforcing feedback loops rather than linear cause-and-effect relationships. Job Replacement concerns are intensified by deskilling trajectories that erode adaptive capacity; Supply Chain Risk heightens Data Vulnerability by extending control beyond organizational boundaries; and Solow's Paradox magnifies skepticism when technological change fails to deliver visible benefits.

These cumulative effects help explain why automation anxiety persists across computing eras, even as specific technologies evolve. Rather than being resolved, anxieties are reconfigured and amplified as new systems layer onto existing infrastructures. Section 5 builds on these interaction patterns to examine how automation anxiety unfolds across five eras of computing and how historical continuity shapes contemporary responses to artificial intelligence.

5. DISCUSSION: DECODING AUTOMATION ANXIETY

To understand how automation anxiety evolves, this section situates the conceptual framework within five eras of computing, adapted from Moschella's (1997) waves-of-power framework. Each era is characterized by a dominant technological configuration and an associated organizing logic, as well as distinct patterns of anxiety that reflect how automation reshapes work, organizational power, and human agency. Crucially, these eras do not cleanly replace one another. Technologies accumulate, adoption scales from millions to billions of users, and anxieties persist and recombine rather than disappear. This is illustrated in Figure 2.

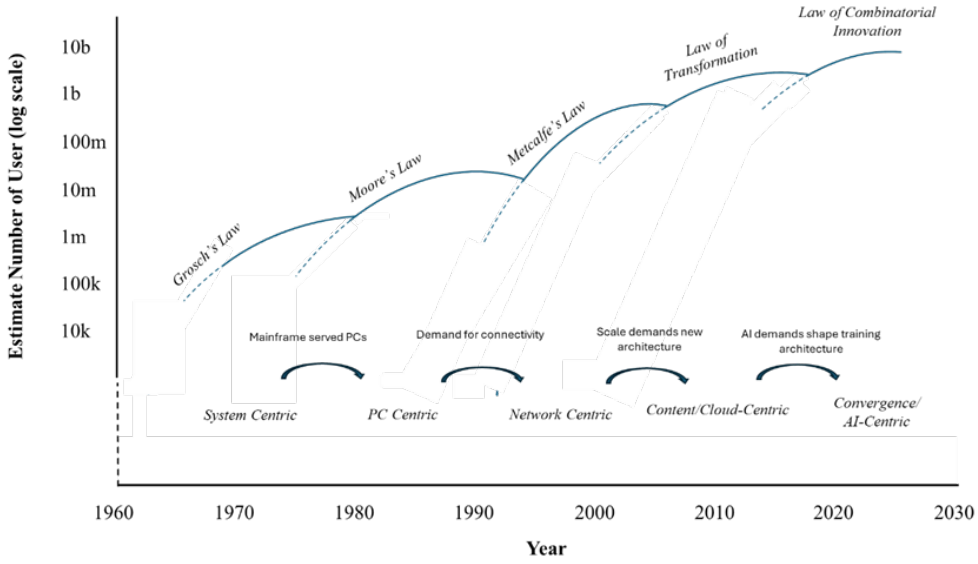

Figure 2. Five Eras of Computing (Source: authors, extended from Moschella, 1997)

5.1 System-Centric Era: Scale and Centralization Anxiety

The system-centric era, dominated by mainframe computing and time-sharing systems, was shaped by strong economies of scale, often captured by Grosch's Law. Computing power was expensive, centralized, and accessible primarily to large organizations. Automation anxiety in this period was closely linked to scale and concentration of power. Job Replacement fears were present but unevenly distributed, primarily affecting clerical and administrative roles. More prominent, however, were anxieties about loss of control and exclusion. Smaller organizations and individual workers experienced barrier anxiety, fearing permanent disadvantage due to limited access to computing resources. Centralized systems also generated anxiety about concentration, as decision-making power became embedded in large technical infrastructures controlled by specialists and senior management.

These anxieties foreshadow later concerns, Supply Chain Risk and Deskilling Effect. Control over systems, and therefore over work, was already shifting away from end users, establishing early patterns of dependence that persist across later eras.

5.2 PC-Centric Era: Speed, Skills, and Obsolescence Anxiety

The diffusion of personal computers and client–server architectures, driven by Moore's Law, fundamentally altered the locus of automation anxiety. Computing power became cheaper, more distributed, and more rapidly advancing. This shift reduced barrier anxiety but introduced acceleration anxiety.

Workers and organizations now face constant pressure to adapt to rapidly changing technologies. The Deskilling Effect became more pronounced as software standardized tasks and shortened skill lifecycles. Even highly skilled workers experienced anxiety about skills, driven by fears of obsolescence rather than immediate job loss. At the same time, productivity gains were uneven and often delayed, reinforcing Solow's Paradox and creating frustration when rapid technical progress failed to translate into visible organizational benefit. This era marks a transition in automation anxiety from concerns about access and scale to concerns about pace, adaptability, and the sustainability of human skills in an environment of continuous technological change.

5.3 Network-Centric Era: Connectivity, Lock-In, and Surveillance Anxiety

The rise of the internet, intranets, and global networks introduced a new organizing logic based on connectivity, often explained through Metcalfe's Law. As network effects intensified, automation anxiety increasingly reflected concerns about dependency and exposure. Job Replacement anxieties persisted but were now accompanied by fears of lock-in, monopoly power, and reduced exit options as platforms and standards became dominant.

Supply Chain Risk intensified as organizations relied on interconnected infrastructures beyond their direct control. At the same time, Data Vulnerability became increasingly salient. Connectivity enabled new forms of value creation but also expanded surveillance, data capture, and privacy risk. Social anxiety also emerged as participation in networks became increasingly compulsory rather than optional. Organizations and individuals feared exclusion if they failed to connect, reinforcing automation anxiety through social and competitive pressure rather than technical necessity.

5.4 Content and Cloud-Centric Era: Human Limits and Transformation Anxiety

The content and cloud-centric era, shaped by virtualization, software-as-a-service, and large-scale integration, exposed a growing tension between technological capability and organizational capacity for change. While technical transformation accelerated, human and institutional adaptation lagged, reflecting the Law of Transformation.

Automation anxiety in this era is dominated by change fatigue and identity anxiety. Continuous transformation initiatives strain organizational resources and undermine confidence in leadership and strategy. The Deskilling Effect re-emerges as systems abstract complexity from users, while Supply Chain Risk deepens as organizations relinquish control over core infrastructure to cloud providers. Solow's Paradox remains central: despite widespread digital transformation, productivity gains often appear ambiguous, delayed, or unevenly distributed.

This uncertainty amplifies skepticism and emotional resistance, reinforcing the perception that automation delivers disruption without proportionate reward.

5.5 Convergence and AI-Centric Era: Combinatorial Disruption and Existential Anxiety

The convergence and AI-centric era are characterized by the combination and interaction effects of SMAC and BRAIDA technologies – social media, mobile, analytics, cloud, blockchain, automation (robotic and cognitive), internet of things, digital fabrication, and augmented reality. These processes are driven by what we will call the Law of Combinatorial Innovation: the increasing combination of digital technologies in new ways will grow value exponentially. In this context, automation anxiety reaches new intensity, not because earlier anxieties disappear, but because they accumulate and interact at scale.

Job Replacement anxieties resurface with renewed force as AI systems extend automation into cognitive and creative domains. The Deskilling Effect is reframed as concern over human redundancy rather than task simplification. Supply Chain Risk extends to ecosystem dependencies, as organizations rely on opaque models, platforms, and data pipelines they do not fully control. Data Vulnerability intensifies as data becomes the primary input for AI systems, raising fears about misuse, bias, and accountability.

A distinctive feature of this era is intensified, even overwhelming anxiety. The explosion of possible technological combinations creates uncertainty about strategic direction, investment prioritization, and originality, for which there arise salving answers (for example, Hoffman and Beato, 2025). Selection anxiety emerges as organizations struggle to identify which innovations matter, while fear of missing out drives premature adoption. These dynamics reinforce Solow's Paradox, as experimentation proliferates faster than demonstrable value. Across all dimensions, anxiety is amplified by Sandman's outrage component of risk: media narratives, speculative futures, and existential framing often outpace empirical evidence, crystallizing broader automation anxiety into what is commonly labelled "AI anxiety."

5.6 Summary: Anxiety as a Cumulative Socio-Technical Phenomenon

Across five eras of computing, automation anxiety evolves from concerns about scale and access to anxieties about speed, dependency, human limits, and existential uncertainty. Rather than following a linear trajectory, anxieties persist, mutate, coalesce, and recombine as technologies accumulate and adoption scales. Each era reactivates familiar concerns in new configurations, reinforcing automation anxiety as a structural feature of digital transformation rather than a temporary reaction to specific technologies.

This longitudinal perspective underscores the value of the conceptual framework developed in this paper. By tracing how Job Replacement, Deskilling Effect, Supply Chain Risk, Data Vulnerability, and Solow's Paradox interact across eras, the framework provides a historically grounded lens for understanding why automation anxiety remains a defining socio-technical challenge in the contemporary AI-centric era.

6. CROSS-ERA DYNAMICS OF AUTOMATION ANXIETY

While Section 5 traced how automation anxiety manifests within successive eras of computing, several recurring dynamics cut across all five eras, shaping how anxiety is generated, amplified, and sustained over time. These dynamics reflect enduring socio-technical patterns rather than features of any single technology, helping to explain why automation anxiety persists and intensifies as digital technologies accumulate and converge (Moschella, 1997; Edgerton, 2008).

6.1 The Automation-Expectations-Anxiety Effect

Across all five eras of computing, automation anxiety is strongly shaped by the gap between expectations and realized outcomes. New digital technologies are repeatedly accompanied by optimistic claims regarding efficiency, productivity, and organizational transformation. When these expectations are unmet, delayed, or unevenly realized, anxiety intensifies rather than subsides (Solow, 1987; Brynjolfsson, 1993; Brynjolfsson et al., 2017). In early computing eras, expectations focused on economies of scale and centralized efficiency. In later eras, particularly the PC-centric and network-centric periods, rapid technological progress reinforced expectations of continuous improvement, even as organizations struggled to translate capability into sustained value (Markus and Tanis, 2000). This persistent misalignment contributes directly to Solow's Paradox, undermining confidence in automation initiatives and heightening skepticism toward subsequent waves of innovation. In the convergence and AI-centric era, this dynamic becomes more pronounced. Expectations escalate rapidly through media discourse, vendor narratives, and analyst reports, while empirical evidence of value creation lags (Brynjolfsson et al., 2017; Economist, 2016; McKinsey Global Institute, 2023b). As a result, automation anxiety increasingly reflects expectation failure, rather than demonstrable technological harm, reinforcing Sandman's (1993) outrage component of risk.

6.2 The Recurring Job Replacement Motif

Across computing eras, Job Replacement remains the most emotionally salient and publicly visible component of automation anxiety. From early mechanization to contemporary artificial intelligence, fears of labour displacement repeatedly resurface, even as the nature of work and technology evolves (Hobsbawm, 1952; Keynes, 1963; Frey and Osborne, 2017). Within the IS literature, job replacement anxieties are rarely treated in isolation. Instead, they are closely linked to organizational restructuring, process standardization, and shifts in skill requirements associated with digital systems (Markus, 1983; Lapointe and Rivard, 2005). Empirical studies consistently show that automation often reconfigures tasks rather than eliminating entire jobs, yet anxieties persist because employment security is experienced subjectively rather than statistically (Willcocks, 2020).

Viewed longitudinally, job replacement anxiety is best understood as a recurring motif rather than a singular outcome. Each era reframes displacement fears in new domains, clerical work, professional services, platform labour, and now cognitive and creative work, reinforcing automation anxiety as a cumulative phenomenon.

6.3 The Technology-Regulation Lag

A further cross-era dynamic shaping automation anxiety is the persistent lag between technological innovation and regulatory response. Across all five eras, governance frameworks struggle to keep pace with the speed, scale, and scope of digital change, contributing to uncertainty around accountability, responsibility, and acceptable use (Wiener, 2004; Currie and Galliers, 1999).

In earlier eras, regulatory concerns focused on organizational control and market concentration. In later eras, particularly the network-centric and AI-centric periods, this lag extends to data governance, algorithmic accountability, and ethical oversight (Bélanger and Crossler, 2011; Zuboff, 2019). As regulation emerges slowly and unevenly, stakeholders experience heightened Data Vulnerability and Supply Chain Risk, amplifying anxiety even in the absence of immediate harm. At the same time, regulatory intervention itself can intensify anxiety. Efforts to govern emerging technologies, such as AI-specific legislation, often raise fears of over-constraint, compliance burden, or competitive disadvantage, reinforcing perceptions that automation operates beyond stable institutional control (Atkinson and Moschella, 2024).

6.4 Fear of Missing Out and Competitive Pressure

Automation anxiety is also driven by Fear of Missing Out (FoMO), which intensifies as adoption scales and competitive narratives take hold. Across computing eras, organizations adopt technologies not only because of demonstrable need, but because competitors, partners, or industry leaders appear to be doing so (Moore, 1991).

In the convergence and AI-centric era, FoMO operates simultaneously at individual, organizational, and societal levels (Gupta and Sharma, 2021). Firms fear being left behind in platform ecosystems, while workers fear skills obsolescence and declining relevance (Collins et al., 2021; Raisch and Krakowski, 2021). This pressure often leads to premature adoption, reinforcing Supply Chain Risk when strategic decisions outpace organizational readiness (Lacity et al., 2010; Benlian et al., 2011). FoMO thus transforms automation anxiety from a response to demonstrable threat into a response to perceived inevitability, where non-adoption itself becomes a source of fear.

6.5 The "Unprecedented Digital Future" Narrative

Finally, automation anxiety is sustained by recurring narratives that frame each technological wave as unprecedented and disruptive beyond historical comparison. Within contemporary discourse, artificial intelligence is frequently portrayed as an existential rupture, amplifying uncertainty and emotional response (Kurzweil, 2008; Center for AI Safety, 2023). Historical analysis, however, suggests strong continuity in the anxieties associated with successive digital technologies (Edgerton, 2008; Moschella, 1997). Many fears surrounding AI echo earlier concerns about enterprise systems, outsourcing, and digital platforms. When these continuities are overlooked, automation is framed as uncontrollable and unknowable, intensifying anxiety by disconnecting present developments from historical experience (Atkinson and Moschella, 2024).

6.6 Synthesis: Automation Anxiety as a Cumulative Socio-Technical Phenomenon

Taken together, these cross-era dynamics reinforce the argument that automation anxiety is structural rather than episodic. Gaps between expectations and outcomes, recurring job replacement fears, regulatory lag, competitive pressure, and narratives of unprecedented change interact to amplify anxiety across eras. Each wave of computing layers new concerns onto existing ones, rather than resolving them. This synthesis strengthens the paper's central contribution. By integrating era-specific developments (Section 5) with cross-era dynamics (Section 6), the framework demonstrates why automation anxiety persists and intensifies in the contemporary AI-centric era, and why it should be understood as a defining socio-technical challenge for Information Systems research.

7. CONCLUSION

This paper interrogates the concept of automation anxiety in the IS field. In response to the persistent fragmentation of related concerns across disparate literature, automation anxiety has five core dimensions: Job Replacement, Deskilling Effect, Supply Chain Risk, Data Vulnerability, and Solow's Paradox. Two complementary integrative frameworks are presented: a web of automation anxiety and a longitudinal analysis across five eras of computing.

Section 5 demonstrates that automation anxiety is not tied to any single technology or historical moment. Instead, it evolves across successive eras of computing, each characterized by a dominant technological configuration and a distinct pattern of anxiety. Early system-centric computing foregrounds anxieties around scale, access, and concentration of power. The PC-centric era intensifies concerns about speed, skills, and obsolescence, while the network-centric era introduces anxieties related to connectivity, lock-in, and surveillance. The content and cloud-centric era expose the limits of organizational and human capacity for continuous transformation, reinforcing skepticism about the value of creating it. Finally, the convergence and AI-centric era reactivates and amplifies earlier anxieties, extending automation into cognitive and creative domains and intensifying concerns across all five dimensions simultaneously. Together, the eras show that automation anxiety accumulates rather than resets, as technologies persist, layer, and scale over time.

Building on this longitudinal analysis, Section 6 identifies a set of cross-era dynamics that explain why automation anxiety persists and intensifies despite technological maturation. These include the recurring gap between expectations and realized outcomes, which reinforces Solow's Paradox; the enduring emotional salience of Job Replacement as a symbolic focal point for broader fears; the persistent lag between technological innovation and regulatory response, which amplifies Supply Chain Risk and Data Vulnerability; competitive pressure and Fear of Missing Out, which drive premature adoption; and recurring narratives that frame each technological wave as unprecedented, disconnecting present developments from historical experience. These dynamics operate across all eras, shaping how anxiety is generated, amplified, and sustained.

Taken together, Sections 5 and 6 reinforce the core argument: automation anxiety is a cumulative socio-technical phenomenon, not a transient or technology-specific reaction. While contemporary discourse often frames anxiety around artificial intelligence as exceptional, the

analysis shows strong historical continuity in both the sources and structure of technological fear. What changes across eras is not the existence of anxiety, but its configuration, intensity, and the domains in which it is expressed.

The contributions of this paper are threefold. First, it offers a clear and integrative definition of automation anxiety that consolidates fragmented IS research into a coherent analytical construct. Second, it demonstrates how automation anxiety operates as a web of interacting dimensions rather than as isolated concerns. Third, by situating this web within a longitudinal perspective, the paper provides a historically grounded explanation for why automation anxiety persists and why it has crystallized so forcefully in the contemporary AI-centric era.

For policymakers and practitioners, the analysis carries several important implications. First, automation anxiety should not be treated as resistance to be managed away, nor as a temporary response to unfamiliar technology. Instead, it reflects structural and recurring concerns that emerge whenever digital technologies reshape work, skills, organizational boundaries, and expectations. Managers should therefore anticipate anxiety as an inherent feature of digital transformation rather than as an implementation failure.

Second, the findings suggest that expectation management is critical. Across eras, anxiety intensifies when promised productivity, efficiency, or strategic benefits fail to materialize clearly or evenly. Managers should be cautious about adopting overly optimistic narratives about automation and AI, and instead communicate more realistically about uncertainty, trade-offs, and time horizons for value creation. Doing so can reduce the outrage component of perceived risk even when technical hazards remain uncertain.

Third, the cumulative nature of automation anxiety highlights the importance of capability development and governance, rather than one-off interventions. Investment in skills, redesign of roles to mitigate deskilling trajectories, and careful management of dependencies on external digital supply chains can help moderate anxiety linked to Job Replacement, Deskilling Effect, and Supply Chain Risk. Similarly, strengthening data governance and accountability mechanisms can reduce perceptions of Data Vulnerability in increasingly complex digital ecosystems. Finally, many anxieties surrounding AI echo earlier concerns associated with enterprise systems, outsourcing, and digital platforms. A historically informed perspective can help organizations avoid framing each new technology as unprecedented and uncontrollable. By drawing on lessons from earlier eras of computing, managers can design more balanced, human-centered approaches to automation that acknowledge anxiety as a signal of misalignment rather than as an obstacle to progress.

REFERENCES

Acemoglu, D. and Restrepo, P., 2017. Robots and jobs: Evidence from US labor markets. *NBER working paper number 23285*, March.

Agogo, D. and Hess, T. J., 2018. How does tech make you feel? A review and examination of negative affective responses to technology use. *European Journal of Information Systems*, 27(5), pp.570–599.

Atkinson, R. and Moschella, D., 2024. *Technology, fears and Scapegoats: 40 myths about privacy, jobs, AI, and today's innovation economy*. Palgrave Macmillan, London.

Bélanger, F. and Crossler, R.E., 2011. Privacy in the Digital Age: A Review of Information Privacy Research in Information Systems. *MIS Quarterly*, 35(4), pp.1017–1042.

Benbya, H. et al. 2024. Navigating GAI Promises and Perils for Knowledge and Creative Work. *Journal of the Association for Information Systems*, 25(1), pp.23–36.

Bhorat, Z., 2023. Automation Anxiety. Carr Centre for Human Rights Policy. *Harvard Kennedy School*, Fall, Issue 2023-02.

Bostrom, R. P. and Heinen, J. S., 1977. MIS Problems and Failures: A Socio-Technical Perspective, Part II: The Application of Socio-Technical Theory. *MIS Quarterly*, 1(4), pp.11–28.

Braverman, H., 1974. *Labour and Monopoly Capital*. Monthly Review Press, New York.

Brynjolfsson, E., 1993. The Productivity Paradox of Information Technology. *Communications of the ACM*, 36(12), pp.67–77.

Brynjolfsson, E. et al., 2017. *Artificial Intelligence and the Modern Productivity Paradox: A Clash of Expectations and Statistics*. Working Paper Series.

Center For AI Safety. (2023). *Statement On AI Risk*. https://www.safe.ai/statement-on-ai-risk, accessed April 12th, 2025.

Coase, R. H., 1960. The Problem of Social Cost. *Journal of Law and Economics*, 3(1), pp.1–44.

Collins, C. et al., 2021. Artificial intelligence in information systems research: A systematic literature review and research agenda. *International Journal of Information Management*, 60.

Currie, W. L. and Galliers, R. D., 1999. *Re-thinking Management Information Systems*. Oxford University Press.

Currie, W. L., Seddon, J., and Willcocks, L. P., 2026. Beyond Job Loss: Mapping Automation Anxiety Across Five Eras of Computing. *Proceedings of the 19th IADIS International Conference*. Zagreb, Croatia.

Currie, W.L. and Willcocks, L.P., 1998. Analysing four types of IT sourcing decisions in the context of scale, client/supplier interdependency and risk mitigation. Information Systems Journal, 8(2), pp.119–143.

Economist, The (2016). *Automation Anxiety*: Special Report, June 25th. Available at: https://www.economist.com/special-report/2016/06/23/automation-and-anxiety.

Ford, M.R., 2009. *The Lights in the Tunnel: Automation, Accelerating Technology and the Economy of the Future*. Acculant Publishing.

Ford, M., 2015. *Rise of the Robots: Technology and the Threat of a Jobless Future*. New York: Basic Books.

Galliers, R. and Currie, W., 2011. *The Oxford Handbook of Management Information Systems*. Oxford University Press, Oxford.

Gupta, M. and Sharma, A., 2021. Fear of missing out: A brief overview of origin, theoretical underpinnings and relationship with mental health. *World Journal of Clinical Cases*, 9(19), pp.4881–4889.

Hobsbawm, E. J., 1952. The Machine Breakers. *Past and Present*, 1(1), pp.57–70.

Hoffman, P. and Beato, G., 2025. *Superagency: What could go right about our AI future?* Authors Equity, USA.

Keynes, J. M., 1963. Economic Possibilities for our Grandchildren. In: *Essays in Persuasion*. New York: W.W. Norton & Co, pp.358–373.

Lapointe, L. and Rivard, S., 2005. A Multilevel Model of Resistance to Information Technology Implementation. *MIS Quarterly*, 29(3), pp.461–491.

MHL-Gadagne, 2023. *The Canut Revolts*. Available at: https://www.gadagne-lyon.fr/sites/gadagne/files/medias/documents/2020-12/MHL-Gadagne_ThemedSheet_19th-TheCanutRevolts.pdf

Mathiassen, L. and Sorensen, C., 2008. Towards a Theory of Organizational Information Services. *Journal of Information Technology*, 23(4), pp.313–329.

Mayor, A., 2018. *Gods And Robots: Myths, Machines and Ancient Dreams of Technology*. Princeton Press, Stanford.

McKinsey Digital, 2023a. *Technology Trends Outlook 2023*. Available at: https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/mckinsey%20technology%20trends%20outlook%202023/mckinsey-technology-trends-outlook-2023-v5.pdf.

McKinsey Global Institute, 2023b. *Generative AI and the Future of Work in America*. Available at: https://www.mckinsey.com/~/media/mckinsey/mckinsey%20global%20institute/our%20research/generative%20ai%20and%20the%20future%20of%20work%20in%20america/generative-ai-and-the-future-of-work-in-america-vf1.pdf?shouldIndex=false.

Mikalef, P. et al., 2022. Thinking responsibly about responsible AI and 'the dark side' of AI. *European Journal of Information Systems*, 31(3), pp.257–268.

Mills, M., 2021. *The Cloud Revolution: How the convergence of new technologies will unleash the next economic boom and a roaring 2020s*. Encounter Books, New York.

Moschella, D. C., 1997. *Waves of Power: Dynamics of Global Technology Leadership*, 1964–2010. New York: AMACOM.

Mumford, E., 2006. The story of socio-technical design: reflections on its successes, failures and potential. *Information Systems Journal*, 16, pp.317–342.

OECD, 2023. *How AI Might Change our Jobs and what we can do about* it. Available at: https://www.oecd-forum.org/posts/will-ai-take-my-job-away

Raisch, S. and Krakowski, S., 2021. Artificial Intelligence and Management: The Automation-Augmentation Paradox. *Academy of Management Review*, 46, pp.192–210.

Sandman, P. M. 1993. *Responding to Community Outrage: Strategies for Effective Risk Communication*. American Industrial Hygiene Association.

Solow, R., 1987. *We'd better watch out*. New York Times Book Review, 12 July, p.36.

Tavory, I. and Timmermans, S., 2014. *Abductive Analysis: Theorizing Qualitative Research*. Chicago: University of Chicago Press.

Willcocks, L., 2020. Robo-Apocalypse cancelled? Reframing the automation and future of work debate. *Journal of Information Technology*. DOI: 10.1177/0268396220925830.

World Bank, 2019. World Development Report 2019: *The Changing Nature of Work*. Washington, DC: World Bank. Available at: https://www.worldbank.org/en/publication/wdr2019

Zuboff, S., 2019. *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. New York: Public Affairs.