Algorithmic Management: Its Implications for Information Systems Research

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Abstract:

In recent years, the topic of algorithmic management has received increasing attention in information systems (IS) research and beyond. As both emerging platform businesses and established companies rely on artificial intelligence and sophisticated software to automate tasks previously done by managers, important organizational, social, and ethical questions emerge. However, a cross-disciplinary approach to algorithmic management that brings together IS perspectives with other (sub-)disciplines such as macro- and micro-organizational behavior, business ethics, and digital sociology is missing, despite its usefulness for IS research. This article engages in cross-disciplinary agenda setting through an in-depth report of a professional development workshop (PDW) entitled "Algorithmic Management: Toward a Cross-Disciplinary Research Agenda" delivered at the 2021 *Academy of Management Annual Meeting*. Three leading experts (Mareike Möhlmann, Lindsey Cameron, and Laura Lamers) on the topic provide their insights on the current status of algorithmic management research, how their work contributes to this area, where the field is heading in the future, and what important questions should be answered going forward. These accounts are followed up by insights from the breakout group discussions at the PDW that provided further input. Overall, the experts and workshop participants highlighted that future research should examine both the desirable and undesirable outcomes of algorithmic management and should not shy away from posing ethical and normative questions.

Keywords: Algorithmic Management, Artificial Intelligence, Digitalization, Automation, Ethics.

1   Introduction

New advances in digital technologies and the rise of artificial intelligence (AI) are transforming how organizations manage their workforce (Berente et al., 2021; Van den Broek et al., 2021). For example, the ride-hailing platform Uber has been successful in efficiently scaling its business by managing millions of remote drivers with an app. Uber collects vast amounts of data, such as drivers' behavior, ratings, and the current traffic situation. This data is then used to "improve learning algorithms that carry out learning and control functions traditionally performed by managers", such as assigning drivers to more jobs or banning them from the platform (Möhlmann et al., 2021, p. 2001).

Through a technique called algorithmic management, these approaches can be understood as systems of control that rely on machine-readable data and software algorithms that largely automate organizational decision-making in areas such as staffing, performance appraisal, compensation, and workforce planning (Duggan et al., 2020; Leicht-Deobald et al., 2019, Möhlmann et al., 2023). Thus, algorithmic management describes how managerial activities that are traditionally performed by a human manager are taken over by a software algorithm. Typically, algorithmic management has been studied in the context of the gig economy and platform work and often from an IS (Möhlmann et al., 2021, Wiener et al., 2021), human-computer interaction (HCI) (Lee et al., 2015), organizational behavior (Cameron 2022) or sociological perspective (Veen et al., 2020; Wood et al., 2019), with ride-hailing platforms such as Uber and Lyft as the key contexts. These studies show how algorithmic management operates through specific practices such as automated matching of workers and consumers, incentives, and nudging (e.g., in the form of surge pricing), and performance management through customer ratings and suspension (e.g., if the average rating does not meet a certain threshold) (Möhlmann et al., 2021).

Although these different perspectives offer important insights, there is a disconnect between literature examining algorithmic management in in online labor platform contexts and other research investigating algorithms and AI in traditional employment contexts (Meijerink et al., 2021) and these different literatures only limitedly relate to each other (Meijerink & Bondarouk, 2023). Amongst other reasons, this may be due to nuanced different understandings of the concepts of algorithms and AI and different research traditions in those fields. However, we see great potential in fostering interchange across these diverging research streams. For instance, as in platform work, similar issues of power, dignity, and control emerge in more traditional work settings when tasks are delegated to AI and algorithms (Jarrahi et al., 2021). Moreover, due to their need to manage large workforces in efficient ways, online labor platforms rely on prescriptive algorithms that automate work activities such as task allocation and scheduling (Veen et al., 2020). Such prescriptive algorithms are currently only used on a limited basis in traditional employment settings but could very well emerge in the near future. As such, organizational and IS researchers interested in AI in traditional work contexts could greatly benefit from the insights gained by those studying algorithmic management in platform contexts. On the other hand, online labor platform studies run the risk of overlooking the role played by human managers, provided that algorithmic management in such contexts afford the full automation of many work practices (Newlands, 2021). Here, insights from the traditional management and IS literature can be useful as they show the important role of human managers and domain experts in augmenting and being augmented by information technologies (Bondarouk et al., 2017; Marler & Boudreau, 2017; Van den Broek et al., 2021).

Our panel report draws on a professional development workshop (PDW) held at the Academy of Management (AOM) Annual Meeting in August 2021. The PDW was organized by authors 3-5 (Leicht-Deobald, Lutz, Meijerink) and involved four expert speakers from both streams of research on algorithmic management, three of whom constitute the remaining authors of this report (Cameron, Lamers, Möhlmann). The report integrates insights from this discussion and makes accessible the current state of the algorithmic management debate to IS scholars and researchers in adjacent fields. In the remainder of this paper, we briefly review the state of the literature in those different fields to set the stage. Then, the three expert speakers summarize their perspectives on a set of questions discussed in the PDW. Then, we review the insights from the subsequent group discussion with the participants. Finally, we integrate these insights and discuss their implications for IS research on algorithmic management as well as address algorithmic management more broadly.

1 Theoretical Background

Table 1 shows the discourses and developments related to algorithmic management in four core fields in which the conversation is taking place and in which the authors specialize: 1) information systems management, 2) management and organizational research, 3) philosophy and ethics, and 4) other fields including human-computer interaction, communication, and sociology. This table illustrates how the literature on algorithmic management is quite fragmented and comes with many different questions and research interests.

Table 1. Key Discourses in Different Disciplines

Discipline	Discourses and Developments
Information systems management	Key discourse 1: Unpacking the role of digital technologies and AI in algorithmic management Key discourse 2: Limited algorithmic transparency and opaque algorithms Key discourse 3: Algorithmic fairness and ethics of algorithmic management
Management and Organizational Research	Key discourse 1: How algorithmic management shapes organizational forms and control. Key discourse 2: How algorithmic management shapes organizational processes. Key discourse 3: Individuals' experiences with working under algorithmic management systems
Philosophy and Ethics	Key discourse 1: Conceptualizing and deepening the understanding of ethical values (i.e., autonomy, bias, dignity, equity, fairness, integrity, privacy) Key discourse 2: Evaluating the effects of algorithmic management on ethical issues such as dehumanization, instrumentalization, and datafication of work Key discourse 3: Development of frameworks and recommendations to develop algorithmic management systems ethically and responsibly in the future
Human-computer interactions, communication, and sociology	Key discourse 1: Looking at new forms of work and emerging practices, especially ride-hailing and food delivery (app-work) Key discourse 2: Power imbalances between workers and platforms Key discourse 3: Tight control of the labor process, with limited opportunities for recourse but grassroots solidarity and organizing

1.1 Literature in Information Systems

Information systems management research has naturally been more focused on unpacking the role of digital technologies in algorithmic management than its neighboring disciplines. Particularly, information systems management scholars are intrigued by how novel advances in AI change how humans interact with technologies (Kane et al., 2021; Van den Broek et al., 2021). IS research has been concerned with unpacking the unique properties of AI, which are crucial to understand regarding algorithmic management for several reasons (Möhlmann, 2021). First, so-called learning algorithms are subject to constant updates and reconstructions based on the user data fed into them, resulting in a deeper learning capacity. Second, due to advances in AI, information systems can now act on their own and exhibit agency. Third, AI entities are often perceived as being more inscrutable, often making them difficult for humans to understand (Berente et al., 2021). These unique properties of AI could result in algorithmic management being detrimental to worker's satisfaction and wellbeing (Giermindl et al., 2021; Jarrahi et al., 2021), for example given that complex AI algorithms exhibit limited transparency and are perceived as highly opaque (Gal et al., 2020, Marabelli et al., 2021, Möhlmann et al., 2023, Tarafdar et al., 2022). Unpredictable AI agency and limited transparency also raise questions about the fairness of algorithmic constructions; thus, information systems management scholars have been particularly concerned about how to design algorithmic management more ethically (Tarafdar et al., 2022).

1.2 Literature in Management and Organizational Sciences

Algorithmic management is a burgeoning area of research in the management and organizational research, as scholars have called for more research into how emerging technologies are changing organizations, organizing, and workers' experiences (Barley et al., 2017; Schildt, 2020). This interest in algorithmic management is demonstrated in a recent special issue in *Organization Science* that emphasized the importance of algorithms for almost any traditional subject in the management science (Bailey et al., 2022).

At the most macro level, one line of research has examined how the rise of algorithmic management can give rise to new organizational forms that externalize key functions of the firm (Davis, 2022; Aneesh, 2009; Schor, 2021). A prominent theme of research in this area is how algorithmic management shapes organizational control, the most fundamental problem in management. Viewing algorithmic technologies as more "encompassing, instantaneous, interactive, and opaque" than previous forms of control (Kellog et. al, 2020, p. 1), research has explored how organizations can use algorithmic management to extend their control over workers to create an "invisible cage" (Rahman, 2021) by taking advantage of information asymmetries, fine-grained measurements, and extensive surveillance (Allen & Choudhury, 2022; Curchod et al., 2019; Vallas et al., 2022). Moreover, Raisch and Krakowski (2020) engage with the divergence between AI automation and augmentation, showing how the two are not mutually exclusive but intricately interwoven in organizational settings. At the meso level, another line of research examines how algorithmic management shapes organizational processes such as coordination (Valentine et al., 2017; Shestakofsky, 2018), evaluations (Orlikowski & Scott, 2014), accountability, (Karunakaran et al., 2022), and conflict resolution (Rahman & Valentine, 2021). Relatedly, scholars have examined how algorithms shape professions, changing the ways professionals update and deploy their expertise (Lebovitz et al., 2022; Pachidi et al., 2021) and can cause occupations to morph (Lee, 2022) or become invisible (Gray & Suri, 2019).

At the micro level (organizational behavior) scholars have explored how these workers, who are typically independent contractors or freelancers, experience and behave under algorithmic management systems. A common theme across this research is that these workers are often "left to their own devices" (Ticona, 2022) to create their own ways to fight back (Cameron & Rahman, 2022; Maffie, 2022; Shapiro, 2018), find meaning (Petrigerleri et al., 2019; Cameron, 2022; Connelly et al., 2021; Kameswaram et al., 2018), and navigate the economic and physical challenges inherent in such precarious work (Caza et al., 2021; Cameron et al., 2021; Ravenelle, 2019) in an increasingly opaque and unfamiliar terrain. A related line of research, at the intersection of psychology and technology, examines how workers think about algorithms when embedded in the everyday decision making of their work, such as in forecasting, predicting, and evaluating performance (Dietvorst et al., 2018, 2020; Jago, 2019; Logg et al., 2019; Raveendhran & Fast, 2021). Taken together, these multiple perspectives have provided a fuller account of how algorithmic management has influenced organizations and organizing.

1.3   Literature in Philosophy and Ethics

In the fields of philosophy of technology and ethics, algorithmic management has not remained unnoticed as a research topic. Increasingly the philosophical and ethical implications of the use of algorithmic software for HRM purposes are scrutinized, against the background of broader studies into the ethics of AI and of information technologies. Although the considerations of the ethical implications of algorithmic management are not exclusive to the literature on philosophy and ethics, notable are the efforts to conceptualize and deepen the understanding of the ethical issues in algorithmic management concerning human rights issues in terms of bias, fairness, and privacy (Oravec, 2022). The literature also considers potential harm to human rights, among which are the right to work, equality, and discrimination (Yam & Skorburg, 2022). Furthermore, scholars emphasize the topics of autonomy (Meijerink & Bondarouk, 2023), bias (Raghavan et al., 2020), dignity (Bankins et al., 2022; Lamers et al., 2022), discrimination (Sánchez-Monedero et al., 2020), equity and bias (Bogen & Rieke, 2018), and personal integrity (Leicht-Deobald et al., 2019). This list of values is by no means exhaustive but reflects the broad range of ethical implications that algorithmic management brings. Also, the variety of ethical values discussed advances the understanding of the ethical challenges and opportunities that surround the use of algorithms in human resource management. Connected to this discourse are publications on the effects of AM on ethical issues such as the dehumanization, instrumentalization, and datafication of work(ers) (Fritts & Cabrera, 2022; Newlands, 2021). Importantly, philosophers and ethicists also develop conceptual frameworks and list practical recommendations that open new avenues to further research on the topic as well as responsible and inclusive design practices for algorithms and AI in the HRM domain (Bankins, 2022; Gal et al., 2020; Lamers et al., 2022; Varma et al., 2022).

1.4   Literature in Human-Computer Interaction, Communication, and Sociology

Beyond IS management, management and organizational research, and philosophy and ethics, other disciplines are interested in algorithmic management. In fact, the term *algorithmic management* itself emerged first in human-computer interaction and was coined by Lee et al., (2015) to describe "software algorithms that assume managerial functions and surrounding institutional devices that support algorithms

in practice" (p. 1603). These researchers' qualitative study of ride-hailing (Uber, Lyft) shows how algorithmic management occurs in the form of matching, surge pricing, and rating mechanisms and how drivers and passengers deal with such algorithmic management, for example by relying on tacit knowledge or implementing a strong service mindset. Researchers across the social sciences have drawn on this work and have started to investigate algorithmic management, especially as it relates to the platform economy and with more interest in localized app-work than remote crowd work (Duggan et al., 2020). Disciplines involved in this endeavor include sociology (Griesbach et al., 2019; Newlands, 2022; Wood et al., 2019), communication and media studies (Grohmann et al., 2022; Rosenblat & Stark, 2016; Sun, 2019), economic geography (Altenried, 2021; Iazzolino, 2021), law and policy (De Stefano & Taes, 2021), and tourism/hospitality (Cheng & Foley, 2019). Much of the work here relies on qualitative data and draws on workers' perspectives and practices, rather than the technology (developers) or the consumers. Labor process theory and adjacent Marxist approaches are frequently used as the theoretical basis (Gandini, 2019), stressing aspects of control and power. The literature is also interested in opportunities for resistance, for example through mutual solidarity and exchange in online communities (Jarrahi & Sutherland, 2019) or collective organizing (Tassinari & Maccarrone, 2020).

2   Insights from the Expert Speakers

Based on the review of the different literatures and their diverging perspectives, we asked the expert speakers to reflect on the three questions below to set the stage for the cross-disciplinary explorations. The idea behind those questions was to better understand those areas where the different literatures show convergence, but also to tease out the nuanced differences and identify the spots where those literatures depart.

Thus, we asked each of our expert speakers to reflect on the following questions from their respective disciplines (i.e., information systems, organizational behavior, and philosophy and ethics):

1. What are the most interesting questions and developments you see in the field of algorithmic management today?
2. How does your research tie into these developments?
3. In which direction do you see the field moving in the next few years?

2.1   Mareike Möhlmann, Bentley University, USA

2.1.1   What are the most interesting questions and developments you see in the field of algorithmic management today?

Early research on algorithmic management was inspired by the empirical context of online labor platforms. For example, Uber's subtle control of drivers is a widely used context to research algorithmic management, and much of my research has drawn extensively from the Uber case (Möhlmann et al., 2021, Möhlmann 2021, Möhlmann & Henfridsson, 2019). Yet, I believe that it may be beneficial to step back and reflect on algorithmic management as a broader concept – well applicable beyond digital platforms or even worker-related contexts. Given those algorithmic capabilities are on the rise in a variety of organizational settings and industries, such as health care, policing, and education, recent research has started to broaden its focus. Furthermore, it takes a more nuanced perspective by addressing both the benefits (e.g., efficiency, scalability) and challenges (e.g., algorithmic opacity, limited human interaction, fairness) of algorithmic management for a variety of stakeholders (e.g., businesses, workers, customers, regulators). Since datafication, AI, and computational systems will continue to transform businesses and societies, we urgently need more research on the different aspects of algorithmic management.

2.1.2   How does your research tie into these developments?

Together with my co-authors, I conducted several in-depth studies of algorithmic management adopted by Uber. For example, in a paper published in the *MIS Quarterly* in 2021, we define algorithmic management as "the large-scale collection and use of data on a platform to develop and improve learning algorithms that carry out coordination and control functions traditionally performed by managers" (Möhlmann et al., 2021, p. 2001). We present a grounded theory that captures the algorithmic management of work on online labor platforms such as Uber. We find that online labor platforms can use algorithms along two dimensions: matching and control. While previous research has devoted considerable attention to how respective platforms optimize matching and accommodate market needs (i.e., algorithmic matching), we

argue that platforms may also employ algorithms to monitor and tightly control platform work (i.e., algorithmic control). We develop a grounded theory that describes how platform workers experience tensions related to work execution, compensation, and belonging when working under algorithms. The emerging theory shows how these tensions trigger market-like (e.g., gaming) and organization-like response behaviors (e.g., loyalty) among platform workers.

In another paper published in the *Journal of the Association of Information Systems* (Möhlmann et al., 2023), I have also been studying algorithmic sensemaking. One specific type of tension experienced by platform workers who are managed by algorithms originate from the fact that algorithms are often perceived as highly opaque, which hinders the understanding of their underlying logic and thus triggers the desire to make sense of them. Together with my co-authors, I conducted an empirical study of the Uber context to theorize how platform workers make sense of the algorithms managing them. Drawing on Weick's enactment theory, we theorize a new form of sensemaking, which we label as algorithm sensemaking, and theorize its sub-elements, focused enactment, selection modes, and retention sources. Our findings suggest that the multi-step process of algorithm sensemaking allows workers to keep up with algorithmic instructions. We extend the previous literature on algorithmic management by theorizing that algorithm sensemaking acts as a mediator, linking perceptions about tensions in the work environment with platform workers' behavioral responses.

My work has also focused on algorithmic nudging, which is a construct that falls under the umbrella term of algorithmic management. For example, in a piece in the *Harvard Business Review* published in 2021, I discuss Uber's approach to algorithmic nudging and how such practices can be designed more ethically. Platforms such as Uber are increasingly using algorithms to "manage and control individuals not by force, but rather by nudging them into desirable behavior — in other words, learning from their personalized data and altering their choices in some subtle way" (Möhlmann 2021, p. 1). While this concept builds on the existing work about nudging by Cass Sunstein and Richard Thaler, due to recent developments in digital technologies and AI, algorithmic nudging has the potential to be even more persuasive than its non-algorithmic counterpart. According to Möhlmann (2021, p. 1), "With so much data about workers' behavioral patterns at their fingertips, companies can now develop personalized strategies for changing individuals' decisions and behaviors at large scale. These algorithms can be adjusted in real-time, making the approach even more effective."

2.1.3   In which direction do you see the field moving in the next few years?

Related to my research in the field of IS management, I am particularly interested in the role of digital technologies, AI, and machine learning in algorithmic management. Tapping into the foundations of algorithms by zooming into the design of the actual technology (i.e., interplay of different algorithms and how they act in synergy) and how algorithmic designs trigger different behavioral responses (i.e., human and IS agent delegation on a granular level) is an important area for future research. Generally, I believe that interdisciplinary research collaborations, such as between IS management scholars and computer scientists/engineers, could be fruitful, and I hope to see more interdisciplinary research in the future.

I believe that we urgently need more research addressing the ethics of algorithmic management. For example, algorithmic management can only effectively be implemented once companies have access to vast amounts of fine-grained data about their users' past behavior and preferences. These companies should be transparent about the collection and storage of this data and explain the algorithms' logic (Möhlmann 2021). In many real-life cases (e.g., Uber), algorithmic management strategies could clearly serve the interests of the (platform) companies over those affected by these practices. We need research on how to design algorithmic management in a way that benefits not only the company, but also workers and society at large.

Given that algorithms become increasingly complex systems, future research must reflect on how to study the new reality in which management becomes interwoven with complex algorithmic technologies. I identify several key issues that scholars need to reflect on: What are the theoretical underpinnings that we have at our disposal to research the interrelationship between humans and algorithms in management? What data can be applied to investigate algorithmic management, and can we extend and combine more conventional sources of data to garner more insight into these systems? What kinds of methods can be used to analyze data about humans and algorithms working together? I encourage future researchers to reflect on these questions when developing novel approaches to investigate algorithmic management.

2.2   Lindsey Cameron, University of Pennsylvania, USA

2.2.1   What are the most interesting questions and developments you see in the field of algorithmic management today?

The implications from algorithmic management on both macro- and micro-organizational theories are tremendous. There are so many interesting questions to explore! One shift I've seen in the field is a pivot from the question, "Is algorithmic management actually a "thing"?, to "How is algorithmic management changing organizations and organizing?." This shift signals a consensus that algorithmic management is indeed reshaping how work is organized within organizations. How algorithmic management influences organizational control will continue to be a central area of inquiry, and I am excited to see the shift away from understanding algorithmic management as a blunt object of control, such as customer ratings as a determinant of whether workers maintain access to a given platform, to a more nuanced understanding of the mechanisms that undergird these management systems such as information asymmetry, opacity, and visibility. In particular, I am excited by the research that goes beyond the normative "good job/bad job" narrative to unpack the theoretical mechanisms undergirding algorithmic management and work. Yes, workers prize the schedule flexibility inherent in gig work which is largely supported by algorithmic management systems. However, there are deeper theoretical reasons on why workers continue to engage in this type of work beyond schedule flexibility. The individuals working under algorithmic management systems are often in incredibly precarious positions, due in large part to the construction of US labor laws written nearly a century before. But there are ways that both organizations and consumers can dampen some of this precarity.

Exciting new questions are arising at the intersection of occupations and algorithmic management. Occupations and professions will continue to change as a result of algorithmic management becoming embedded into day-to-day work, and I am excited for the events to come. Similar to the transfer from the horse and buggy to the automobile, some professions will become obsolete, and others will appear. Yet in even greater numbers than occupations appear, others will be radically altered in terms of how professionals coordinate activities, transfer knowledge, and make decisions. Consider for example how nearly every research article about algorithmic management ends with some – usually dire – prediction about the future. It's fun and a bit self-indulgent to predict a dystopian future in which humans are gone and everything is managed by algorithms. Yet we all know that the future is here, though perhaps not evenly distributed. Will algorithmic managers really replace human managers? A look inside warehouses and car assembly plants, some of the most automated workplaces in the world, suggests a more nuanced future with a reduction of line, but not staff, management. Algorithmic management is certainly an exciting area, and I looking forward to seeing how the field develops!

2.2.2   How does your research tie into these developments?

As an organizational scholar interested in both macro- and micro-organizational theories, I have conducted multiple studies surrounding algorithmic management in a variety of digital platform companies. In a comparative ethnography of two digital labor platforms with Hatim Rahim in *Organization Science*, we examine how algorithmic management extends the service encounter to include the period both before and the execution of the work task (Cameron & Rahman, 2022). Because of the extended service encounter, workers now have more opportunities to deploy resistance even though the latitude for deploying decreases with each temporal stage of work.

In another paper in *Organization Science*, I examine how workers stay engaged in a work setting that has none of the traditional organizational scaffolds that foster meaning-making (e.g., socialization; Cameron, 2022). Through interactions with touchpoints — in this context, the customer and the app — individuals turn their work into games they find meaningful and can control and "win." In the relational game, workers craft positive customer service encounters, offering gifts and extra services, in the pursuit of high customer ratings which they track through the app's rating system. In the efficiency game, workers set boundaries with customers in the pursuit of maximizing money for the time spent driving, and they create their own tracking tools outside the app. While each game resulted in engagement, as workers were trying to "win," the games were associated with two divergent stances or relationships towards the work, amicable or adversarial, with contrasting implications for retention.

Other research has focused squarely on how workers on digital platforms navigate their work lives. In a *Journal of Applied Psychology* article, I examine how TaskRabbit workers navigate ideal worker expectations — including how they interact with the digital platform, the algorithms, and the customers —

while they navigate the inherent risk of the COVID-19 pandemic (Cameron et al., 2021). In an Organizational Behavior and Human Decision Process article, I explore how workers on digital platforms, namely shoppers on the Instacart platform, react to the sudden moralization of their occupation, by being labeled as heroes during the pandemic (Cameron et al., 2022). My in-progress research builds on many of these themes. For example, in a series of papers with Bobbi Thomason and Nick Occhiuto, I explore how algorithmic management changes across countries and impacts workers' experience. And in a work with Kalie Wertz and Hatim Rahman, I investigate worker activism in response to algorithmic management. Taken together, I feel that these approaches are all important for understanding how algorithmic management shapes organizations, organizing, and worker experience.

2.2.3   In which direction do you see the field moving in the next few years?

I expect the organizational literature will continue to pursue work about the relationship between algorithmic management and control. It is an important topic with far-reaching implications. At the same time, as algorithmic management becomes more embedded into the process, I expect that research will start to explore adjacent areas that algorithmic management may directly or indirectly affect, such as autonomy, resistance, collective organizing, teaming, and voice.

To date, researchers on algorithmic management have deployed primarily qualitative methods (e.g., interviews, observations, forum data) all of which allow for an in-situ understanding of the lived experience of algorithmic management. I am a fan of this approach, since I am always a bit skeptical of research that claims we need the source code itself to understand the "black box" of algorithmic management. Technology exists in a social world, and workers don't experience the algorithm as a black box; they make inferences, test theories, and tell stories about their experiences with the algorithm and respond in ways that align with their perspectives. However, I believe that quantitative approaches, especially experience sampling, longitudinal surveys, and field surveys, can also allow for similar in-depth worker accounts. As algorithmic management becomes more firmly embedded in work and quantitative data becomes available, I imagine scholars will use these other data collection approaches.

2.3   Laura Lamers, University of Twente, Netherlands

2.3.1   What are the most interesting questions and developments you see in the field of algorithmic management today?

The use of algorithmic management systems is most frequently discussed in the platform economy context, in which digital labor platforms such as Fiverr, Deliveroo, and Upwork found highly efficient ways to coordinate large workforces. A first noteworthy development in the algorithmic management research field is a spread from studies on algorithmic management in the platform economy to algorithmic management in the more traditional work setting (e.g., Jarrahi et al., 2021). Also interesting is the emphasis that many researchers place on the perceptions and actions of employees/workers under algorithmic management systems (e.g., Bucher et al., 2021; Meijerink & Bondarouk, 2023). This emphasis on the way workers interact with algorithmic management practices not only reflects how deeply the working life can be impacted by automation through algorithmic management but also recognizes how workers, through their behavior, (re)shape algorithmic management practices. This idea corresponds well with the interesting rise in sociotechnical accounts (e.g., Bucher et al., 2021; Jarrahi et al., 2021) used in algorithmic management studies that acknowledge both technological and social factors in algorithmic management.

Also important is the emerging interest in algorithmic management in the field of philosophy. In particular, the growing attention for HR software algorithms in the field of ethics of technology is worth sharing. Recently, scholars like Fritts and Cabrera (2021), Yam and Skorburg (2021), and Bankins (2021) have shared normative work on the ethical use of algorithms and AI for HR management practices. Interestingly, this attention among philosophers emerged along the lines of the growing interest in intrinsic or normative values in algorithmic management research, such as well-being (e.g., Lee et al., 2015), fairness (e.g., Köchling & Wehner, 2020) and autonomy (Meijerink & Bondarouk, 2023). The shared interest between philosophers and social scientists on the use of algorithmic management systems and their impact on intrinsic values is, to me, a fruitful setting in which to start discussions on value-based algorithmic management or human-centered algorithmic management.

2.3.2   How does your research tie into these developments?

In our research, we study the use of algorithmic management systems with an interdisciplinary approach, combining philosophy with HR management research. Specifically, our aim is to study and evaluate the impact of algorithmic management systems on the intrinsic value of worker dignity. Using a framework based on the Capabilities Approach, in an *Ethics and Information Technology* paper, we conceptualized worker dignity in the context of algorithmic management systems to study automated management practices with a focus on the impact on workers subject to these systems (Lamers et al., 2022). With ethnographic accounts, we aim to study how worker dignity can both be enabled and restrained in working under algorithmic management. This means our research ties into and contributes to developments in algorithmic management research in two ways. First, by building on recent studies using intrinsic worth and values in algorithmic management research, we contribute to the HR literature in which the value of dignity is rarely used. Second, through our empirical and ethnographic approach, we contribute to the philosophical debate on the ethics of algorithmic management, which is mainly theoretical and normative. Ultimately, we aim to develop knowledge on how worker dignity is shaped under algorithmic management and thereby seek opportunities to build and implement algorithmic management systems in a way that enhances the development of worker dignity.

2.3.3   In which direction do you see the field moving in the next few years?

One important task for future research is deepening our understanding of human-technology relations in the context of algorithmic management. For example, one could approach algorithmic management and machine learning as human-technology partnerships or human-technology configurations or interactions. Hereby, scholars build forth on recent sociotechnical accounts (Jarrahi et al., 2021; Bucher et al., 2021) or work on human-AI interaction or the duality of algorithmic management in terms of (re-) shaping effects of human-algorithmic management system interactions (Meijerink & Bondarouk, 2023). Here, fruitful collaborations could be established between philosophers in the field of human-technology relations and information system management researchers. In terms of methodologies, a stronger focus on digital, virtual, and online ethnographies (e.g., netnography) can be expected. Especially given the character of (online) platform work; the growing availability of digital data, materials, and tools; the shift towards working from home; and more generally the current COVID-19 restrictions such as social distancing, a stronger focus on collecting data online and virtually can be expected. While philosophical/ethical papers show increasing focus on specific managerial practices within the topic of AM (i.e., Fritts & Cabrera (2022) focusing on recruitment), bridging the knowledge on management, ethics, and IS further would be valuable. For example, identifying and balancing the managerial and technical principles necessary to make AM work would be an essential addition to the impressive list of ethical principles for algorithms at work.

3   Insights from the Group Discussions

In addition to gauging insights from the presenters, three of whom are featured above, a goal of the PDW was to give a voice to participants across (sub-)disciplines and career stages to contribute aspects and points that might otherwise not have been captured. At the PDW, this was facilitated through group discussions that allowed for in-depth interaction.

In the group discussions, the PDW participants were randomly assigned into Zoom break-out groups. Each break-out group had at least one of the PDW organizers or presenters as a moderator and consisted of five to six people (including the moderators), making a total of five break-out groups. The PDW organizers had prepared a set of guiding questions for the break-out group discussions (see Appendix) but tried to facilitate a natural flow within the conversations in the break-out group to allow for emerging themes and opinions. The questions in the interview guideline were used to stimulate and structure the interactions. The group discussions started with a short introduction round and then moved on to a conversation about algorithmic management, aiming at identifying open questions, future research directions, and disciplinary synergies. Table 2 provides an overview of key discussion points that emerged across groups.

Table 2. Insights from the Group Discussions on Algorithmic Management

Topic	Insights
How do you — or would you — go about studying algorithmic management in terms of *methods*?	Text mining and methods that rely on the existing (large) corpora of text data, for example from Twitter, online discussion boards, and media coverage, can be a suitable approach; in that regard, the challenge can be to obtain the data. Focus groups are a good method to study collective sensemaking, going beyond individualized voices and perspectives. In order to fully grasp algorithmic management, it is crucial to collect data on the platform, or organizational level. Only by engaging with those who are responsible for algorithmic management can one fully understand it. Getting access to platforms is a challenge; with some more public-facing and open platforms (e.g., Amazon's Mechanical Turk), it is less of a problem to scrape data, but for other platforms, such as Uber, getting the data is challenging and normally requires collaboration with the platform itself. Some economists have received premium access to Uber data, but then the question of research integrity and independence emerges. Participant research (e.g., researcher being an Uber driver themselves) is valuable and helps widen perspectives and see the situation of workers on the ground. A difficult aspect of this, however, is that the situation and design of platforms in each market can change quickly, and by the time a paper is published, the lived experiences by the researcher might not reflect the situation anymore.
How do you — or would you — go about studying algorithmic management in terms of *theories*?	From a HR perspective, *incentive systems* and incentives are a good way of theorizing and thinking about algorithmic management; which incentives and rewards are embedded into algorithmic systems? A *socio-materiality perspective* will help to shed light on the entanglement of the social and material. Another angle that could be fruitful is *explainability/transparency*; this goes in the direction of opacity: to whom are algorithms understandable? Perhaps not even the developers and organizations implementing them fully understand them. Platform churn, also among platform employees, makes tracing platforms from a *historical perspective* challenging, but adopting such a historical lens allows to put algorithmic management into perspective. *Agency and management* perspectives offer another fruitful venue: Who manages? Platform owners? Workers and worker collectives? Developers? The perspective that "The algorithm is the boss" is problematic; there is always someone behind the algorithm(s). Some participants proposed to focus less on new theories but instead on an empirical investigation of the hidden layers and aspects related to algorithmic management.
Which *contexts* are particularly interesting?	Current research largely addressed the platform perspective; however, algorithmic management may also be relevant in non-platform, more traditional organizational settings. While algorithmic management has received focus in the context of work, it may be relevant beyond work contexts (think about interactions in online environments more generally). Big tech (e.g., Amazon, Google): Google Maven project (a planned Google AI project with the US Department of Defense) was mentioned as an example of how big tech companies are increasingly facing ethical questions and pressures, also from within. An important direction is to pull away from platforms as the locus of algorithmic management and look toward more fine-grained managerial processes within organizations. Instead of looking at "the algorithm" or "one algorithm," an assemblages perspective (multiple algorithms, systems) could be more fruitful.
Where do you see opportunities for *interdisciplinary research* (beyond IS research)?	In order to unpack the technology behind algorithmic management, one fruitful direction could be collaborations between management researchers and computer scientists or engineers. Algorithmic management is an interdisciplinary topic, thus, collaborations with HR, sociology, or management scholars seem promising.

4 Conclusion: Key Takeaways for Information Systems Research

The insights from the expert speakers, together with the insights from the group discussions, helped us approach the topic of algorithmic management from a cross-disciplinary perspective. In the remainder of the article, we offer a synthesis in the form of a forward-looking research agenda, first more generally, then specifically for the discipline of IS.

In terms of the theoretical perspective, the experts of our panel and members of the breakout session expressed the expectation that the field will continue to study aspects related to organizational control, one of the most fundamental topics of organizational scholarship (Kellogg et al., 2020, Wiener et al., 2021), but also will start to explore more adjacent areas scrutinizing how algorithmic management may influence workers' autonomy, resistance, and voice (Gal et al., 2020, Meijerink & Bondarouk, 2023, Möhlmann et al., 2022, Tarafdar et al., 2022). Here, the workshop participants stressed the need to examine both the desirable and undesirable outcomes of algorithmic management to workers and go beyond the deterministic assumptions on the effects of algorithmic management. Furthermore, experts and participants highlighted that it could be fruitful to further tap into the "black box" of algorithms (Benlian et al., 2022, Möhlmann et al., 2023) by zooming into the design of the actual code of those algorithms and examine how different algorithmic designs can trigger different behavioral responses. As such, our experts and participants saw great opportunities for research collaboration between information systems scholars, computer scientists, and user design experts to further explore the interaction between the actual code and the user or recipients of the code of algorithms. This aligns with the current call for broader study of AI (Bailey and Barley 2020, Berente et al., 2021, Raisch and Krakowski 2020). To realize these aims, we call for reflexivity (Alvesson et al., 2008) regarding the different paradigmatic assumptions that algorithmic management scholars (from different academic fields) draw on. Discussion and comparison of these assumptions, we believe, help to better understand and integrate insights from different fields of inquiry and drive novel research questions on the nature and outcomes of algorithmic management.

One common suggestion from the symposium was that future research on algorithmic management should not shy away from posing ethical and normative questions. Algorithmic management, in both the gig economy and traditional organizations raises important ethical questions (Möhlmann 2021) around intrinsic values, such as dignity (Lamers et al., 2022), the social valuation of work (Newlands, 2022), privacy/data protection (Ebert et al., 2021; Gal et al., 2020), transparency (Felzmann et al., 2019, 2020, Möhlmann et al., 2023), fairness and discrimination (Köchling & Wehner, 2020, Benlian et al., 2022), accountability (Jarrahi et al., 2020), and trust (Lee, 2018; Schafheitle et al., 2020). This situation offers a unique chance to reinvigorate normative questions regarding the role of intrinsic values in business and shift the focus from an exclusively efficiency-driven perspective on organizations and create space for normatively justifying the importance of alternative values, such as dignity, fairness, and accountability.

Furthermore, in terms of methods, throughout all contributions, the necessity of listening to those most affected by algorithmic management was emphasized. A human-centric approach that closely accounts for the perspectives of workers and managers interacting with complex algorithmic technologies on the ground is key to understanding the phenomenon (Gal et al., 2020, Möhlmann et al., 2023, Tarafdar et al., 2022, Wiener et al., 2021). Future research from an IS perspective may therefore continue to use qualitative methods such as ethnography and discourse analysis of online communities. Qualitative approaches are also suitable to study among those developing or implementing algorithmic management (e.g., platform firms in the gig economy, IT managers in established companies). While many examine algorithmic management from a worker perspective, we also see the need to adopt a managerial perspective. Specifically, in-depth, qualitative accounts of how managers respond to the introduction of algorithmic management and act on algorithm-based insights are key. At the same time, such methods face limitations including generalizability, access to key decision-makers (who are hard to recruit for qualitative research), and legal and competitive constraints (e.g., terms of service and non-disclosure agreements on the side of firms that provide algorithmic management tools). Therefore, quantitative approaches, such as experience sampling, longitudinal and field surveys, and big data methods, such as natural language processing of large corpora of data, also have their place in the arsenal of tools in the study of algorithmic management. Furthermore, creative computational and human-computer interaction approaches from other fields, for example the walkthrough method (Light et al., 2018), algorithm audits (Bandy et al., 2021), patent analysis (Delfanti & Frey, 2021), and digital ethnography (Pink et al., 2015), could be adopted to open the algorithmic black box and study algorithmic management from a socio-technical perspective (Möhlmann et al., 2023). Established organizational methods such as comparative

case studies (Fitzgerald & Dobson, 2009) and historical methods (Stutz & Sachs, 2018) merit attention for uncovering both the macro and micro aspects of algorithmic management.

The field of IS in specific could theorize on more immediate questions around a finer-grained operationalization of core facets of algorithmic management and examine how specific technological affordances of algorithms can establish and permit algorithmic management in different contexts (Benlian et al., 2022). In particular, IS scholars could further investigate important design features of algorithmic management, harvesting the strength of qualitative research methods and using case study methodologies (Rai, 2017). Overall, we see information systems research in an excellent position to further explore algorithmic management design and governance, thus providing directions for maximum beneficence and minimal harm of algorithmic management's implementation.

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Appendix: PDW Guideline for Breakout Group Moderators

Please be aware that the questions are guiding questions and are intended to act as a stimulus for discussion. You can be selective in answering them and add your own questions that emerge. The goal of the break-out groups is to foster an open conversation so that the participants get to know each other and see synergies in their research.

Please take notes in the break-out groups and elect at least one person to report back later in the plenary session. The elected person should give a (very) brief summary of the key discussion points:

- Based on the four presentations you just saw and your own research, what would you say are the key open questions to be answered for research on algorithmic management?

- How do you — or would you — go about studying algorithmic management in terms of theories? Which theories do you see as particularly fruitful?

- How do you — or would you — go about studying algorithmic management in terms of methods? Which methods do you see as particularly fruitful?

- Which contexts are you particularly interested in for studying algorithmic management? Why?

- How can we foster interdisciplinary collaboration in research on algorithmic management? Do you have any best practice experiences from your own research? If not, what are some desirable methods for interdisciplinary collaboration?

- How would you characterize the publication landscape on the topic of algorithmic management? Where do you see opportunities? Where do you see challenges?

- Specifically with regard to HR management, how do you think algorithmic management will change the field in the next five to ten years?

- How has the Covid-19 pandemic affected the application of algorithmic management in business and management in general and in HR management in particular?

If you run out of discussion material, you can also try to address the questions raised in the PDW proposal:

- Will we need managers in the future? What views can help us redefine management?

- What technologies and methodologies will help us better understand managerial issues?

- Will artificial intelligence render management obsolete due to situations in which there are contradictions too uncertain and/or too routinized to manage?

What new and old sources of power might emerge? What makes for an effective manager in a virtual/hybrid workforce?

About the Authors

First Name Last Name. After the references and the appendices, if there are any, come short biographical sketches of each author. The bios should be in normal text format, with a separate bio for each author. Put the author's name in bold at the start of the bio. Do not include titles such as "Dr." or "Professor". Italicize all journal titles in the biography. If referencing the *Communications of the Association for Information Systems,* spell out the entire name of the journal, just as in this sentence, rather than using the acronym for AIS. The maximum length of each biography should be approximately 150 words. Do not include email addresses.

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