Algorithmic Control in Platform and Traditional Work Settings: An Updated Conceptual Framework

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ALGORITHMIC CONTROL IN PLATFORM AND TRADITIONAL WORK SETTINGS: AN UPDATED CONCEPTUAL FRAMEWORK

Research Paper

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Abstract

Algorithmic control (AC) is an emerging phenomenon shaping the future of work. While AC is already well established in the platform economy, it is also gaining traction in traditional organizations. Given that AC represents a new phenomenon, it still suffers from a relatively immature conceptual basis. Here, an up-and-coming conceptual AC framework is the so-called "6R" framework by Kellogg et al. (2020). This framework, however, has not been conceptually and empirically validated yet, which is the focus of the study at hand. To validate the 6R framework, we use a combination of a literature review (top-down) and interviews (bottom-up). Our study sets forth to refine and extend the framework, resulting in an updated 5RSM framework of AC. The proposed framework represents an updated conceptualization of AC, applicable to both platform and traditional work settings, and lays the foundation for future research, including scale development.

Keywords: Algorithmic Control, Future of Work, Algorithmic Management, Control Forms.

1 Introduction

Algorithmic control (AC) is an emerging phenomenon that has been described as a vital ingredient of the future of work (Benlian et al., 2022). In prior literature, AC has been defined as "the managerial use of intelligent algorithms and advanced digital technology as a means to align worker behaviors with organizational objectives" (Wiener et al., 2021, p. 1). A key difference between AC and traditional forms of organizational role is that the enactment and delivery of controls is no longer performed by humans but by algorithms and related digital technology (e.g., smartphone apps), which means that the human controller is often no longer visible to controllees. In other words, while the use of technology, including algorithms, to *support* organizational control processes has long been common in many organizations, what is new about AC is that it essentially *automates* such processes (ibid). With that, it has been argued that AC is more encompassing, instantaneous, interactive, and opaque than traditional organizational control (Kellogg et al., 2020).

AC is already established and widely adopted in the platform economy (Benlian et al., 2022, Zhang et al., 2022). Companies like Uber could simply not function without relying on AC, given the sheer number of active drivers that are controlled via the Uber app, which steers driver behaviors and matches passengers with drivers. Most Uber drivers have little or no interaction with human managers or employees throughout the entire time they work for the company (Rosenblat and Stark, 2016). Besides its prevailing use in the platform economy, AC is also steadily making its way into more traditional organizations. For example, Amazon warehouses control their workers mainly via digital devices such

as tablets, scanners or wearable devices (Delfanti, 2021). While AC adoption in practice, especially in traditional organizations is still in its infancy, some expect that using algorithms and technology may become the 'new normal' in terms of how organizations manage and control the behaviors of their workforce (Scheiber, 2017, Benlian et al., 2022, Jarrahi et al., 2021, Bucher et al., 2020).

Given the novelty of the research area, it seems unsurprising that, to this point, there is still a relative paucity of conceptual AC frameworks. A promising one is the so-called "6R" framework by Kellogg et al. (2020), which distinguishes six forms of AC (recommending, restricting, recording, rating, replacing, and rewarding) along the basic control steps of directing, evaluating, and disciplining (Kellogg et al., 2020, Edwards, 1979). However, the 6R framework entails two decisive shortcomings. First, it has not yet been validated or operationalized. As Edwards (2010) noted, this is a typical pattern in organizational and management research. If many theories are built and published around a particular topic without testing or validating them and questioning their core propositions, all theories around the respective topic are at risk. Instead of constantly suggesting novel theories, Edwards (2010) suggests identifying existing theories on a particular topic, selecting the best one among those available, and then validating, refining, and extending it towards an updated and improved theory. Second, the 6R framework mainly focuses on the gig/platform economy and is therefore mainly applicable in such work contexts. Since AC is, as already mentioned, increasingly used in traditional organizations as well, an AC framework should be applicable to both platform and traditional organizations and respective work contexts.

Against this backdrop, the research objectives of our study are twofold. First, we set forth to conceptually and empirically validate the 6R framework proposed by Kellogg et al. (2020). Second, based on the insights gained, we aim to refine and extend this framework to derive an updated conceptual AC framework that applies to both platform and traditional organizations. Pursuing these objectives aims to address the above-described shortcomings of the 6R framework and will result in an updated framework that provides a common foundation for future research on AC. To achieve these objectives, we followed a top-down approach (via a systematic literature review) and a bottom-up approach (via an interview study). As a result, we present the 5RSM conceptual framework of AC, consisting of the AC forms of recommending, restricting, requiring, rating, rewarding, sanctioning, and monitoring. Our findings represent an updated conceptual framework for the phenomenon of AC. It both stands solidly on the grounds of (organizational) control theory and highlights the algorithmic features of AC. The framework applies to platform organizations, where AC is already applied extensively, but it can also be applied to traditional organizations that are just beginning to integrate AC into their control structures. Our framework helps to deepen the understanding of AC for practitioners and academics. For the former, a solid and comprehensive understanding of AC is essential to assess whether AC could be applied in their organization to steer their workforce and to guide the implementation of AC or specific AC sub-forms. Our framework lays the foundation for future investigations for the academic community, particularly for developing a scale to allow a quantitative assessment of the phenomenon, which extant research has called for. In addition, our framework will also support future research in investigating how the use of AC by organizations affects the respective workers regarding their perceptions of these novel control forms and the resulting worker reactions.

This paper is structured as follows: First, the conceptual foundations of AC are outlined, including a delineation of AC against traditional (human-based) control and an overview of existing AC frameworks is given. Next, we introduce the 6R framework by Kellogg et al. (2020) and describe our methodological approach. This is followed by the presentation of the results of validating the 6R framework, as well as the presentation of our updated AC framework. We conclude by discussing our study's theoretical and practical implications, limitations, and promising directions for future research.

2 Conceptual Foundations

2.1 Algorithmic control

Some researchers describe control as "management's most fundamental problem" (Cardinal et al., 2017, p. 559). AC was previously defined as "the managerial use of intelligent algorithms and advanced digital

technology as a means to align worker behaviors with organizational objectives" (Wiener et al., 2021, p. 1). This definition adopts a behavioral view toward control. Key to this view is the attempt to align an individual worker's behavior with organizational objectives. These attempts are commonly understood as *control* (Kirsch, 2004). Laurie Kirsch was among the first researchers to take the topic of organizational control into the domain of information systems (IS) research in the late '90s, describing digital technologies as the context in which organizational control took place (Kirsch, 1996, Kirsch, 1997). Since then, technological developments have had a tremendous impact on organizational control. Sophisticated algorithms, sensors, real-time data, cloud computing, and many more initially *supported* human managers controlling workers (Cram and Wiener, 2020). With the increasing sophistication of available algorithms and the increased use of digital devices like laptops, smartphones, tablets, wearables, and laser scanners by workers, technology, and algorithms gained agency themselves and control was no longer exclusively *supported by,* but *automated* with the help of algorithms (Cram and Wiener, 2020). Until today, technology has oftentimes only served as the context for organizational control research. With AC, this is no longer the case since technology becomes essential to the control processes itself.

2.2 Existing conceptual frameworks of algorithmic control

As noted above, while there is still a relative paucity of conceptual AC frameworks, existing literature already contains a few (initial) frameworks for AC, as well as for algorithmic management in general. Three prominent ones are the frameworks by Parent-Rocheleau and Parker (2022), Wiener et al. (2021), and Kellogg et al. (2020). In the following, we will briefly introduce each of these three frameworks and compare them with each other (see also Table 1).

Parent-Rocheleau and Parker (2022) conceptualize algorithmic management as a synthesis of "six key managerial functions and HRM activities" (Parent-Rocheleau and Parker, 2022, p. 3): *Monitoring, goal setting, performance management, scheduling, compensations,* and *job termination*. Their conceptualization is not based on (organizational) control theory, but instead on the theory of *work design* (Hackman and Oldham, 1976, Humphrey et al., 2007, Parker et al., 2017) and the job-demands resources model (Demerouti et al., 2001).

Wiener et al. (2021) conceptualize AC in the forms of *gatekeeping AC* and *guiding AC*. They build their framework on a stream of organizational control theory, in which control is categorized in different control *modes* (Choudhury and Sabherwal, 2003, Kirsch, 1997, Wiener et al., 2016). Wiener et al. (2021) develop their conceptualization of AC along the control modes *input control* (Jaworski, 1988) for gatekeeping AC and *behavior/output* (Kirsch, 1997) control for guiding AC and therefore present a solid foundation based on organizational control theory.

Kellogg et al. (2020) conceptualize AC as consisting of six AC forms: recommending, restricting, recording, rating, replacing, and rewarding. They based their AC conceptualization on the well-known description of control systems by Edwards (1979), consisting of the three control elements: direction, evaluation, and discipline. Therefore, the framework of Kellogg et al. (2020) builds solidly on the grounds of (organizational) control theory.

When comparing these three conceptual frameworks, it becomes apparent that the framework by Parent-Rocheleau and Parker (2022) is quite extensive; that is, besides aspects and elements of AC, it also includes aspects/elements that are clearly related to the broader sphere of algorithmic management (e.g., goal setting or scheduling). As well, building on the job-demands-resources model, its focus arguably deviates from the focus and purpose of our study (i.e., to develop an updated conceptual AC framework on). The framework by Wiener et al. (2021) solidly builds on control theory. However, it has a strong focus on the gig/platform economy and is thus not considered suitable for achieving the research objective of this paper to develop an AC framework that is applicable to both platform and traditional work contexts. Also, consisting of only two dimensions, their AC framework was considered too generic to serve as a basis for developing a comprehensive framework. Moreover, it seems that the rather generic nature of the Wiener et al. (2021) framework and the conceptual breadth of the Parent-Rocheleau and Parker (2022) framework contributed to the fact that these frameworks do not sufficiently emphasize

the critical characteristics and new affordances of AC. In contrast, the 6R framework by Kellogg et al. (2020) has a solid foundation on control theory, highlights the novel and unique characteristics of AC, and yields the potential to be expanded toward various work contexts. We therefore chose this framework as the basis for developing a refined and extended AC framework.

Reference	Kellogg et al. (2020): "6R framework"	Wiener et al. (2021)	Parent-Rocheleau & Parker (2020)
Focal concept	AC	AC	Algorithmic management (including AC)
Contextual focus	Mainly platform work contexts	Platform work contexts	Mainly traditional work contexts
AC dimensions/forms	Recommending, restricting, recording, rating, replacing, rewarding	Gatekeeping and guiding AC	Monitoring, goal setting, performance management, scheduling, compensations, job termination
Theoretical basis	Labor process theory (Edwards, 1979)	Organizational control theory (e.g.,Kirsch (1996), Ouchi (1979))	Job-demands resources (Demerouti et al., 2001)

Table 1.   Comparison of existing conceptual AC frameworks

3   Research Methodology

To address the research objectives of validating, refining, and extending the 6R framework of Kellogg et al. (2020), we conducted both a systematic literature review for a top-down perspective and interviews to add a bottom-up perspective. The top-down perspective aimed towards gaining a comprehensive overview of the status quo on AC in the scientific literature by identifying AC practices; that is, descriptions and reports of situations where organizations apply AC practices to control their workforce. To also consider potential novel AC practices that are not yet described in the literature, we added a bottom-up perspective in the form of interviews with workers and managers who have gained experience with AC in their everyday work life.

3.1   Top-down approach: Systematic literature review

To assess the status quo on AC in the literature, we performed a theoretical review following Paré et al. (2015), which aims towards developing "*a conceptual framework or model with a set of research propositions or hypotheses*" (Paré et al., 2015, p. 188) that is designed to tackle "*an emerging issue that would benefit from the development of new theoretical foundations*" (Paré et al., 2015, p. 188). This fits our research objectives, since AC represents an emerging phenomenon that would benefit from new findings.

Literature search: For the literature search, we applied the approach suggested by Webster and Watson (2002). For the first step, we defined the leading outlets for the topic under research. For this paper the selection included the AIS Basket of Eight Journals, the European Conference on Information Systems, the International Conference on Information Systems, the CHI Conference on Human Factors in Computing Systems, the Academy of Management Journal, Administrative Science Quarterly, Management Science, Organization Science, and the Academy of Management Annals. The search in the respective outlets was structured as follows: "algo* AND (management* OR control*)." As mentioned previously, the concepts of algorithmic management and AC are interconnected, so we included both terms in the search. Conceptual as well as empirical publications were included in our scope, though work-in-progress publications were excluded. Following the initial search in the leading outlets, we conducted a backward search. In this step, we searched the citations of the publications from the first step for relevant publications. The inclusion and exclusion criteria remained the same as in the

first step, supplemented by one further criterion: Only publications from scientific, peer-reviewed sources were included. The third step in the process included a forward search using Google Scholar to identify articles citing the articles identified in the previous steps.

A final search step was carried out to make sure that no pertinent publications were missed. We conducted a broad search using the scientific databases Web of Science, Scopus, and Business Source Complete, again relying on the above-mentioned inclusion and exclusion criteria and the search string from the first search step. The final literature sample consists of 66 publications of which 16 are conference proceedings and 50 are journal articles. The scientific disciplines of the respective outlets primarily included *information systems* and *management studies,* but further disciplines were present in the final sample as well such as *sociology* and *psychology*. The time span reaches from 2015 to this year of 2022, with 42 publications among the total of 66 having been published in years 2021 and 2022.

Literature analysis: To analyze the final literature sample, we used the coding tool MAXQDA. We combined a deductive (concept coding) and an inductive (open coding) coding technique to analyze the data (Saldaña, 2013). In this process, the framework of Kellogg et al. (2020) served as the guiding framework for the concept coding. When an AC practice was identified in the literature, it was analyzed in terms of whether it could be grouped into one of Kellogg et al.'s (2020) six AC forms. This corresponds to the first research objective of this paper: validating the 6R framework (Saldaña, 2013, Edwards, 2010). Whenever a scenario was identified in the literature, which could not be assigned to any of Kellogg et al.'s (2020) categories, we generated a code for this specific scenario (open coding). This step aimed towards identifying novel AC forms, not captured by the existing framework yet, which then served as the basis for refining and extending the 6R framework.

3.2   Bottom-up approach: Interviews with workers and managers

To gain a comprehensive view on AC, we conducted interviews to supplement the systematic literature review with an additional bottom-up perspective. The main goal was to capture AC practices that were not yet described in the literature, to extend the 6R framework with these additional AC practices, respectively the underlying AC forms.

Data collection: We recruited seventeen participants for our interview study. Potential participants were approached via a call for participation, which was posted to various online forums, Facebook groups and Telegram groups, which workers who gained experience with AC were likely to frequent (Rosenblat and Stark, 2016). These groups and forums were selected based on our findings from the literature regarding companies that already apply AC such as Uber, Lieferando, and Amazon. In addition, we also contacted the respective companies directly. The workers of our sample experienced AC either as employees with permanent employment contracts or as freelancers. The managers we interviewed worked for companies that apply AC to steer their workforce. The participants work for organizations such as the ride-hailing companies Uber and Lyft, food-delivery companies like Instacart, and multiple smaller crowd-working platforms, as well as more traditional organizations like logistics companies with permanently employed workers. Some worked for several companies simultaneously. Our final sample consists of nine participants from platform companies, of which five were workers and four were managers, as well as eight participants from more traditional organizations, of which six were workers and two were managers. The participants from more traditional organizations worked in warehouses or logistics companies, or as permanently employed couriers. The interviews were conducted via Zoom in a semi-structured form (Dresing and Pehl, 2018). Since it was of particular interest to unveil novel types of AC applications not described in the scientific literature, the interviews were held as open as possible. Participants were asked to describe a typical working day in their current job, with a focus on the interaction with digital devices they used in the context of their job. When potentially interesting aspects were mentioned, the participants were asked to describe those aspects in more detail, while paying attention to not make use of suggestive questions or statements and not to give confirming or disapproving answers or feedback to the participants during the interviews (Dresing and Pehl, 2018). The duration of the interviews was approximately 60 minutes.

Data analysis: The interviews were recorded, transcribed, and anonymized and then coded according to the same procedure described above for the literature sample. After both the literature sample and the interview transcripts were coded, we had established a total of 277 codes from 66 publications and 17 interviews. The codes were merged and aggregated, omitting duplicates and condensing the set of AC practices. This final set of AC practices was then matched against the 6R of Kellogg et al. (2020) to identify the aspects of the framework which can be confirmed and those which need to be refined and also what aspects of AC are not yet captured by the framework and therefore requires to be extended.

4   Results

In this section, we present the integrated results of our top-down and bottom-up approaches; that is, to validate, refine, and extend the 6R framework of AC by Kellogg et al. (2020), we drew on a combination of 'cases' (i.e., real-life applications of AC) described in prior literature (top-down) and the interviews we conducted (bottom-up). In this regard, to enable the reader to clearly distinguish between these two sources of data, all quotes taken from our interviews are marked with either a "W" (i.e., quote from an interview with a worker) or an "M" (i.e., quote from an interview with a manager) in the following.

4.1   Validating, refining, and extending the 6R framework

Algorithmic recommending encompasses implicit and explicit suggestions initiated automatically by the algorithmic system (Kellogg et al., 2020). One common variant of implicit recommendations are announcements sent to the worker by notification or e-mail. These recommendations are presented as unbiased information on current job opportunities, higher expected demand, or increases in compensation and do not contain specific instructions for action (Duggan et al., 2020, Jarrahi et al., 2020, Kuhn and Maleki, 2017, Pignot, 2021, Parth and Bathini, 2021). Rosenblat and Stark (2016, p. 3769) for example report of the Uber App sending a notification to drivers saying *"GET READY FOR A BIG WEEKEND IN NEW ORLEANS! There are a lot of events in New Orleans this weekend where we expect Uber demand to be high!"*.

Implicit recommendations often arrive as nudges. Nudges are defined as "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler and Sunstein, 2008, p. 6). Previously, Uber drivers who wanted to log out were not logged out immediately but instead asked: *"Are you sure you want to go offline? Demand is very high in your area. Make more money, don't stop now!" (Rosenblat and Stark, 2016, p. 3768)*. Another prominent example of nudging is Uber's surge pricing mechanism (Pregenzer et al., 2021, Möhlmann et al., 2021, Pignot, 2021, Veen et al., 2019, Lee et al., 2015, Rosenblat and Stark, 2016). Here, areas with high demand are highlighted so that workers pay particular attention. A worker reported to Pregenzer et al. (2021, p. 6), *"For me, if the heat map is red for an adjacent zone, that's enough incentive for me to go there [...]"*, showing how Uber nudges workers towards entering a specific area, without telling them explicitly to ensure waiting times for customers are as low as possible even in areas with high demands.

Companies use explicit recommendations to provide workers with concrete suggestions for action. Chan and Humphreys (2018, p. 33) described how Uber issues recommendations such as "offer riders bottled water, snacks, gum, and cell phone chargers" to their entire workforce. Our interviewees also received such general work behavior instructions as *"always wear your uniforms", "always wash them", and "always keep them in tip-top condition during your shift, because the customer likes that"* (W3). Targeted recommendations are even more sophisticated (Huang, 2022, Parth and Bathini, 2021). For example, platforms use natural language processing to send warnings when unwanted behavior is detected or suspected (Jarrahi et al., 2020). By analyzing and utilizing worker-specific data like tracking a worker's current location, companies try to increase the effectiveness of recommendations. As the CEO of a crowd working platform explained:

"They [crowd workers] then get a push message, an e-mail [...] look, there is a job near you [...] don't you want to do it? [...] We have found that this works [...], for example, if someone has just done a job, they are very receptive to these hints" (M2).

Our analysis of the category of recommending revealed that organizations use implicit and explicit recommendations, which remain one of the most common forms of AC used to influence an entire workforce or the behavior of an individual worker.

Algorithmic restricting is present when the AC system withholds information from or restricts workers' behavior (Kellogg et al., 2020). One can find many examples of information restrictions used in companies today. For example, ride-hailing companies withhold the destination address until the driver accepts the ride (Pregenzer et al., 2021, Möhlmann et al., 2021), food delivery companies only ever show drivers the next stop (Griesbach et al., 2019, Heiland and Brinkmann, 2020, Huang, 2022), and grocery delivery companies conceal information about the exact composition of deliveries (Griesbach et al., 2019). An interviewee highlighted this information asymmetry for both ride-hailing *"It's just a blind. [...] it doesn't show you anything about the ride [...], so they just want you to accept the rides" (W3)* and grocery delivery:

"What they will do is they will put batches together, [..] so they will disguise there might be one customer pay a tip, another one might not [...] because if they offered it individually, no one would shop or pick them the batch with no tip" (W3).

Furthermore, it is common for companies "known for strategically withholding information about their HRM algorithms in an attempt to control their workforces" (Meijerink and Bondarouk, 2021, p. 4). Examples include crowd working platforms that do not display the full range of available jobs (Meijerink and Bondarouk, 2021, Glavin et al., 2021), but narrow them down based on different criteria. For example, a CEO reported that freelancers on his platform are *"categorized from 2-5 stars. 5 stars is the highest category, there I can then see everything and edit. And below that, if I am 4 stars, then just 4 stars and lower"* (M1). Another platform manager reported that workers can see all available jobs, but "*there are certain exclusion criteria*" (M2). Another interesting finding in which restricting becomes particularly apparent was an AC practice described by several Uber drivers. By *"always monetizing the transparency,"* W6 reported, *"we do things that are very often not profitable for us".* The participant referred to a mechanism that Uber has implemented in California, which a colleague described as follows:

"You could only see [the destination] if you accepted consecutive rides. So, if you accepted five out of ten rides, you would be shown the next ride destination. How far and where they were going. If you didn't, you don't see it" (W3).

Companies are also restricting the behavior of their workers through the use of algorithmic decision-making. Heiland and Brinkmann (2020) described how a food-delivery company deploys geofencing to deactivate riders who move too far from the center of their designated delivery zone. As the CEO of a crowd working platform illustrated, they restrict behavior by imposing time limits („as soon as he accepts the order, 48 hours start to run"), set a maximum number of simultaneous jobs individually "*accept a maximum of three jobs*" or restrict the repeated choice of jobs (*"After a reservation has expired, the user cannot accept this order for a certain period of time"*) (M2).

Algorithmic requiring describes all AC attempts that instruct workers to perform specific actions that they cannot reject without negative consequences. While workers may or may not follow AC attempts based on recommendations, this decision-making power is taken away in some cases. The AC system then exercises complete control because the worker is left with no discretion of their own. A permanently employed delivery rider described this as follows:

"Then it is like the delivery algorithm has access to one [...] when an order comes in [...] you cannot reject it. (W1).

Similar cases, where workers have no choice but to follow instructions, are described by Schaupp (2021) for a mechanical engineering company, where workers receive precise instructions on assembly via a display, and Parent-Rocheleau and Parker (2022) for a hotel chain, which uses algorithmic systems to

direct its cleaning staff on demand. Surprisingly, these cases are also found in companies with independent contractors (Laursen et al., 2021, Timko and van Melik, 2021). As an Uber driver pointed out: *"It automatically accepts it for me, which is super weird, because I am supposed to be like an independent contractor. I'm supposed to be able to [...] choose my own stuff" (W7).* The algorithm does not recommend a certain behavior change but requires it:

"I am on my way there. Switch, they switched it, [imitating the switch sound] it is updated, now you are going somewhere else. Sometimes it happens as often as three times in one request that they changed it [...] And now you don't know where that person is going. So, you have lost your choice, the so-called informed choice of your business" (W6).

These examples uncover that, in some cases, the AC system does not need to rely heavily on workers' decisions but can exercise complete control over the labor force. We argue that this form of AC will become even more relevant in the future as more and more platform companies move to hire a core workforce with corresponding directive authority alongside independent contractors (Ke Li, 2021). In addition, as already mentioned, AC is about to become more and more important in traditional organizations. These organizations usually employ workers based on permanent contracts. We therefore expect to uncover an increased use of the AC form of requiring in traditional organizations during future research endeavors. Therefore, we propose extending the existing 6R framework by adding the AC form of algorithmic requiring.

Algorithmic rating includes measurement and evaluation of work performance based on internal and external sources, as well as predictions of future work performance (Kellogg et al., 2020, Holtz et al., 2022). Regarding the evaluation, there are two categories: disclosed and undisclosed forms. When disclosed, rankings or individual performance metrics are communicated directly to workers. Customer ratings are a well-known example, including: ride-hailing companies where drivers and customers can rate the shared driving experience (Möhlmann and Zalmanson, 2017, Rosenblat and Stark, 2016); e-commerce platforms, where buyers can rate dealers (Curchod et al., 2020); rental platforms, where renters can rate the landlord (Jhaver et al., 2018); delivery-services, where customers can rate couriers (Kusk and Bossen, 2022, Heiland and Brinkmann, 2020); and freelancer platforms, where customers can provide detailed ratings on various categories such as skills, availability, adherence to schedule and more (Jarrahi et al., 2020, Rahman, 2021). However, the rankings formed may also be based on much more extensive data, including acceptance rate (Lee et al., 2015), proven worker knowledge (Jarrahi et al., 2020), weather (Van Doorn and Chen, 2021), and police records (Huang, 2022). Based on their performance data, workers are then ranked, often in terms of a specific status level. The higher a worker is ranked, the more benefits they receive, such as earlier availability of shifts and orders (Huang, 2022, Yu et al., 2022, Chan, 2021, Gal et al., 2020, Heiland, 2021, Griesbach et al., 2019).

Undisclosed ratings and rankings are not communicated to the worker but influence the work to a similar extent. Companies use internal rankings to assign jobs based on the worker's performance. One CEO reported how his platform uses an internal group system for job allocation:

"The typical acceptance rates are just about 97% [...] but if someone has, let us say, only an acceptance rate of 70%, then he is obviously worse than all the others and has a problem. [...] simply in order not to jeopardize the completion of jobs, we use this group system for a limited number of jobs and would exclude people who do not have the necessary experience and quality level" (M2).

With **algorithmic rewarding**, algorithms are in place that "interactively and dynamically reward high-performing workers with more opportunities, higher pay, and promotion" (Kellogg et al., 2020, p. 381). Reward mechanisms that we identified can be broadly divided into two categories, namely monetary and non-monetary rewards. Dynamic pricing and bonus systems are used as monetary rewards. That is, the labor compensation increases depending on the demand, working hours, and performance of the worker (Griesbach et al., 2019, Kuhn and Maleki, 2017, Muldoon and Raekstad, Van Doorn and Chen, 2021). For example, workers receive an "extra allowance for working during hot weather" (Van Doorn and Chen, 2021, p. 1356). As Parth and Bathini (2021) find, companies also "actively managed driver earnings instead of letting the driver effort and the supply–demand dynamics determine their earnings" (Parth and Bathini, 2021, p. 83), according to specific incentive schemes. Interviewees consistently

reported that new drivers receive higher bonuses (W3). The extent that drivers are controlled by these bonuses is evident from a statement made by a Lyft driver:

"They give bonuses based on when you drive when they want you to drive. Last week I would start later, because my bonus, I had a bonus hour at like 2:30, but this week I have bonus hours at like 7 in the morning [...] normally I go to the gym first, but this week I am not doing that because I can get 15 extra dollars if I work earlier" (W7).

Companies recognize desirable work behavior through a range of non-monetary rewards. These include better placement on the platform through higher search rank (Jarrahi et al., 2020) or badges visible to customers (Jhaver et al., 2018). In addition, high-performing workers receive "priority in the allocation of orders" (Griesbach et al., 2019, p. 7) or "notifications of newly posted jobs before other workers, and thus have priority to accept desirable assignments" (Kuhn and Maleki, 2017, p. 190). Some of these AC rewarding practices blend with gamification elements. While many companies reward their workers with non-monetary badges for predefined goals (Pignot, 2021, Pregenzer et al., 2021), a few imitate existing games and regularly organize competitions accompanied by prize money (Yu et al., 2022).

Algorithmic sanctioning includes all forms of penalties that the AC system issues for undesirable worker behavior. In the process of concept coding, we noticed that in the 6R framework of Kellogg et al. (2020), the only AC form sanctions can be grouped in is replacing. Replacing (i.e., firing) a worker is of course the harshest form of sanctioning. Since organizations often apply milder forms of sanctions prior to firing a worker, the definition of the AC form of replacing from the 6R framework is too narrow. We have identified several instances where companies automatically distribute sanctions to workers if they act contrary to the desired behavior. Temporarily freezing a worker's account is an example of such a mechanism (Möhlmann et al., 2021, Duggan et al., 2020, Huang, 2022). One interviewee pointed out that when rejecting a ride, drivers "will get a warning that says you have now canceled or rejected this or that. You will be put in a, I saw a screenshot of this not long ago, 17 minutes timeout, like a little baby. So, you will not be able to get any work for 17 minutes because you didn't fill these and these standards" (W6). Another interviewee reported that the benefit of being able to see where a potential passenger wants to go and how much money can be made from that ride is taken away as a sanction for not accepting enough rides in a row: "As soon as I missed that one threshold or as soon as it breaks the loop, then I no longer get to see it until I refill those five out of ten" (W9). Other forms of sanctions include demotion in rankings and loss of delivery fees if the worker exceeds the specified time window for the delivery (Zheng and Wu, 2022):

"The penalty is not only financial [...] but also affects their ranking in the system, [...] a lower score of punctuality could mean losing current 'privileges' in selecting orders."

Therefore, we propose substituting the current AC form *replacing* contained in the 6R with a wider defined AC form covering all kinds of sanctions, including replacing of workers, that is the AC form of algorithmic sanctioning.

Algorithmic monitoring describes the (indirect) supervision of workers' behaviors through the collection, aggregation, and display of detailed data on their work activities. In the course of our data analysis, we discovered that all observed AC cases in the literature, as well as in the interviews, contain the recording and aggregation of *"finely grained behavior and statistics from internal and external sources"* (Kellogg et al., 2020, p. 377), suggesting that this AC form is probably too broad and cannot be distinguished from other forms of AC. During the study of the recording form of AC, we came across some cases where companies capture data in real-time and display them to customers as a second instance of control. This included, among others, showing the location of the worker (Rosenblat and Stark, 2016), previously collected ratings (Griesbach et al., 2019), overall client satisfaction (Chan, 2021), and response rate (Jhaver et al., 2018). According to Chan (2021, p. 76), customers are supposed to track the worker and thus act as an *"additional layer of surveillance [...] speeding up the entire food delivery sector."* A platform manager made the following statement regarding data transparency:

"We also always show the cancellation rate, which an author does not like either. But that is actually only fair to others if I stick to my deadlines" (M1).

To narrow down the currently (overly) broad definition of algorithmic recording, while considering the AC cases shown above, we propose renaming this AC form as algorithmic monitoring. This highlights that in addition to the constant data collection and processing, which usually accompanies the adoption of AC in practice, monitoring workers is additionally applied as a separate, control form, applied situational. In the interviews conducted, it became clear that workers who are confronted with AC in their daily work are well aware that they are monitored in a rather comprehensive way: "I think the companies are aware of absolutely everything that goes on, including when they send me a message saying I was speeding, [...] saying 'don't speed,' so they are tracking everything you do. Uber does this, Lyft does this [...], which is a little scary" (W8).

Based on our combined top-down and bottom-up approach, we propose three changes (one addition and two refinements) to the 6R framework. The resulting 5RSM framework is summarized in Table 2.

AC form	**Definition:** To align worker behaviors with organizational goals, the AC system...	**Examples** (worker perspective)
Recommending *(confirmed)*	...automatically suggests specific behavior to the worker that takes the form of either explicit recommendations for action or implicit forms (such as nudges).	A crowd worker receives e-mails at the beginning of each week showing a list of job offerings. During work hours, specific jobs are highlighted. After completing his work, he receives recommendations on how to behave towards customers.
Restricting *(confirmed)*	...withholds information or limits the scope of action for the worker.	A ride-hailing worker cannot see where a ride is going before accepting it. A freelancer can only accept a certain number of jobs and must turn them in within a time window.
Requiring *(added)*	...instructs workers to perform specific actions which they cannot reject without negative consequences.	A warehouse worker gets exact instruction, what tasks he must perform during his shift. He has to follow these instructions and may not deviate from them.
Rating *(confirmed)*	...ranks workers or allows third parties to rate work behavior and outcome.	A permanently employed delivery driver receives a notification that she has been placed in the "gold tier" of drivers based on their excellent performance, as rated by customers.
Rewarding *(confirmed)*	...assigns rewards for work behaviors that align with organizational goals.	A warehouse worker gets a reward for having reached a high productivity level in the past month.
Sanctioning *(refined)*	...issues penalties for work behaviors that do not align with the organizational goals.	An app tester can no longer log in with her user data after agreeing to participate in some tests, but not doing so.
Monitoring *(refined)*	...enables supervision of the work process by the worker or third party by collecting, aggregating, and displaying data on working behavior.	A freelance worker knows that his webcam and screen are recorded at specific intervals. A parcel delivery driver knows that his location is permanently forwarded to the headquarters.

Table 2.   5RSM framework

4.2   Illustrating the 5RSM framework

Leading to the 5RSM framework, the above-presented extensions and refinements of the 6R framework served our overarching research goal of developing an updated AC framework that is applicable to both

traditional and platform work contexts. To illustrate the broad applicability of the 5RSM framework, this section discusses two prime examples of one platform-based and one traditional organization using AC to manage their workforce. The two organizations are Uber, which has been referred to as an AC pioneer in the platform context (Rosenblat and Stark, 2016, Möhlmann and Zalmanson, 2017, Wiener et al., 2021), and Amazon, which has been recognized for its use of AC in a traditional work context, especially in its fulfillment centers/warehouses (Altenried, 2022, Delfanti, 2021). Providing examples of context-specific AC practices, Table 3 outlines and compares the two organizations' use of AC along the seven dimensions/forms of the 5RSM framework.

Context AC form	Platform context: Ride- hailing at Uber	Traditional context: Warehouse work at Amazon
Recommending	The Uber driver app recommends drivers to offer passengers free bottled water, play other music (e.g., Jazz); etc.	Use of wearable devices that can detect when a warehouse worker is exhausted or stressed and therefore recommend that she or he take a break; etc.
Restricting	When receiving a ride request, Uber drivers cannot see the ride destination in the app until they accept the request; etc.	Warehouse workers are only shown a limited number of available tasks from which they can choose via a (mobile) digital device; etc.
Requiring	*Not applicable.*	Via their mobile scanner, warehouse workers receive explicit instructions on where to pick up or store goods; etc.
Rating	Drivers are constantly rated by Uber (e.g., ride-request acceptance rate for last week) and their passengers (driver rating); ratings are displayed via the driver app, where they are compared to those of "top drivers."	Warehouse workers are evaluated on their overall job performance, which is tracked by the equipment they work with.
Rewarding	Uber drivers receive monetary rewards (e.g., for accepting many rides in a row), as well as non-monetary ones (e.g., digital badges for "great conversation").	High performing warehouse workers may receive both monetary and non-monetary rewards based on their overall performance (see also "rating" above); etc.
Sanctioning	If Uber drivers do not accept several ride requests in a row, they will be blocked from the driver app for some time; any misconduct by drivers (including traffic violations) may result in the immediate deactivation of their account; etc.	*Not applicable.*
Monitoring	Driver location is always visible to Uber, and is also displayed to passengers while waiting for their Uber driver; etc.	In some cases, worker location is monitored by digital devices (e.g., overhead cameras); collection of fine-grained data on workers' behavior and their performance via digital devices that workers are required to use for their job; etc.

Table 3.   Illustration of 5RSM framework across platform and traditional work contexts

Table 3 illustrates the applicability of the 5RSM framework to both platform-based gig- and traditional organizational contexts. While the 6R framework was already well suitable for the platform context, the extensions and refinements opened the 5RSM framework towards being applicable to traditional work contexts as well. As illustrated, the novel AC form of *requiring* and the refined AC forms of *sanctioning* and *monitoring* play an important role when considering AC in traditional work contexts and organizations, which is to become more and more important in the future in both research and practice.

5 Discussion

Given the need for a sound theoretical conceptualization of AC, our study aimed to conceptually and empirically *validate* the 6R framework by Kellogg et al. (2020) and *refine* and *extend* it based on the insights gained to derive an updated AC framework. Based on an extensive interdisciplinary literature review and a series of interviews, we propose an updated conceptual framework for AC, the 5RSM framework.

5.1 Research contributions and practical implications

As our overarching research contribution, we present an updated framework for AC, the 5RSM. The first specific contribution of our paper is the result of validating the 6R framework of AC by Kellogg et al. (2020), which we identified as the most suitable current AC framework. The 6R framework has not been validated before, a pattern which is typical in organizational and management research. As Edwards (2010) states, if many theories are built and published around a particular topic without testing them and questioning their core propositions, all theories around the respective topic are at risk. In addition, the still infant research landscape on the topic of AC represents itself as rather fragmented, terms, definitions and concepts are often not used consistently (Heinrich et al., 2022).

To validate the 6R framework, we conducted a systematic literature review and an additional interview study. Large parts of the 6R framework could be confirmed during the validation phase proving that platforms (and to a lesser degree also traditional organizations) are in fact using algorithms to steer their workforce, and that large parts of the 6R framework can serve as a sufficient guiding framework to structure these findings along the categories defined by Kellogg et al. (2020). With this step, we also address calls for future research of extant publications that suggested to develop "more fine-grained typologies of AC practices; for example by drawing on Kellogg et al. (2020) "6Rs" framework" (Wiener et al., 2021, p. 15).

However, the validation phase of the 6R framework revealed potential for improvements, which were addressed by refining and extending the 6R to the 5RSM framework, which is the second theoretical contribution of this paper. A key shortcoming of the 6R framework of AC we identified in the validation phase is that it is primarily suitable to gig- and platform work contexts and organizations. Since AC is steadily making its way into traditional organizations, we adapted the 6R framework to make it suitable to both platform and traditional organization contexts. Taking traditional contexts into account when researching AC is also suggested for future research in extant literature (Wiener et al., 2021, Benlian et al., 2022). In particular, the AC form of *replacing* can be primarily or almost exclusively be found in platform contexts, especially with freelance workers, since with permanent employees it is usually not possible to have employees being *replaced* by an algorithm automatically. Therefore, we removed the AC form of *replacing* and added the form of *sanctioning,* which can be applied to a variety of worker situations. Another step towards developing the 5RSM framework was adding the AC form of *requiring,* based on the discovery that companies make use of algorithms to give direct and clear instructions to their workers and realizing that such cases could not be grouped into any category of the 6R framework. This AC form occurred especially in traditional work contexts and organizations (e.g., with warehouse workers or permanently employed delivery-drivers).

The third adaption of the 6R is the AC form of *monitoring*. The definition of the AC form of *recording* from the 6R framework is quite broad and rather unspecific, so we renamed this AC form to *monitoring*. While *recording* practically describes all data collection happening around a respective worker, *monitoring* highlights the surveillance and supervision aspect, and therefore sharpens the understanding of this AC form.

Given these results, our study contributes to the research on AC by providing an updated AC framework, which includes the validated and confirmed parts of the 6R framework by Kellogg et al. (2020), as well as two refinements and one extension. With these, we address calls from extant research to closer examine the 6R framework of Kellogg et al. (2020), as well as to suit AC frameworks towards both gig- and traditional work contexts and organizations. To our knowledge, our paper presents the first

validation of an AC framework in the scientific literature. Having conducted this validation on a systematically collected literature sample and interviews with workers and managers form both platform and traditional organizations applying AC, the results represent an important contribution to the development of a common understanding of the phenom of AC and a consolidation of the fragmented research landscape. Given the potential AC yields for transforming how organizations steer and control their workforce, it is of great importance to scientifically accompany and guide these developments.

Regarding the practical implications, our framework defines a solution space for organizations planning to apply AC to steer their workforce. With the AC forms we defined and described in this paper, it is also possible for organizations to first implement a subset of the AC forms of the 5RSM framework, with the option of expanding the automation of control tasks in the future. With organizations applying algorithms to control and steer their workforce, both workers and managers need to build algorithmic competencies to engage with these applied algorithms. These competencies require a sound understanding of AC and its control forms. Our 5RSM framework of AC delivers the foundation to build these competencies among workers, managers and further stakeholders involved when AC is applied.

5.2 Limitations and future research

Some limitations should be considered when interpreting the results of our study. First, since participants were invited by an open call for participation and chose to participate in our interviews themselves, a self-selection bias might be inherent to our sample. However, given that we analyzed the conducted interviews qualitatively and do not claim representativeness, we believe this risk to be low.

Second, when analyzing our data, we focused on the most apparent AC form in the identified practices. This approach allowed for a precise classification of AC practices but may disguise some of the subtle connections and interrelations between different AC forms. As such, future research may want to look more deeply into connections between AC forms and try to identify patterns of frequent combinations of AC forms in practice. On a related note, future studies also may want to look at the AC phenomenon from a more "applied" perspective. For example, different forms of AC are not used in isolation but in combination and in a specific organizational context, where they interact with each other, as well as with other control-related aspects, such as the underlying purpose of an AC system (cf. Wiener et al. (2019)). As such, adopting a system perspective on the organizational use of AC is arguably a promising avenue for future research in the area. In this regard, the developed 5RSM framework can serve as a starting point and guiding framework.

6 Conclusion

This study validated, refined, and extended the 6R framework of AC by Kellogg et al. (2020) by conducting a systematic literature review (top-down) and interviews (bottom-up). As a result, large parts of the 6R framework could be confirmed, while two refinements and one extension were applied, resulting in the updated AC conceptual framework of 5RSM. With this, we addressed the two major shortcomings of the 6R framework; namely, not having been validated yet and not being equally applicable to both platform- as well as traditional work contexts. With this address the development of AC gaining traction in traditional organizations while already being used widely in the platform economy. The 5RSM framework defines a solution space for the development of AC systems in practice and represents the basis for the development of an AC scale to also be able to measure AC empirically in the future. With this we hope that our 5RSM framework gives researchers as well as practitioners an advanced understanding of the phenomenon of AC and paves the way for future research.

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[1] Due to space constraints, not all publications identified in our literature review (top-down approach) are listed in this section; the complete list of publications included in our review sample is available from the authors upon request.

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