EXPLORING THE BOUNDARIES AND PROCESSES OF DIGITAL PLATFORMS FOR KNOWLEDGE WORK: A REVIEW OF INFORMATION SYSTEMS RESEARCH

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ABSTRACT

Digital platforms for knowledge work (DPKW), such as Upwork, Freelancer, and Fiverr, connect clients with millions of workers for a range of knowledge work services, including app development, graphic design, and data analytics. Research on this emergent phenomenon has recently gained traction in terms of publication volume and research diversity. Focusing on the contributions of information systems research, we conducted a literature review to distinguish papers on DPKW from related types of digital platforms, to synthesize what we know about knowledge work on DPKW, and to guide future research. Based on a comprehensive literature search, we derived five boundary conditions, which constitute our definition of DPKW: digitality, value network paradigm, centralized governance, contractual work, and knowledge work. We further developed a conceptual process framework of the constituent processes of DPKW. With this framework, we elaborate on an established process model to distinguish the three macro-level processes of matching, contracting, and executing. We further examined micro-level processes suggested in extant research based on a process linking approach in order to understand how they synchronically instantiate each macro-level process. Emphasizing the significance of the micro- and macro-level processes and the emergent stage of the literature on DPKW, we offer an agenda for future research and outline implications for practice.

Keywords: Digital platforms, knowledge work, online labor markets, outsourcing, crowdwork, literature review.

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INTRODUCTION

Digital platforms for knowledge work (DPKW[1]) are emerging as a distinct phenomenon in information systems (IS) research. Well-known platforms such as Freelancer, Upwork, and Fiverr feature project categories such as virtual assistance, development of apps and websites, graphic design, translation, digital marketing, and data analytics. With a range of knowledge work services being sourced from these platforms, we begin to witness their transformational effects on individual workers, organizations, industries, and labor markets (cf. Huang et al. 2018). On the one hand, these platforms provide on-demand access to a global pool of digital talents, who are notoriously difficult to recruit and retain (cf. Khan and Sikes 2014; Trost 2014), while offering flexibility and independence to workers (Howcroft and Bergvall-Kåreborn 2019). On the other hand, there is a "dark side" to these platforms, introducing new levels of global wage competition, and potentially leaving workers frustrated, voiceless, and marginalized (Deng et al. 2016; Gegenhuber et al., 2021; Möhlmann and Henfridsson 2019; Zuboff 2019). Presenting significant challenges and opportunities, these platforms already employ a substantial number of workers (Manyika et al. 2015), and are on a trajectory to create major online labor markets with global labor mobility (Clemens 2011).

Recent research has advanced our understanding of varying types of digital platforms (e.g., de Reuver et al. 2018). Conceiving platforms as two-sided markets (e.g., Tiwana et al. 2010), there are research streams on micro-task work (e.g., Wang et al. 2017), crowdsourcing contests (e.g., Majchrzak and Malhotra 2013), and digitally mediated sales of knowledge work products (e.g., Ghazawneh and Henfridsson 2015). Research has started to explore the platform artifact, the platform ecosystem, and the practices of outsourcing knowledge work services on platforms (Du and Mao 2018; Gol et al. 2019b; Taylor and Joshi 2018). In parallel, further research has been dedicated to the management of knowledge work in organizations, as well as to the activities that workers engage in to produce, apply, and share knowledge (Alavi and Leidner 2001; Newell et al. 2009). At the intersection of these research streams, DPKW, which mediate the matching and contracting processes between skilled workers and clients as well as the execution of knowledge work services, are emerging as a distinct phenomenon.

Although DPKW have raised initial interest, there is no shared definition. The plethora of terms, such as knowledge work, online labor, gig work, and on-demand labor, make it challenging to understand the scope of IS research on this topic. In particular, the processes unfolding on DPKW are underresearched, with academics and practitioners lacking a coherent understanding of the processes of knowledge work and worker-client interactions on DPKW[2]. For example, extant research has proposed contradicting views on the general role of collaboration between clients and workers (e.g., Chen and Horton 2016; Lavilles and Sison 2017), and created confusion regarding the communication of work objectives (cf., Chen and Horton 2016; Du and Mao 2018). Furthermore, researchers increasingly question whether insights into one type of platform extend to related platforms (cf. Chen and Horton 2016), and call for clearer distinctions between different types of platforms (cf. de Reuver et al. 2018; Nevo and Kotlarsky 2020). A coherent conceptualization of DPKW and their constituent knowledge work processes is therefore needed as a basis for future contributions to a cumulative body of research and for informing practitioners operating on DPKW.

From a strategic IS perspective, three main stakeholders benefit from advancing coherent

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[1] The abbreviation DPKW refers to digital platforms for knowledge work.

[2] In this review, we consistently refer to workers and clients. In the literature, further terms have been used for worker, such as contractor, (service/task) provider, digital entrepreneur, freelancer, e-lancer, (digital) crowdworker, participant, solver, seller, and vendor. Clients have been referred to as the requestors, seekers, employers, buyers, outsourcers, principals, job providers, customers, and firms.

conceptualizations and understanding of DPKW. First, for client organizations, it is critical to understand how to capitalize on the profound opportunities of sourcing external expertise from DPKW. The opportunities are at least three-fold and pertain to (a) meeting ad-hoc demand for knowledge work services (e.g., Nevo and Kotlarsky 2020; Taylor and Joshi 2018), (b) accessing specialized skill-sets without creating permanent internal positions (e.g., Gol et al. 2019b), and (c) filling staffing needs that cannot be addressed by traditional labor markets (e.g., Khan and Sikes 2014; Trost 2014). The second group of stakeholders are platform providers, who act as intermediaries to the exchange and strategically manage interactions between clients and workers through measures of platform governance, operation, and design (Gol et al. 2019b). Research combining the perspectives of platform technology, outsourcing, and labor markets has the opportunity to inform such platform strategies. Third, IS research on DPKW is relevant for micro-entrepreneurial practices of knowledge workers, providing insights on individual-level tactics, strategies for client interactions, and crafting of career trajectories. Thus, the collective expertise and scholarship of IS have a unique opportunity to offer a forward-thinking platform for DPKW research aimed at informing strategic decision-making, advancing design science research, and shaping the discourse on the future of work.

Our goal is to advance current understanding of DPKW by addressing three research questions: (1) *how should DPKW be defined?* (2) *how should its processes be conceptualized?* (3) *what are the opportunities for future IS research on this topic?* To answer these questions, we conducted a literature review of extant IS research. A literature review offers an appropriate method for conceptualizing a research topic, identifying research gaps, and developing a research agenda (Schryen et al. 2020). We start by developing a definition for DPKW and iteratively identify boundary conditions. Following an approach proposed in the strategic management literature (Kouamé and Langley 2018), we offer a conceptual framework of the knowledge work processes on DPKW. On the macro-level, we adapt the established theory of inter-organizational relationships (Ring and Van de Ven 1994) to frame the processes of matching, contracting, and executing. These macro-level processes serve as a framework for our in-depth analysis of the literature in which we synthesize micro-level processes that synchronically instantiate the macro-level processes. The research agenda is structured according to the three macro-level processes.

Our review offers three main contributions. First, we provide a definition for DPKW, which is based on five constituent boundary conditions and explicit rationales as to why the boundary conditions are consequential. Second, we offer a framework conceptualizing the synchronic macro-level processes of knowledge work on DPKW and their instantiations through embedded micro-level processes. Third, based on the framework, we propose a detailed research agenda and outline considerable opportunities for future research. The remainder of this paper is structured as follows. After outlining our methodological approach, each section is dedicated to one of the contributions, the definition, the framework, and the research agenda. Finally, we discuss the limitations of our work, and conclude the paper.

REVIEW METHODOLOGY

Our review aims at distinguishing DPKW from related phenomena based on boundary conditions and a corresponding definition, as well as synthesizing the micro- and macro-level processes that constitute knowledge work on DPKW. Our paper can be classified as a review aimed at understanding (Rowe 2014) because we go beyond a descriptive summary, but do not suggest a comprehensive theoretical model. Because methodological guidelines for reviews aimed at understanding are relatively scant, our approach draws inspiration from the methodology of scoping reviews (e.g., Arksey and O'Malley 2005). In our viewpoint, these guidelines are appropriate here because they are generally concerned with emerging topics, aimed at assessing the size and scope of research, and suitable for informing prospective authors about research opportunities (Schryen et al. 2020; Templier and Paré 2018). We carefully designed the review with systematicity and

transparency in mind (Paré et al. 2016) and provide further methodological details in Appendix A. We adapted the steps recommended by methodologists of scoping reviews (Arksey and O'Malley 2005; Levac et al. 2010; Tricco et al. 2018). Specifically, our methodology complements the traditional search and inclusion screen (screens 1 and 2) with the development of boundary conditions and a definition of DPKW. In this overall process, the boundary conditions are developed based on a broad sample of papers on different types of digital platforms and forms of online work (sample 1). In our main analysis, we developed a conceptual process framework based on sample 2, which exclusively contains DPKW papers. An overview of our methodological approach is provided in Figure 1.
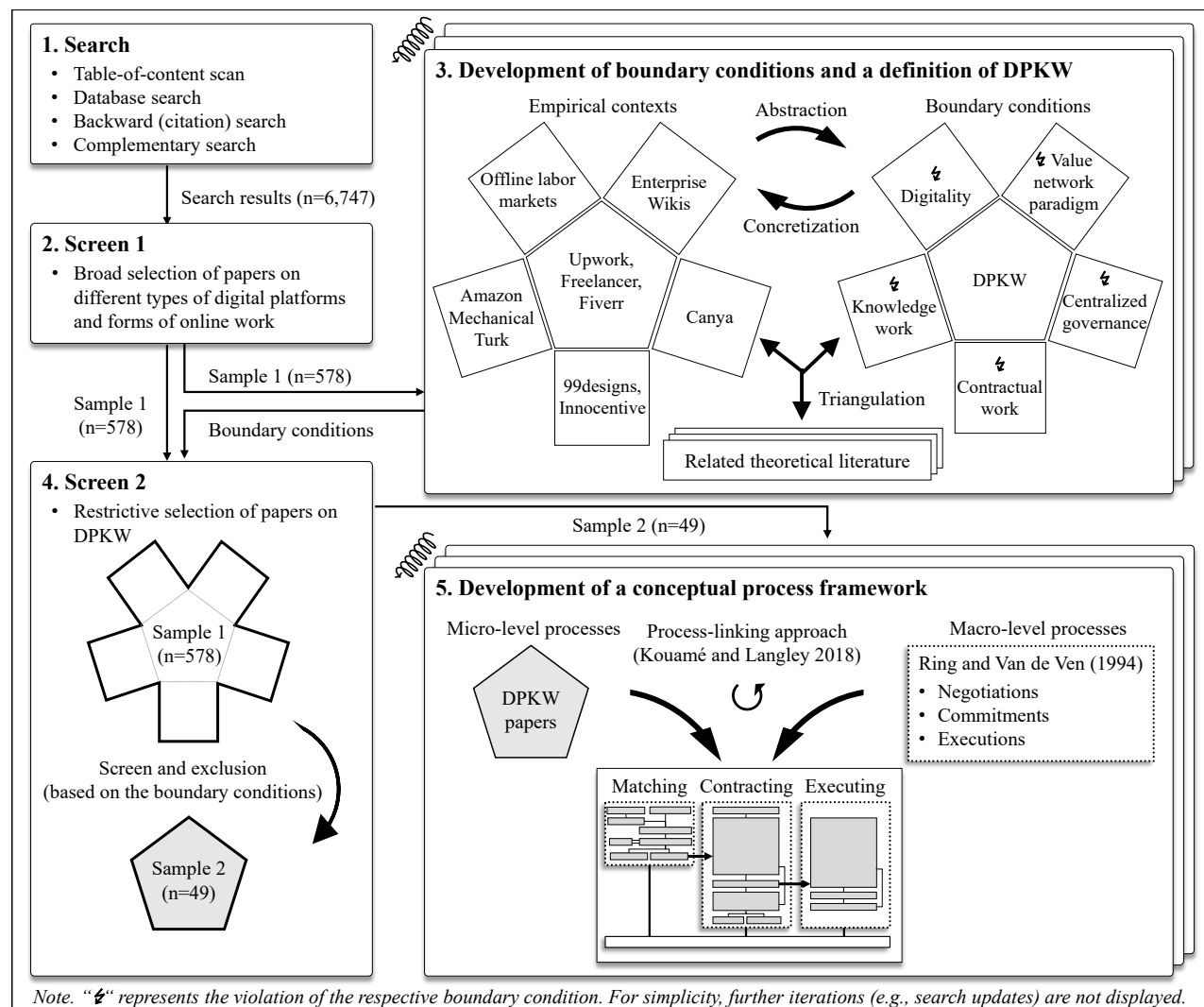

Note. "⚡" represents the violation of the respective boundary condition. For simplicity, further iterations (e.g., search updates) are not displayed.

Fig. 1. Overview of the methodological approach

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Our search strategy covers a table-of-contents scan, database searches, backward (citation) searches, and a complementary search focusing on IS journals and conference proceedings. Our rationale for focusing on the IS literature lies in its key position at the intersection of social and technical phenomena. Furthermore, DPKW involves mainstay topics in IS research such as knowledge management and knowledge work (Alavi and Leidner 2001; Newell 2015), digital platforms (de Reuver et al. 2018; Tiwana et al. 2010), and sourcing (Lacity et al. 2009; Nevo and Kotlarsky 2020). We emphasize that our review – despite focusing on IS research – does not ignore related work from fields such as economics, organization studies, and sociology.

The first screen, like the search, was intended to inclusively identify papers on a variety of digital platforms and tasks that may qualify as knowledge work. Borderline cases were deliberately retained for the second screen.

After the first screen, we developed the boundary conditions that constitute our definition of DPKW. Establishing boundary conditions to define and conceptualize a phenomenon is an important avenue to advance theory with literature reviews (Post et al. 2020). Traditionally, boundary conditions have been defined as "plac[ing] limitations on the propositions generated from a theoretical model" (Whetten 1989, p. 492). Complementing this traditional understanding, we follow the recent methodological literature (Busse et al. 2017; Post et al. 2020) and take a phenomenological perspective of boundary conditions, which emphasizes the importance of a particular empirical context and the static and dynamic boundaries delineating it. Thus, our goal in developing boundary conditions is not to explore the boundaries of a particular theory, but rather to establish a deep understanding of the phenomenon of DPKW and its consequential boundaries. Following an iterative approach (as outlined in Appendix A), we developed the boundary conditions by abstracting general principles distinguishing DPKW, by triangulating our rationales for each boundary condition with related theoretical work, and by concretizing which platforms are excluded by the respective boundary conditions. In this process, we considered exemplary platforms, and the broader literature on digital platforms (e.g., de Reuver et al. 2018; Tiwana et al. 2010) as well as the literature on knowledge work (e.g., Newell et al. 2009; Schultze and Leidner 2002). Corresponding rationales were triangulated with theoretical perspectives such as agency theory (Eisenhardt 1989; Ross 1973), outsourcing and transaction cost economics (Lacity et al. 2009; Williamson 1979; Williamson 1991), economics of labor markets (Clemens 2011; Spence 1978), and economics of value networks (Stabell and Fjeldstad 1998). This approach ensures that the boundary conditions reflect relevant distinctions in existing platforms, and that the underlying rationales are consistent with the broader theoretical literature. Rationales concerning why the respective boundary conditions are considered consequential, including relevant literature, were summarized and are presented in the definition section.

In the second screen, we used the five boundary conditions to dissociate the final sample of papers on DPKW (sample 2) from papers addressing related phenomena. This more restrictive selection process ensured that the boundary conditions reliably distinguish the phenomenon of interest in a given set of papers. Exclusion statistics are provided in Figure A.1 (Appendix A). Overall, the final sample includes 49 papers.

After the second screen, we developed a conceptual process framework, which links the micro-level and macro-level processes of knowledge work (cf. Figure 2). To identify the micro-level processes, we applied inductive methods of qualitative content analysis (Hsieh and Shannon 2005) and extracted process descriptions based on a range of exploratory coding techniques (cf. Neuendorf 2002; Strauss and Corbin 1998). Further details are provided in Appendix A. The macro-level structure of the framework was derived from the process theory of inter-organizational relationships proposed by Ring and Van de Ven (1994). Theoretical rationales for selecting and adapting the macro-level process structure are presented in the section titled Conceptual process

framework. In this final step, we aligned the micro-level process structure with the macro-level framework, thereby following the guidelines for process linking approaches proposed by Kouamé and Langley (2018).

DEFINITION OF DPKW

We developed the definition and the constituent boundary conditions by iterating between the literature on DPKW, exemplary platforms (such as Freelancer, Upwork, and Fiverr), and related theoretical literature (e.g., de Reuver et al. 2018; Newell et al. 2009; Schultze and Leidner 2002; Tiwana et al. 2010). The latter led us to consider theoretical perspectives such as agency theory (Eisenhardt 1989; Ross 1973), outsourcing and transaction cost economics (Lacity et al. 2009; Williamson 1979; Williamson 1991), economics of labor markets (Clemens 2011; Spence 1978), and economics of value networks (Stabell and Fjeldstad 1998). We further consider the three main processes[3] necessary for sourcing knowledge work from digital platforms: (1) matching, which refers to the market exchange in which clients select workers, (2) contracting, which refers to the negotiation, monitoring, and follow-up on formal and informal agreements, and (3) executing, which refers to the collaborative conduct of knowledge work. This approach ensures that the boundary conditions reflect relevant distinctions in existing platforms, and that the underlying rationales are consistent with the broader theoretical literature.

There are many possible distinctions and ways to classify digital platforms, warranting clarification of how our conception dissociates DPKW from other categories of digital platforms. Overall, the results of our inductive literature analyses align with a market-oriented view of multi-sided digital platforms (Evans and Schmalensee 2016; Parker and Alstyne 2005; Rochet and Tirole 2003)[4], focusing on the market and service interactions between clients and workers, which are governed by a platform provider and supported by digital technology. In this regard, the underlying notion of a digital platform is distinct from the internal platform and supply-chain platform categories proposed by Gawer (2014). In line with platforms mediating two-sided online service exchanges, DPKW are characterized by centralized governance and potentially include interoperable interfaces (APIs), contrasting with non-extensible artefacts (Tiwana et al. 2010) and related decentralized arrangements (Gol et al. 2019b).

Each boundary condition excludes related phenomena and types of platforms[5], progressing from the technology dimension (boundary condition 1) to dimensions pertaining to the economic value configuration (boundary condition 2), the management paradigm of platform governance (boundary condition 3), the contractual foundation (boundary condition 4), and concluding with the nature of the work itself (boundary condition 5). While the boundary conditions correspond to properties whose existence can be judged effectively, we emphasize that our definition does not constrain the scope to those DPKW that are effective or successful. At the same time, we acknowledge that there are many possible distinctions, raising the question of why the selected boundary conditions are consequential.

Ultimately, we contend that the five boundary conditions are consequential because they delineate the phenomenon in theoretically significant ways (cf. Doty and Glick 1994). For instance, one consequence of boundary condition 1 (digitality of matching, contracting and executing) pertains to the geographical reach of worker-client relations. Since matching on DPKW, in contrast

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[3] The three processes are displayed in Figure 2 and conceptualized in the following section.

[4] Definitions of multi-sided market platforms are still underdeveloped (Baldwin and Woodard 2009; Sánchez-Cartas and León 2018),

  resembling the "You know a two-sided market when you see it" approach observed by Rochet and Tirole (2006).

[5] Since the term "digital platform" has been used to refer to a variety of phenomena (de Reuver et al. 2018), it has limited discriminatory power and is therefore not included as a separate boundary condition.

to traditional offline labor markets, allows clients to capitalize on global labor arbitrage, this matching is more likely to occur on a global scale (Roach 2003). Similarly, a major consequence of boundary condition 4 is that, unlike in crowdsourcing contests, contracts precede the execution of work on DPKW, resulting in further ramifications regarding the competitive dynamic among workers. Recognizing that conflating the definition of a concept with its impacts is problematic (cf. Vial 2019), we believe that explaining the implications of each boundary condition can be instructive for understanding and dissociating the phenomenon under investigation. We, therefore, summarize these implications as a rationale for specifying the respective boundary conditions, cautioning the reader that conformance to the boundary conditions is not a sufficient condition for the associated impacts. Table 1 summarizes the boundary conditions and corresponding implications.

Table 1
Boundary conditions and rationales

Boundary condition	Rationale
1. Digitality A digital platform mediates the three processes of matching, contracting, and executing. *Excluded: Traditional forms of (offline) employment*	• Extensibility of the platform artifact • Lower search, transaction, and coordination costs of digital markets • Exchange is not restricted to national boundaries, enabling workers around the globe to access the platform, and clients to capitalize on opportunities of global labor arbitrage
2. Value network paradigm Knowledge work is sourced in individual-level value networks. *Excluded: Inter-organizational outsourcing arrangements and intraorganizational crowdsourcing platforms*	• Distinct control mechanisms due to higher spatial separation and the replacement of hierarchy-based work by platform-mediated market coordination • Higher supply-side scalability and worker specialization
3. Centralized governance The platform provider exercises centralized governance by regulating and facilitating the exchange. *Excluded: Decentralized platforms for knowledge work*	• Governance involves constraining and enabling the flow of information, the allocation of incentives, and client-worker interactions (strategically increasing network externalities and addressing agency problems) • Effective governance is associated with improvements in quality of work, cost of labor, work delivery time, etc.
4. Contractual work The contract between the client and the worker involves financial compensation of the worker and is closed before work execution commences. *Excluded: Platforms hosting crowdsourcing contests*	• Clients bear the risk arising from worker and task-related uncertainty • Work that is compensated monetarily differs from voluntary work, e.g., regarding motives to participate and suitability for confidential projects
5. Knowledge work Knowledge work is contingent on domain-specific expertise and involves uncertainty. *Excluded: Micro-task platforms and platforms selling knowledge work products (e.g., mobile apps)*	• Important role of collaboration and communication • Knowledge work as involving emergence, complexity and uncertainty, e.g., in codifying and evaluating requirements • Requirement for domain-specific expertise and specialized skill sets

Boundary condition 1: Digitality

The first boundary condition refers to the digitality of the matching, contracting, and executing processes and the mediation by a digital platform. It excludes research on non-digital platforms (de Reuver et al. 2018), such as traditional, offline knowledge work and labor markets, as well as matchmaking platforms mediating between a supply-side and a demand-side of work without getting involved in the contracting and execution processes. Thus, DPKW can be considered as a digital successor of traditional matchmaking organizations and contracting agencies (Barley and Kunda 2006; Kunda et al. 2002). Digital mediation of the entire value chain from posting a project to rating the work upon completion enables a more comprehensive scope of data-driven operation and governance compared to platforms restricted to individual macro processes. We contend that considering the constituent (macro) processes and their mediation by the digital platform offers a meaningful criterion for distinguishing DPKW in the light of increasingly complex service ecosystems that cover selected processes, combine different technological components, and integrate with complementary platforms.

Technical consequences of boundary condition 1 pertain to the extensibility and adaptability of the platform artifact, which aligns with the broader literature on digital platforms (e.g., de Reuver et al. 2018; Tiwana et al. 2010). Extensibility refers to the modification of the platform core by the platform operator, the integration of knowledge-intensive services into existing workflows through boundary resources (e.g., APIs), as well as to practices of "circumtechventing" (cf. Sison and Lavilles 2018). These practices refer to "the use of technology to find ways around perceived obstacles to one's main concern" (Sison and Lavilles 2018, p.12).

Digitalizing knowledge work services has been associated with significant economic implications. Consistent with economics of electronic (service) markets (e.g., Kauffman and Walden 2001; Malone et al. 1987), transaction cost theory (Williamson 1979; Williamson 1991), and the literature on outsourcing (Lacity et al. 2009), digitalizing (knowledge work) services and mediating them on a platform results in lower search, transaction, and coordination costs (Gefen and Carmel 2008; Gong et al. 2018).

From a macro-economic perspective, digitalization of labor markets that are not rooted in the physical world (Huang et al. 2020) further implies unrestricted access of workers on a global scale (Chan and Wang 2014). In this context, Clemens (2011) insightfully contends that digitizing work arrangements could – by circumventing legal barriers to physical migration – result in global GDP gains "one or two orders of magnitude larger than the gains from dropping all remaining restrictions on international flows of goods and capital" (p.83). Enabled by lower barriers to labor mobility, the success of platforms like DPKW is partly driven by vast global imbalances in the cost of labor. The corresponding potential for global labor arbitrage has been considered to induce client preferences for workers from low-income countries over workers from high-income countries and to trigger migration of workers from high-income countries to low-cost destinations (cf. Roach 2003; Schlagwein et al. 2019). These implications are primarily driven by digitality but also enabled by the departure from traditional value-chain logic and organizational-level outsourcing arrangements for knowledge work.

Boundary condition 2: Value network paradigm

The second boundary condition requires the service exchange to occur between organizationally independent workers and clients and to be mediated by a third party (the platform provider), effectively following the paradigm of value networks as opposed to traditional value chain logic (Stabell and Fjeldstad 1998). It excludes research on intra-organizational platforms, and bi-lateral inter-organizational outsourcing arrangements (Chen and Horton 2016). In contrast to traditional, dyadic outsourcing arrangements between large organizations, sourcing from DPKW

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involves triadic interactions and (trust) relationships (Lu et al. 2016). Sourcing predominantly occurs at the level of individual workers or small teams, enabling even fine-grained division of labor and specialization (Malone et al. 2011) with significant implications for control, coordination, and the scalability of knowledge work services.

An important consequence of the value network paradigm is that clients are likely to adopt distinct sourcing strategies because control mechanisms are weakened by a higher spatial separation and by platform-mediated market coordination (cf. Zuchowski et al. 2016). The spatial and temporal separation between clients and workers has been considered as one of the main challenges for effective control and sourcing of knowledge work (Liang et al. 2017). Such settings require clients to go beyond traditional command-and-control approaches and focus on orchestrating knowledge work services from complex and evolving ecosystems (Marton and Ekbia 2019). Portfolios of control and coordination mechanisms can be expected to co-evolve with workers' transition from traditional employment relationships towards a more flexible and contingent future of on-demand work in flattened market hierarchies (cf. Chen and Horton 2016; Marton and Ekbia 2019).

Further implications pertain to the dynamics on both market sides. From the perspective of clients, the scalability of the workforce in its different areas of expertise easily exceeds the possibilities of traditional employment relationships (cf. Gol et al. 2019b), especially for diverse skill-sets that are required on short notice (Taylor and Joshi 2018). From the perspective of workers, serving multiple clients in DPKW work arrangements provides opportunities for stronger specialization, allowing them to craft jobs even from niche skills "for which total global demand might be 40 hours per week" (Chen and Horton 2016, p. 407). Effectively capitalizing on the opportunities arising in value networks requires appropriate governance.

Boundary condition 3: Centralized governance

The third boundary condition requires the platform to implement centralized governance by regulating the exchange and by directing resources to facilitate the matching, contracting, and executing processes. It excludes decentralized forms, such as peer-to-peer markets and hybrid governance arrangements (Gol et al. 2019b). Governance pertains to the strategic management of control and coordination mechanisms (Gol et al. 2019b), including systems for data-driven match-making services, managing requirements, tasks, incentives, contracts, periodical evaluation, quality assessment, conflict resolution, worker reputation, and accountability of clients (Du and Mao 2018; Gol et al. 2019b). Platform providers are contractually enabled to exercise governance based on the terms of service (Deng et al. 2016; Holthaus and Stock 2017), through which clients and workers subject themselves to the workflows designed by the platform provider (Du and Mao 2018; Gol et al. 2019a). Challenges of establishing similarly viable economic models in decentralized government arrangements have been deemed to constrain decentralized platforms (Gol et al. 2019a). The distinction between centralized and decentralized governance has been considered to be of both theoretical and practical significance (Gol et al. 2019b; Tate et al. 2017).

Centralized governance enables platform providers to strategically constrain and enable the flow of information, allocate incentives, and facilitate client-worker interactions (Gol et al. 2019b). Managing the flow of information is a particularly powerful instrument because clients and workers are spatially separated, relying almost exclusively on the platform for exchanging information (cf. Allon et al. 2012; Hong et al. 2016; Liang et al. 2018a). Regulation of information flow is ingrained in almost all platform components, most notably in its recommendation algorithms (Wu et al. 2019), monitoring functionality (Liang et al. 2016; Liang et al. 2017), reputation systems (Kokkodis and Ipeirotis 2016), and profile pages of workers (Sison and Lavilles 2018). In this context, platform providers are challenged to anticipate and strategically assess how information and changes in information transparency differentially affect worker and client behavior (cf. Hong et al. 2016).

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Beyond regulating information flows, centralized governance of DPKW typically involves allocating economic incentives to facilitate the efficiency of market exchange and operations (Allon et al. 2012). This involves setting the relative contributions to platform commissions, the cost of arbitration, and premium fees (Du and Mao 2018; Gol et al. 2019a; Hong et al. 2016). Because DPKW tend to mediate buyer's markets with potential excess and fluctuation of workers, platforms can be more restrictive for workers, potentially imposing charges for individual bids (Snir and Hitt 2003).

The effective implementation of governance mechanisms has been associated with a range of outcomes. These mechanisms have been hypothesized to increase network externalities (Stabell and Fjeldstad 1998), enable trust between workers and clients (Du and Mao 2018), and lead to improved outcomes, such as higher quality of work, scalability of the workforce, better reputation of clients, and decreases in labor costs as well as work delivery time (Gol et al. 2019b). We notice that governance mechanisms on DPKW differ fundamentally from those designed for crowdsourcing contests due to the contractual nature of work.

Boundary condition 4: Contractual work

The fourth boundary condition requires contractual agreements that precede the execution of work and involve the financial compensation of workers. The requirement for ex-ante contracts represents a distinction to crowdsourcing contests which have been considered in recent research on crowdworking platforms (cf. Chan et al. 2019; Deng and Joshi 2016; Deng et al. 2016). While contests follow the execute-and-contract logic of product markets, contractual work follows the contract-and-execute logic of service markets. This specific order of macro-level processes has significant implications for client and worker interactions on the micro-level as well as for corresponding governance mechanisms (Goldthorpe 2007). For instance, pre-contract communication (Hong et al. 2018), monitoring of workers (Liang et al. 2017), and renegotiation of conditions (Guo et al. 2017) are considerably more salient in contractual work than in crowdsourcing contests. Furthermore, contests imply that projects are assigned to a crowd with clients selecting the submission of a worker at the end of the contest. In contrast, the contractual work scheme relies on the assignment of projects to individuals. To illustrate why this distinction is theoretically and practically significant, we describe its implications for the distribution of risk and respective client and worker behavior.

Closing of contracts before the work commences has the profound implication of clients bearing the transaction risks after being given the opportunity to assess a range of workers (Chan et al. 2019; Gefen and Carmel 2008). This contrasts with crowdworking contests, in which workers can observe their competition and strategically decide whether to drop out (Straub et al. 2015), and in which clients "can observe and compare work outcomes from various workers before paying for the final selection" (Chan et al. 2019, p. 1). With contractual work, clients face agency problems, which arise when workers (agents) have incentives or motivations not to act in the clients' (principals) best interest (cf. Eisenhardt 1989). Workers may strategically leverage information asymmetries and withhold information that might interfere with their chances of being offered a contract, potentially leading to adverse selection (Gefen and Carmel 2008; Liang et al. 2017; Pavlou et al. 2007). When a client has hired a worker, and thereby bears most of the transaction risks, moral hazard may arise with workers deliberately reducing or misrepresenting their efforts (Gefen and Carmel 2008; Pavlou et al. 2007). Agency problems, therefore, represent a significant difference between contract and contest-based work.

Further implications derive from the nature of paid contractual work and its differences to non-paid knowledge work (cf. Howcroft and Bergvall-Kåreborn 2019; Schaarschmidt et al. 2019), for instance, in the context of open-source projects. In the DPKW context, initial research has explored the role of economic incentives that drive participation in financially compensated

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knowledge work (Durward et al. 2020; Gong et al. 2018; Ye and Kankanhalli 2017). Knowledge work services on DPKW occur in a bilateral, contractually regulated exchange between clients and workers, in which communication can be protected both through technical and legal measures (Lavilles and Sison 2017; Liang et al. 2018b). This makes exchanges on DPKW more suitable for confidential projects than contests, which tend to rely on public calls disclosing project details and submissions of multiple solvers (cf. Rechenberger et al. 2015). Further contractual specifics arise from the nature of work, which is notably distinct from micro-task work.

Boundary condition 5: Knowledge work

The fifth boundary condition restricts the type of work to knowledge work services that are contingent on frequent communication, involve uncertainty, and require domain-specific expertise. Beyond micro-task work (e.g., Amazon Mechanical Turk), this boundary condition excludes sales of products resulting from knowledge work (e.g., Google Play Store), and the search for offline work (e.g., LinkedIn). The literature commonly contrasts knowledge-intensive work with labor-intensive work, which is associated with monotonous and industrial labor (Costas and Kärreman 2016; Liebowitz 1999). Furthermore, Scarbrough (1995) contends that more commodified transactions, like micro-task work, are primarily governed by economic relations, or transaction cost rationales (Williamson 1979; Williamson 1991), while the communication and transaction of technical knowledge are governed by social relations.

Collaboration and communication are key to solving novel knowledge work problems. The more work relies on encultured knowledge and a collective understanding of the project (Blackler 1995), the more the solutions need to be developed through shared expertise and communication (Hong and Pavlou 2017; Pettersen 2019; Scarbrough 1995). In contrast, selling commodified knowledge products requires limited interactions, and micro-task work rarely involves communication beyond the original job specification (cf. Chen and Horton 2016). Because of the requirements for (synchronic) collaboration, country-specific factors such as time zone, language, and culture become critical (Hong and Pavlou 2017). Ultimately, the development of a thriving professional relationship enables workers to resolve ambiguities, prevent costly miscommunication, and acquire a more nuanced understanding of the clients' requirements (Gefen and Carmel 2008; Radkevitch et al. 2009; Sison and Lavilles 2018).

The complexity and uncertainty of knowledge work services (Alvesson 2004; Hong and Pavlou 2012; Hong et al. 2020) manifests in the processes of matching, contracting and executing. Uncertainties stem from low codifiability of project requirements (Guo et al. 2017), the complexity of knowledge work (Newell et al. 2009), challenges associated with evaluating it (Wang et al. 2017), and information asymmetries between workers and clients (Du and Mao 2018). Further, projects can involve several iterations, require adequate combinations of diverse knowledge resources and vary significantly across clients and projects. They often give rise to ambiguity regarding problem definitions and solutions, which can only be resolved through active communication between workers and clients (cf. Scarbrough 1995).

The domain-specific expertise, and specialized skill sets required for knowledge work (Huang et al. 2020; Malone et al. 2011; Schultze 2000) tend to be in high demand. Consequently, hourly rates are substantially higher compared to micro-task work (Taylor and Joshi 2019; Wang et al. 2017) and whereas micro-tasks can typically be completed within minutes, the length of knowledge work contracts ranges between days and weeks (Deng and Joshi 2016; Taylor and Joshi 2018). Workers can draw on their experience from solving similar problems (Curtis et al. 1988) and adapt their knowledge for new projects (Cook and Brown 1999). Thus, their sought-after skill set often empowers them and affords them with more freedom in selecting projects and shaping their entrepreneurial pursuits (Taylor and Joshi 2018). In this regard, the literature identified more elaborate forms of job crafting and self-management by workers (Lavilles and Sison 2017), who adapt their jobs and thereby redesign what work means for them (Deng and Joshi 2016). These

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characteristics may contrast with the ominous image of gig work, in which micro-task workers find themselves trapped in precarious working conditions and exploitative employment relationships (Deng et al. 2016). In contrast to microtask work, in which skill requirements are low, knowledge work may be less exposed to potential algorithmic automation (Stokel-Walker 2018).

Based on our synthesis of the five boundary conditions, their consequences and interrelations, we propose the following definition for DPKW: *A digital platform that relies on centralized governance to mediate the processes of matching, contracting, and executing knowledge work in networks of clients and workers bound by contractual agreements*.

CONCEPTUAL PROCESS FRAMEWORK

To advance a coherent understanding of what knowledge work on digital platforms encompasses, we synthesized the literature from a process perspective. Our framework (summarized in Table 2 and displayed in Figure 2) distinguishes the macro-level processes of matching, contracting, and executing from micro-level processes that capture situated and specific interactions between workers and clients (cf. Kouamé and Langley 2018). It was developed by extracting micro-level processes from the papers on DPKW and linking them to three macro-level processes, which resulted from adapting the established model of cooperative economic relationships, originally formulated for the dyadic exchange between large organizations (Ring and Van de Ven 1994). Compared to alternative models focusing on how (inter-organizational) relations mature and decline (Blut et al. 2011; Dwyer et al. 1987; Jap and Anderson 2007), the model of Ring and Van de Ven (1994) provided the best fit with the process descriptions observed in the DPKW literature.

The model of Ring and Van de Ven (1994) explains how relationships between cooperating organizational entities are shaped as they transition through the processes of negotiating joint expectations, committing to future action, and executing their commitments. It was primarily developed to explain traditional forms of inter-organizational relationships such as outsourcing arrangements, strategic alliances, or joint ventures. The original model is based on four underlying assumptions. First, trust and reputation mechanisms are essential for dealing with uncertainties, which may arise from the emergent and ambiguous nature of both parties' mutual expectations. Second, work relationships are assessed on the principle of 'fair dealing', which implies that parties are motivated to maintain working relationships instead of extracting maximum surplus from each transaction. Third, formal contracts and informal agreements give priority to internal resolution as the primary mechanism to cope with uncertainty. Fourth, working relationships are shaped by situated role relationships in which an actor can fulfill different roles depending on the particular context. Because these underlying assumptions resonate well with those of platform-mediated knowledge work, we contend that the model of Ring and Van de Ven (1994) provides a useful basis for conceptualizing the macro-level processes of DPKW. On DPKW, workers and clients must also deal with uncertainties inherent to the nature of knowledge work and the behavior of the other party. Workers and clients try to maintain a reputation for fair dealing to continue existing working relationships, internal conflict resolution mechanisms are crucial, and both parties' actions can be considered as a function of the situated role within a knowledge work practice.

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Table 2

Macro-level processes: characteristics and constituent microlevel processes

Macrolevel process	Characteristics	Constituent microlevel processes [a]
Matching The market exchange in which clients solicit worker bids.	• Competition dynamics • Multilateral market interactions • Communication partially public and partially confidential • Strict regulation by the platform (primarily formal control)	• Client participation • Worker participation • Project description • Search and bid placement • Worker and bid assessment • Interview • Project withdrawal • Selection decision
Contracting The negotiation, monitoring, and follow-up on agreements.	• Bargaining dynamics • Bilateral negotiation of a contract • Increasingly restricted communication • Guidance by the platform, combining both formal and informal control	• Agreement with terms/conditions • Negotiation of (changes in) project requirements • Closure of formal and informal contracts • Monitoring of contracted services • Arbitration • Completion
Executing The collaborative conduct of knowledge work.	• Collaboration dynamics • Iterations between individual work execution and collaboration • Confidential communication • Platform offering support and complementary resources, relying primarily on informal control	• Communication of work objectives, status, and changes • Conduct of actual knowledge work • Exchange of results

Note. [a] Further details are provided in Appendix A.

Macrolevel process 1: Matching

Contrasting the inter-organizational context of the original model (Ring and Van de Ven 1994) with interactions between workers and clients, the literature points to two main differences of work on DPKW.

First, the exchange, by definition (cf. boundary condition 2), involves a third party, thereby extending the traditional dyadic relation to triadic relations in which client-worker interactions are mediated by the platform. The platform provider governs the exchange by strategically allocating information and incentives in every process (cf. boundary condition 3)[6]. The second main difference is that the macro-level processes of DPKW have distinct characteristics and dynamics (cf. Table 2). Generally, interaction episodes on DPKW are shorter and more frequent compared to inter-organizational relationships, which often exceed the tenure of individual actors (Ring and Van

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[6] Consistent with the literature and Stabell and Fjeldstad's (1998) observation that third parties tend to facilitate interactions in value networks in a simultaneous and parallel way, we conceive governance mechanisms as concurrently mirroring the structure of macro-level and micro-level processes instead of forming independent sequences.

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de Ven 1994). To account for the differences between our context and inter-organizational relationships, we adapted the macro-level process. Specifically, we refer to the first macro-level process as a matching process instead of a negotiation of joint expectations because this process typically involves multiple workers. Similarly, we refer to the second macro-level process as a contracting process instead of a process of making commitments for future actions because this is more consistent with the literature on DPKW.

We adopted Kouamé and Langley's (2018) process linking approach to systematize descriptions of micro-level processes (provided by the papers on DPKW included in sample 2) and to link them with the three macro-level processes. Following this methodological approach, which is aimed at sensitizing the researcher to the significance of micro-level processes (Kouamé and Langley 2018), we broadly conceived knowledge work as a range of micro-level processes which are synchronically embedded in macro-level processes. We provide details on the qualitative content analyses of the micro-level processes in Appendix A. The resulting framework conceives each matching process as instantiating a new, virtually concurrent episode of knowledge work. Due to the synchronic nature of the processes, the framework does neither imply a linear notion of temporality nor the necessary but insufficient logic of process theories (Kouamé and Langley 2018; Markus and Robey 1988). In the following, we describe the characteristics and dynamics of the three macro-level processes and how they are instantiated through specific micro-level processes.

The macro-level process of matching is characterized by competition dynamics that emerge on two heterogeneous market sides (Hong et al. 2020, p.19). These market interactions occur on a global scale (cf., Gong et al. 2018) and often remain incomplete with only half of the project postings leading to contracts (cf. Hong and Zheng 2015). Communication between clients and workers is partially public (e.g., project descriptions and bids) and partially confidential (e.g., interviews). Platforms tend to regulate the micro-level processes and interactions between clients and workers strictly, primarily implementing formal modes of control (Gol et al. 2019b; Kirsch 1997). For instance, this pertains to the algorithmic filtering of workers based on ratings and work histories (Wood et al. 2018). DPKW can further restrict the projects that workers can apply for or exclude under-performing workers to address challenges related to low matching rates and client dissatisfaction (cf. Hong and Zheng 2015). In this context, IS research has started to explore various facets of client selection and worker application strategies. The matching process starts with the participation of clients and workers and it concludes either with the selection of a specific worker for the project, or with the project withdrawal. We proceed by outlining the micro-level processes in between.

On the demand-side, the fundamental pre-condition for the matching process, and by extension, the whole knowledge work process, is the participation of clients. Although research has only considered this micro- process cursorily, initial studies suggest that clients' participation arises from an interplay of organizational demand for complementary or rare expertise (Lu et al. 2015), demand for new sources of labor (Hong and Zheng 2015), IT-leaders' knowledge of potential benefits, and their vision of how sourcing strategies and processes must be adapted (Taylor and Joshi 2018).

In a succeeding step, clients formalize their demand by developing the project description and initiate the market activities by posting it on the platform (as a request for proposal). These project descriptions may specify both project-related details, which vary regarding codifiability, requirements, and flexibility (cf. Guo et al. 2017), and worker-related details, which pertain to different levels of education, experience, and localization (Andrea and Lorenzo 2010). In posting the project description, clients specify auction parameters such as the auction duration, and the bid visibility. Hong et al. (2016) show that although sealed bids, in which workers are not informed about competing bids, are often offered as a premium feature that leads to more bids, open bids may

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perform better, most notably in terms of client surplus and satisfaction. While the project description primarily facilitates worker selection at this stage, it simultaneously instantiates the initial micro-processes of the contracting and executing processes. Finally, clients can invite selected workers to submit bids (Chan and Wang 2014; Radkevitch et al. 2009).

On the supply-side, the participation of workers represents an initiating process parallel to client participation. Monetary incentives and dynamics of local labor markets are primary drivers of worker participation (Gong et al. 2018; Huang et al. 2018). Decisions for (continued) participation may depend on how workers deal with cold-start problems (Liang et al. 2016; Pallais 2014), fierce competition for perfect ratings (Rahman 2018), and, to some degree, marginalization problems that are common on micro-task platforms (cf. Deng et al. 2016; Ma et al. 2018). Over time, the iterative and synchronic completion of projects may become a factor that allows workers to benefit from the cumulative ratings, and to establish their position in the market. Initial evidence for this progression has been found in individual profiling strategies of workers, which evolve through distinct stages (Holthaus and Stock 2017; Sison and Lavilles 2018).

When workers have decided to participate and posted projects are available, the search and bid placement process begins (Zheng et al. 2015). For workers, the bidding process is always costly, requiring time, or even actual payments when the platform imposes bidding charges (Hong et al. 2020; Snir and Hitt 2003). Since platform providers increasingly recognize the problem of too many workers applying for projects, filters, and additional fees for individual bids have been considered as a mechanism to counteract information overload on the client side (Hong and Zheng 2015; Huang et al. 2020). Facets of bidding include timing, complementary signaling strategies, and avoidance of monitoring (Liang et al. 2018b; Sison and Lavilles 2018). Due to the increasingly important role of close collaboration between workers and clients, analyses of how multi-stage strategies of workers may lead to long-term commitments are particularly promising (Wu et al. 2019). Efforts to influence client decisions, which accompany the bid placement process (Hong et al. 2018), are a necessary but not sufficient condition for concluding the matching process, because the clients make the ultimate selection decisions.

The worker and bid assessment refer to the bid descriptions, and the evaluation of worker skills (cf. Hong and Pavlou 2017). This process may result in the selection of a particular worker, but it may also fail in transitioning to the contracting stage (Guo et al. 2017; Zheng et al. 2015). In this process, clients have been theorized to infer future worker behavior, and to reduce uncertainty by observing the characteristics of bids that have been placed (Hong et al. 2016). As Liang et al. put it, clients "rely on the observable signals or some heuristics to extrapolate the individual workers' capability and effort" (2018, p. 5). In this line of research, there are several studies explaining selection decisions (e.g., Hong and Pavlou 2017; Hong et al. 2016). The selection decision is significant because it is the pivotal mechanism for the transition to the next macro-level process of bilateral contracting.

Research is also starting to recognize the importance of the interview process on DPKW. Since transaction risks are more substantial compared to micro-task platforms, interviews give clients the opportunity to gather information beyond what is provided by the platform before making a hiring decision (Liang et al. 2018a). Consistent with offline-hiring processes, it may follow iterations between applicant assessments and interviews (cf. Sison and Lavilles 2018, p. 9). For workers, interviews are a critical part of the overall application strategy and the study of Sison and Lavilles (2018) suggests that workers approach interviews differently based on their level of experience. A possible variation of client-initiated interviews is worker-initiated pre-contract communication, which may result in encounters that develop into more formal interviews and lead to a successful selection decision (Hong et al. 2018).

The matching process either concludes with a selection decision or project withdrawal.

Selection decisions are made by clients who send a contract offer or an invitation to negotiate (cf. Hong et al. 2016, p. 64). While this does not necessarily imply successful contract closure, it tends to coincide with the freezing of the posted project description, prohibiting other workers from continuing to bid (Zheng et al. 2015). Alternatively, clients may decide to withdraw project descriptions, or platforms may set expiration dates on project descriptions, leading to automated withdrawal. Early evidence suggests that projects successfully transition to the contracting process at a rate of less than 50% (Snir and Hitt 2003).

Macrolevel process 2: Contracting

The contracting process, which is instantiated concurrently with the matching and executing processes, captures the bargaining dynamics between workers and clients as they work towards closure of contracts. Communication in the contracting process is restricted to bilateral exchange, coinciding with the increasingly important role of trust, and in some cases, complementary non-disclosure agreements. Platforms tend to guide both parties through the contracting process by combining formal and informal modes of control (Gol et al. 2019b; Kirsch 1997). For instance, this includes recording important decisions, such as the closure or completion of the contract, but also leaving workers and clients some freedom, for example regarding how to negotiate or monitor contracts (e.g., Idowu and Elbanna, forthcoming; Lavilles and Sison 2017). Initial evidence suggests that consistent with the nature of knowledge work (cf. boundary condition 5), corresponding microlevel processes, such as (re) negotiating contracts (e.g., Scholz and Haas 2011), are considerably more pronounced on DPKW than on micro-task platforms (Sison and Lavilles 2018). We discuss each one in turn.

The first micro-level process of agreeing to the terms and conditions of the platform (cf. Rahman 2018), and parts of negotiating the project requirements, occur synchronically with the matching process. When clients and workers register on a platform, they agree to terms and conditions, which serve as a framework for bilateral contracting on the platform and define the role of the platform provider.

Similarly, the first part of the micro-process *negotiating project requirements* synchronically coincides with the development and posting of the project description, the submission of bids, and iterative bilateral interviews in the matching process. Finalizing contract details, as part of negotiations, may continue after the client has selected a specific worker. One particularity of contractual knowledge work is that project uncertainty may need to be resolved through renegotiation of the contract conditions (Guo et al. 2017).

With the closure of a formal contract that may include informal agreements, the cycle of monitoring contract execution, negotiating changes in project requirements, and closing of a new, in/formal contract begins. Due to the complexity of knowledge work, clients and workers are often forced to compromise on specificity, and rely on incomplete contracts (Hong et al. 2020). As part of the contract, workers and clients can specify work modalities regarding deliverables and conditions such as budget, milestones, and means of communication (Liang et al. 2018b). Initial exploratory research is studying how clients and workers commit to particular work arrangements, including aspects related to work specification, non-disclosure agreements, salary, and schedule (Sison and Lavilles 2018). The critical role of informal agreements that complement formal contracts (Lavilles and Sison 2017) suggests that the complexity of committing to future action is not fully captured by the outcome of formal contracts. Contract closure effects a transition from the why of initiating the contract to the how of executing the work.

Parallel to the third macro-level process, clients exercise different forms of control, including outcome control, which may involve setting milestones and evaluating deliverables (Taylor and Joshi 2019), and process control, which may involve tools recording screen activity of the workers

(Liang et al. 2017; Sison and Lavilles 2018). While control of outcomes aligns with fixed-price contracts involving pre-specified deliverables, process control is more suitable for hourly contracts in which workers may be tempted to misrepresent efforts (moral hazard). Borrowing from both process and outcome control, periodical evaluation and harmonious conflict resolution have been considered as a means to avoid potentially disengaging arbitration processes (Du and Mao 2018). Complementing the work execution, payments are usually executed and monitored by the platform provider.

Contracting usually concludes with the completion process, in which feedback, ratings and potential bonus payments are exchanged (Rahman 2018; Wang et al. 2017). Alternatively, conflicts may prompt clients and workers to initiate arbitration services offered by the platform provider (Du and Mao 2018; Gol et al. 2019a). Neither of these two micro-level processes has been considered in-depth by extant research.
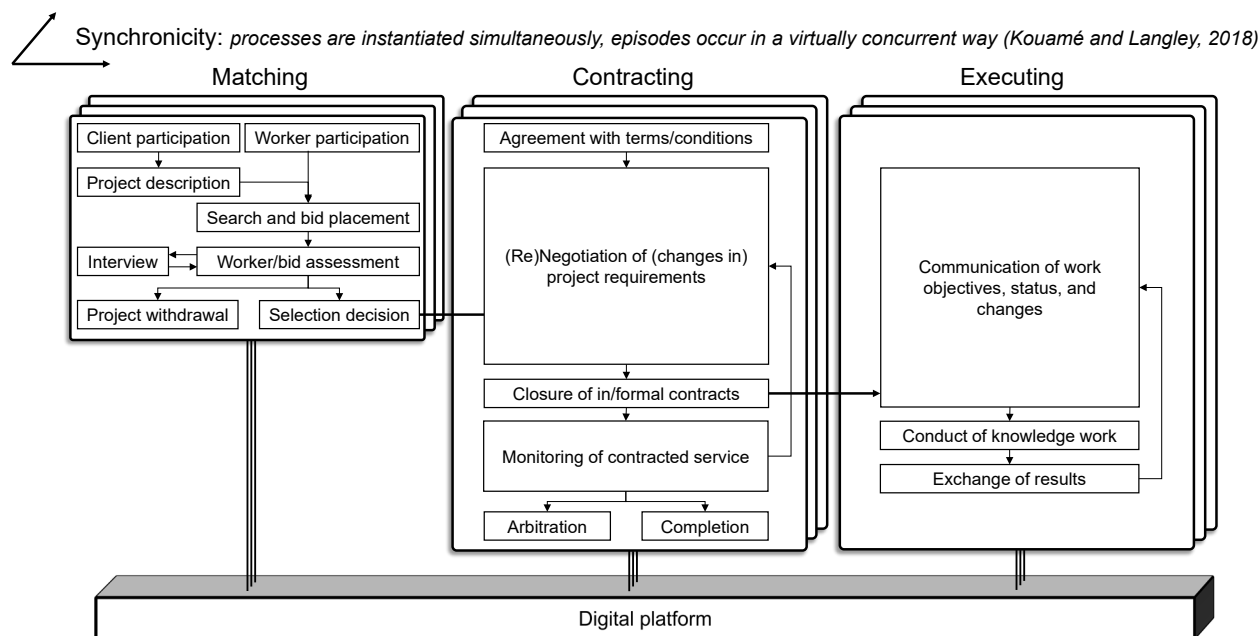
Macrolevel process 3: Executing

The macro-level process of executing commitments is characterized by bilateral collaboration dynamics between workers and clients. Synchronically mirroring the contracting cycle, the execution of knowledge work comprises iterations of individual work execution as well as exchange and collaboration between workers and clients. Once initiated, the conduct of knowledge work involves communication that is kept confidential. In this process, platforms offer support and complementary resources aimed at facilitating rather than restricting client-worker interactions (Lavilles and Sison 2017). Gol et al. (2019) outline a range of informal control mechanisms aimed at supporting the execution of work, including shared resources, policies, and work standards. The constituent micro-level processes, outlined in the following, have received considerably less research attention compared to the first macro-level processes.

Initial work objectives are communicated in the project description, refined throughout synchronic interviews and negotiations, and specified in formal and informal contracts. This synchronic notion of work objectives emerging across all three macro-level processes is a noteworthy difference compared to existing process models, which strictly situate the execution process after the closure of contracts (e.g., Taylor and Joshi 2018). In this context, the process linking approach (Kouamé and Langley 2018) allows us to capture initial communication that occurs before the contract is closed, as coinciding with the communication of work objectives. Iterative communication related to the progress of and changes in work objectives may be initiated when predefined milestones are reached, or when clients and workers encounter evolving project requirements. In knowledge work, which includes a range of IT-related tasks, the need for iterative work, evaluation, and adjustment may arise from different types of project uncertainties, for example, related to codifiability, requirements, and flexibility (Guo et al. 2017).

The conduct of knowledge work, as the goal pursued by clients and workers on DPKW, has received limited attention in IS research. Initial case studies have explored themes related to the knowledge work practices (Lavilles and Sison 2017), and to the allocation of tasks, coordination, self-management, the reuse of knowledge, as well as the affordances of epistemic technologies (Sison and Lavilles 2018).

After the execution of knowledge work, the *exchange of results* microlevel process signifies an inflection point at which the client evaluates the results and integrates them into business processes and environments (Taylor and Joshi 2018). This may lead to the completion of the knowledge work or it may trigger a new iteration of communicating (updated) work objectives. Completing the conduct of work coincides with the final micro-level processes of contracting. If arbitration processes have not been initiated, workers and clients typically exchange ratings and feedback to conclude the episode of knowledge work.

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Synchronicity: *processes are instantiated simultaneously, episodes occur in a virtually concurrent way (Kouamé and Langley, 2018)*

Note. The process can terminate at any stage. For readability, explicit termination processes and relationships were restricted to the most cogent ones.

AN AGENDA FOR IS RESEARCH ON DPKW

In this section, we outline an agenda for IS research on DPKW (cf. Table 3). At its core, our work contends that DPKW are distinct from other types of digital platforms and that they offer promising opportunities for future IS research.

Opportunities for future work on DPKW can be approached based on various research traditions and methodologies. For behavioral IS research, DPKW offer promising data sources with frequent episodes of the respective processes, providing a valuable basis for large-scale, quantitative studies identifying and explaining patterns in worker and client interactions (cf. Gefen and Carmel 2008). The possibility to contact workers and clients through the platform and, to some degree, observe their interactions, further enables promising qualitative research designs. Such work could advance research at the client and worker side, focusing on how platformization can shape and facilitate distributed knowledge work. Consistent with our focus on the distinct contributions of the IS community, we further envision design-oriented research. In line with the IS tradition of design science research, the centralized platform artifact of DPKW offers a natural starting point for theorizing constituent architectural components and their effects on different worker-client interactions (cf. Kokkodis 2020). Specifically, design science research has a rich tradition of combining behavioral theories with principles related to designing digital platform architectures (e.g., Spagnoletti et al. 2015; Tiwana 2018; Yoo et al. 2010) and advancing artifact design, which may be beneficial to a range of objectives such as improving communication, reducing stress, preventing worker exploitation, and ensuring compliance with applicable labor laws. This line of research could have a considerable practical impact since there are still major challenges related to DPKW, considering, for example, the low rates of successful contracting (Snir and Hitt 2003), the inflation of perfect worker ratings (Horton et al. 2015), information overload created by peaks on worker supply (Hong and Zheng 2015; Huang et al. 2020), or the latent susceptibility to worker exploitation (Deng et al. 2016). Overall, the emerging phenomenon of DPKW is opening up several opportunities on the levels of individual workers, organizations, industries, and societies.

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Consistent with the framework (Figure 2), our research avenues correspond to the macro-level processes of matching, contracting, and executing. While we approach DPKW from a process perspective, there are ample opportunities of contrasting DPKW and related types of digital platforms from complementary perspectives (Fisher and Aguinis 2017), including architecture, governance, affordances, and impacts. Eventual differences can serve as a basis for elaborating on extant theories on digital platforms.

Research avenues related to the matching process

In the matching process, skills that workers leverage to deliver high quality knowledge work services are one of the cornerstone elements. Evidence suggests that, compared to micro-task platforms, skills yield higher compensation rates, are more diverse, and are harder to evaluate (Leung 2018; Snir and Hitt 2003). Although IS research on DPKW has focused on the matching process, further research is needed to conceptualize and quantify worker skills. To enable large-scale analyses, prospective researchers may consider measure development approaches that are based on natural language processing (NLP) and can be automated (Pandey and Pandey 2017). Reliable measures for worker skills that can be applied across studies and platforms would be an invaluable tool for assessing skill value and variation of skill supply over time. They could also be leveraged as an input for design science research aimed at improving matching performance. Such insights could further form the basis for appreciating the heterogeneity of worker skills and examining generalizability of research findings. For instance, there is a need to further explore how experience in one skill category transfers to related categories (cf. Leung 2018). Understanding these fundamental characteristics of skill supply has implications for pricing and sourcing strategies of clients and workers alike.

With initial studies analyzing the antecedents of selection decisions, we would like to draw the attention of prospective authors to two specific aspects of DPKW, i.e., rating inflation and the interview processes. First, the increasing prevalence of perfect worker ratings (cf. Horton et al. 2015) makes it challenging for clients to effectively select workers. Future research has the opportunity to examine worker qualities, as reflected by ratings, work portfolios, and skill-tests, more closely and analyze which of them are associated with successful project completion. Better explanations of the worker characteristics that predict successful project completion have significant implications for platform design, ranging from the development of skill-tests to recommendation algorithms driven by reliable worker signals. Second, due to high contract volumes, the uncertainty of skills, and the frequency of transactions, DPKW offer unique opportunities to examine remote, technology-mediated interviews. Prospective researchers may find inspiration in studies conducted in more traditional settings (cf. Chapman et al. 2003) and in theories of media richness and media-synchronicity (cf. Dennis et al. 2008). Implications for clients and workers regarding technology choices and overall interview strategies are evident.

Research avenues related to the contracting process

To advance our understanding of the heterogeneity in contracting episodes, we outline a research avenue aimed at dissociating categories of knowledge work and their downstream effects on the processes of executing knowledge work services. Knowledge work may differ from other types of work in many regards, such as uncertainty arising from the emergence and low codifiability of requirements (cf. Guo et al. 2017). We expect contrasting successful and failed contracting episodes to yield more nuanced insights concerning the characteristics and requirements of respective categories of knowledge work. Such disentangling of heterogeneous categories further allows prospective researchers to critically assess the generalizability of research and to select interesting work categories as starting points for empirical studies. Research could build on extant knowledge in the software development literature (e.g., Faraj and Sproull 2000; Maruping et al. 2009) and contribute novel insights to this body of literature, based on insights of many (partly)

publicly observable software development projects. More nuanced dissociation of knowledge work is also promising to impact practitioners. For instance, particular requirements and early signs of emerging, or changing requirements (cf. Benschop et al. 2020) could be incorporated in guidelines and dedicated software agents. Similarly, workers could benefit from such insights by anticipating emerging requirements, and by strategically avoiding contracts associated with high probabilities of failure.

The second research avenue acknowledges the complex and evolving strategies of individual workers and clients, and their interplay with the platform design. Options to strategically manipulate the exchange permeate each micro-level process depicted in our framework (cf. Figure 2). For instance, this includes strategic withdrawing and reposting of project descriptions (Chilton et al. 2010), swaying clients into an interview through private messages (Hong et al. 2018), and withdrawing feedback (Bolton et al. 2018). There are a plethora of theories dedicated to different facets of strategic behavior in exchanges between agents (Bolton and Dewatripont 2005; Homans 1958), which can be leveraged both in large-scale studies of data sets provided by a platform, and in-depth qualitative studies with selected workers and clients. Overall, this research avenue offers unique opportunities to explore the manifestations of strategic behavior in micro-level processes and their association with contractual outcomes at the macro-level.

Last, we call for research dedicated to opening the black box of arbitration processes. Similar to micro-task platforms, this potential dark side of DPKW should be examined carefully, adopting perspectives such as critical social theory (Myers and Klein 2011), or value sensitive design (Deng et al. 2016). Arbitration processes are particularly delicate on DPKW due to the excess bargaining power of clients, dependence of workers on perfect ratings, and high contract volumes. Challenges related to the legal and ethical role of platform intermediaries could be approached from a perspective of engaged scholarship (van de Ven 2007). Societal implications and the need to reinforce fair resolution, avoid worker marginalization, and eliminate discrimination are evident.

Research avenues related to the executing process

While most research has been dedicated to the processes of matching and in parts contracting on DPKW, little consideration has been given to the process of executing knowledge work. This leaves considerable opportunities for in-depth explorations that focus on knowledge work practices (Newell 2015). We envision that future research may unpack how work content and practices are being reconfigured throughout evolving episodes of micro-level encounters, and throughout career trajectories of workers. Further, studies of worker interactions may direct research toward studying communication and collaboration practices occurring in digital and geographically dispersed workplaces (Brummans et al. 2014). Such research could go beyond studying workers from an individualistic perspective and instead focus on relations between workers and clients, and possibly explore the heterogeneity of a larger ecosystem of stakeholders and digital platforms beyond the DPKW. While gaining access to such rich descriptions of situated knowledge work practices presents different challenges compared to the analysis of publicly observable data of the matching process, we encourage scholars to find cases, for example, through field studies, digital ethnographies, and analyses of anonymized data sets provided by platform owners (cf. Rahman 2018). The reward for DPKW research may include interesting insights into how knowledge work is performed and effective guidance on how practices can be improved.

A second, related research avenue considers the central role that digital technologies play in knowledge work and how the platform artifact and complementary technologies employed by the workers and clients matter in the production of knowledge. In particular, the notion of epistemic technologies, tools used to construct knowledge (Anthony 2018), could be explored further to unpack how workers use and engage with different technologies. Research pursuing these aspects may yield in-depth insights into the different types of digital work environments, or digital cubicles,

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in which workers leverage, reuse, and combine knowledge and technology to deliver services. The pervasiveness of digital platforms also prompts a rethinking of our theoretical approaches that capture the role of IT affordances and the relationship between social and material actors (Barrett et al. 2016). Further theoretical routes for prospective studies are thus related to the development of performative and socio-material theories of knowledge work that investigate, for example, digital/human work configurations on DPKW.

In a third research avenue, we call for research that looks into knowledge transfer on DPKW, including job-shifting, knowledge reuse, and confidentiality. Although knowledge work has been considered to be highly context-dependent and situated in social structures (Pettersen 2019), initial research suggests that knowledge transfer across jobs may be possible in some cases (Sison and Lavilles 2018). With workers transitioning frequently between jobs, we believe that insights can be equally beneficial for managing transitions to new knowledge work projects in more traditional organizational settings. Researchers may also turn to questions of confidentiality in the context of knowledge transferability (cf. Gefen and Carmel 2008). There are limited insights into whether and how platforms manage the aspect of confidentiality and how workers balance the trade-off between reusing knowledge and preserving confidentiality. From a client perspective, such considerations can play an important role in decision-making processes when deciding on a sourcing strategy (Gefen and Carmel 2008).

We conclude the agenda by noticing further opportunities beyond the three processes. First, some processes do not occur on DPKW and are therefore not part of our framework, for example, organizational decision processes to initiate sourcing of knowledge work services. On the worker side, there are limited insights into aspects of preparation and training enabling them to compete on global markets for knowledge work services. In addition, research on platform governance has primarily examined governance of the three internal macro-level processes (cf. Du and Mao 2018; Gol et al. 2019b), leaving opportunities to explore how platform providers attract participants on both market sides through outreach activities like education and incentives. Second, the architectural view on DPKW is arguably underdeveloped, setting aside the distinction between centralized and decentralized archetypes, which mirror corresponding governance modes (Gol et al. 2019a; Gol et al. 2019b). Due to the distinct processes of knowledge work on DPKW, this lack of research leaves promising opportunities for exploratory research contrasting innovative product platforms and service platforms to uncover how each type of platform manifests potentially divergent architectural elements and patterns. This line of research could draw inspiration from extant work conceiving digital platforms as implementing a distinct logic of digital innovation through layered modular architectures (Yoo et al. 2010). Third, while our process-centric framework focuses on the interactions that simultaneously involve workers, clients, and a mediating platform provider, a promising approach would be to zoom in on one of these actors, targeting more in-depth insights. For instance, adopting a worker-centric perspective, it would be worthwhile to explore how novel work engagements on DPKW mutually shape work-life balance and technostress. Another related research trajectory would be to explore how the data provided by platforms like DPKW can be harnessed for labor markets by informing workers' choices related to education and career development (Manyika et al. 2015). Fourth, impacts and regulation of DPKW should be explored more comprehensively on different levels. Research should further examine the tension between individual outcomes like autonomy and marginalization, implications for strategic sourcing of digital talent by organizations, and the transformation of industries and entire labor markets. Dissociating measures that expand the benefits of DPKW while limiting negative side effects is deemed to produce strong policy implications.

Table 3
An agenda for strategic IS research

Research avenue and approach	Potential implications
Matching avenue 1: Conceptualizing and quantifying worker skills, value, and variation of supply over time - **Methods** Measure development based on NLP (Pandey and Pandey 2017), hidden Markov models (Andrea and Lorenzo 2010), time-series analyses - **Data sources** Publicly observable worker profiles and bids - **Recommended studies** Leung (2018)	**Research**: More comprehensive measures of observable worker qualities, understanding of market segmentation, and examining generalizability of research **Practice**: Price-setting informed by comparison with same-skill workers (workers), consideration of potential seasonality and pre-selection based on skills (clients)
Matching avenue 2: Selecting knowledge workers effectively while facing low variance in worker ratings and restrictions of media channels - **Theories** Signaling theory (Spence 1978), theory of two-sided markets, media synchronicity (Dennis et al. 2008), information asymmetry, auction theory, price discovery theory - **Methods** Identification designs (Bowen III et al. 2016) - **Data sources** Publicly observable market exchange, combined with private data on bilateral interactions - **Recommended studies** Chapman et al. (2003)	**Research:** Explanation of how worker qualities, skill-tests, and signals affect outcomes of the contracting and executing processes **Practice:** Technology-choice and individual strategies for interviews (clients, workers), development of worker skill-tests, recommendation algorithms that are based on reliable worker signals (platform providers)
Contracting avenue 1: Dissociating categories, characteristics, and requirements of knowledge work - **Foundational literature** Software development (requirements elicitation, classification, and analysis), categories of knowledge work (Schultze 2000) - **Recommended studies** Guo et al. (2017), Kokkodis and Ipeirotis (2016), Benschop et al. (2020)	**Research:** Understand differences between categories of knowledge work and the generalizability of findings across categories **Practice:** Guidelines for codification of emergent project requirements depending on the type of work (clients) and strategies for preventing miscommunication (workers**)**
Contracting avenue 2: Exploring the interplay of strategic worker and client behavior and platform design - **Theories** Incentive theory, (social) contract theory (Bolton and Dewatripont 2005), social exchange theory, game theory - **Data sources** Remote interviews with selected workers/clients, de-identified data provided by the platform - **Recommended studies** Bolton et al. (2018), Rahman (2018)	**Research**: Explaining the significance of microlevel processes (such as interviews and project descriptions) by predicting macrolevel outcomes **Practice**: Improving platform mediation, terms and conditions, and guidelines (platform providers**)**
Contracting avenue 3: Unpacking the black box of arbitration processes and outcomes - **Theories** Value sensitive design, legal and ethical aspects, critical social theory - **Recommended studies** Schlagwein et al. (2019), Deng et al. (2016), Lacity and Willcocks (2017)	**For research:** Understanding the dark side of DPKW, i.e., how arbitration processes lead to marginalization or fair resolution **For practice:** Evidence and recommendations for public policymakers and legislators

Executing avenue 1: Appreciating the situated practice of knowledge work and worker-client relationships
  - **Theories** Practice theory, social identity theory
  - **Methods** Ethnography, field studies
  - **Recommended studies** Boons et al. (2015), Lifshitz-Assaf (2018), Schultze (2000)
	Research: Knowledge of the situated work practices, and discovery of constructs explaining superior performance
	Practice: Work routines for platform redesign (providers) and informed collaboration with high-performing workers (clients**)**

Executing avenue 2: Exploring the role of technology and affordances
  - **Theories** Socio-material theory, affordances
  - **Methods** Trace data analyses, Netnography (Kozinets 2010)
  - **Recommended studies** Anthony (2018), Barrett et al. (2016), Leidner et al. (2018), Rossi et al. (2020)
	Research: Understanding DPKW as enactments of user interactions, technologies, and strategic initiatives rather than distinct, mediating systems
	Practice: Targeted design of digital work environments (workers**)**

Executing avenue 3: Analyzing cross-project knowledge-transfer and confidentiality when working for different clients
  - **Theories** Knowledge reuse, and protection
  - **Methods** Qualitative interview studies
  - **Data sources** Workers who frequently switch clients
  - **Recommended studies** Markus (2001)
	Research: Understanding the interplay and trade-offs between knowledge reuse and confidentiality
	Practice: Best-practices for converging on expectations regarding knowledge confidentiality and reuse (clients, workers**)**

LIMITATIONS

Our results should be interpreted in the light of four limitations. First, the search was designed to cover the contributions of IS research. While we can be reasonably confident in the completeness regarding the scope of 40 IS journals and five IS conferences, we did not systematically search for research published in related disciplines (like Management and Organizational Behavior). Second, the state of research on DPKW is emergent and evolving, requiring careful interpretation of research findings, focusing more on transferability than on generalizability (Kouamé and Langley 2018; Lincoln and Guba 1985). For instance, evolving platforms may be hybrid, with one part conforming to our definition and another violating one of the boundary conditions. Third, our synthesis focuses on the instantiation of three macro-level processes. This implies that some aspects are only covered cursorily, such as impacts external to the platforms (e.g., on labor markets) and strategies overarching ecosystems (e.g., multi-homing). Fourth, while the process linking approach and the principles of synchronic instantiation allows us to integrate heterogeneous processes in one framework, it also has inherent limitations. Most notably, the logic of embeddedness implies that they are not linked through a strict temporal sequence.

CONCLUSION

In this paper, we sought to understand emerging IS research on DPKW. Our review offers three main contributions. First, we propose a definition of DPKW as the type of digital platform that focuses on knowledge work services. In deriving a coherent and well-bounded definition from the extant literature on digital platforms and knowledge work, we seek to improve definitional clarity in this upcoming stream of research. Second, we synthesize extant knowledge in a conceptual process framework, which explains knowledge work on DPKW based on synchronic and recurrent macro- and micro-level processes. Third, we provide a detailed agenda for the emergent area of DPKW research, emphasizing potential implications for research and practice.

With a high proportion of exploratory papers and a range of open research gaps, we conclude that sourcing of knowledge work services from DPKW is still an emerging topic in strategic IS research. At this early stage of research, it is imperative to provide an integrated research platform for the increasingly heterogeneous research contributions. We trust that this review paper

will serve as such a platform, stimulate more research, and provide fruitful guidance. Future research on DPKW can be expected to offer a range of practical implications for strategic IS, potentially informing sourcing strategies of clients, micro-entrepreneurial practices of workers, strategic platform management, and public policy aimed at constraining worker marginalization. Capitalizing on these opportunities requires decision makers to understand the constitutive processes and unique dynamics of DPKW and disentangling them from related types of platforms.

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APPENDIX A. METHODOLOGICAL DETAILS

We followed review methods documented in the literature (Templier and Paré 2018; Webster and Watson 2002) and the stages originally recommended by Arksey and O'Malley (2005) and updated by Levac et al. (2010) and Tricco et al. (2018). For transparency, we followed established reporting guidelines for each step of the scoping review methodology (Templier and Paré 2018). References of the papers included in this review (sample 2) are available in Appendix B.

Literature search

The search strategy comprises a range of search techniques to identify relevant papers published in IS outlets that are explicitly presented as research on DPKW. We aim at an inclusive assessment of available research that is not restricted to papers using specific search terms. At the same time, our goal is not to include papers that violate the boundary conditions (BCs) presented in the definition section. The specified scope is not limited to a certain time frame, covering peer-reviewed research published in IS journals and conferences. We include publication outlets listed in the top 40 IS journals identified by Lowry et al. (2013) and proceedings of the five major IS conferences (Table A.1 provides the complete list).

In the first stage, we scanned tables of contents to identify papers focusing on DPKW (searching 5,737 papers). Since these manual paper-by-paper analyses of titles and abstracts are not restricted to pre- specified search terms, they offer a robust search technique for emergent topics, such as DPKW. This search, which covered the entire *AIS Senior Scholars' Basket of Journals* between 2000 and 2020, was executed between January 28th and February 23rd, 2019. It was then extended between November 19th and December 3rd 2019 and between September 2th and September 3rd 2020.

Table A.1

Publication outlets covered in the search

Publication outlet
ACM Transactions on MIS
AIS Transactions on HCI
Americas Conference on Information Systems
Australian/Australasian Journal of Information Systems
Business & Information Systems Engineering
Communications of the Association for Information Systems
Decision Support Systems
e-Service Journal
Electronic Commerce Research and Applications
Electronic Markets
European Conference on Information Systems
European Journal of Information Systems
Hawaii International Conference on System Sciences
Information & Management
Information & Organization
Information Resources Management Journal
Information Systems Frontiers
Information Systems Journal
Information Systems Management
Information Systems Research
Information Technology & People
Information Technology and Management
International Conference on Information Systems
International Journal of Electronic Commerce
Journal of Computer Information Systems
Journal of Database Management
Journal of Global Information Management
Journal of Global IT Management
Journal of Information Systems Education
Journal of Information Technology
Journal of Information Technology Case and Application Research
Journal of Information Technology Management
Journal of Information Technology Theory and Applications
Journal of Management Information Systems
Journal of Organizational and End-User Computing
Journal of Organizational Computing and Electronic Commerce
Journal of Strategic Information Systems
Journal of the Association for Information Systems
MIS Quarterly
MIS Quarterly Executive
Pacific Asia Conference on Information Systems
Revista Latinoamericana y del caribe de la Associacion de Sistemas de Informacion
Scandinavian Journal of Information Systems
The DATABASE for Advances in Information Systems
Wirtschaftsinformatik

In the second stage, we ran database searches on *Google Scholar*, the *AIS Electronic Library* (AISeL), *ABI/INFORM, EBSCO*, and the *ACM digital library*. Consistent with the keywords identified throughout the table-of-content scan, we specified the search terms *"knowledge work platform"*, *"digital platform"*, *"digital labor platform"*, *"online labor market"*, *"digital labor market"*, or *"microsourcing"*. We also covered variations of the search terms in British English, including *"digital labour platform"*, *"online labour market"*, and *"digital labour market"*. Since search terms are particularly difficult to justify for emergent phenomena characterized by heterogeneous terminology, the selection of search terms was additionally compared with prominent exemplars in literature (e.g., Gol et al. 2019; Rai et al. 2019). Additional search-terms (e.g., *"knowledge work"*, *"gig work"*, or *"online work"*) resulted in papers that often lacked the platform element of the DPKW definition. Results from the database searches were restricted to the pre-specified journals and conferences using the source tag (*Google Scholar*), the filter functionality (*AISeL*), the publication title (*ABI/INFORM*), the journal name (*EBSCO*), and the published in filter (*ACM digital library*). Detailed search queries are available upon request. Database searches were executed between March 7th and August 12th, 2019. They were updated between November 19th and November 21st, 2019, and September 3rd and September 6th 2020. The database searches yielded 583 papers.

In the third stage, we executed backward (citation) searches, checking reference sections of all papers included in the final sample. In parallel to the iterative execution of the other search techniques, the backward search was updated for all papers added to sample 2. Backward searches are a particularly powerful search technique since they allow researchers to rely on the collective literature searches executed as part of previous research. Ultimately, this search technique can be expected to be less susceptible to variation in terminology used in titles, abstracts, and keywords. In this search, 415 papers were identified.

In the fourth stage, we asked two colleagues to check our sample of relevant papers selected after the second screen, and to identify missing papers. This search uniquely identified twelve additional papers.

Papers identified by the search were imported into a database (BibTeX). Duplicates were identified by the semi-automated matching algorithm of Jabref (4.3.1). In addition, manual checks for duplicates were conducted, resulting in four additional duplicates. Overall, 404 duplicates were removed. The search results can be obtained from the authors upon request.

Paper screening

In the first screen, we included papers that focus broadly on digital platforms and fall inside the formal search scope (e.g., correcting for indexing errors in the databases). Papers whose relevance was difficult to judge were deliberately retained for the next step. The high number of papers excluded during the first screen results from the number of papers identified in the table-of-content scan. Overall, the sample size after the first screen is 578. The list of papers in this sample can be obtained from the authors upon request.

The development of boundary conditions followed a highly iterative approach as outlined in the methods section. Subsequent iterations resulted in the adaptation of the respective boundary conditions, as exemplified by boundary conditions 2 and 5. Boundary condition 2, which originally referred to organizationally independent clients and workers, was intended to exclude cases in which clients and workers are part of the same organization and subject to traditional measures of control. We noticed that this is more aptly described by the notion of networks of users, i.e., clients and workers, which are mediated by a platform. Corresponding distinctions in the strategic management literature (Stabell and Fjeldstad 1998) further sensitized us to the implications associated with network-oriented value configurations, which also contrast with traditional, dyadic outsourcing arrangements. The second boundary condition was revised accordingly. Boundary

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condition 5 is another example of iterative refinement. Originally, this boundary condition did not effectively exclude micro-task work, i.e., it did not ensure that work on DPKW was indeed knowledge work. The updated version of boundary condition 5 emphasizes the requirement of skills, the uncertainty of knowledge work, and the need for collaboration between workers and clients, as key characteristics that are lacking in micro-task work. Regular team meetings were held to discuss external feedback of colleagues, reviewers, and editors as well as potential changes. Borderline cases were retained for additional iterations in which they were compared to similar papers to ensure consistency of the boundary conditions.

In the second screen, we tested each of the five BCs by applying them to the entire set of 578 papers. Throughout the process, we recognize that there is further research that could be transferred to DPKW. However, the BCs and the corresponding formal inclusion criteria applied throughout this review focus on research explicitly conducted on DPKW. We do not actively extrapolate studies whose original focus is not on DPKW. At the same time, we recognized that for some boundary conditions (e.g., BC 3), exact binary decisions were difficult and therefore considerate judgment was needed. Papers focusing on multiple platforms were included and interpreted carefully if a meaningful part of the results is based on DPKW[7]. Throughout the inclusion screen, the main focus of the papers (the empirical part, if applicable) was considered; mere speculation that the results and conclusions could be transferred to this type of platform, for example in the discussion section, did not warrant inclusion. Although time intensive, this procedure was necessary to identify and consistently select eligible papers.

Overall, 49 papers are included in our sample. In the Figure A.1, we provide an adapted PRISMA-ScR chart (based on Tricco et al. (2018)), displaying the flow of the papers through the identification and inclusion process.

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[7] Note that the paper of Liang et al. (2018) is one such case since the research design covers both a DPKW (Freelancer.com) and a micro-task platform (Amazon Mechanical Turk). Since two of the research questions are addressed based on DPKW data exclusively, we included the paper, restricting our analyses to the evidence on DPKW as far as possible.
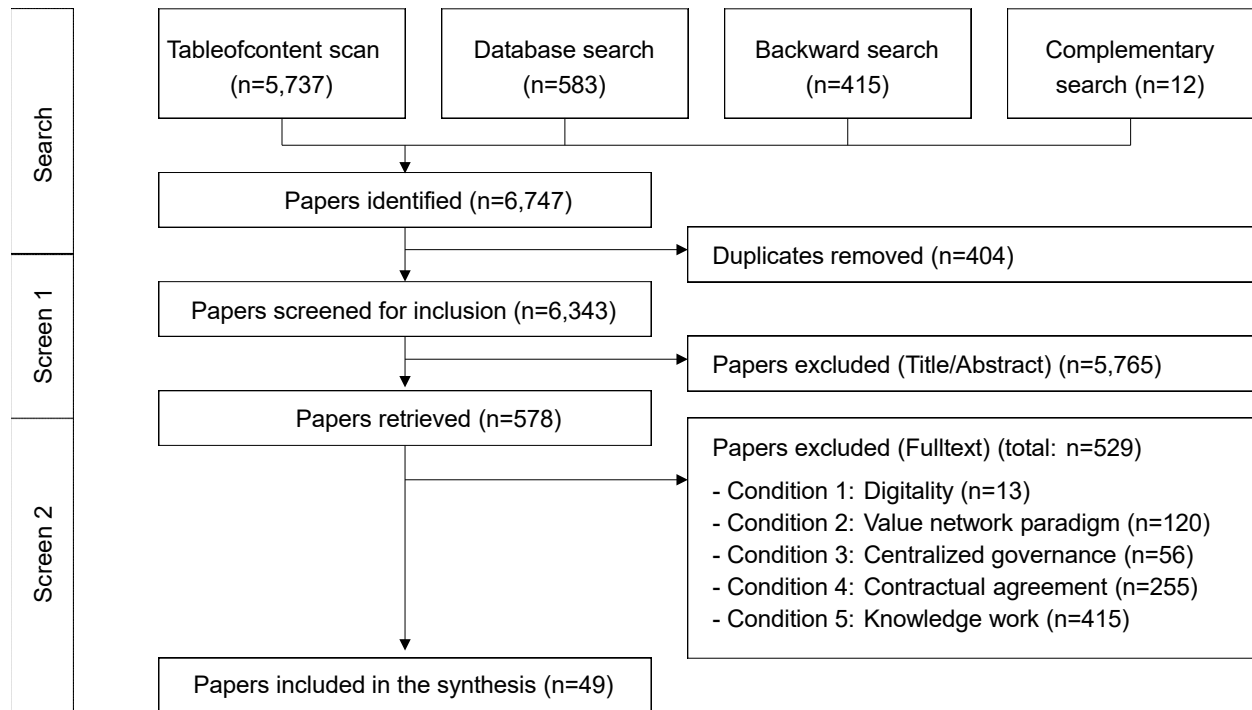
Fig. A.1. PRISMA-ScR flow diagram (adapted from Tricco et al. 2018)

Profile of the papers

Next, we report descriptive statistics of the paper metadata. In Table A.2, we cross-tabulate papers per year and publication outlet. The sample includes three research-in-progress conference papers (6.12%), 24 completed conference papers (48.98%), and 22 journal papers (44.90%).

Table A.2
Frequency table

Journals and conferences	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Sum
Decision Support Systems	-	1	-	-	1	-	-	-	1	-	-	-	-	3
e-Service Journal	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Electronic Markets	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Information & Management	-	-	-	-	-	-	-	1	-	-	-	-	-	1
Information Systems Frontiers	-	-	-	-	-	-	-	1	-	1	-	-	1	3
Information Systems Journal	-	-	-	-	-	-	-	-	-	-	-	2	-	2
Information Systems Research	-	-	-	-	-	-	-	-	1	1	1	-	1	4
International Journal of Electronic Commerce	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Journal of Management Information Systems	-	-	-	-	-	-	-	-	-	-	1	-	-	1
MIS Quarterly	1	-	-	-	-	-	-	-	-	-	-	-	-	1
MIS Quarterly Executive	-	-	-	-	-	-	-	-	-	-	1	-	-	1
The Journal of Strategic Information Systems	-	-	-	-	-	-	-	-	-	1	1	1	-	3
Americas Conference on Information Systems	-	-	-	1	-	-	-	1	-	-	1	1	-	4
European Conference on Information Systems	-	-	-	1	-	-	-	-	-	-	-	1	-	2
Hawaii Int. Conference on System Sciences	-	-	-	-	-	-	-	-	-	1	3	-	-	4
International Conference on Information Systems	-	-	-	-	1	-	2	2	1	2	4	2	*	14
Pacific Asia Conference on Information Systems	-	-	-	-	-	-	-	-	-	1	1	-	1	3
Sum	1	2	-	2	2	-	2	5	3	7	13	8	5	49

Note. ∗ The Proceedings of the 41st International Conference on Information Systems (2020) were not yet available.

Coding of processes

The coding process was initiated by open coding in which we annotated the micro-processes described in the papers, extracted them, and organized them in a table. In this step, we focused on how situated instantiations of processes were described (such as "describing the project") instead of more abstract interpretations (such as "reducing uncertainty regarding project valuation"). Tables 7, 8, and 9 (Appendix C) document the chain of evidence by connecting the micro- and macro-level processes with corresponding quotes from the literature. Consistent with process theory perspectives (Kouamé and Langley 2018; Langley 1999), we further concentrated on the co-occurrence and sequence of processes. The coding process was completed by an analytical coding phase, which involved homogenizing terminology across papers, and converging towards the archetypal micro-processes that are at the core of knowledge work on DPKW. Activities which primarily occur outside of DPKW were not retained after the selective coding process (e.g., learning and career development activities).

Effectiveness and restrictions of the search

To justify the restrictions of the search (Templier and Paré 2018) and to analyze its effectiveness, we monitored several search metrics. Considering all papers that were included in sample 2 as the reference set of actually relevant papers, we calculated metrics for each search technique and the respective data source, if applicable (see Table A.3). Techniques with a lower precision return more irrelevant results, causing more effort throughout the identification and inclusion screening processes; techniques with a lower recall miss more papers that would in fact be relevant. Considering this trade-off, our search metrics indicate that the database searches produce more precise results (less noise) compared to the table-of-contents search. At the same time, less restrictive search terms (such as "*platform*") would have led to a further decrease in precision. With regard to the databases, *AISeL* and *Google Scholar* were most effective (in terms of percentage identified). *ABI/INFORM*, *EBSCO*, and the *ACM digital library* did not add papers that would otherwise have been missed. The high recall of the backward search and the high percentage of identified papers confirm that this search technique is by far the most effective one in our selection. Our analysis further indicates that the combination of search techniques was necessary for identifying all relevant papers, because none of the techniques individually identified all of the relevant papers.

Table A.3

Search Metrics

Search Technique	Precision	Recall	Percentage identified	Uniquely identified
Table-of-content search	0.00	0.22	22.45%	1
Database search (Google Scholar)	0.06	0.43	42.86%	5
Database search (AISeL)	0.09	0.31	30.61%	8
Database search (ABI/INFORM)	0.21	0.08	8.16%	0
Database search (EBSCO)	0.00	0.00	0.00%	0
Database search (ACM library)	0.00	0.00	0.00%	0
Backward search	0.07	0.55	55.10%	11
Complementary search	0.42	0.10	10.20%	2

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APPENDIX C. DATA EXTRACTION

Table C.1

Extracts illustrating the micro-level processes (matching)

Micro process	Representative descriptions*	Source
Client participation	"Before buyers and vendors are able to enter the exchange, they are **required to register** at the website."	Radkevitch et al. (2009, p. 400)
	"**new source of labor for firms**"	Hong and Zheng (2015, p. 2)
Project description	"**clients post IT development projects** (typically of about two weeks duration) on an ITCS platform for digital crowdworkers to bid on"	Taylor and Joshi (2018, p. 281)
	"1) an employer **posts a CFB to describe the required services, deliverables, and duration**; 2) potential service providers browse the website to find suitable CFBs that match their skills and propose bids by entering a reverse auction"	Guo et al. (2017, p. 2)
	"A typical form of crowdsourcing is **publishing the request for proposals** through an online marketplace with the details of the needed service and its expected duration and (a range of) cost. Then potential participants bid on the task by submitting their proposals."	Gong (2017, p. 301)
	"Clients **categorize** each project into a specific area of expertise (type of work), **provide** a project description, and **propose** a budget and end time. Vendors who are registered with the marketplace read the project descriptions and place bids on the basis of price."	Kathuria et al. (2015, pp. 8–9)
	"One critical decision the buyer needs to make when posting a CFB of an auction is to choose a pricing rule (the way the price of the auctioned good or service is determined). Specifically, the buyer can choose to use the fixed-price (FP) mechanism, or the open-price (OP) mechanism."	Hong et al. (2019, p. 2)
Worker participation	"Workers need only **register an account on the platform** to begin bidding on projects"	Huang et al. (2018, p. 2)
	"new workers who **register** as a result of being laid off during a local economic crisis may be more likely to then drop out of the online labor platform when the local market recovers"	Huang et al. (2018, p. 15)

Search and bid placement	"freelancers [...] **search, review projects, prepare proposals and decide which project and how much to bid**"	Zheng et al. (2015, p. 2)
	"Multiple workers **start bidding for the job** and eventually the employer chooses to hire one (or several) of them."	Kokkodis and Ipeirotis (2014, p. 1)
	"**placing a bid** is always accompanied by costs"	Hong et al. (2020, p. 22)
	"Sellers **apply for the job** after finding it from a list of search results based on a self-specified query; the application consists of a written cover letter, price the seller is charging, and the seller's profile and past job performance is visible to the buyer"	Kabra and Wang (2020, p. 2)
Interview	"*After a series of **interviews**, they hired me*"	Sison and Lavilles (2018, p. 9)
	"Having gone through the step of **interviewing** and selecting a worker from a pool of applicants, employers are expected to bear the responsibility of making bad online hires."	Chan et al. (2019, p. 2)
	"Buyer selects sellers to conduct an **interview**, and eventually selects one or more sellers to work on this job and contracts are formed"	Kabra and Wang (2020, p. 2)
Worker and bid assessment	"Given the limited information about workers, **employers usually rely on the observable signals or some heuristics to extrapolate the individual workers capability and effort**"	Liang et al. (2018, p. 5)
	"a **buyer has to select among freelancers** who vary in their quality"	Hong and Zheng (2015, p. 2)
	"buyer's difficulty in assessing the seller's true characteristics, **predicting whether the seller [i.e., workers] will act opportunistically**"	Zheng et al. (2015, p. 3)
	"At the end of the auction, clients **evaluate competing bids** on the basis of price and vendor attributes and award projects. [...] A reputation system tracks all feedback ratings a provider receives from historical clients and forms a key attribute of vendors at the time of **bid evaluation**."	Kathuria et al. (2015, p. 9)
Project withdrawal	"Before the bidding period **expires**, the employer can review bidders' basic information"	Liang et al. (2017, p. 48), Liang et al. (2016, p. 7)
	"The auction **automatically closes** for bidding after the auction duration expires (e.g., 7 days)."	Hong et al. (2018, p. 3413)

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	“An auction can **fail** if the buyer cannot find a satisfactory bid from those received.”	Hong et al. (2019, p. 3)
	“There is no obligation for the buyer to allocate the project to any of the vendors, which results in quite a low project allocation rate of 30–40% [39].”	Radkevitch et al. (2009, p. 300)
Selection decision	“The client must evaluate the individual bids to **determine which crowdworker, if any, will be awarded the contract**.”	Taylor and Joshi (2018, p. 283)
	“Having gone through the step of interviewing and **selecting** a worker from a pool of applicants, employers are expected to bear the responsibility of making bad online hires.”	Chan et al. (2019, p. 2)
	“the buyer could **end the auction** early at any time (i.e., the buyer does not need to wait until the full auction duration elapses)”	Hong et al. (2018, p. 3413)
	“The requester then **selected an applicant** based on the proposals.”	Schlagwein et al. (2019, p. 11)
	“A firm could then **choose a service provider** by considering the bidding price, experience, skills, past working relationships and ratings of past work done for other clients.”	Lu et al. (2015, p. 605)

*Notes. * We highlighted parts of the extracts that correspond to the respective micro process in bold. References are provided in Appendix B.*

Table C.2

Extracts illustrating the micro-level processes (contracting)

Micro process	Representative descriptions*	Source
Agreement with terms/conditions	“user **agreement**, and legal terms and conditions”	Rahman (2018, p. 4)
Negotiation of (changes in) project requirements	“clients **negotiate** with the chosen vendor concerning deliverables and contract prices”	Du and Mao (2018, p. 8)
	“workers could **negotiate** their rate with employers”	Idowu and Elbanna (forthcoming, p. 4)
	“When I **negotiate,** I will ask bout details but most of them will have no specific idea how to do it. [...] I will give them options”	Lavilles and Sison (2017, p. 7)

Closure of in/formal contracts	"**reach a contract** (conditional on the buyers making a selection)"	Hong et al. (2016, p. 49)
	"in practice the parties are likely to end up **writing a highly incomplete contract** as a compromise [...], especially when the focal project is complex."	Snir and Hitt (2003), cited by Hong et al. (2020, p. 25)
	"If a **contract is awarded**, the worker can begin to work"	Huang et al. (2018, p. 2)
	"projects **fail to reach to a contract**"	Zheng et al. (2015, p. 1)
Monitoring of contracted service	"**Monitoring** through TimeProof or other software that captures screen or through a camera has been mechanisms for clients (employers) to check the work of a developer"	Lavilles and Sison (2017, p. 7)
	"**monitoring** turns the individual information about contractors' actual effort into information that the principals could observe"	Liang et al. (2017, p. 46)
	"**Evidence of hours worked was provided through a screenshot tool** on the worker's side."	Schlagwein et al. (2019, p. 11)
Arbitration	"most disputes do not go beyond **arbitration** and do not seek legal recourse"	Gefen and Carmel (2008, p. 372)
	"**Arbitration** by platform-appointed agent"	Gol et al. (2019, p. 6)
	"Some requests are more complex, because they involve conflicts and require **arbitration**."	Du and Mao (2018, p. 7)
Completion	"Finally, the hired worker(s) completes the task and **receives a payment**"	Kokkodis and Ipeirotis (2014, p. 1)
	"the winning service provider finishes the project, and the **employer and provider then give feedback to each other**"	Guo et al. (2017, p. 2)
	"Ratings on StarWorks were designed as a double-blind process. Once the contract ended, the client and contractor were both **prompted to provide feedback** on their experience of working together."	Rahman (2018, p. 3)

*Notes. * We highlighted parts of the extracts that correspond to the respective micro process in bold. References are provided in Appendix B.*

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Table C.3

Extracts illustrating the micro-level processes (executing)

Micro process	Representative descriptions*	Source
Communication of work objectives, status, and changes	"language barriers may impose hurdles in effective **communication** between service providers"	Hong and Pavlou (2017, p. 550)
	"Business oriented employer **defined** the main objective of the project and the developer will **define** the specific tasks needed to achieve the business objective."	Lavilles and Sison (2017, p. 7)
	"When a project is awarded, the parties can use a virtual "working space" to **communicate, exchange documents, track milestones**, and settle payments via an escrow account."	Radkevitch et al. (2009, p. 300)
Conduct of knowledge work	"process of **performing and completing a task or project**, and has three sub-activities or tasks: tasking, coordinating, and self-managing"	Sison and Lavilles (2018, p. 8)
	"**cooperative process between clients and vendors**"	Du and Mao (2018, p. 296)
Exchange of results	"**submitting** solutions to tasks on the crowdsourcing platform"	Ye and Kankanhalli (2017, p. 109)
	"Clients are also responsible for integrating and implementing the completed jobs into their technology environments."	Taylor and Joshi (2018, p. 284)
	"by restricting access to **work submissions** exclusively to one select worker, the contract-based scheme does not incentivize workers to put in their best effort"	Chan et al. (2019, p. 3)
	"information exchanges and facilitate **knowledge transfer and integration processes**"	Lu et al. (2016, p. 107)

*Notes. * We highlighted parts of the extracts that correspond to the respective micro process in bold. References are provided in Appendix B.*